B.Tech –Computer and Communication Engineering | Academic Year: 2022-2023

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

[PO.1].Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2].Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3].Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4].Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5].Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6].The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7].Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8].Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9].Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

Vision

Inculcate academic excellence and research aptitude for global competency and leadership

Mission

- Nurture the technical skillset of students to enable them to create an innovative solution
- Sharpen the problem-solving skills through project-based learning.
- Serve society by inspiring young minds for research and innovation with ethical values.

Program Educational Objectives

PEO1: Graduates shall exhibit leadership skills to foster academic excellence with productive research and social reforms engaging in lifelong learning with ethical practices.

PEO2: Graduates shall pursue higher education to upgrade technical competency in the field of computation.

PEO3: Graduates shall showcase industry readiness with a strong understanding of logical, analytical, critical thinking with teamwork.

Program Articulation Matrix																
Sem.	Sr. No.	Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
III	1	CC2101	2.00	1.50	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.20	1.00	1.00
	2	CC2102	2.60	2.20	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.00	1.60	1.00
	3	CC2103	3.00	1.25	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.50	2.00	1.67
	4	CC2104	2.50	2.00	1.83	1.33	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.25	2.17	1.00	2.50
	5	CC2130	3.00	2.00	2.00	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.50	1.50	1.00
	6	CC2131	1.67	2.00	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25	2.75	0.00	0.00
	7	CC2132	2.33	1.80	1.60	1.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	1.00	0.00
	8	MA2101	2.67	2.17	2.33	2.17	2.00	0.00	0.00	0.00	1.67	2.00	2.40	2.33	2.50	1.83	1.67
	9	EO2001	0.00	2.00	2.00	2.50	2.00	1.00	2.00	0.00	2.00	0.00	1.67	2.00	0.00	0.00	0.00
IV	10	CC2201	2.00	0.00	2.50	0.00	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	1.00	2.50
	11	CC2202	1.60	2.00	2.50	3.00	1.00	0.00	0.00	1.00	1.00	1.00	0.00	1.00	2.50	2.33	1.00
	12	CC2203	2.00	2.33	2.25	1.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	1.83	1.80	1.00
	13	CC2230	1.00	1.00	1.25	2.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00
	14	CC2231	1.33	1.00	1.50	1.33	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
	15	CC2232	1.00	1.00	1.40	1.50	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00
	16	MA2201	3.00	2.00	1.00	2.00	1.00	1.60	3.00	3.00	2.00	1.00	2.00	1.00	2.80	1.80	1.60
	17	BB0025	0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00	2.00	2.00	1.00	1.00	0.00	0.00	0.00
V	18	CC3101	2.50	1.50	1.50	1.25	2.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.25	1.00	1.00
	19	CC3102	1.60	1.50	2.25	1.75	1.00	0.00	0.00	0.00	1.50	2.00	2.00	1.00	1.00	2.60	2.20
	20	CC3103	2.20	1.60	1.50	0.00	0.00	1.50	2.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00
	21	CC3104	1.50	1.50	1.50	1.67	3.00	2.00	1.00	0.00	1.00	1.00	1.00	1.50	1.75	1.60	1.50
	22	CC3130	1.00	1.00	1.25	2.00	1.67	1.00	1.00	1.00	1.00	1.50	1.33	2.00	0.00	0.00	1.00
	23	CC3131	1.80	1.40	1.25	0.00	0.00	1.50	2.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	
	24	CC3140	2.00	2.00	3.00	2.33	2.00	1.00	2.00	1.50	1.50	1.50	3.00	2.00	1.25	1.75	2.60
	25	CC3141	1.80	1.67	3.00	3.00	1.25	1.25	0.00	0.00	0.00	0.00	2.00	1.33	1.50	2.00	0.00
VI	26	CC3201	2.80	1.60	1.00	1.00	2.00	1.00	0.00	1.00	1.20	2.00	0.00	1.00	1.20	2.33	1.00
	27	CC3201	1.40	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00
	28	CC3203	2.00	1.50	1.50	1.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	1.00	1.25	0.00
	29	CC3230	1.50	1.00	1.00	1.50	2.50	1.00	0.00	2.25	1.50	2.00	0.00	1.00	1.75	1.25	1.00
	30	CC3231	2.00	1.67	1.25	1.67	1.67	0.00	0.00	1.00	2.00	1.00	1.00	1.00	1.25	2.00	2.00
	31	BB0026	2.33	1.33	2.00	3.00	0.00	1.00	3.00	0.00	0.00	0.00	0.00	0.00	1.67	1.50	2.00
	32	CC3240	1.67	1.67	2.00	1.00	3.00	0.00	0.00	0.00	0.00	0.00	1.00	1.50	2.00	1.75	2.50
	33	CC3241	3.00	2.00	1.00	1.67	0.00	1.00	0.00	1.00	1.00	2.00	1.00	1.00	2.25	1.75	1.00
	34	CC3270	1.80	2.50	2.25	3.00	2.00	2.00	1.33	2.00	1.60	2.67	1.33	2.60	1.40	1.67	1.33
VII	35	CC4140	2.50	1.00	2.40	2.33	3.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	2.25	1.00	0.00
	36	CC4141	3.00	1.50	1.00	1.50	2.40	1.00	2.00	1.50	1.50	1.50	3.00	2.00	2.00	1.60	2.60
	37	CC4142	2.20	2.40	1.75	2.00	1.67	2.00	0.00	0.00	1.00	0.00	0.00	1.00	3.00	3.00	2.00
	38	CC4143	2.20	1.00	1.20	1.60	1.50	0.00	0.00	0.00	2.00	2.20	0.00	2.00	0.00	2.80	0.00
	39	CC4149	2.25	2.00	1.25	1.00	1.00	1.00	0.00	1.00	1.50	1.00	1.67	1.00	2.00	2.00	2.00
	40	CC4150	2.40	2.40	2.80	3.00	3.00	0.00	0.00	0.00	2.00	2.00	0.00	3.00	2.00	2.00	2.00
	41	CC4151	2.60	2.40	1.40	1.00	1.00	2.00	0.00	0.00	0.00	1.60	0.00	0.00	2.20	1.80	1.00
	42	CC4155	2.00	2.00	2.20	1.80	2.00	1.00	0.00	0.00	1.40	1.50	3.00	1.40	1.33	1.00	2.00
	43	CC4156	1.25	2.00	1.75	2.00	2.25	1.67	1.00	1.00	1.33	1.00	1.00	1.75	1.33	1.25	2.50
	44	CC4158	2.00	2.33	2.00	2.00	2.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	45	CC4159	1.33	2.33	2.00	2.00	3.00	0.00	0.00	0.00	2.00	1.00	2.00	0.00	2.25	1.67	2.00
	46	CC4161	1.00	1.00	1.00	1.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	1.50	1.00
	47	CC4162	1.67	2.00	1.80	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	2.00	1.00	0.00
	48	CC4170	1.33	2.33	2.33	2.25	2.25	2.00	1.00	2.00	1.50	1.67	1.75	1.75	1.67	2.00	1.50
VIII	49	CC4270	1.33	2.33	2.33	2.25	2.25	2.00	1.00	2.00	1.50	1.67	1.75	1.75	1.67	2.00	1.50

MANIPAL UNIVERSITY
JAIPUR

MANIPAL UNIVERSITY JAIPUR
School of Computer and Communication Engineering
DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING
Course Hand-out

Economics | EO 2001 | 3 Credits | 3003

Session: July 22 – December 22 | Course coordinator: Dr Manas Roy | Class: B. Tech | Semester III

A. Introduction: This course is offered by Dept. of Economics to the Engineering departments, targeting students to give a basic understanding in the concept of economics. It mainly deals with economic issues related to consumer behavior, firms, industries, and business organizations to make aware the students regarding the economic environment. This course also discusses the preliminary concepts associated with macroeconomic variables like GDP inflation, balance of payments, etc. It explores various possibilities emerging in an economy and the role of economic policy in this context.

Course Outcomes: At the end of the course, students will be able to

EO-2001.1: Describe the basic principles of micro and macroeconomic analysis.

EO-2001-2: Aware of the tools and techniques of economics and be able to prepare projects.

EO-2001-3: Recognize the problems and give solutions which in turn will lead to create employability.

EO-2001.4:. Interpret and illustrate decision-making process in practical life and hence enhance employability.

EO-2001.5: Apply the learning of economic concepts in their life.

B. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO1]. Engineering knowledge: Apply the knowledge of mathematics, science, and engineering fundamentals to the solution of complex engineering problems.

[PO2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO3]. Design/development of solutions: Upon analysing, the B Tech graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO6]. The engineer and society: The engineers are called society builders and transformers. B. Tech graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO7]. Environment and sustainability: The zero effect and zero defect are not just a slogan; it is to be practised in each action. Thus, a B Tech should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO9]. Individual and team - work: United we grow, divided we fall is a culture at MUJ. Thus, an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO12]. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

At the end of the B Tech program, the student:

[PSO1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. ASSESSMENT RUBRICS:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments (Accumulated and Averaged)	10
	Assignments	10
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction; Microeconomics: Consumer behaviour, cardinal and ordinal approaches of utility, law of diminishing marginal utility, theory of demand and supply, law of demand, exceptions to the law of demand, change in demand and change in quantity demanded, elasticity of demand and supply, consumer surplus and producer; Indifference curve, properties, consumer equilibrium, Price and income effect; **Production:** Law of production, production function, SR and LR production function, law of returns and returns to scale, Isoquant curve, characteristics, Iso-cost, producer's equilibrium; **Cost and revenue analysis:** Cost concepts, Opportunity cost, Incremental and sunk cost, Recurring and non-recurring cost, fixed and variable cost, short run and long- run cost and revenue curves**;** **Introduction to markets:** Characteristics and types, **Introduction to Macro Economics:** National Income, Monetary Policy, Fiscal Policy, Inflation and Business Cycle; **Economic decision making:** Cash flow and rate of return analysis, Pay - back period, Internal rate of return(IRR), Net present value(NPV), Time value of money.

F. TEXT- BOOKS

1. H.L Ahuja, Macroeconomics Theory and Policy, (20e) S. Chand Publication.
2. Peterson H C et.al., Managerial Economics, (9e), Pearson, 2012
3. P L Mehta, Managerial Economics, Sultan Chand & Sons, New Delhi, 2012.
4. G J Tuesen & H G Tuesen, Engineering Economics, PHI, New Delhi, 2008.
5. James L Riggs, David D Bedworth, Sabah U Randhawa, Engineering Economics, Tata - McGraw Hill, 2018.

G. LECTURE PLAN:

Lec. No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Overview of the course structure, Introduction to Economics	To acquaint and clear the overview of the course	Lecture	NA	NA
2	Objective and scope of the course	Discussion of the objective of the course for the engineers, its scope, differences between micro and macro economics	Lecture	NA	NA
3,4,5,6	Introduction to Consumer Behaviour, Cardinal approaches of utility	Describe the concept of cardinal approach of utility, Law of DMU and equi-marginal utility	Lecture	2001.1	Class Test Mid Term I
7,8	Law of demand and supply	Describe the concept of demand, supply,	Lecture	2001.1	Class Test Mid Term I
9,10,11,12	Elasticity of demand and supply	Elasticity of demand and supply with examples, conceptual questions	Lecture	2001.1	Class Test Mid Term I
13,14,15,	Ordinal approaches of utility, Consumer and producer's surplus	Recall of the differences between the concept of the cardinal approach and ordinal approach of utility , IC analysis, Consumers equilibrium, IE,SE,PE, Consumer and Producer surplus	Lecture	2001.5	Class Test Mid Term I End Term
16	Revision of previous lectures	Recall all the concepts discussed in previous classes	Lecture, Activity		Home Assignment Mid Term 1
					End term
17	Discussion of the topics related to assignment	Discussion about the assignment topics	Lecture	2001.5	Class Test Mid Term I End Term

18,19	Production, laws of production and return to scale	Discussion of the concept of production, recognize production function, producers equilibrium, RTS	Lecture	2001.4	Class Test Mid Term II End Term
20,21	Cost and revenue analysis	Discussion of the concept of different types of cost and cost function, recognize SR and LR cost curves, revenues	Lecture	2001.4	Class Test Mid Term II End Term
22,23	Types of Market Competition	Aware of market morphology with examples, Interpret the forms of market situations	Lecture	2001.3	Class Test Mid Term II End Term
24	Revision of previous lectures	Recall all the concepts discussed in previous classes	Lecture	2001.5	Class Test Mid Term II End Term
25	Discussion of the topics related to assignment	Recall the discussion about the assignment topics	Lecture, Activity	2001.5	Home Assignment Mid Term II End term
26,27	Macro Economics: National income and its concepts	Interpret and illustrate the concept of CB and various tools	Lecture	2001.2	Home Assignment Class Test End Term
28,29	Monetary and fiscal policies	Interpret and illustrate the concept of NI,GDP,GNI,PI etc., circular flow	Lecture	2001.2	Home Assignment Class Test End Term
30	Inflation	Concept of monetary and fiscal policies, Aware of its instruments, importance and limitations	Lecture	2001.3	Home Assignment Class Test End Term
31	Business Cycle	Concept of Business Cycles, Role of monetary and fiscal policy to counter business cycles	Lecture	2001.3	Home Assignment Class Test End Term
32, 33,34	Economic Decision Making	Cash flow and rate of return analysis, payback period,	Lecture	2001.3	Home Assignment Class Test

		IRR, NPV and Time value of money			End Term
35	Revision of Previous Lectures	Recall the discussion about the assignment topics	Lecture	2001.5	End Term
36	Conclusion and Course Summarization	Recall all the concepts discussed in previous classes	Lecture	2001.5	End Term
37	Quiz-1	Microeconomics	Quiz	NA	Internal Assessment
38	Quiz-II	Macroeconomics	Quiz	NA	Internal Assessment
39	Quiz-III	Microeconomics Macroeconomics Economic Decision Making	Quiz	NA	Internal Assessment

H. Course Articulation Matrix: (Mapping of COs with POs and PSOs)

CO	Statement	Correlation With Program Outcomes (POs)												Correlation With Program Specific Outcomes			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
EO-2001.1	Describe the basic principles of micro and macroeconomic analysis		2	2													
EO-2001.2	Aware of the tools and techniques of economics and be able to prepare projects				2			2		1		2					
EO-2001.3	Recognize the problems and give solutions which in turn will lead to create employability			2	3	2						2					
EO-2001.4	Interpret and illustrate decision-making process in practical life and hence enhance employability						1			2		1	2				
EO-2001.5	Apply the learning of economic concepts in their life						1	2					3				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering

Engineering Mathematics III | MA2101 | 3 Credits | 3 0 0 3

Session: August 2022– December 2022 | Faculty: Dr Anamika Jain | Class: II Year B.Tech. III Sem.

A. Introduction: This course is offered by Department of Mathematics & Statistics as a regular course, targeting students who wish to pursue B.Tech., in Computer Science and Engineering, Information Technology & Computer Communication Engineering. It offers in depth knowledge of relations, functions, Basic counting techniques, propositional and predicate and propositional logic, basic/introductory level algebraic structures, graph theory and trees. Students are expected to have background knowledge on number system.

B. Course Outcomes: At the end of the course, students will be able to

[2101.1]. Describe the concept of Partial Order Relations, lattices and their applications.

[2101.2]. Describe the concepts of Graph Theory and apply the graph algorithms to evaluate and analyze the problems, which enhance the analytical skills.

[2101.3]. Describe the concepts of Trees and apply the tree algorithms to analyze the shortest path problems, which enhance the analytical skills.

[2101.4]. Describe basic counting techniques and their applications to evaluate the relevant problems

[2101.5]. Describe the concept of Predicates, logics, and their properties which enhance the logical and programming skills and make them employable in the relevant industry.

[2101.6]. Describe the concept of Algebraic structure and Group theory, Boolean Algebra which helps to increase the logical skills.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PO1. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

PO2. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions

using basic principles of mathematics, computing techniques and communication engineering principles.

PO3. Design/development of solutions: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

PO4. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus, a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.

PO9. Individual and teamwork: United we grow, divided we fall is a culture at MUJ. Thus, an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

PO12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of the B. Tech. CCE program, the student:

PSO1. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

PSO2. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

PSO3. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	20
	Sessional Exam II	20
	In class Quizzes and/or Assignments, Activity feedbacks	20
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a online class session Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ online classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Boolean Algebra: Partial ordering relations, Poset, Lattices, Basic Properties of Lattices. Distributive and complemented lattices, Boolean lattices and Boolean Algebra. Propositional and Predicate Calculus: Well formed formula, connectives, quantifications, Inference theory of propositional and predicate calculus. Elementary configuration: Permutations and Combinations, Generating function, Principle of inclusion and exclusion Partitions, compositions. Ordering of permutations: Lexicographical and Fikes. Graph theory: Basic definitions, Degree, regular graphs, Eulerian and Hamiltonian graphs, Trees and Properties, Center, radius and diameter of a graph, Rooted and binary trees, Matrices associated with graphs, Algorithms for finding shortest path, Algorithm. Group theory: Semi groups, Monoids, Groups subgroups, Normal Subgroups, Cosets, Lagrange's Theorem, Cyclic groups.

References:

1. C. L. Liu, *Elements of Discrete Mathematics,* (2e), McGraw Hill, New Delhi, 2007.

2. J. P. Trembaly, R. Manohar, *Discrete Mathematics Structures with application to computer science*, McGraw Hill, 2012.

3. E. S. Page, L. B. Wilson, *An Introduction to Computational Combinatorics*, Cambridge Univ. Press, 1979.

4. N. Deo, *Graph theory with Applications to computer science*, Prentice Hall of India, 2012.

F. Lecture Plan:

L. No.	Topic	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1	Introduction about the course content, teaching methodology & Assessment Plan	To develop the understanding about the course	Lecture	NA	NA
2	Introduction about the set theory and relations	Knowledge of basics of Relation	Lecture	2101.1	Mid Term I, Quiz & End Term
3	Principle of inclusion and exclusion, Partitions	Knowledge of basics of sets and Partitions	Lecture	2101.1	Mid Term I, Quiz & End Term
4	Partial ordering relations, Poset	Knowledge of basics of Relation	Lecture	2101.1	Mid Term I, Quiz & End Term
5	Hasse diagram of Posets	Explore different way of representation	Lecture	2101.1	Mid Term I, Quiz & End Term
6	Hasse diagram of Posets	Explore different way of representation	Lecture	2101.1	Mid Term I, Quiz & End Term
7-8	Lattices, Basic Properties of Lattices	Learn new way of representation	Lecture	2101.1	Mid Term I, Quiz & End Term
9	Distributive and complemented lattices	Explore new properties of relations	Lecture	2101.1	Mid Term I, Quiz & End Term
10	Axiomatic definition of Boolean Algebra and examples	Will be able to identify comparison between elements	Lecture	2101.1	Mid Term I, Quiz & End Term
11	Boolean lattices	Can able to make subsets with some interesting properties	Lecture	2101.1	Mid Term I, Quiz & End Term
12-13	Graphs, digraphs, Simple graph, multi graph, pseudo graph and some basic theorems (statements only)	Basic knowledge of Graph formation	Lecture	2101.2	Mid Term I, Quiz & End Term
14	Degree of a vertex in a graph, adjacency and incidence.	Basic definitions and representation in matrix form	Lecture	2101.2	Mid Term I, Quiz & End Term
15	Matrices associated with graphs	Basic definitions and representation in matrix form	Lecture	2101.2	Mid Term I, Quiz & End Term
16	Some basic properties, Subgraphs	Properties of graphs	Lecture	2101.2	Mid Term I, Quiz & End Term
17	Complete graphs Regular graph, bipartite graphs	Different types of graphs	Lecture	2101.2	Mid Term I, Quiz & End Term
18	Graph isomorphism	Equivalence of two graphs	Lecture	2101.2	Mid Term I, Quiz & End Term

19, 20	Walk, path, cycle in a graph	Different types of graphs	Lecture	2101.2	Mid Term I, Quiz & End Term
21	Eulerian and Hamiltonian Graphs	Application of graph with important graphs	Lecture	2101.2	Mid Term I, Quiz & End Term
22	Trees and Properties	Extended form of type of graphs	Lecture	2101.3	Mid Term II, Quiz & End Term

23	Trees and Properties Examples & problems	Basic knowledge of tree	Lecture	2101.3	Mid Term II, Quiz & End Term
24	Centre, radius and diameter of a graph	Basic knowledge of tree	Lecture	2101.3	Mid Term II, Quiz & End Term
25	Rooted and binary trees	Type of the trees and properties	Lecture	2101.3	Mid Term II, Quiz & End Term
26	Algorithms for finding shortest pathDijkstra algorithm (along with diagram and tabulated data)	How to apply the graph theory to find shortest path	Lecture	2101.3	Mid Term II, Quiz & End Term
27	Algorithms for finding shortest path	How to apply the graph theory to find shortest path	Lecture	2101.3	Mid Term II, Quiz & End Term
28	Basic Principle of Counting-Product rule, Sum rule	Understand a way of counting	Lecture	2101.4	Mid Term II, Quiz & End Term
29	Review on Permutations and Combinations	Revision of few fundamental concepts	Lecture	2101.4	Mid Term II, Quiz & End Term
30	Problems under Permutations and Combinations	Exercise new problems	Lecture	2101.4	Mid Term II, Quiz & End Term
31	Definition of Generating Function, examples, finding generating function for the sequence of real numbers	Able to make association between sequence & series	Lecture	2101.4	Mid Term II, Quiz & End Term
32	Propositions, conjunction and disjunction of propositions, negation of a proposition, implications,	Basics of Predicate calculus	Lecture	2101.5	Mid Term II, Quiz & End Term
33	Converse, contrapositive and inverse of a proposition, contradiction and tautology	Properties of Predicate calculus	Lecture	2101.5	Mid Term II, Quiz & End Term
34	Contradiction and tautology, logical equivalences	Identify nature of language	Lecture	2101.5	Mid Term II, Quiz & End Term
35, 36	Predicates - ways of expressing sentences using predicates, predicate calculus	Application of predicate calculus	Lecture	2101.5	Mid Term II, Quiz & End Term
37	Quantifiers - expressing sentences using predicates and quantifiers and quantified express into sentences, Inference theory of propositional: Introduction	Extension of language writing	Lecture	2101.5	Mid Term II, Quiz & End Term
38	Semi-groups, monoids definition and examples	Basics of Algebraic structure	Lecture	2101.6	Quiz & End Term
39	Group definition and examples, some basic theorems (statements only)	Extension of Algebraic structure with some properties	Lecture	2101.6	Quiz & End Term
40	Subgroups, Normal Subgroups (Definition with examples),	extended properties of the group	Lecture	2101.6	Quiz & End Term
41	Cosets, Lagrange's Theorem, Cyclic groups	New property of Groups	Lecture	2101.6	Quiz & End Term

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
2101.1	Describe the concept of Partial Order Relations, lattices and their applications.	3	2	1	1	2	3	1	1	1	1	2	1	2	1	2
2101.2	Describe the concepts of Graph Theory and apply the graph algorithms to evaluate and analyze the problems, which enhance the analytical skills.	3	3	3	2	1	2	2	1	1	1	1	2	2	1	1
2101.3	Describe the concepts of Trees and apply the tree algorithms to analyze the shortest path problems, which enhance the analytical skills.	3	2	3	1	2	2	3	1	1	1	1	3	3	1	1
2101.4	Describe basic counting techniques and their applications to evaluate the relevant problems	3	3	3	2	1	3	2	1	1	1	1	2	1	1	1
2101.5	Describe the concept of Predicates, logics, and their properties which enhance the logical and programming skills and make them employable in the relevant industry	2	1	1	1	1	3	3	2	1	1	1	1	1	1	1
2101.6	Describe the concept of Algebraic structure and Group theory, Boolean Algebra which helps to increase the logical skills.	2	2	2	1	1	2	2	1	1	1	1	2	3	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering
Course Hand-out

Digital Design and Computer architecture | CC 2101 | 4 Credits | 3 0 1 4

Session: July 22 – Nov. 22 | Faculty: Dr. Kusum Lata Jain, Dr. Vijay Kumar Sharma | Class: III Semester

A. **Introduction:** This course is offered by Dept. of Computer and Communication Engineering for third semester students. The core objective of this course is to describe the general organization and architecture of a computer system. It covers in detail various functional units of a computer system, machine instructions, addressing techniques and instruction sequencing. It provides a detailed coverage of logic circuits to perform various arithmetic operations and use of pipelining in the design of high-performance processors.

B. **Course Outcomes:** At the end of the course, students will be able to

- **[2101.1].** Digital Logic Circuits and digital components for computer system
- **[2101.2].** Describe various data representation and formulate assembly language programs for a given high level language construct.
- **[2101.3].** Analyse the design of fast arithmetic circuits.
- **[2101.4].** Describe various parts of a system memory hierarchy
- **[2101.5].** Evaluate the performance of CPU, memory, and I/O operations.
- **[2101.6].** Build the required skills to read and research the current literature in computer architecture.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1] Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2] Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3] Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4] Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5] Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6] The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7] Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8] Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9] Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10] Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11] Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12] Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

PSO1: Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

PSO2: Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

PSO3: Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Date	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	22 Sep-26 Sep (As per academic Calendar)	20
	Sessional Exam II (Closed Book)	10-14 Nov (As per academic Calendar)	20
	Quizzes and Assignments (Accumulated and Averaged)	Regularly	20
End Term Exam (Summative)	End Term Exam (Closed Book)	28 Nov- 9 Dec (As per academic Calendar)	40
	Total		100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.		

E. SYLLABUS

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Software, Performance; Digital logic circuits: logic gates, Boolean algebra, map simplification, combinational circuits, flip-flops, sequential circuits; Digital components: Integrated circuits, decoders, multiplexers, registers, shift registers, binary counters; Machine instructions and programs: numbers, arithmetic operations and characters, memory locations and addresses, instructions and instruction sequencing, addressing modes, assembly language, additional instructions, encoding of machine instructions; Arithmetic: addition and subtraction of signed numbers, design of fast adders, multiplication of positive numbers, signed operand multiplication, fast multiplication, integer division, floating point numbers and operations;
Introduction to CPU design: instruction interpretation and execution, micro-operation and their RTL specification, memory hierarchy, main memory, types and interfacing; Cache Memory: organization and operations, levels of caches; RISC and CISC processors; Introduction to input/output processing: programmed controlled i/o transfer, interrupt controlled I/O transfer, DMA controller; Pipelining and pipeline hazards: design issues of pipeline architecture; Instruction level parallelism and advanced issues.

References:

1. M. M. Mano, Computer System Architecture, (3e), Pearson Education, 2014.

2. C. Hamacher, Z. Vranesic, S. Zaky, Computer Organization, (6e), McGraw Hill, 2011.

3. J. P. Hayes, Computer Architecture and Organization, (3e), McGraw Hill, 2017.

4. T. L. Floyd, Digital Fundamentals, (10e), Pearson Education, 2014.

5. W. Stallings, Computer Organization and Architecture–Designing for Performance, (8e), Pearson Education, 2010.

F. Lecture Plan:

Lectures	Major Topics	Topics	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1	**Introduction**	Discussion of Course handout, course Outcome	**Lecture**	**NA**	NA
2	Basic Structure of Computers	Computer Types, Functional Units, Basic Operational Concepts	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
3		Software, Performance	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
4	**Digital logic circuits**	Boolean algebra, logic gates	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
5		map simplification,	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
6		combinational circuits	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
7		flip-flops	**Lecture**	**2101.1 & 2101.6**	Mid Term I, Quiz & End Term
8		sequential circuits	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
9	**Digital components:**	Integrated circuits, decoders,	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
10		Multiplexers	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
11		Registers, shift registers, binary counters	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
12	Machine Instructions and Programs	Numbers, Arithmetic Operations and Characters	Flipped Class	**2101.2**	Mid Term I, Quiz & End Term
13		Memory Locations and Addresses, Memory Operations	Lecture	**2101.2**	Mid Term I, Quiz & End Term
14		Instructions and Instruction Sequencing	Lecture	**2101.2**& **2101.3**	Mid Term I, Quiz & End Term
15		addressing modes	Lecture	**2101.2**	Mid Term I, Quiz & End Term
16		assembly language, additional instructions, encoding of	Lecture	**2101.2 & 2101.6**	Mid Term II, Quiz & End Term
		MID TERM I			
17		Remedial Classes			
18		Remedial Classes			
19	Arithmetic	Addition and Subtraction of Signed Numbers	Lecture	**2101.3**	Mid Term II, Quiz & End Term
20		Design of Fast Adders	Lecture	**2101.3**& 1301.6	Mid Term II, Quiz & End Term
21		Carry Look Ahead Adders	Lecture	**2101.3**& 1301.5	Mid Term II, Quiz & End Term
22		Multiplication of Positive Numbers-Array Sequential Circuit	Lecture	**2101.3**& 1301.5	Mid Term II, Quiz & End Term
23		Signed Operand Multiplication-Booth Algorithm	Lecture	**2101.3**	Mid Term II, Quiz & End Term

24		Fast Multiplication-Bit Pair Recoding Of Multipliers	Lecture	**2101.3**& 1301.5	Mid Term II, Quiz & End Term
25		Carry-save addition of summands	Lecture	**2101.3**	Mid Term II, Quiz & End Term
26		Integer Division-Restoring	Lecture	**2101.3**	Mid Term II, Quiz & End Term
27		Integer Division- Nonrestoring	Lecture	**2101.3**	Mid Term II, Quiz & End Term
28		Floating Point Numbers & Operation-Standards	Lecture	**2101.3**	Mid Term II, Quiz & End Term
29		Arithmetic Operations on Floating Point Numbers	Lecture	**2101.3**	Mid Term II, Quiz & End Term
30		Tutorial	Activity		
		MIDTERM II			
33	Memory Systems	Memory Systems: Basic Concepts	Flipped Class	**2101.4**	Mid Term II ,Quiz & End Term
34		Speed, Size & Cost	Lecture	**2101.4**& **2101.5**	Mid Term II ,Quiz & End Term
35		types and interfacing;	Lecture	**2101.4**& **2101.5**	Mid Term II ,Quiz & End Term
36		Cache Memory: organization and operations	Lecture	**2101.4**& **2101.5**	Mid Term II ,Quiz & End Term
37		Cache Memories: Levels of Cache	Lecture	**2101.4**	Mid Term II , Quiz & End Term
38	Input / Output Processing	Performance Considerations: Hit Rate & Miss Penalty, Caches on Processor Chip	Lecture	**2101.4**& **2101.5**	Mid Term II , Quiz & End Term
39		RISC and CISC processors	Lecture	**2101.4**& **2101.6**	Mid Term II , Quiz & End Term
		instruction interpretation and execution	Lecture	**2101.5**	Mid Term II, Quiz & End Term
		micro-operation and their RTL specification	Lecture	**2101.5**	Mid Term II, Quiz & End Term
40		programmed controlled i/o transfer,	Lecture	**2101.5**	Mid Term II , Quiz & End Term
41		interrupt controlled I/O transfer,	Lecture	**2101.5**	Mid Term II , Quiz & End Term

42		Accessing I/O Devices,	Lecture	**2101.5**	Quiz & End Term
43		Handling Multiple Devices, Controlling Device Requests, Exceptions	Lecture	**2101.5**	Quiz & End Term
44		Direct Memory Access,	Lecture	**2101.5**	Quiz & End Term
45		DMA controller;	Lecture	**2101.5**	Quiz & End Term
46	Instructional Level Parallelism	Design issues of pipeline architecture.	Lecture	**2101.5** & **2101.6**	Quiz & End Term
47		Pipelining	Lecture	**2101.5**	Quiz & End Term
48		Data Hazards	Lecture	**2101.5**	Quiz & End Term
49		Instruction Scheduling: Static and Dynamic	Lecture	**2101.5**	Quiz & End Term
50		Instruction level parallelism	Lecture	**2101.5**	Quiz & End Term
51		Tutorial	Activity	**2101.6**	Quiz & End Term
52		Revision			
		ENDTERM			

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
2101.1	Digital Logic Circuits and digital components for computer system	2	1										1	2	1	
2101.2	Describe various data representation and formulate assembly language programs for a given high level language construct	3	2										1	1	1	
2101.3	Analyse the design of fast arithmetic circuits.	2	2	1									1	1		
2101.4	Describe various parts of a system memory hierarchy	3	2										1		1	1
2101.5	Evaluate the performance of CPU, memory, and I/O operations.	3	2	1									2	1	1	2
2101.6	Build the required skills to read and research the current literature in computer architecture.												2	1		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Data Communications| CC2102| 4 Credits | 3 1 0 4

Session: Aug 2022-Dec 2022 | Faculty: Dr. Lal Pratap Verma, Dr. Arvind Dhaka| Class: B.Tech III SEM

A. **Introduction:** This course is offered by the Department of Computer & Communication Engineering which provides students with the fundamental concepts and techniques used for communicating data in an efficient and reliable manner. The student will be able to gain a practical understanding of relevant terminology and describe various encoding techniques, flow & error control mechanisms, multiplexing & multiple-access techniques used for enabling data communication. The course lays down the foundation for Computer Networks, Wireless Communications.

B. **Course Outcomes:** At the end of the course, students will be able to:

[CC 2102.1] Utilize the fundamental concepts of data communication, transmission media, and transmission impairments on analog and digital transmission.

[CC 2102.2] Apply the principles of signal encoding techniques used for digital data to digital signal conversion and analog data to digital signal conversion and compare them.

[CC 2102.3] Apply the knowledge of various error detection and correction techniques to find and overcome errors encountered during transmission and discuss flow control and error control techniques.

[CC 2102.4] Distinguish between different types of multiplexing techniques and spread spectrum techniques.

[CC 2102.5] Apply various multiple access techniques and IEEE 802.X LAN Standards.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

[PO.6]. The Engineers and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.

[PO.9]. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

[PO.12]. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

D. Program Specific Outcomes (PSOs)

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of computing and communication to assess social, health, safety and cultural issues and endure the consequent responsibilities relevant to the professional engineering practice.

E. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	20
	Sessional Exam II (Close Book)	20
	In class Quizzes and Assignments, Activity feedback (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Close Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Makeup Assignments (Formative)	Students who miss a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	

F. SYLLABUS

Introduction: General block diagram of communication system, Data communications, Protocol, Need for Protocol Architecture, OSI Model, TCP/IP Protocol Architecture; Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments, Channel Capacity; Transmission Media: Guided Transmission Media, Wireless Transmission, Wireless Propagation, Line-of-Sight Transmission; Signal Encoding Techniques: Analog and Digital Signals, Digital-To-Digital Conversion: Line Coding Schemes, Block Coding, Scrambling, Analog-To Digital Conversion: Pulse Code Modulation, Delta Modulation; Digital Data Communication Techniques: Asynchronous and Synchronous Transmission, Types of Errors, Error Detection, Error Correction, Line Configurations; Data Link Control Protocols: Flow Control, Error Control, High-Level Data Link Control (HDLC); Multiplexing: Frequency Division Multiplexing (FDM), Time-Division Multiplexing (TDM); Spread Spectrum: The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS); Multiple Access- Aloha, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Code-Division Multiple Access (CDMA); Introduction to IEEE 802.X LAN Standards.

G. Reference Books

1. 1. W. Stallings, Data and Computer Communications, (10e), Pearson Education, 2014.
2. B. A. Forouzan, Data Communications & Networking, (5e), McGraw Hill, 2013.
3. D. P. Bertsekas, R. G. Gallager, Data Networks, (2e), Prentice Hall of India, 2011.
4. A. S. Tenenbaum, Computer Networks, (5e), Prentice Hall of India, 2008.
5. L. L. Peterson, B. S. Davie, Computer Networks: A Systems Approach, (5e), Morgan Kaufmann Publishers, 2011.

H. Lecture Plan:

Lecture No.	Major Topics	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	**Introduction and course handout briefing**	**Course handout**	**Lecture**	**NA**	**NA**
1.	Introduction to Data Communication	Introduction: General block diagram of communication system, Data communications	Lecture	[2102.1]	Class Quiz Mid Term - I End Term
2.		Protocol, Need for Protocol Architecture, OSI Model	Lecture	[2102.1]	Class Quiz Mid Term - I End Term
3.		TCP/IP Protocol Architecture	Lecture & Activity	[2102.1]	Class Quiz Mid Term - I End Term
4.	Data Transmission	Concepts and Terminology – Simplex, Half-Duplex, Full-Duplex, Frequency, Bandwidth	Lecture	[2102.1]	Class Quiz Mid Term - I End Term

5.		Time Domain and Frequency Domain Concepts, Data Rate	Lecture & Problem Solving Practice	[2102.1]	Class Quiz Mid Term - I End Term
6.	Analog and Digital Data Transmission	Analog and Digital Data and Signals,	Lecture	[2102.1]	Class Quiz Mid Term - I End Term
7.		Analog and Digital Transmission	Lecture	[2102.1]	Class Quiz Mid Term - I End Term
8.	Transmission Impairments	Attenuation, Delay Distortion, Noise	Lecture & Problem Solving Practice	[2102.1]	Class Quiz Mid Term - I End Term
9.	Channel Capacity	Data Rate and Nyquist Bandwidth	Lecture	[2102.2]	Class Quiz Mid Term - I End Term
10.		Shannon Capacity Formula	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - I End Term
11.	Transmission Media: Guided Transmission Media	Twisted Pair & CAT Types	Lecture & Activity	[2102.2]	Class Quiz Mid Term - I End Term
12.		Coaxial Cable, Optical Fiber	Lecture	[2102.2]	Class Quiz Mid Term - I End Term
13.	Wireless Transmission	Antennas, Terrestrial Microwave	Lecture	[2102.2]	Class Quiz Mid Term - I End Term
14.		Satellite Microwave, Broadcast Radio, Infrared	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - I End Term

15.	Wireless Propagation	Ground Wave Propagation, Sky Wave Propagation	Lecture & Activity	[2102.2]	Class Quiz Mid Term - I End Term
16.		Line-of-Sight Propagation	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - I End Term
17.	Line-of-sight Propagation	Free Space Loss, Atmospheric Absorption, Multipath, Refraction	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - I End Term
MID-TERM-1 EXAM					
18.	Signal Encoding Techniques: Digital-To Digital Conversion	Analog and Digital Signals, Line Coding Schemes: Unipolar, Polar	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - II End Term
19.		NRZ & Bipolar – AMI	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - II End Term
20.		Biphase – Manchester & Differential Manchester	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - II End Term
21.		Modulation Rate and Scrambling Techniques	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - II End Term
22.	Digital Data – Analog Signal	ASK & FSK	Lecture	[2102.2]	Class Quiz Mid Term - II End Term
23.		PSK – BPSK	Lecture	[2102.2]	Class Quiz Mid Term - II End Term

24.		MFSK	Lecture	[2102.2]	Class Quiz Mid Term - II End Term
25.		QAM	Lecture	[2102.2]	Class Quiz Mid Term - II End Term
26.	Analog-To-Digital Conversion	Pulse Code Modulation	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - II End Term
27.		Delta Modulation	Lecture	[2102.2]	Class Quiz Mid Term – II End Term
28.	Digital Data Communication Techniques	Asynchronous and Synchronous Transmission	Lecture	[2102.3]	Class Quiz Mid Term - II End Term
29.		Type of Error, Redundancy, Detection Vs Correction	Lecture	[2102.3]	Class Quiz Mid Term - II End Term
30.		Cyclic Redundancy Check	Lecture	[2102.3]	Class Quiz Mid Term - II End Term
31.		Polynomials & CRC Architecture	Lecture & Problem Solving Practice	[2102.3]	Class Quiz Mid Term - II End Term
32.		Error Correction and Block Code Principle	Lecture & Problem Solving Practice	[2102.3]	Class Quiz Mid Term - II End Term
33.		Line Configurations	Lecture	[2102.3]	Class Quiz Mid Term - II End Term
34.	Data Link Control	Framing	Lecture	[2102.3]	Class Quiz Mid Term - II End Term

35.	Protocols	Flow Control - Stop-and-Wait Protocol	Lecture & Problem Solving Practice	[2102.3]	Class Quiz Mid Term - II End Term
36.		Sliding Window	Lecture & Problem Solving Practice	[2102.3]	Class Quiz Mid Term - II End Term
37.		Error Control: Stop-and-Wait ARQ	Lecture & Problem Solving Practice	[2102.3]	Class Quiz Mid Term - II End Term
MID-TERM-II EXAM					
38.	Data Link Control Protocols	Go-Back-N ARQ	Lecture & Problem Solving Practice	[2102.3]	Class Quiz End Term
39.		Selective Repeat ARQ	Lecture & Problem Solving Practice	[2102.3]	Class Quiz End Term
40.		High-Level Data Link Control (HDLC)	Lecture	[2102.3]	Class Quiz End Term
41.	Multiplexing	Introduction to Multiplexing	Lecture	[2102.4]	Class Quiz End Term
42.		Frequency Division Multiplexing (FDM)	Lecture	[2102.4]	Class Quiz End Term
43.		Time-Division Multiplexing (TDM)	Lecture & Activity	[2102.4]	Class Quiz End Term
44.	Spread Spectrum	The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS)	Lecture	[2102.4]	Class Quiz End Term

45.		Direct Sequence Spread Spectrum (DSSS)	Lecture & Problem Solving Practice	[2102.4]	Class Quiz End Term
46.	Multiple Access	Aloha, Carrier Sense Multiple Access (CSMA),	Lecture	[2102.5]	Class Quiz End Term
47.		Carrier Sense Multiple Access with Collision Detection (CSMA/CD)	Lecture	[2102.5]	Class Quiz End Term
48.		Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Code-Division Multiple Access (CDMA);	Lecture	[2102.5]	Class Quiz End Term
49.	IEEE 802.X LAN Standards	Introduction	Lecture	[2102.5]	End Term
50.		LAN Standards	Lecture	[2102.5]	End Term
END TERM EXAM					

I. Course Articulation Matrix: (Mapping of COs with POs& PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES AND PROGRAM SPECFIC OUTCOMS														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
[CC 2102.1]	Utilize the fundamental concepts of data communication, transmission media, and transmission impairments on analog and digital transmission.	3	3	1									1	2	1	
[CC 2102.2]	Apply the principles of signal encoding techniques used for digital data to digital signal conversion and analog data to digital signal conversion and compare them.	3	2	1									1	3	2	
[CC 2102.3]	Apply the knowledge of various error detection and correction techniques to find and overcome error encountered during transmission, and discuss flow control and error control techniques.	3	2	1									1	2	2	1
[CC 2102.4]	Distinguish between different types of multiplexing techniques and spread spectrum techniques.	2	2											2	2	
[CC 2102.5]	Apply various multiple access techniques and IEEE 802.X LAN Standards.	2	2											1	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

A. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 50%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC 2102.1]	Interpret the fundamental concepts of data communication, transmission media, and transmission impairments on analog and digital transmission.															
[CC 2102.2]	Outline the principles of signal encoding techniques used for digital data to digital signal conversion and analog data to digital signal conversion and compare them.															
[CC 2102.3]	Apply the knowledge of various error detection and correction techniques to find and overcome error encountered during transmission, and discuss flow control and error control techniques.															
[CC 2102.4]	Distinguish between different types of multiplexing techniques and spread spectrum techniques.															
[CC 2102.5]	Discuss various multiple access techniques and IEEE 802.X LAN Standards.															

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGG.

Course Hand-out

Data Structures and Algorithms | CC2103 | 4 Credits | 3 1 0 4

Session: Aug 22 – Dec 22 | Faculty: Prashant Hemrajani | Class: III CCE

A. Introduction: This course is offered by Computer and Communication Engg. Dept., targeting students who wish to pursue development and research in industries or higher studies in fields of Computer Science, IT, and Communication Engineering. This course will form the base of computer science and engineering and hence this course is introduced at this level to make the students understand various ways of organizing data and storing it into memory and use the type depending upon the application.

B. Course Outcomes: At the end of the course, students will be able to:

[CC 2103.1] explains basic concepts of various data structures

[CC 2103.2] describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory and their operations

[CC 2103.3] select and/or apply appropriate data structures to solve problems and assess the trade-offs involved in the design choices and hence develop employability skills

[CC 2103.4] describe and analyze various sorting algorithms like bubble, selection, insertion, merge sort, heap sort, and quick sort.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	20
	Sessional Exam II	20
	In class Quizzes, Assignments and Online Certification Courses (Coursera, etc), Activity feedbacks (Accumulated)	20
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Makeup Assignments (Formative)	Students who miss a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work at home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction: algorithm specification; Performance analysis: time and space complexity, asymptotic notation; C revision: pointer declaration and definition, memory allocation functions, array of

pointers, structures in C, arrays of structures, structures and functions; Recursion in C; Linked list: implementation, various types and operations; Stack: implementations using array and linked list, operations and its applications; Queue: implementations using array and linked list, operations and its applications; Tree: terminologies, different types, implementations of binary tree using array and linked structure, binary search tree, different operations (recursive, non-recursive), red-black tree, AVL trees, B-tree, 2-3 tree, tree applications; Graph: representations, BFS, DFS; Searching techniques and hashing; Sorting.

F. Text Book

Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein, "Data Structures using C", Pearson Education, 2013.

G. REFERENCE BOOKS

R1. *Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", University Press (India) Pvt. Ltd., 2014.*

R2. *Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 2012.*

R3. *Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, " Introduction to algorithms", PHI, Third Edition, 2009.*

R4. *Seymour Lipschutz, "Data Structures with C (Schaum's Outline Series)", McGraw Hill Education Private Limited, 2011.*

R5. *Mark Allen Weiss, "Data structures and Algorithm Analysis in C", Pearson, Second edition, 2014.*

H. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1.	Introduction to the subject, course plan, course outcomes and assessment plan.	To acquaint and clear teacher's expectations and understand student expectations	Lecture	NA	NA
2.	Introduction to data structures, Algorithm Specifications, How to Write Algorithms	define data structure and list various data structures.	Lecture	CC2103.1	Class Quiz End Term
3.	Performance Analysis- Time and Space Complexity, Asymptotic Analysis, Example, Functions in 'C', Example Programs on Functions	analyze the time complexity of simple algorithms.	Lecture	CC2103.1 CC2103.1	Class Quiz Home Assignments I Sessional End Term
4.	Example Programs on Functions, Arrays: Introduction, Single Dimensional Arrays: Declaration, Initialization, Operations (Insertion and Deletion of Element)	define arrays and apply knowledge on single-dimensional arrays in writing programs.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments I Sessional End Term
5.	Sorting Algorithms – Selection Sort, Bubble Sort and Insertion Sort	construct searching and sorting algorithms and write programs using single-dimensional arrays.	Lecture	CC2103.2	Class Quiz Home Assignments I Sessional End Term
6.	Multidimensional Arrays, Two Dimensional Arrays: Declaration, Initialization, Addition of Two Matrices, Row Major and Column Major Representation	explain row major and column major memory allocation in 2-D arrays, Apply knowledge on two-dimensional arrays in writing programs	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments I Sessional End Term
7.	Example Programs on Two Dimensional Arrays, Row Major and Column Major Representation	apply knowledge on two-dimensional arrays in writing programs.	Lecture	CC2103.2 CC2103.3	Class Quiz Home Assignments I Sessional End Term
8.	Pointers: Introduction, Example Programs on Pointers, Pointers and Arrays, Dynamic Memory Allocation	illustrate dynamic memory allocation using pointers in solving problems requiring a list of values.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments I Sessional End Term
9.	Dynamic Memory Allocation: Dynamic Array creation, Dynamic structure creation.	apply knowledge on pointers in writing programs.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments I Sessional End Term
10.	Problems solving by students on an array	analyze the applicability of array as an appropriate Data Structure to solve the problem and develop an	Tutorial	CC2103.3	Class Quiz Home Assignments I Sessional

		algorithm/program to provide the solution to a given problem through it.			End Term
11.	Problems solving by students on an array	structure mapping and model a given real-world problem into an array.	Tutorial	CC2103.3	Class Quiz Home Assignments I Sessional End Term
12.	Linked List: Introduction, Basic Terminologies, Advantages over Arrays, Applications, Structures in 'C', Example Programs on Structures and pointer to Structure	describe linked list data structure, disadvantages of array-based storage, and the need for linked list data structure, develop structures in 'C' and deal it with pointers.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments I Sessional End Term
13.	Passing Structures to Functions, Singly Linked List: Introduction, Operations	pass structures to functions, to explain self-referential structures and functions, and describe linked list storage structure and basic operations.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments I Sessional End Term
14.	Singly Linked List: Operations (Continued)	Implement singly linked list storage structure and basic operations (insertion, deletion, and searching) defined over it.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments I Sessional End Term
15.	Circular Linked List: Introduction, Operations	understand and implement circular linked list storage structure and basic operations (insertion, deletion, and searching) defined over it.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments I Sessional End Term
16.	Doubly Linked List: Introduction, Operations	understand and implement circular linked list storage structure and basic operations (insertion, deletion, and searching) defined over it.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments I Sessional End Term
17.	Some Example Programs on Linked List	implement linked list operations like reversing a linked list, finding the middle of the list, sorting a list, etc.	Lecture	CC2103.3	Class Quiz Home Assignments I Sessional End Term
18.	Problems solved by students on the linked list	analyze the applicability of a linked list as an appropriate Data Structure to solve the problem and develop an algorithm/program to provide the solution to a given problem through it.	Tutorial	CC2103.3	Class Quiz Home Assignments I Sessional End Term
19.	Problems solving by students on linked list	structuring, mapping, and modeling a given real-world problem into a linked list.	Tutorial	CC2103.3	Class Quiz Home Assignments I Sessional End Term
20.	Recursive Functions, Example Programs on Recursive Functions, Stack: About, Applications	explain the working philosophy of the stack and how the system stack stores local function calls.	Lecture/ Expert-Lecture	CC2103.1 CC2103.3	Class Quiz Home Assignments II Sessional End Term
21.	Stack: Operations, Implementation of Stack using Array and Linked List	develop a stack-based application and realize the stack functioning using arrays as well as a linked list and compare their implementations.	Lecture/ Expert-Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments II Sessional End Term

22.	Expression Notations: Polish Notation, Reverse Polish Notation, Infix Notation, Evaluation of Expression written in Polish Notation	explain various forms of mathematical notations to express an expression and their evaluation	Lecture	CC2103.3	Class Quiz Home Assignments II Sessional End Term
23.	Evaluation of Expression written in Reverse Polish Notation Evaluation of Expression written in Infix Notation	evaluate the postfix(infix) expression using stacks	Lecture	CC2103.3	Class Quiz Home Assignments II Sessional End Term
24.	Conversion of Expression from one Notation to Another	explain how to realize a mathematical expression using stacks and to convert an infix expression to postfix notation using stack.	Lecture	CC2103.3	Class Quiz Home Assignments II Sessional End Term
25.	Conversion of Expression from one Notation to Another	convert an infix expression to prefix notation using stack	Lecture	CC2103.3	Class Quiz Home Assignments II Sessional End Term
26.	Problems solving by students on stack applications	develop recursive code, to handle the problem using stacks, to analyze the applicability of stack with respect to a given problem	Tutorial	CC2103.3	Class Quiz Home Assignments II Sessional End Term
27.	Linear Queue: Introduction, Applications, Operations, Implementation using Array and Linked List	explain Queue Data structure, its application in the real world and its operations enqueue and dequeue, to implement queue data structure using array and linked list.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments II Sessional End Term
28.	Circular Queue: About, Applications, Operations, Implementation using Array and Linked List	explain Circular Queue Data structure, its application in the real world, and its operations enqueue and dequeue	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments II Sessional End Term
29.	Priority Queue and Deques: About, Applications, Operations, Implementation using Array and Linked List	explain Priority Queue Data structure and Deques, its application in the real world and its operations enqueue and dequeue.	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments II Sessional End Term
30.	Problems solving by students on queue applications	analyze the applicability of queue as an appropriate Data Structure to solve the problem, to develop an algorithm/program to provide the solution to a given problem through it.	Tutorial	CC2103.3	Class Quiz Home Assignments II Sessional End Term
31.	Trees: Introduction, Basic Terminology, Types of Trees, Binary Search Tree: Creation,: Searching an Element, Insertion of Node	describe binary tree (BT), tree-terminology, types of BT, creation of Binary Search Tree, search operations	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments II Sessional End Term
32.	Binary Search Tree: Deletion of Node, Determining Height	describe about the deletion of a node in BST and computing height	Lecture	CC2103.2	Class Quiz Home Assignments II Sessional End Term

33.	Binary Search Tree: Traversal (In-order, Pre-order and Post- order)	explain different traversal in BST	Lecture	CC2103.2	Class Quiz Home Assignments II Sessional End Term
34.	AVL Tree: Introduction, Applications Creation, Searching an Element, Insertion of Node	describe drawbacks of BST, Use of AVL tree, how to insert a value in AVL and then required rotations (LL, RR, LR and RL)	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments End Term
35.	AVL Tree: Deletion of Node	describe how to delete a node from AVL tree and then required rotations	Lecture	CC2103.2	Class Quiz Home Assignments End Term
36.	2-3 Tree	Applications AVL tree	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments End Term
37.	Red black Tree	Describe the definition and its operations	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments End Term
38.	Heaps: Insertion of Node, Binary Heap: Creation, Insertion of Element, Deletion of Element	describe what is heap, types, creations of max and min heaps, heap sort, use of heap in priority queue implementation	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments End Term
39.	Problems solving by students on tree and its use	construct BST and AVL tree from given sequence of values	Tutorial	CC2103.3	Class Quiz Home Assignments End Term
40.	Problems solving by students on tree and its use	construct heap from given sequence of values and implement priority queue	Tutorial	CC2103.3	Class Quiz Home Assignments End Term
41.	Graphs: Introduction, Basic Terminology, Applications, Representation of Graphs: Adjacency Matrix Representation	describe representation of graph in term of adjacency matrix with their complexity	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments End Term
42.	Representation of Graphs: Adjacency List Representation	describe representation of graph in term of adjacency list with their complexity	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments End Term
43.	Graph Traversal: Breadth First Traversal, Depth First Traversal	conceptualize on the various methods of graph traversal and understand the concept of Queue and Stack data structure	Lecture	CC2103.2	Class Quiz Home Assignments End Term
44.	Minimum Spanning Tree, Prims Algorithm, Kruskal's Algorithm	understand the application of graph such as TSP problem	Lecture	CC2103.2	Class Quiz Home Assignments End Term
45.	Shortest Path Algorithms: Dijkstra's Algorithm, Floyd's Algorithm	understand the application of graph such as computer networking(Routing System)	Lecture	CC2103.2	Class Quiz Home Assignments End Term
46.	Problems solving by students on graph algorithms	find shortest path using Dijkstra's Algorithm and Floyd's Algorithm for a given graph	Tutorial	CC2103.3	Class Quiz Home Assignments End Term
47.	Problems solving by students on graph algorithms	find MST using Prims Algorithm and Kruskal's Algorithm for a given graph	Tutorial	CC2103.3	Class Quiz

					Home Assignments End Term
48.	Sorting: Introduction, Bubble Sort, Insertion Sort	describe the concept of sorting with various sorting algorithm	Lecture	CC2103.1	Class Quiz Home Assignments End Term
49.	Sorting (Continued): Radix Sort, Heap Sort	describe the concept of priority queue with the help of heap sort	Lecture	CC2103.1 CC2103.4	Class Quiz Home Assignments End Term
50.	Hashing: Introduction, Applications, Hash Functions	describe different hashing techniques/functions	Lecture	CC2103.1 CC2103.2 CC2103.4	Class Quiz Home Assignments End Term
51.	Hash Collisions, Collision Resolution: Open Addressing, Chaining	describe different collision resolving techniques with examples	Lecture	CC2103.1 CC2103.2	Class Quiz Home Assignments End Term
52.	Problems solving by students on soring and its application	develop program for searching and sorting	Tutorial	CC2103.3	Home Assignments End Term

H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES **(POs)**												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES **(PSOs)**		
		PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
[CC2103.1]	explain basic concepts of various data structures	3	2										2	3		
[CC2103.2]	describe how arrays, linked lists, stacks, queues, trees and graphs are represented in memory and their operations		1	2									2		2	2
[CC2103.3]	Select and/or apply appropriate data structures to solve problems and assess the trade-offs involved in the design choices and hence develop employability skills		1	2									2		2	2
[CC2103.4]	describe and analyze various sorting algorithms like bubble, selection, insertion, merge sort, heap sort and quick sort		1	2									2	2		1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Object Oriented Programming | CC 2104 | 4 Credits | 3 1 0 4

Session: Aug 22-Nov 221 | Faculty: Dr. Ghanshyam Raghuwanshi | Class: BTech CCE III SEM | Sec: A|B

A. Introduction: This course is offered by the Department of Computer and Communication Engineering as object-oriented techniques have revolutionized the software development process and are used tremendously in IT industry to develop software products of various kinds. The course is designed to give students an in-depth understanding of the basic concepts of object-oriented programming such as encapsulation, inheritance and polymorphism using Java programming language as an aid in tool. The course curriculum and structure has been divided into eight basic modules which cover the programming aspects related to object-oriented domain such as exception handling, multithreading, GUI programming, event handling etc. The course will be taught with the help of several teaching aides such as power point presentations and via live debugging and execution demonstrations of several programming problems using the Eclipse tool. The main objective of the course is to teach students about the basics of classes and objects using Java programming language, to enable the students to properly use the basic object-oriented pillars such as encapsulation, inheritance, and polymorphism, to enable the students to understand the basic difference between a class and an interface, to teach students about the implementation aspect of various basic data structures such as Linked Lists and Arrays using object-oriented techniques.

B. Course Outcomes: At the end of the course, students will be able to:

[CC 2104.1] Apply to compile and execute Java Application using Command Based Interface as well as using Eclipse Tool.

[CC 2104.2] Identify and implement the concepts of encapsulation and abstraction using class, objects and interfaces for better programming skills.

[CC 2104.3] Describe and Implement various inheritance and polymorphism forms using Java Classes and Interfaces.

[CC 2104.4] Implement various collection data structure such as linked lists, queues, stacks using Java's collection framework

[CC 2104.5] Apply, Learn and finally implement the use of advanced programming constructs/features such as exception handling, multithreading and event handling in real-life programming domains.

[CC 2104.6] Visualize a real world problem in the form of various collaborating classes and objects for enhancing employability.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. Individual and team work: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked	

	blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work at home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.

D. SYLLABUS

Introduction: OOP paradigm, the creation of java, the java buzzwords; C, C++ and Java comparison;**Java Basics:** Compilation and execution of a java program, access modifiers, garbage collection; **Class and Objects:** Class definition, creating objects, role of this keyword, garbage collection, finalize() method, method overloading, objects as parameters, argument passing, returning objects, access control, final, nested and inner classes; **I/O Basics:** Reading console input, writing console output, Files **Array and Strings:** Arrays in java, 1-D, 2-D and dynamic arrays, string basics, string comparison and manipulation; **Inheritance:** Inheritance and its types, abstract class, inner and outer class, super, final, static keywords; **Package and Interface:** In-built packages and user define packages, role of interface, polymorphism via inheritance; **Collection Framework & Generics:** List, set, map, generic classes; **Exception Handling:** Errors and exceptions, types of exceptions, handling exceptions, **Multithreading:** Thread class, runnable, thread life cycle, synchronization, thread priority; **Event Ha ndling and GUI Programming:** Events, action listener, swing package;

E. REFERENCE BOOKS

1. Java: The Complete Reference (9th Edition), By Herbert Schildt, McGraw Hill Education.
2. Balagurusamy E, "Object Oriented Programming with Java", Tata McGraw Hill, 2011.
3. Arnold K, & Gosling J, "The Java Programming Language", 2002.
4. Horstmann CS, "Big Java", Wiley's Interactive Edition, 2015.

F. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1	Introduction and Course Hand-out briefing	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
2	Overview of Java: History, Evolution, C, C++ and Java Comparison, Java Byte Code ,Java Buzzwords, Java SE 8	Identify and implement the concept of OOP Java	Lecture	CO 1	Mid Term I, Quiz & End Term
3-7	Lexical issues, java keywords, OOP Programming, Control Statements, Operators	Describe the programming constructs of OOP Java	Lecture	CO 1	Mid Term I, Quiz & End Term
8-11	Data Types, Variables and Arrays: Primitive Types, Floating point, Characters, Booleans, Literals, Variables, Type Conversion and casting, wrapper classes, Boxing and Unboxing, 1D Arrays, 2D Array, multi dimension Array, Variable Length Array	Recall programming construct of OOP Java	Flipped Class	CO 1	Mid Term I, Quiz & End Term
12-17	Introduction to classes: Class Fundamentals, Declaring Objects Methods in Classes, returning values, parameterized methods Garbage Collection, finalize() method Constructors, parameterized constructors This keyword, This Constructor, Constructor Chaining	Identify and implement the concepts of class and objects.	Lecture	CO 2 & CO 6	Mid Term I, Quiz & End Term
18-23	Classes and its Methods: Overloading Methods, Using Objects as parameters, Argument passing, Returning Objects, Recursion,	Apply and describe the concept of interaction for classes and its methods	Lecture	CO 2	Mid Term I, Quiz & End
24-26	I/O Basics: Using Command line arguments ,I/O Basics, reading Console Input and Writing Console Output, PrintWriter Class, Scanner Class, reading and Writing Files, Closing files	Recall I/O basics of OOP Java	Flipped Class	CO 1 & CO 2	Mid Term II, Quiz & End Term
27-29	Inheritance: Basics, Using Super, Creating multilevel hierarchy,	Examine and describe the concept of Inheritance of OOP	Lecture	CO 3	Mid Term II,
30-34	Packages, Access protection, Importing packages, static import Interfaces: Default interface methods, static methods in interfaces	Experiment the access control using package and interfaces	Lecture, activity	CO 3	Mid Term II, Quiz & End Term

35-38	Exception Handling: Fundamentals, Exception types, Uncaught Exceptions, check uncheck Exception, Using try and catch, multiple catch clauses, nested try statements, Throw, throws, finally, built-in exceptions, creating own exception Sub classes	Recall and implement exceptions in classes	Lecture	CO 2, CO 5 & CO 6	Mid Term II, Quiz & End Term
39-42	Multithreaded Programming: Thread Model: thread priorities, synchronization, main thread, creating single thread and multiple threads, using isAlive(), join(), Interthread communication, suspending, resuming and stopping threads, using multithreads	Implement and describe the concept of multithreading	Flipped Class	CO 2 & CO 6	Quiz & End Term
43-45	String Handling: Constructors, Constructor chaining, string operations, Character extraction, comparison, searching and modifying, String Class Methods and String Buffer Class	Recall and experiment string handling in OOP Java	Lecture	CO 4	Quiz & End Term
46-49	Generic Class: Collection framework, Arraylist , LinkList, HashMap,Vector, Making own generics class	Implement and describe the generic class and collection framework	Lecture	CO 4	Quiz & End Term
50-52	GUI and Event Handling: GUI lifecycle, Events, Events listener, adapter classes, Different Event classes, Event Listener Interfaces	Apply GUI and Event handling using adapter class and interfaces	Flipped Class	CO 4 & CO 5	Quiz & End Term

G. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	Correlation with Program Outcomes(POs)												Correlation with Program Specific Outcomes (**PSOs**)		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC 2104.1]	Apply to compile and execute Java Application using Command Based Interface as well as using Eclipse Tool.	**1**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**2**	**-**	**-**
[CC 2104.2]	Identify and implement the concepts of encapsulation and abstraction using class, objects and interfaces for better programming skills.	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**2**	**-**	**-**
[CC 2104.3]	Describe and Implement various inheritance and polymorphism forms using Java Classes and Interfaces.	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**3**	**-**	**-**
[CC 2104.4]	Implement various collection data structure such as linked lists, queues, stacks using Java's collection framework	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**2**	**-**	**-**
[CC 2104.5]	Apply, Learn and finally implement the use of advanced programming constructs/ features such as exception handling, multithreading and event handling in real-life programming domains.	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**2**	**1**	**2**
[CC 2104.6]	Visualize a real world problem in the form of various collaborating classes and objects for enhancing employability.	**1**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**2**	**2**	**1**	**3**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY
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(University under Section 2(f) of the UGC Act)

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Data Communications Lab| CC2130| 3 Credits | 0 0 2 1

Session: Aug 2022-Dec 2022 | Faculty: Dr. Arvind Dhaka| Class: B.Tech III SEM

A. Introduction: This laboratory course is offered by the Department of Computer and Communication Engineering and aims to facilitate the practical understanding of the concepts and principals being discussed in the course - Data Communications. Students will be able to perform experiments related to digital modulation techniques, analog data to digital signal encoding techniques, multiplexing techniques and multiple accessing techniques & wireless open access research protocol (WARP) boards.

B. Course Outcomes: At the end of the course, students will be able to:

[CC 2130.1] Analyze and interpret signals and working of basic equipment (Function Generator and Digital Storage Oscilloscope (DSO)).

[CC 2130.2] Demonstrate various digital modulation, demodulation techniques in data communications.

[CC 2130.3] Identify multiplexing and multiple accessing techniques and trace the corresponding waveforms.

[CC 2130.4] Experiment with packet tracer & wireless open access research protocol (WARP) boards to get real time exposure of Data Link Layer operations.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: the sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analyzing the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are terms society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. Individual and team work: United we grow, divided we fall is a culture at MUJ that an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

D. Program Specific Outcomes (PSOs)

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of computing and communication to assess social, health, safety and cultural issues and endure the consequent responsibilities relevant to the professional engineering practice.

E. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous assessment (Lab records, Performance in Lab, Viva-Voce and mini-project)	70
End Term Exam (Summative)	End Term Exam (2 Hr. Lab Exam including Viva-Voce)	30
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

F. SYLLABUS

Signal Modulation Techniques: ASK, PSK, FSK, Pulse Code Modulation (PCM), Delta Modulation; CDMA; Various Line Coding Techniques; Packet Tracer: Introduction, PC to PC Communication using Crossover Cable, Star Topology Using Hub and Switch as Network Devices; Study using Wireless Open Access Research Platform (WARP).

G. Reference Books

1. W. Stallings, Data and Computer Communications, (10e), Pearson Education, 2014.
2. B. A. Forouzan, Data Communications & Networking, (5e), McGraw Hill, 2013.
3. D. P. Bertsekas, R. G. Gallager, Data Networks, (2e), Prentice Hall of India, 2011.
4. A. S. Tenenbaum, Computer Networks, (5e), Prentice Hall of India, 2008.
5. L. L. Peterson, B. S. Davie, Computer Networks: A Systems Approach, (5e), Morgan Kaufmann Publishers, 2011.

H. Laboratory Plan:

Lab No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Introduction and Course Hand-out briefing	To acquaint and clear teachers expectations and understand student expectations	Lecture/Discussion	NA	NA
2.	To analyze signal using Function Generator and Digital Storage Oscilloscope (DSO)	To get acquainted with the working of essential equipment (Function Generator and Digital Storage Oscilloscope (DSO))	Demonstration and Practically performing	CC2130.1	Internal Evaluation End Term Exam
3.	To analyze a PCM system and interpret the modulated and demodulated waveforms	To perform and visualize waveforms that occur at various steps involved in PCM; Sampling, Quantization and Encoding.	Demonstration and Practically performing	CC2130.2	Internal Evaluation Project End Term Exam
4.	To analyze a BPSK modulation system and interpret the modulated and demodulated waveforms.	To identify the need of analog modulation and visualize how the two different phases of carrier is used to represent the digital signal	Demonstration and Practically performing	CC2130.2	Internal Evaluation Project End Term Exam
5.	To analyze a DPCM system and interpret the modulated and demodulated waveforms.	To identify the need of DPCM as compared to PCM and visualize the DPCM modulated and demodulated signals.	Demonstration and Practically performing	CC2130.2	Internal Evaluation Project End Term Exam
6.	To analyze a Delta modulation system and interpret the modulated and demodulated waveforms.	To comprehend the advantages of Delta modulation over PCM and understand the issues involved in Delta modulation.	Demonstration and Practically performing	CC2130.2	Internal Evaluation Project End Term Exam
7.	To analyze Frequency Division Multiplexing and De-multiplexing technique and draw its waveforms.	To visualize the FDM multiplexing technique by performing it experimentally	Demonstration and Practically performing	CC2130.3	Internal Evaluation End Term Exam
8.	To analyze a CDMA-DSSS modulation system and interpret the modulated and demodulated waveforms.	To firmly grasp the working principle of spread spectrum and visualize the use of PN Sequence to spread and de-spread the signal at transmitter and receiver.	Demonstration and Practically performing	CC2130.3	Internal Evaluation End Term Exam
9.	To understand working of packet tracer & create star topology using switch.	To get acquainted with the simulated environment of software tool by Cisco.	Demonstration and Practically performing	CC1530.4	Internal Evaluation End Term Exam
10.	To understand working of WARP boards.	To get acquainted with WARP boards.	Demonstration and Practically performing	CC2130.4	Internal Evaluation End Term Exam

11.	To perform networking with WARP boards.	To get acquainted with networking with WARP boards.	Demonstration and Practically performing	CC2130.4	Internal Evaluation End Term Exam

I. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CC 2130.1	Analyze and interpret signals and working of basic equipment (Function Generator and Digital Storage Oscilloscope (DSO)).	**3**												**3**		
CC 2130.2	Demonstrate various digital modulation, demodulation techniques in data communications.	**3**	**2**	**2**	**2**	**2**								**2**		
CC 2130.3	Identify multiplexing and multiple accessing techniques and trace the corresponding waveforms.	**3**	**2**	**2**										**2**	**1**	
CC 2130.4	Experiment with packet tracer and wireless open access research protocol (WARP) boards to get real time exposure of Data Link Layer operations.	**3**	**2**	**2**	**2**	**2**							**2**	**3**	**2**	**1**

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

J. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC 2130.1	Analyze and interpret signals and working of basic equipment (Function Generator and Digital Storage Oscilloscope (DSO)).															
CC 2130.2	Demonstrate various digital modulation, demodulation techniques in data communications.															
CC 2130.3	Identify multiplexing and multiple accessing techniques and trace the corresponding waveforms.															
CC 2130.4	Experiment with packet tracer and wireless open access research protocol (WARP) boards to get real time exposure of Data Link Layer operations.															

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY JAIPUR

School of Computer & Communication Engineering

PARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Data Structures and Algorithm Lab | CC 2131 | 1 Credit | 0 0 2 1

Session: Aug 22 – Dec 22 | Faculty: Prashant Hemrajani

A. Introduction: This course is offered by Computer and Communication Engineering Department, targeting students who wish to pursue development and research in industries or higher studies in field of Computer Science, IT and Communication Engineering. This course will form the base of computer and communication engineering and hence this course is introduced at this level to make the students understand various ways of organizing data and storing it into memory and use the type depending upon the application.

B. Course Outcomes: At the end of the course, students will be able to

[CC2131.1] Recall basic concepts required to implement data structures.
[CC2131.2] Apply linear and nonlinear data structures to solve a specified problem.
[CC2131.3] Experiment with various standard techniques for searching and sorting.
[CC2131.4] Build various application using appropriate data structure.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1] Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2] Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3] Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4] Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5] Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6] The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7] Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8] Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9] Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10] Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11] Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12] Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1] Will be able to design, develop and implement efficient software for a given real life problem.

[PSO.2] Will be able to apply knowledge of AI, Machine Learning and Data Mining in analyzing big data for extracting useful information from it and for performing predictive analysis.

[PSO.3] Will be able to design, manage and secure wired/ wireless computer networks for transfer and sharing of information.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous Assessments	60
Exam (Summative)	Exam (Small Project/Exam)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a lab will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 2 throughout the entire semester.	

E. SYLLABUS

Review of C and programs on Recursion, Stacks, Stacks, Queues, lists, Trees, Graphs, using C language.

F. TEXT BOOKS

T1. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein, “Data Structures using C”, Pearson Education, 2013.

G. REFERENCE BOOKS

R1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, “Fundamentals of Data Structures in C”, University Press (India) Pvt. Ltd., 2014.

R2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 2012

R3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “ Introduction to algorithms”, PHI, Third Edition, 2009

R4. Seymour Lipschutz, “Data Structures with C (Schaum's Outline Series)”, McGraw Hill Education Private Limited, 2011.

R5. Mark Allen Weiss, “Data structures and Algorithm Analysis in C”, Pearson, Second edition, 2014.

H. LAB PLAN

Lec No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	**Arrays**	Programs based on 1-D array operations	Lab	CC2131.1 CC2131.2 CC2131.3	Internal Evaluation Home Assignments External Evaluation
2.		Programs based on 2-D array operations	Lab	CC2131.1 CC2131.2 CC2131.3	Internal Evaluation Home Assignments External Evaluation
3.		Programs based on 2-D array operations with pointer notations	Lab	CC2131.1 CC2131.2	Internal Evaluation Home Assignments External Evaluation
4.	**Linked List**	Programs to implement singly linked-list list operations	Lab	CC2131.2	Internal Evaluation Home Assignments External Evaluation
5.		Programs to implement Circular Linked list and Doubly linked list operations	Lab	CC2131.2	Internal Evaluation Home Assignments External Evaluation
6.	**Stacks**	Programs to implement stack and its operations	Lab	CC2131.2 CC2131.4	Internal Evaluation Home Assignments External Evaluation
7.		Programs based on implementation of stack	Lab	CC2131.2 CC2131.4	Internal Evaluation Home Assignments External Evaluation
8.	**Queue**	Programs based on implementation of queue and its operations	Lab	CC2131.2 CC2131.4	Internal Evaluation Home Assignments External Evaluation
9.	**Tree**	Programs to implement tree and its operations	Lab	CC2131.2	Internal Evaluation Home Assignments External Evaluation
10.		Programs based on implementation of trees	Lab	CC2131.4	Internal Evaluation Home Assignments External Evaluation
11.	**Graph**	Programs to implement graph and its operations	Lab	CC2131.2	Internal Evaluation Home Assignments External Evaluation

12.		Programs based on implementation of graphs	Lab	CC2131.4	Internal Evaluation Home Assignments External Evaluation
13.	**Sorting and Searching**	Programs to perform sorting using different sorting techniques over data	Lab	CC2131.3 CC2131.4	Internal Evaluation Home Assignments External Evaluation

Course Articulation Matrix: (Mapping of COs with POs)

CO	**STATEMENT**	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC2131.1	Recall basic concepts required to implement data structures.	3											2	3		
CC2131.2	Apply linear and nonlinear data structures to solve a specified problem.	1	2	3									2	2		
CC2131.3	Experiment with various standard techniques for searching and sorting.		3	2									2	3		
CC2131.4	Build various application using appropriate data structure.	1	1	3									3	3		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Signature of CR **Signature of Course Coordinator** **Signature of Course Instructors** **Signature of HOD**

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering

Course Hand-out

Object Oriented Programming Lab | CC 2131 | 1 Credit | 0 0 2 1

Session: Aug 22-Dec 22 | Faculty: Dr Ghanshyam Raghuwanshi | Class: BTech CCE III SEM | Sec: A|B

A. Introduction**:** This course is offered by the Department of IoT and Intelligent Systems. It introduces the basic principles of object-oriented programming. It will cover the basic programming principle of java. It will introduce the concept of classes and objects, Multi-threading, Graphical user interface and Event-driven programming.

B. **Course Outcomes:** At the end of the course, students will be able to:

[IS 2131.1] Apply to compile and execute Java Application using Command Based Interface as well as using Eclipse Tool.

[IS 2131.2] Identify basic programming construct of Java language Learn and implement the concepts of encapsulation and abstraction using class, objects, and interfaces for better programming skills.

[IS 2131.3] Identify and develop different classes based on real-world scenarios.

[IS 2131.4] Analyse and experiment with the different classes to demonstrate polymorphism and inheritance and exception handling model

[IS 2131.5] Apply Multi-threading Model and built classes to demonstrate multi-threading programming.

[IS 2131.6] Visualize a real-world problem in the form of various collaborating classes, event handling, Servlet, AWT, and database connectivity

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C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. Individual and team work: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	20(oracle Academy)+20(continuous Evaluation)+20(Viva)	60
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work at home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction to Java basics; Control statements and arrays; Stacks and lists; Strings; Classes and methods; Inheritance; Packages; Interfaces; Exception handling; Threads; Input/output; Event handling; Applets; Programs involving AWT; Swing; JDBC; Servlet.

F. REFERENCE BOOKS

1. Java: The Complete Reference (9th Edition), By Herbert Schildt, McGraw Hill Education.
2. Balagurusamy E, "Object Oriented Programming with Java", Tata McGraw Hill, 2011.
3. Arnold K, & Gosling J, "The Java Programming Language", 2002.
4. Horstmann CS, "Big Java", Wiley's Interactive Edition, 2015.

G. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1-2	Introduction to IDE and Java Basics	Understand project structure of eclipse and learn how to compile and run java program.	Lecture	CO 1	Continuous Evaluation, Project
3	Reading Inputs and Basics of Class Design	Demonstrate the use of class and Build class to model real world object and their behaviour	Lecture Demonstration	CO 1 and CO 2	Continuous Evaluation, Project
4-5	Packages, Arrays and Vectors in Java Inheritance in Java	Understand polymorphism and experiment with different class to model inheritance	Demonstration	CO 2 and CO 3	Continuous Evaluation, Project
6-7	Exception Handling in Java , String Handling in Java	Analyze different exception classes and experiment with different construct to handle them.	Lecture Demonstration	CO 2 and CO 3	Continuous Evaluation, project
8-9	Multithreading in Java	Illustrate multithreading programming and solve real world problem using multithreading model	Lecture Demonstration	CO 2, CO 3 and CO 4	Continuous Evaluation, project
10-11	Servlet & JDBC database connectivity	Analyze real world scenario and develop client server applications	Lecture Demonstration	CO5	Continuous Evaluation, project
12	Event handling & GUI	Implement program to add GUI in an application along with event handling	Lecture Demonstration	CO5	Continuous Evaluation, project

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	Correlation with Program Outcomes(POs)											
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
[CC 2132.1]	Learn to compile and execute Java Application using Command Based Interface as well as using Eclipse Tool.	1				1							
[CC 2132.2]	Identify basic programming construct of Java language Learn and implement the concepts of encapsulation and abstraction using class, objects and interfaces for better programming skills.	1	1	1		1							
[CC 2132.3]	Identify and develop different classes based on real world scenario.	1	2	2	1	1							
[CC 2132.4]	Analyze and experiment with different class to demonstrate polymorphism and inheritance and exception handling model	1	2	2	1	1							
[CC 2132.5]	Apply Multithreading Model and built classes to demonstrate multi-threading programming.	1	2	2	1	1							
[CC 2132.6]	Visualize a real-world problem in the form of various collaborating classes, event handling, Servlet, AWT, and database connectivity	1	2	1	1	-	-	-	-	1	-	-	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering
Course Hand-out

Value, Ethics & Governance | BB 0025 | 1 Credits | 2 0 0 2

Session: Jan 23 – May 23 | Faculty: Dr Sonal Sidana | Class: BTech IV Semester

A. COURSE INTRODUCTION: This course helps students to improve understanding of values, ethics and governance so that we help them become responsible citizens of the country.

B. COURSE OUTCOMES: At the end of the course, students will be able to
[0025.1] To improve understanding of values, ethics, and corporate governance so that we produce responsible citizens for the larger society.
[0025.2] Define the meaning and relevance of value and ethics and apply in personal and professional life.
[0025.3] Describe the importance of three Gunas for self-development, lifelong learning, and growth.
[0025.4] Explain the relevance of Companies Act 2013 with reference to corporate world.
[0025.5] Find issues and identify solutions related to public and private governance systems.
[0025.6] Demonstrate the social and environmental responsibilities of corporate for sustainability, harmony and growth.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Programme Specific Outcomes:

[PSO.1]. Analyse, design and diagnose automotive systems to improve performance, safety, service and maintenance.

[PSO.2]. Apply knowledge of Electric and Autonomous vehicle technologies for smart mobility.

[PSO.3]. Demonstrate the use of quality tools for internship projects to solve industrial problems.

D. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	20
	Sessional Exam II	20
	In Class Assignments/Quiz	20
End Term Exam (Summative)	End Term Exam	40
	Total	100

E. SYLLABUS

Value: Meaning & Relevance of Value Education. **Mantra for Success**: Meaning & perspective of Values, Morals & Ethics, Determinants of human nature (Three Gunas), Kinds of Value and their relevance with examples. Understanding Harmony at Various Levels, Nature, in existence. **Relevance of Personality traits like** Attitude & Behaviour, Sigmund Freud Theory of Ego, Character, introspection, Motivation. **Leadership traits:** 4Qs (PQ, IQ, EQ, SQ), Professional Ethics, Ethical Conflict, Ethical Dilemmas. **Governance:** Understanding of Public and Private sector Governance systems, **Companies Act 2013:** Its Salient Features, Roles & Responsibilities of Directors & Regulatory Authorities. Public Finance: – Scope, Principals, Role of Audit & Control, Relevance of Ethics in Governance. **Corporate Social Responsibility (CSR):** Meaning, Importance and Responsibility under CSR, CSR Models, Best Practices & Triple Bottom Line concept.

F. TEXTBOOKS

No textbooks for this course/ Recorded video of contents are provided.

G. REFERENCE BOOKS

- Gaur R.R., Sangal R. and. Bagaria, G.P: "A Foundation Course in Human Values Professional Ethics," Excel Books, 2010.
- Sadri S & Sadri, J Business Excellence Through Ethics & Governance, 2nd edition, 2015
- Mathur, U C Corporate Governance and business ethics, MacMillan India Ltd, Latest Edition
- Baxi, C V: Corporate Governance, Excel Books, Latest Edition
- Sadri S, Sinha A K and Bonnerjee, P: Business Ethics: concepts and cases, TMH, Latest Edition

H. LECTURE PLAN:

SESSION NO.	TOPICS	Session Objective	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
Lecture/Video 1	Introduction of the course, Syllabus	To acquaint and clear teacher's expectations and understand student expectations.	Lecture, Presentation	BB0025.1	Mid Term I End Term Exam
Lecture/Video 2	Introduction: Values: Meaning & Relevance of value education	To learn the Basics of Value Education and its relevance.	Lecture, Presentation	BB0025.1	Mid Term I End Term Exam
Lecture /Video 3	Success: Meaning in perspective of morals & ethics	To understand the concept of success achieved with or without morals / ethics/ values.	Lecture, Presentation	BB0025.1	Mid Term I End Term Exam
Lecture/Video 4	Three Gunas and their relevance, Nature, and kinds of value with examples	To understand basic traits in one's personality, its causes and relevance with value-based living.	Lecture, Presentation	BB0025.3	Mid Term I End Term
Lecture/Video 5	Understanding Harmony at Various Levels, Nature, in existence	To acquaint with the concepts of harmony at various levels.	Lecture, Presentation	BB0025.1 BB0025.2	Mid Term I End Term
Lecture/Video 6	Relevance of Personality	To acquaint & develop positive traits of personality in oneself.	Lecture, Presentation	BB0025.3	Mid Term I End Term
Lecture/Video 7	Relevance of Attitude & Behaviour	To acquaint & develop positive traits of personality in oneself.	Lecture, Presentation	BB0025.2	Mid Term I End Term
Lecture/Video 8	Sigmund Freud Theory of Ego	To understand the concepts of theory of ego	Lecture, Presentation	BB0025.3	Mid Term I End Term
Lecture/Video 9	Character, introspection, Motivation	To acquaint & develop positive traits of personality in oneself and understand negative traits.	Lecture, Presentation	BB0025.2	Mid Term I End Term
Lecture/Video 10	Leadership traits	To realize importance of leadership and to imbibe in life.	Lecture, Presentation	BB0025.2	Mid Term I End Term

Lecture/Video 11	4Qs (PQ, IQ, EQ, SQ)	To acquaint with 4Qs.	Lecture, Presentation	BB0025.2	Mid Term I End Term
Lecture/Video 12	Professional Ethics	To understand the role of professional ethics in the life & deal with dilemmas.	Lecture, Presentation	BB0025.1 BB0025.2	Mid Term I End Term Exam
Lecture/Video 13	Ethical Conflict	To understand the importance of ethical conflict.	Lecture, Presentation	BB0025.1 BB0025.2	Mid Term I End Term Exam
Lecture/Video 14	Ethical Dilemmas	To understand the role of professional ethics in the life & deal with dilemmas.	Lecture, Presentation	BB0025.1 BB0025.2	Mid Term I End Term Exam
Lecture/Video 15	Introduction to Governance	To acquaint with the concept of Governance.	Lecture, Presentation	BB0025.5	Mid Term II End Term
Lecture/Video 16	Public Sector Governance: Part I	To understand various aspects of public sector governance.	Lecture, Presentation	BB0025.5	Mid Term II End Term
Lecture/Video 17	Public Sector Governance: Part II	To understand various aspects of public sector governance.	Lecture, Presentation	BB0025.5	Mid Term II End Term
Lecture/Video 18	Companies Act 2013: Roles & Responsibilities of Directors & Regulatory Authorities	To explain various Regulations and practices of Corporate Governance internationally & understand key role of directors.	Lecture, Presentation	BB0025.4	Mid Term II End Term
Lecture/Video 19	Companies Act 2013: Salient Features	To explain various Regulations and practices of Corporate Governance internationally & understand key role of directors.	Lecture, Presentation	BB0025.4	Mid Term II End Term
Lecture/Video 20	Private Sector Governance	To understand meaning of proprietary & partnership in a firm / company and its perspectives.	Lecture, Presentation	BB0025.5	Mid Term II End term
Lecture/Video 21	Public Finance: – Scope & Principals	To understand basics of Public Finance, audit & control.	Lecture, Presentation	BB0025.5	End Term
Lecture/Video 22	Public Finance: - Audit & Control	To understand basics of Public	Lecture, Presentation	BB0025.5	End Term

		Finance, audit & control.			
Lecture/Video 23	Relevance of Ethics in Governance	To recognize the necessity of ethics & transparency in Governance.	Lecture, Presentation	BB0025.1 BB0025.5	End Term
Lecture/Video 24	CSR: Meaning, Importance and Responsibility under CSR	To understand the relevance of giving back to society by a corporate & its importance in society.	Lecture, Presentation	BB0025.6	End Term
Lecture/Video 25	CSR: Models and Best Practices	To understand the various models of CSR used by corporates and their best practices.	Lecture, Presentation	BB0025.6	End Term
Lecture/Video 26	CSR: Policy	To understand CSR policy of India and its impact on Business organisation.	Lecture, Presentation	BB0025.6	End Term
Lecture/Video 27	Triple Bottom Line	To understand the concept of TBL in organizational frameworks.	Lecture, Presentation	BB0025.6	End Term

I. COURSE ARTICULATION MATRIX: (MAPPING OF COS WITH POS)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
BB0025.1	To improve understanding of values, ethics, and corporate governance so that we produce responsible citizens for the larger society.								2	1	1		1			
BB0025.2	Define the meaning and relevance of value and ethics and apply in personal and professional life.								2	1	1		2			
BB0025.3	Describe the importance of three Gunas for self-development, lifelong learning, and growth.								2	1	1		1			
BB0025.4	Explain the relevance of Companies Act 2013 with reference to corporate world.								2	1	1		1			
BB0025.5	Find issues and identify solutions related to public and private governance systems.								2	1	1		1			
BB0025.6	Demonstrate the social and environmental responsibilities of corporate for sustainability, harmony, and growth.								2	2	2	1	1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communications Engineering

Department of Computer and Communications Engineering

Course Hand-out

Engineering Mathematics IV | MA2201| 3 Credits | 2 1 0 3

Session: January 2023– May 2023 | Faculty: Dr Anamika Jain | Class: B.Tech. IV Sem

A. Introduction: This course is offered by Dept. of Mathematics & Statistics as a regular course to make the students acquainted with the subject of probability and statistics at an early stage. Probability and statistics is an important foundation for computer science fields such as machine learning, artificial intelligence, computer graphics, randomized algorithms, image processing, and scientific simulations. In this course, students will expand their knowledge of probabilistic methods and apply them to diverse computational problems. The first part of the course offers in depth knowledge of probability theory (random event, probability, characteristics of random variables, probability distributions and moment generating functions) which is necessary for simulation of random processes. In the second part, sampling theory is discussed. Each concept is explained through various examples and application-oriented problems.

B. Course Outcomes: After completing this course, the students will be able to

[2201.1] Apply the concept of probability and related theorems in solving various real world problems.

[2201.2] Understand the key concept of random variable, its probability distributions including mean, expectation, variance and moments.

[2201.3] Implement the variation and the relation between two random variables by using the concept of correlation.

[2201.4] Comprehend the concept of random sample and its sampling distribution which will enhance the logical & analytical skills.

[2201.5] Apply the statistics for testing the significance of the given large and small sample data by using t-test, F-test and Chi-square test.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PO1. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

PO2. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

PO3. Design/development of solutions: Upon analysing, the B Tech CCE & IOT graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

PO4. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE & IOT graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE & IOT should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

PO9. Individual and team work: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of the B Tech. program, the students will:

PSO1. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

PSO2. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions

PSO3. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	20
	Sessional Exam II	20
	Quizzes and Assignments	20
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before an online class session Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ online classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Basic Set theory, Axioms of probability, Sample space, conditional probability, total probability theorem, Baye's theorem. One dimensional and two-dimensional random variables, mean and variance, properties, Chebyschev's inequality, correlation coefficient, Distributions, Binomial, Poisson, Normal and Chisquare. Functions of random variables: One dimensional and two-dimensional, F & T distributions, Moment generating functions, Sampling theory, Central limit theorem, Point estimation, MLE, Interval estimation, Test of Hypothesis: significance level, certain best tests; Chi square test.

References:

1. P. L. Meyer, Introduction to probability and Statistical Applications, (2e), Oxford and IBH publishing, 1980.
2. Miller, Freund and Johnson, Probability and Statistics for Engineers, (8e), Prentice Hall of India, 2011.
3. Hogg and Craig, Introduction to mathematical statistics, (6e), Pearson Education, 2012.
4. Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, 2010

F. LECTURE PLAN

Lecture Number	Topic	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1	Introduction of the Course	Develop the understanding about the course	Lecture	MA2201.1	
2	Basic Set Theory	Students will get the acquaintance with the basic concept of Set Theory	Lecture	MA2201.1	Quiz, Sessional & End Term Exam.
3	Axioms of Probability	Learn about the basic concept of Probability	Lecture	MA2201.1	Quiz, Sessional & End Term Exam.
4	Conditional Probability	Understand the Conditional Probability	Lecture	MA2201.1	Quiz, Sessional & End Term Exam.
5	Total Probability Theorem	Learn about Total Probability Theorem	Lecture	MA2201.1	Quiz, Sessional & End Term Exam.
6	Bayes Theorem	Learn about Bayes Theorem	Lecture	MA2201.1	Quiz, Sessional & End Term Exam.
7	Tutorial Problem Solving Session	Apply the concepts in real world problems	Tutorial	MA2201.1	Quiz, Sessional & End Term Exam.
8	Random Variable: One Dimensional	Learn about Random Variable	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
9	Classification: Discrete & Continuous Random Variable	Understand the classification of Random Variables	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
10	Mathematical Expectation and Variance	Develop the notion of Mean & variance	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
11	Chebyschevs Inequality	Understand the concept of Chebyschevs Inequality	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
12	Moments & Moment Generating Function (Mean, variance)	Elaborate the concept of Mgf	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
13	Tutorial-Problem Solving Session	Apply the concepts in real world problems	Tutorial	MA2201.2	Quiz, Sessional & End Term Exam.
14	Random variable: Two Dimensional	Elaborate the concept of Random Variable in two dimensions	Lecture	MA2201.3	Quiz, Sessional & End Term Exam.
15	Joint Distribution Function	Get the knowledge of Joint Distribution Function	Lecture	MA2201.3	Quiz, Sessional & End Term Exam.
16	Marginal Distribution & Conditional Distribution	Get the knowledge of Marginal & Conditional Distributions	Lecture	MA2201.3	Quiz, Sessional & End Term Exam.
17	Expectation	Elaborate the concept in two dimensions	Lecture	MA2201.3	Quiz, Sessional & End Term Exam.

18	Functions of Random Variables	Develop the notion of Functions of Random Variables	Lecture	MA2201.3	Quiz, Sessional & End Term Exam.
19	Covariance, Correlation Coefficient (by using expectation)	Understand the concept of Covariance	Lecture	MA2201.3	Quiz, Sessional & End Term Exam.
20	Tutorial-Problem Solving Session	Elaborate the notion of Expectation	Lecture	MA2201.3	Quiz, Sessional & End Term Exam.
21	Probability Distributions: (mean, variance with proof and examples): Binomial Distribution	Get the knowledge of Binomial Distribution	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
22	Poisson Distribution	Get the knowledge of Poisson Distribution	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
23	Normal Distribution	Get the knowledge of Normal Distribution	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
24	Chi-square Distribution	Understand Chi-square Distribution	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
25	t-Distribution	Understand t-Distribution	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
26	F- Distribution	Understand F-Distribution	Lecture	MA2201.2	Quiz, Sessional & End Term Exam.
27-28	Brief overview about Sampling Theory	Develop the concept of Sampling Theory	Lecture	MA2201.4	Quiz, Sessional & End Term Exam.
29	Point Estimation	Understand the concept of estimators	Lecture	MA2201.4	Quiz, Sessional & End Term Exam.
30	MLE (Maximum Likelihood Estimate)	Understand the concept of estimators	Lecture	MA2201.4	Quiz, Sessional & End Term Exam.
31	Central Limit Theorem	Understand the concept of Central Limit Theorem	Tutorial	MA2201.4	Quiz, Sessional & End Term Exam.
32	Interval Estimation	Understand the concept of estimators	Lecture	MA2201.4	Quiz, Sessional & End Term Exam.
33-34	Testing of Hypothesis: Statistical Hypothesis, Null Hypothesis, Alternate Hypothesis & Types of Error	Analyze the Hypothesis	Lecture	MA2201.5	Quiz, Sessional & End Term Exam.
35	Level of Significance & Critical Region	Analyze the Hypothesis	Lecture	MA2201.5	Quiz, Sessional & End Term Exam.
36	Test of Significance based on t-Distribution	Apply the tests of Hypothesis	Lecture	MA2201.5	Quiz, Sessional & End Term Exam.
37	Test of Significance based on F-Distribution	Apply the tests of Hypothesis	Lecture	MA2201.5	Quiz, Sessional & End Term Exam.
38	Chi square Test	Apply the tests of Hypothesis	Lecture	MA2201.5	Quiz, Sessional & End Term Exam.
39	Tutorial-Problem Solving	Apply the concepts in real world problems	Tutorial	MA2201.5	Quiz, Sessional & End Term Exam.

G. COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA2201.1	Apply the concept of probability and related theorems in solving various real world problems.	3	2	1	2	1	2	3	3	2	1	2	1	3	2	1
MA2201.2	Understand the key concept of random variable, its probability distributions including mean, expectation, variance and moments.	3	2	1	2	1	1	3	3	2	1	2	1	3	1	2
MA2201.3	Implement the variation and the relation between two random variables by using the concept of correlation.	3	2	1	2	1	1	3	3	2	1	2	1	3	1	1
MA2201.4	Comprehend the concept of random sample and its sampling distribution which will enhance the logical & analytical skills.	3	2	1	2	1	2	3	3	2	1	2	1	2	2	2
MA2201.5	Apply the statistics for testing the significance of the given large and small sample data by using t-test, F-test and Chi-square test.	3	2	1	2	1	2	3	3	2	1	2	1	3	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering
Course Hand-out

Computer Networks | CC2201 | 4 Credits | 3 1 0 4

Session: Jan 2023 – May 23 | Faculty: Dr. Arjun Singh/Dr. Rajesh Kumar | Class: IV Semester

UNIVERSITY VISION AND MISSION

VISION

Global Leadership in Higher Education and Human Development

MISSION

UM1 Be the Most Preferred University for Innovative and Interdisciplinary Learning

UM2 Foster Academic, Research, and Professional Excellence in all Domains

UM3 Transform Young Minds into Competent Professionals with Good Human Values

DEPARTMENT VISION AND MISSION

VISION

Inculcate academic excellence and research aptitude for global competency and leadership

MISSION

M1- Nurture the technical skillset of students to enable them to create an innovative solution

M2- Sharpen the problem-solving skills through project-based learning.

M3- Serve society by inspiring young minds for research and innovation with ethical values.

A. Introduction: The main objective of this course is to familiarize students with the computer networks of today which are based on the TCP/IP model and its layered structure.

B. **Course Outcomes: At the end of the course, students will be able to**
[2201.1]: Understand the basic concepts of networking which are used in real networking situations.
[2201.2]: Design subnets and calculate the IP addresses to fulfil the network requirements of an organization.
[2201.3]: Analyze, specify and design the topological and routing strategies for an IP-based networking infrastructure.
[2201.4]: Configure the Switches, routers, and gateways based on the organization's need.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. Individual and team work: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close/Open Book)	20
	Sessional Exam II (Close/Open Book)	20
	CWS	10 marks from Introduction to Networks, 10 marks quiz/assignments
End Term Exam (Summative)	End Term Exam (Close/Open Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Studenmiss misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to homework, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

1. Students will be registered for two CISCO networks academy courses: Introduction to Networks and Switching, Routing, and Wireless Essentials (SRWE). Registration is compulsory for every student.
2. CC2230 Computer Networks Lab experiments: for each lab students will be assigned a module from SRWE. Faculty members are advised to conduct the extra lab sessions apart from regular labs to teach the basics of Packet Tracer and make students comfortable with the simulator. If it is required students may use Lab 0111AB, to perform the experiments on CISCO switches and Routers.
3. For CC2201, in CWS marks, out of 20, 10 marks will be awarded based on the performance in "Introduction to Networks". starttarting of each week (Monday), faculty will activate the assignments from the www.netacd.com portal.
4. For CC2230, in CWS marks, out of 60, 30 marks will be awarded from the "SRWE" , the rest 20 marks will be based on mini-project and 10 marks will be awarded for the lab experiments file. After each lab, the faculty will activate the assignments from the www.netacd.com portal.

5. Students need to submit a mini project configured on packet tracer (e.g. simulation and configuration of MUJ network, find out the bottlenecks and proposed solution, or secure the MUJ network/any other organization). The mini-project must be large enough to exhibit the learning of both certificates.
6. CISCO placed MUJ alumni will be invited to motivate and inspire the students.

E. SYLLABUS

Network Layer: network layer design issues, routing algorithms, congestion control algorithms, Quality of Service (QoS), MPLS; Classful addressing, subnetting, classless addressing, variable length blocks, block allocation, NAT; IPV4: header format, fragmentation, options, checksum; ARP & DHCP: introduction, packet format, message types; ICMP: message format, message types; Dynamic routing protocols: RIP, OSPF & BGP, Multicasting Protocol: IGMP; Introduction to IPV6; Transport Layer: elements of transport protocols: addressing, connection establishment, connection release, congestion control, transport services, transport layer protocols, state diagrams; UDP: UDP datagram, UDP services, checksum; TCP: TCP services, TCP features, segment, TCP connection establishment, data transfer, connection termination, TCP window management, flow control, congestion control, timer management; Application Layer: DNS: Name space, domain resource records, Electronic Mail - SMTP, POP, IMAP, MIME, HTTP, HTTPS, SNMP.

F. References:

R1. B. A. Forouzan, TCP/IP Protocol Suite, (5e), McGraw Hill, 2010.
R2. A. S. Tenenbaum, Computer Networks, (7e), Prentice Hall of India, 2016.
R3. D. E. Comer, Internetworking with TCP/IP Principles, Protocols and Architecture, (6e), Pearson Education, 2014.
R4. W. Stallings, Data and Computer Communications, (10e), Pearson Education, 2014.

G. Lecture Plan:

lecture	Topics	Session Outcome	Corresponding CO	Mode of delivery	Mode of Assessing CO
1	Introduction of course	Understanding of course, objectives, evaluation		lecture	
2	Store-and-Forward Packet Switching, Services Provided to the Transport Layer	Understanding of packet switching and services provided to transport layer	2201.1	lecture	Mid Term I, Quiz & End Term
3	Implementation of Connectionless Service, Implementation of ConnectionOriented Service	learn implementation of connectionless and connectionoriented service	2201.1	lecture	Mid Term I, Quiz & End Term

4	Characteristics and Types, The Optimality Principle	Understanding of types and characteristics of routing protocols and optimality principle	2201.2	lecture	Mid Term I, Quiz & End Term
5	Shortest Path Routing, Flooding	Understanding of shortest path routing algorithm	2201.2	lecture	Mid Term I, Quiz & End Term
6	Distance Vector Routing,	Understanding of distance vector routing algorithm	2201.2	lecture	Mid Term I, Quiz & End Term
7	Link State Routing, Hierarchical Routing,	Understanding of link state routing protocol and Hierarchical routing	2201.2	lecture	Mid Term I, Quiz & End Term
8	IP Addresses, Classful addressing, Classless addressing	Knowledge of IP Address	2201.2	lecture	Mid Term I, Quiz & End Term
9	Subnetting	Understanding of need of subnetting	2201.2	lecture	Mid Term I, Quiz & End Term

10	Subnetting	Understanding implementatio of subnetting	2201.2	lecture	Mid Term I, Quiz & End Term
11	CIDR—Classless Interdomain Routing	Understanding of CIDR	2201.3	lecture	Mid Term I, Quiz & End Term
12	NAT—Network Address Translation	Learn Network address translation	2201.3	lecture	Mid Term I, Quiz & End Term
13	DHCP, ARP, RARP	Understanding of network protocols	2201.3	lecture	Mid Term I, Quiz & End Term
14	ICMP, IPV4 header format	Understanding of network protocols	2201.3	lecture	Mid Term I, Quiz & End Term
15	Fragmentation	Learn concept of fragmentation	2201.2	lecture	Mid Term I, Quiz & End Term
16	RIP, OSPF, BGP	Understanding of dynamic routing protocols	2201.2	Flip Class	Mid Term I, Quiz & End Term
17	RIP, OSPF, BGP	Understanding of dynamic routing, protocols	2201.2	Flip Class	Mid Term I, Quiz & End Term

18	General Principles of Congestion Control, Congestion Prevention Policies	Understanding of congestion principles and prevention	2201.1	lecture	Mid Term I, Quiz & End Term
19	Congestion Control in Virtual-Circuit Subnets	Understanding of congestion control in virtu ıl circuit subnets	2201.1	lecture	Mid Term I, Quiz & End Term
20	Congestion Control in Datagram Subnets	Understanding of congestion control in Datagram subnets	2201.1	lecture	Mid Term I, Quiz & End Term
21	Requirements	Understanding of Quality of Service requirements	2201.1	lecture	Mid Term I, Quiz & End Term
22	Techniques for Achieving Good Quality of Service	Understanding of Techniques for achieving good QoS	2201.1	lecture	Mid Term I, Quiz & End Term
23	Techniques for Achieving Good Quality of Service	Understanding of Techniques for achieving good QoS	2201.2	lecture	Mid Term I, Quiz & End Term
	First Sessional Examination				
24	Introduction to Transport Layer, Transport Service Primitives	Understanding of transport layer and service primitives	2201.4	lecture	Mid Term II, Quiz & End Term
25	Elements of Transport Protocols, Addressing,	Understanding of elements of transport protocols	2201.4	lecture	Mid Term II, Quiz & End Term
26	Connection Establishment, Connection Release	Understanding of connection establishment and release process	2201.4	lecture	Mid Term II, Quiz & End Term
27	Flow Control and Buffering	Understanding of flow control and buffering in transport layer	2201.4	lecture	Mid Term II, Quiz & End Term
28	Multiplexing	Understanding of Multiplexing in transport layer	2201.4	Lecture	Mid Term II, Quiz & End Term

29	UDP,UDP Header	Understanding of UDP	2201.4	Lecture	Mid Term II, Quiz & End Term
30	TCP Service Model, TCP Protocol	Understanding of TCP	2201.4	Lecture	Mid Term II, Quiz & End Term
31	TCP Segment Header,	Understanding of TCP segment header	2201.4	Lecture	Mid Term II, Quiz & End Term
32	TCP Connection Establishment, TCP Connection Release	Understanding of TCP connection establishment and release process	2201.4	Lecture	Mid Term II, Quiz & End Term
33	TCP Transmission Policy, Window Management	Understanding of TCP transmission policy and window management	2201.4	Lectur.e	Mid Term II, Quiz & End Term
34	Connection Control	Understanding of Connection control	2201.4	Lecture	Mid Term II, Quiz & End Term
35	Timer Management	Understanding of timer management	2201.4	Lecture	Mid Term II, Quiz & End Term
36	Introduction to Application Layer	Understanding of application layer	2201.1	Lecture	Mid Term II, Quiz & End Term
37	DNS—The Domain Name System	Understanding of DNS	2201.2	Lecture	Mid Term II, Quiz & End Term
38	SMTP, POP	Understanding of email	2201.2	Lecture	Mid Term II, Quiz & End Term
39	IMAP, MIME	understanding of email	2201.2	Lecture	Mid Term II, Quiz & End Term
40	HTTP	Understanding of web and protocol	2201.2	Flip class	Mid Term II, Quiz & End Term
41	HTTPS	Understanding of secure web protocol	2201.2	Flip class	Mid Term II, Quiz & End Term
42	SNMP	Understanding of network management protocol	2201.2	Lecture	Mid Term II, Quiz & End Term

H. Course Articulation Matrix: (Mapping of COs with POs and PSOs)

CO	Statement	Correlation with Program Outcomes and Program Specific Outcome														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CC2201.1	Understand the basic concepts of networking which are used in real networking situations.	2		3		3								3	1	2
CC2201.2	Design subnets and calculate the IP addresses to fulfil the network requirements of an organization			2										1	1	3
CC2201.3	Analyze, specify and design the topological and routing strategies for an IP-based networking infrastructure.					1								1	1	
CC2201.4	Configure the Switches, routers, and gateways based on the organization's need					1								1	1	

1: Low Correlation 2: Moderate Correlation 3: Substantial Correlation

I. **Course Outcome Attainment Level Matrix:**

CO	Statement	ATTAINMENT OF PROGRAM OUTCOMES and PROGRAM SPECFIC OUTCOMES THRESHOLD VALUE: 40%														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CC2201.1	Understand the basic concepts of networking which are used in real networking situations.															
CC2201.2	Design subnets and calculate the IP addresses to fulfil the network requirements of an organization															
CC2201.3	Analyze, specify and design the topological and routing strategies for an IP-based networking infrastructure.															
CC2201.4	Configure the Switches, routers, and gateways based on the organization's need.															

1: Low Correlation 2: Moderate Correlation 3: Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering

Course Hand-out

Relational Database Management Systems | CC2202 | 4 Credits | 3 1 0 4

Session: Jan'23 – May'23| Course Coordinator: Dr. Sourabh Singh Verma | Class: B.Tech 2nd Year / 4th Semester

Faculty: Dr Vijaypal Singh Dhaka

A. Introduction: This course introduces the concepts of Relational Database Management Systems. More emphasis will be given to understanding the internal working of database management systems and development of database application. Database Management System will be taught using MySQL and ERD plus.

B. Course Outcomes: At the end of the course, students will be able to

CC2202.1: Illustrate the advantages of using database management systems over file based systems in an organization with no ambiguity.

CC2202.2: Construct the Entity Relationship Model for a real life application by identifying accurate relationship between different entities, cardinality, mapping and various constraints.

CC2202.3: Solve the queries written in SQL, Relation Algebra, and Relational Calculus for correctly inserting, updating, accessing or deleting the data related to real-life applications.

CC2202.4: Identify the correct normal form of a database by analyzing its' given relations and convert it into a desired normal form.

CC2202.5: Correctly interpret and apply the transaction processing, concurrency control, recovery mechanisms, storage structures and access techniques used in a database.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1] Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2] Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3] Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4] Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5] Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6] The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7] Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8] Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9] Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10] Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11] Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12] Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change Program Specific Outcomes.

[PSO.1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	(1) MOOC/Value Added Course. (2) Two video assignments, and/or assignments related to problem solving(video: case study on ER & Normalization)	10 10
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	

Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.

E. SYLLABUS

Introduction: database systems, RDBMS definition, data models, 3-schema architecture, challenges in building RDBMS, different components of a RDBMS. Relational data model: concept of relation and its characteristics, schema-instance, integrity constraints, E/R Model, Extended E/R model, converting the database specification in E/R and Extended E/R notation to the relational schema; Relational Query Language: relational algebra operators - selection, projection, cross product, various types of joins, division, example queries, tuple relation calculus, domain relational calculus; Introduction to SQL: data definition in SQL, table and different types of constraints definitions, data manipulation in SQL, nested queries, notion of aggregation; Relational Database Design: functional dependencies and normal forms, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, multi-valued dependencies and 4NF; Transaction Processing: concepts of transaction processing, ACID properties, concurrency control, locking based protocols, recovery and logging methods; Data Storage and Indexing: file organizations, primary, secondary index structures, hash-based indexing, dynamic hashing techniques, multi-level indexes, B-tree and B+ trees.

F. Text Books

T1. Avi Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, TMH, New Delhi, 2013

T2. R. Elmasri, S. B. Navathe, “Fundamentals of Database Systems”, Addison & Weisely, New Delhi, 2010

Ramakrishnan, J. Gehrke, Database Management Systems, (3e), McGraw Hill, 2014. 4. I. Bayross, SQL, PL/SQL The Programming Language of Oracle, (4e), BPB Publications, 2010. 5. C. J. Date, An Introduction to Database Systems, (8e), Prentice Hall of India, 2006.

G. Reference Books

R1. Ramakrishnan, J. Gehrke, Database Management Systems, (3e), McGraw Hill, 2014.
R2. Bayross, SQL, PL/SQL The Programming Language of Oracle, (4e), BPB Publications, 2010.
R3. C. J. Date, An Introduction to Database Systems, (8e), Prentice Hall of India, 2006.

H. Lecture Plan: 54 Lectures

Lectures	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Introduction to Data, data processing requirement, desirable characteristics of an ideal data processing system.	Classify, Compare & recall different file based system, Data Model.	PPT, Lecture, Class Notes	CC2202.1	N. A.

2.	Traditional file based system, its drawback, File processing systems versus database management systems.	Compare file systems and DBMS	PPT, Lecture, Class Notes	CC2202.1	Mid Term I, & End Term
3.	Data Models, Schemas and Instances. Categories of Data Models.	Classify and Compare different Data Models.	PPT, Lecture, Class Notes	CC2202.1	Mid Term I, Assignment & End Term
4.	Three Schema Architecture, Data Independence (Logical & Physical).	Classify and Compare various architectures and data independence.	PPT, Lecture, Class Notes	CC2202.1	Mid Term I, Assignment & End Term
5.	Benefits of DBMS. Database system applications, Purpose of database systems, Different database users.	Classify, Compare & recall different file based system, Data Model.	PPT, Lecture, Class Notes	CC2202.1	Mid Term I, Assignment & End Term
6.	Conceptual data model, Conceptual data modelling using E-R data model.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	CC2202.1 & CC2202.2	Mid Term I, Assignment & End Term
7.	Entity Types, Entity Sets, Attributes, Keys and Weak Entity type.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	CC2202.1 & CC22022.2	Mid Term I, Assignment & End Term
8.	Relationship Types, Relationship Sets, Roles, and Structural Constraints.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	CC2202.1 & CC2202.2	Mid Term I, Assignment & End Term
9.	Enhanced EntityRelationship (EER) Model: Subclass, Super classes and Inheritance.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	CC2202.1 & CC2202.2	Mid Term I, Assignment & End Term
10.	Specialization and Generalization, Constraints and characteristics of Specialization and Generalization Hierarchies.	Understand the concepts of generalization and specialization and various constraints associated.	PPT, Lecture, Class Notes	CC2202.1 & CC2202.2	Mid Term I, Assignment & End Term

11.	Relational Model Concepts: Domain, Attributes, Tuples and Relations.	Understand the concepts of relational model	PPT, Lecture, Class Notes	CC2202.1 & CC2202.2	Mid Term I, Assignment & End Term
12.	Relational Model Constraints and Relational Database Schema: Domain Constraints, Key Constraints and Constraints on NULL Values.	Understand and design Entity Relationship Model and illustrate the concept of NULL values.	PPT, Lecture, Class Notes	CC2202.1 & CC2202.2	Mid Term I, Assignment & End Term
13.	Entity Integrity, Referential Integrity and Foreign Keys.	Understand various concepts of key constraints.	PPT, Lecture, Class Notes	CC2202.1 & CC2202.2	Mid Term I, Assignment & End Term
14.	Relational database design using ERtoRelational Mapping.	Understand mapping of ER models into relations	PPT, Lecture, Class Notes	CC2202.1 & CC2202.2	Mid Term I, Assignment & End Term
15.	Mapping EER Model constructs to Relations.	Understand mapping of EER models into relations	PPT, Lecture, Class Notes	CC2202.1 & CC2202.2	Mid Term I, Assignment & End Term
16.	Relational Algebra: Unary Relational Operations SELECT and PROJECT.	Understand unary relational operations like SELECT and PROJECT	PPT, Lecture, Class Notes	CC2202.3	Mid Term I, Assignment & End Term
17.	Sequences of Operations and the RENAME Operation.	Understand the sequences of operations and the RENAME Operation.	PPT, Lecture, Class Notes	CC2202.3	Mid Term I, Assignment & End Term
18.	Relational Algebra Operation from Set Theory: UNION, INTERSECTION, CARTESIAN PRODUCT (CROSS PRODUCT) Operations.	Interpret different Relational Algebra operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CC2202.3	Mid Term I, Assignment & End Term
19.	Binary Relational Operations: JOIN and DIVISION Operation	Interpret JOIN and DIVISON operations and apply the techniques and rules in different problems.	PPT, Lecture, Class Notes	CC2202.3	Mid Term I, Assignment & End Term

20.	Variations of JOIN: THETA JOIN, EQUI JOIN, NATURAL JOIN, INNER JOIN and OUTER JOIN	Interpret different types of JOIN operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CC2202.3	Mid Term I, Assignment & End Term
21.	Additional Relational Operations: Generalized Projection, Aggregate Functions and Grouping.	Interpret additional Relational Algebra operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term
22.	Tuple Relational Calculus: Tuple Variable and Range Relations, Expressions and Formulas in tuple relational calculus.	Interpret different Relational Calculus operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term
23.	The Existential and Universal Quantifiers, Safe Expressions.	Understand existential and universal and existential quantifiers.	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term
24.	Domain Relational Calculus.	Understand concepts of domain relational calculus.	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term
25.	SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema change	Understand fundamentals of SQL	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term
	statements in SQL.				
26.	Basic queries in SQL, More complex SQL queries: Comparisons involving NULL and Three-Valued Logic, Nested Queries, Tuples, and Set/Multiset Comparisons.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term
27.	Correlated Nested Queries, EXISTS and UNIQUE functions in SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term
28.	Joined tables in SQL and Outer Joins, Aggregate functions in SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term

29.	GROUP BY, HAVING Clauses, INSERT, DELETE, AND UPDATE Statements in SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term
30.	Views (Virtual tables) in SQL, Specifying General Constraints as assertion and Triggers, Additional features of SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CC2202.3	Mid Term II, Assignment & End Term
31.	Database Design: Redundant information in tuples and update anomalies, insertion anomalies, deletion anomalies and modification anomalies.	Understand the concepts of different anomalies and how they can be removed	PPT, Lecture, Class Notes	CC2202.4	Mid Term II, Assignment & End Term
32.	Properties of Relational Decompositions: Dependency preservation and Lossless join property of a decomposition.	Understand concepts of relational decompositions	PPT, Lecture, Class Notes	CC2202.4	Mid Term II, Assignment & End Term
33.	Functional Dependencies: Definition of functional dependencies, Inference rules for functional dependencies.	Understand concepts of functional dependencies	PPT, Lecture, Class Notes	CC2202.4	Mid Term II, Assignment & End Term
34.	Equivalence of sets of functional dependencies, Minimal sets of functional dependencies.	Understand the process of finding out equivalence among given sets of FDs and finding out minimal sets of functional dependencies	PPT, Lecture, Class Notes	CC2202.4	Mid Term II, Assignment & End Term
35.	Normal forms based on Primary keys, Normalization of relations, Definition of Super Key and Candidate Key. Definition of Prime and Non-Prime Attribute.	Understand different normalization techniques for optimizing database and analyse database design	PPT, Lecture, Class Notes	CC2202.4	Mid Term II, Assignment & End Term
36.	Normal Forms: First normal form, Second normal form.	Understand 1NF and 2NF	PPT, Lecture, Class Notes	CC2202.4	Mid Term II, Assignment & End Term

37.	Third normal form and Boyce-Codd normal form.	Understand 3NF and BCNF	PPT, Lecture, Class Notes	CC2202.4	Mid Term II, Assignment & End Term
38.	Multivalued dependencies and fourth normal form.	Understand concepts of multivalued dependencies	PPT, Lecture, Class Notes	CC2202.4	Mid Term II, Assignment & End Term
39.	Introduction to transaction processing, Desirable properties of transactions.	Understand and summarize transaction processing	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
40.	Characterizing schedules based on recoverability.	Understand and summarize concepts of recoverability of schedules	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
41.	Characterizing schedules based on Serializability: Serial, Nonserial and conflict serializable schedules.	Understand and summarize concepts of schedules	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
42.	View equivalence and View Serializability.	Understand and summarize concepts of serializability	PPT, Lecture, Class Notes	1402.5	Assignment & End Term
43.	Concurrency control techniques: Two Phase locking Techniques (Binary Lock, Shared/Exclusive Lock).	Understand and summarize concurrency control techniques.	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
44.	Basic 2PL, Strict 2PL, Rigorous 2PL.	Understand the concepts of locking for concurrency control	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
45.	Deadlock prevention protocol (Wait-Die, Wound-Wait), Deadlock detection and starvation.	Understand different strategies of deadlock prevention and detection strategies	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
46.	Concurrency control based on Timestamp Ordering (Basic TO, Strict TO and Thomas's Write Rule.	Understand concurrency control based on timestamp ordering.	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
47.	Granularity of Data items and Multiple Granularity Locking.	Understand concepts of multiple granularity locking	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term

48.	Database Recovery Techniques: Recovery Concepts, Recovery Technique based on Deferred Update.	Understand and summarize recovery techniques.	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
49.	Recovery Technique based on Immediate Update, Recovery Systems Check pointing and Shadow paging.	Understand and summarize recovery techniques.	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
50.	File Storage: File structures (Fixed Length Record, Variable Length Record), Record Blocking and Spanned	Explain different database storage structure and access technique	Lectures, Flipped Classroom	CC2202.5	Assignment & End Term
	versus Un-spanned Records.				
51.	RAID organization and Levels, Hashing Techniques (Internal and External Hashing).	Explain RAID organization and Hashing techniques	Lectures, Flipped Classroom	CC2202.5	Assignment & End Term
52.	Indexing Structure: Single Level ordered indexes (Primary, Clustering, and Secondary).	Explain different indexing techniques	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
53.	Multilevel Indexes, Dynamic multilevel indexes using B-Trees.	Explain different indexing techniques	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term
54.	Dynamic multilevel indexes using B+-Trees.	Explain different indexing techniques	PPT, Lecture, Class Notes	CC2202.5	Assignment & End Term

I. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC2202.1	Illustrate the advantages of using database management systems over file based systems in an organization with no ambiguity.	2												3		
CC2202.2	Construct the Entity Relationship Model for a real life application by identifying accurate relationship between different entities, cardinality, mapping and various constraints.	1	2	3		1			1	1	1		1		3	
CC2202.3	Interpret different query languages SQL, Relation Algebra, calculus and acquire the skill apply the techniques and rules in different real-life problems.	3							1							1
CC2202.4	Identify the correct normal form of a database by analyzing its' given relations and convert it into a desired normal form.	1	2	2	3				1	1	1		1		3	
CC2202.5	Correctly interpret and apply the transaction processing, concurrency control, recovery mechanisms, storage structures and access techniques used in a database.	3							1					2	1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

J. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES THRESHOLD VALUE: 40%												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC2202.1	Illustrate the advantages of using database management systems over file based systems in an organization with no ambiguity.															
CC2202.2	Construct the Entity Relationship Model for a real life application by identifying accurate relationship between different entities, cardinality, mapping and various constraints.															
CC2202.3	Interpret different query languages SQL, Relation Algebra, calculus and acquire the skill apply the techniques and rules in different real-life problems.															
CC2202.4	Identify the correct normal form of a database by analyzing its' given relations and convert it into a desired normal form.															
CC2202.5	Correctly interpret and apply the transaction processing, concurrency control, recovery mechanisms, storage structures and access techniques used in a database.															

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY
JAIPUR

SCHOOL OF COMPUTER & COMMUNICATION ENGINEERING

DEPARTMENT COMPUTER & COMMUNICATION ENGINEERING
COURSE HAND-OUT
Computer Networks Lab| CC2230| 1 Credit | 0 0 2 1

Session: Jan 2023– May 2023 | Faculty: Dr. Arjun Singh/Dr. Rajesh Kumar| Class: IV Semester

A. Introduction:

To familiarize the students with the fundamental concepts of networking, connecting devices, implementation of routing, virtual LAN, NAT, DHCP, socket programming and network utilities.

B. Course Outcomes: At the end of the course, students will be able to

[CC2230.1]:	Identify the basic factors that driving the need of networking and understanding the uses s of packet tracer.
[CC2230.2]:	Configuration and simulation of various topologies e.g. star, ring and Mess.
[CC2230.3]:	Identify the suitable routing algorithm and configuration of protocol using packet tracer.
[CC2230.4]:	Configuration of NAT protocol and VLAN on packet tracer.

C PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. **Engineering knowledge**: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. **Design/development of solutions**: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. **Conduct investigations of complex problems**: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by

the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.**9]. Individual and teamwork**: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. **Communication**: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Received the marks from Netacad courses. Students need to submit a mini project configured on packet tracer (e.g. simulation and configuration of MUJ network, find out the bottlenecks and proposed	60 out of 60, 20 marks will be awarded from the "SRWE" and the rest 20 marks will be based on a mini-project and 10 marks will be awarded for the lab experiments file. After each lab, the faculty will

	solution, or secure the MUJ network/any other organization). The mini-project must be large enough to exhibit the learning of both certificates.	activate the assignments from the www.netacd.com portal. 10 marks quiz.
End Term Exam (Summative)	End Term (Final Exam+VIVA)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

Experiment with Packet Tracer: Introduction to Packet tracer and networking device components; Router Mode, Switch/Router basic commands; designing of star topology using HUB and Switch, IP configuration of end devices; configuring DHCP server, static routing, RIP, OSPF, VLAN and NAT; Network programming: Transmission Control Protocol (TCP) socket and User Datagram Protocol (UDP) socket; Network Utilities: PING, NETSTAT, IPCONFIG, IFCONFIG, ARP, TRACE-ROUTE

F. REFERENCES

R1. A S Tanenbaum,"Computer Networks", 5th Edition, Pearson, 2010.
R2. B.A. Forouzan, "TCP/IP Protocol Suite", 4th Edition, TMH, 2010.
R3. Netacd.com

G . Lab Plan

Lab No.	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1	Introduction to Packet tracer and networking device components. Router Mode, Switch/Router basic commands.	Understand and troubleshoot packet tracer, types of interface and networking devices. Identify and configuration of various router and switch modes	Demonstration at system	CC2230.1	Continuous Evaluation End Term Examination
2	Star Topology using HUB and Switch, IP configuration of end devices, show command, copy command, password setting, hostname setting	Configuration of various topology and troubleshooting.	Lecture Demonstration at system	CC2230.2	Continuous Evaluation End Term Examination
3	DHCP configuration	Configuration of DHCP protocol.	Lecture Demonstration at system	CC2230.3	Continuous Evaluation End Term Examination
4	Configuration of Static Routing Protocol Configuration of RIPv1 and RIPv2. Configuration of OSPF and troubleshooting	implementation of static and dynamic routing protocols	Lecture Demonstration at system	CC2230.3	Continuous Evaluation End Term Examination
5-8	Configuration of VLAN and troubleshooting	Configuration of VLAN and troubleshooting	Demonstration at system	CC2230.3	Continuous Evaluation End Term Examination
9	NAT Protocol Configuration and troubleshooting	Configuration of NAT protocol	Demonstration at system	CC2230.4	Continuous Evaluation End Term Examination
10,	Network Utilities- Ping, Netstat, Ipconfig, Arp, Trace-route	Use of different network utilities to manage the networks.	Demonstration at system	CC2230.4	Continuous Evaluation End Term Examination

11-12	Security and WLANs	Implement the security on switches and routers	Demonstration at system	CC2230.4	Continuous Evaluation End Term Examination

Each week student need to complete one module in CISCO network academy portal.

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC2230.1]:	Identify the basic factors that driving the need of networking and understanding the uses s of packet tracer.	1	1	2	2	1	1		1	1		1		1	1	
[CC2230.2]:	Configuration and simulation of various topologies e.g. star, ring and star.	1	1	1										1		
[CC2230.3]:	Identify the suitable routing algorithm and configuration of protocol using packet tracer.	1	1	1										1		
[CC2230.4]:	Configuration of NAT protocol and VLAN on packet tracer.	1		1					1	1	1	1		1		

I. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**														
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC2230.1]:	Identify the basic factors that driving the need of networking and understanding the uses s of packet tracer.															

[CC2230.2]:	Configuration and simulation of various topologies e.g. star, ring and star.															
[CC2230.3]:	Identify the suitable routing algorithm and configuration of protocol using packet tracer.															
[CC2230.4]:	Configuration of NAT protocol and VLAN on packet tracer.															

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering
Course Hand-out

Relational Database Management Systems Lab | CC 2231 | 1 Credits | 0 0 2 1

Session: Jan'23 – May'23 | Course Coordinator: Dr. Sourabh Singh Verma | Class: B.Tech 2nd Year / 4th Semester

Faculty: Mr. Monu

A. Introduction: To familiarize the students with the fundamental concepts, techniques and tools of Relational DBMS. Participation in this course will enable students to better use Database in many application areas and will prepare them to take advanced courses in more specific areas of Database.

B. Course Outcomes: At the end of the course, students will be able to

CC2231.1: Construct the ER, and EER diagrams for a given scenario with correct identification of entities, attributes and relations among different entities.

CC2231.2: Write the queries to build a database, insert, update, delete, transfer, secure, and manage the data in a database, with no anomaly.

CC2231.3: Use different types of triggers in a given database and to create a hypothetical situation to undo the changes in a table.

CC2231.4: Demonstrate the role of stored procedures and transactions with no ambiguity in a database built for a real life application.

C PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1] Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2] Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3] Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4] Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5] Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6] The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7] Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8] Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9] Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10] Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11] Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12] Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change Program Specific Outcomes.

[PSO.1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous evaluation: Viva and demonstration of experiments done in each lab, and/or lab assignments	40
	Lab project (Synopsis and report + constraints + data entry and query writing + GUI design)	5 + 5 + 5 + 5 = 20
End Term Exam (Summative)	End Term Exam (CLOSED BOOK)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

DB application development with MS Access, Experiments on DDL and Basic SQL, Advanced SQL, ER diagrams using DIA tool, Data Integrity Constraints and Built-in Functions, Design and Implementing the data requirements of a simple DB application, Experiments on Basic PL/SQL, PL/SQL Exceptions and Transactions, PL/SQL Cursors, PL/SQL Procedures, Functions and Packages, DB application development with Java as front end

F. Text Books

T1. Avi Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, TMH, New Delhi, 2006

T2. R. Elmasri, S. B. Navathe, “Fundamentals of Database Systems”, Addison & Weisely, New Delhi, 2008

G. Reference Books

R1. “Teach yourself SQL & PL/SQL using Oracle 8i & 9i with SQLJ”, Ivan Bayross, BPB Publications, 2010

R2. Avi Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, TMH, New Delhi, 2006

G. Lecture Plan

Lab No.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	• Introduction to basic DDL, DML and DCL commands and domain types in SQL. • DDL statements to create, drop, alter, view and rename the Database.	• Understand basic concepts of DDL, DML and DCL • Demonstrate working of various DDL statements	Lecture Demonstration at system	CC2231.1	Continuous Evaluation, End Term Examination
2	• Write DML statements to insert the values into the tables. Use variants to insert values such as insert multiple records and insert records resulting from a select query. • Write statements to add and delete a column in a table which is preexistent. • Write DML statements to update a table for single and multiple field updation. • Write DML statements to delete single or multiple record(s) from a table.	• Demonstrate working of various DML statements	Lecture Demonstration at system	CC2231.2	Continuous Evaluation, End Term Examination

3-4	• Add primary key constraint to a preexistent table. • Add NOT NULL / UNIQUE constraint to a pre-existent column. • Define the foreign key constraint. Show the errors returned by Database when: • a) FK constraint is violated • b) A referenced item is deleted	• Understand use of different types of constraints	Lecture Demonstration at system	CC2231.1 CC2231.2	Continuous Evaluation, End Term Examination

	• Define and demonstrate cascading effect in foreign key referenced tables. • Define, add and drop the check/default constraint. • Define auto increment arguments/attributes of a table.				
5-6	• Practice SELECT query with following options: Distinct, order by, between, top/max/min and other aggregation keywords, group by, having, wild card matching, exists • Nested subqueries	Demonstrate nested subqueries and different DML statements	Lecture Demonstration at system	CC2231.3	Continuous Evaluation, Project, End Term Examination
7-8	• Write a query to create INNER JOIN / LEFT JOIN / RIGHT JOIN / FULL JOIN in two tables.	Demonstrate different JOIN operations	Lecture Demonstration at system	CC2231.3	Continuous Evaluation, Project, End Term Examination

9	• Write a query to create/delete VIEW from two tables including some selection criteria. • Write a query to create and delete clustered/non-clustered index for a table.	Demonstrate the use of VIEW and indexing	Lecture Demonstration at system	CC2231.3	Continuous Evaluation, Project, End Term Examination
10-11	• To implement the concept of trigger in database: How to apply database triggers Types of database triggers Create/delete database triggers	Demonstrate use of TRIGGERS	Lecture Demonstration at system	CC2231.3	Continuous Evaluation, Project, End Term Examination
	Create trigger to demonstrate magic tables (INSERTED and DELETED). Create a hypothetical situation to undo the changes in a table via Trigger (Max credit limit reached/ Balance insufficient etc.).				
12-13	• Write some stored procedures to cover the following problems: Demonstrate Control structures Swap two numbers Find the sum of digits Calculate grades etc. • Define Transaction, demonstrate the Commit and Rollback operations using hypothetical situations.	Demonstrate stored procedures and transaction	Lecture Demonstration at system	CC2231.4	Continuous Evaluation, Project, End Term Examination

H Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC2231.1]:	Construct the ER, and EER diagrams for a given scenario with correct identification of entities, attributes and relations among different entities.	1	1	3	2	3			1	1	1	1	1	1	3	
[CC2231.2]:	Write the queries to build a database, insert, update, delete, transfer, secure, and manage the data in a database, with no anomaly.	1	2	3		3			1	1	1	1	1	1	3	
[CC2231.3]:	Use different types of triggers in a given database and to create a hypothetical situation to undo the changes in a table.	1			2	3			1	1	1	1	1	1	2	
[CC2231.4]:	Demonstrate the role of stored procedures and transactions with no ambiguity in a database built for a real life application.	1			2	3			1	1	1	1	1	1	3	2

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

J. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES THRESHOLD VALUE: 40%												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC2231.1]:	Construct the ER, and EER diagrams for a given scenario with correct identification of entities, attributes and relations among different entities.															
[CC2231.2]:	Write the queries to build a database, insert, update, delete, transfer, secure, and manage the data in a database, with no anomaly.															
[CC2231.3]:	Use different types of triggers in a given database and to create a hypothetical situation to undo the changes in a table.															
[CC2231.4]:	Demonstrate the role of stored procedures and transactions with no ambiguity in a database built for a real life application.															
[CC2231.1]:	Construct the ER, and EER diagrams for a given scenario with correct identification of entities, attributes and relations among different entities.															

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Operating Systems Lab | CC 2232 1 Credit | 0 0 2 1

Session: Jan 23-May 23 | Class: B. Tech. IV SEM

Dr. Renu Kumawat| Mr. Vivek Sharma

A. Introduction: The objective of this lab is to provide students practical knowledge of Unix Commands, various scheduling page replacement and deadlock handling algorithms and to familiarize the students with the fundamental concepts, techniques and implementation details of operating systems. Participation in this course will enable students to compare the working behaviour and functions of different operating systems.

B. Course Outcomes: At the end of the course, students will be able to:

[CC 2232.1]: Explain basic Unix commands and write shell Scripts.
[CC 2232.2]: Build Skills to develop system programs using file and process system calls.
[CC 2232.3]: Compare various algorithms used for process scheduling.
[CC 2232.4]: Describe concepts related to concurrency and achieve the same for cooperating processes, apply various deadlock handling strategies to solve resource allocation problems.
[CC 2232.5]: Evaluate the performance of different memory management techniques and page replacement algorithms.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analysing, the graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech IT graduate should be able to apply reasoning informed by the contextual knowledge to assess societal,

health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus, a B Tech IT should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. Individual and teamwork: United we grow, divided we fall is a culture at MUJ. Thus, an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous evaluation (Record + Execution + Viva)	50
	Lab project	10
End Term Exam (Summative)	End Term Exam (CLOSED BOOK)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

Testing the use of UNIX commands, UNIX shell commands, Basics of Shell Programming, UNIX System Calls, CPU Scheduling Algorithms, Deadlock Detection Algorithms, Deadlock Avoidance Algorithms, Page Replacement Algorithms, Memory Allocation Algorithms, Disk Scheduling Algorithms, and UNIX Inter Process Communication

TEXT BOOKS

T1. S. Das, "*Unix Concepts and Applications*", 4th Edition, Tata McGraw-Hill, 2017.
T2. A. Silberschatz, P. B. Galvin and G. Gagne, *"Operating System Concepts"*, 9th Edition, Wiley, 2014.

REFERENCE BOOKS

R1. R. Blum, and C. Bresnahan, *"Linux Command Line and Shell Scripting Bible"*, 3rd Edition, Wiley, 2015.
R2. Maurice J. Bach, "*The Design of the UNIX Operating System*", Pearson Education.

F. Lecture Plan

Lab No.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1-3	**Introduction- Linux Operating System, Unix Commands and Shell Scripts**	Define basic terminology related to OS. List and demonstrate various basic Unix and shell script commands. Illustrate use of Unix and Shell scripts commands in writing shell scripts.	Lecture Demonstration at system	**CC 2232.1**	Continuous Evaluation End Term Examination
4	**System Calls**	Program writing using file system related system calls.	Lecture Demonstration at system	**CC 2232.2**	Continuous Evaluation End Term Examination
5-6	**Process Control**	Illustrate process creation and its termination. (Using fork and kill) Illustrate Inter-Process communication using pipes. Illustrate Zombie and Orphan Process.	Lecture Demonstration at system	**CC 2232.2**	Continuous Evaluation End Term Examination
7	**Thread**	Implementation of concept of Multi-Threading using PThread in Linux OS.	Lecture Demonstration at system	**CC 2232.2**	Continuous Evaluation End Term Examination
8	**Process Scheduling**	Apply knowledge of CPU scheduling algorithms in Implementing various CPU Scheduling Algorithms viz. FCFS, SJF, Priority and Round Robin.	Lecture Demonstration at system	**CC 2232.3**	Continuous Evaluation End Term Examination
9-10	**Process Synchronization**	Implementation of Producer-Consumer, Reader-Writer Synchronization Problems using Semaphores	Lecture Demonstration at system	**CC 2232.4**	Continuous Evaluation End Term Examination
11	**Deadlock**	Apply Bankers Algorithm for Deadlock Avoidance.	Lecture Demonstration at system	**CC 2232.4**	Continuous Evaluation End Term Examination
12-13	**Memory Management Policies**	Illustration of Page Replacement Algorithms: FIFO, Optimal and LRU Illustration of memory allocation strategies: First Fit, Best Fit, Next Fit and Worst Fit	Lecture Demonstration at system	**CC 2232.5**	Continuous Evaluation End Term Examination

G. Course Articulation Matrix: (Mapping of COs with POs):

CO	STATEMENT	Correlation with program outcomes												Correlation with program specific outcomes		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC 2232.1]:	Explain basic Unix commands and write shell Scripts.	**1**	**1**	**2**	**2**	**1**	**1**		**1**	**1**		**1**		**1**	**1**	**1**
[CC 2232.2]:	Build skills to develop system programs using file and process system calls and PThread API.	**1**	**1**	**1**										**1**		
[CC 2232.3]:	Compare various algorithms used for process scheduling.	**1**	**1**	**1**										**1**		
[CC 2232.4]:	Describe concepts related to concurrency and achieve the same for cooperating processes, apply various deadlock handling strategies to solve resource allocation problems.	**1**		**1**					**1**	**1**	**1**	**1**		**1**	**1**	
[CC 2232.5]:	Evaluate the performance of different memory management techniques and page replacement algorithms.	**1**	**1**	**2**	**1**	**1**				**1**		**1**		**1**		

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Operating Systems Lab | CC 2232 1 Credit | 0 0 2 1

Session: Jan 23-May 23 | Class: B. Tech. IV SEM

Dr. Renu Kumawat| Mr. Vivek Sharma

A. Introduction: The objective of this lab is to provide students practical knowledge of Unix Commands, various scheduling page replacement and deadlock handling algorithms and to familiarize the students with the fundamental concepts, techniques and implementation details of operating systems. Participation in this course will enable students to compare the working behaviour and functions of different operating systems.

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[CC 2232.4]: Describe concepts related to concurrency and achieve the same for cooperating processes, apply various deadlock handling strategies to solve resource allocation problems.
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C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

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D. ASSESSMENT PLAN:

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Internal Assessment (Summative)	Continuous evaluation (Record + Execution + Viva)	50
	Lab project	10
End Term Exam (Summative)	End Term Exam (CLOSED BOOK)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

Testing the use of UNIX commands; Working with VI editor; Shell: UNIX shell commands, System Administration: user management, security, file management; Inter-process communication: shared memory, message passing, pipes; UNIX system calls: system calls for process management, file management; Process synchronization: bounded buffer problem, Peterson's solution, semaphore; Building multi-threaded and multi-process applications: multithreading using pthread library; CPU scheduling algorithms; Deadlock: detection algorithms, deadlock avoidance algorithms; Page replacement algorithms; Memory allocation algorithms;

Disk scheduling algorithms.

TEXT BOOKS

T1. S. Das, "*Unix Concepts and Applications*", 4th Edition, Tata McGraw-Hill, 2017.
T2. A. Silberschatz, P. B. Galvin and G. Gagne, *"Operating System Concepts"*, 9th Edition, Wiley, 2014.

REFERENCE BOOKS

R1. R. Blum, and C. Bresnahan, *"Linux Command Line and Shell Scripting Bible"*, 3rd Edition, Wiley, 2015.
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F. Lecture Plan

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9-10	**Process Synchronization**	Implementation of Producer-Consumer, Reader-Writer Synchronization Problems using Semaphores	Lecture Demonstration at system	**CC 2232.4**	Continuous Evaluation End Term Examination
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G. Course Articulation Matrix: (Mapping of COs with POs):

CO	STATEMENT	Correlation with program outcomes												Correlation with program specific outcomes		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC 2232.1]:	Explain basic Unix commands and write shell Scripts.	**1**	**1**	**2**	**2**	**1**	**1**		**1**	**1**		**1**		**1**	**1**	**1**
[CC 2232.2]:	Build skills to develop system programs using file and process system calls and PThread API.	**1**	**1**	**1**										**1**		
[CC 2232.3]:	Compare various algorithms used for process scheduling.	**1**	**1**	**1**										**1**		
[CC 2232.4]:	Describe concepts related to concurrency and achieve the same for cooperating processes, apply various deadlock handling strategies to solve resource allocation problems.	**1**		**1**					**1**	**1**	**1**	**1**		**1**	**1**	
[CC 2232.5]:	Evaluate the performance of different memory management techniques and page replacement algorithms.	**1**	**1**	**2**	**1**	**1**				**1**		**1**		**1**		

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

SCHOOL OF COMPUTER AND COMMUNICATION ENGINEERING

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGG

Course Hand-out

Software Engineering | CC3101 | 4 Credits | 4 0 0 4

Session: Aug 22 - Nov 22 | Faculty: Prof. Dinesh Kumar Saini, Ms. Somya Goyal and Ms. Kundu | Class V SEM

INTRODUCTION: This course is offered by the Department of computer and communication engineering as elective subject for the students to familiarize students with the concepts, steps and building block of software engineering.it also provides knowledge about basic working of the organization, importance of requirement engineering. It helps them to analyses the requirement and create proper design document with the help of tools. The course also deals with testing to check whether software meets the requirements and also to estimate cost to build the software

A. COURSE OUTCOMES: At the end of the course, students will be able to:

[CC 3101.1] The basic knowledge and concept of Software Engineering and importance of requirement engineering to solve the real time problems
[CC 3101.2] Use of tools and utilities to create proper design document and also to check the quality of code.
[CC 3101.3] Design and develop the software based on the requirements.
[CC 3101.4] Identifying and applying appropriate technique to solve the real time problems.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem Analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyses complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analyzing, the B. Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice**.**

D. ASSESSMENT PLAN:

Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	Sessional Examination I (closed book)	20
	Sessional Examination II (Closed Book)	20
	QUIZ, Video Assignment, MOOC Certification	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	**100**
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

Software Engineering: introduction, importance, evaluation, characteristics, and components. Software applications; Software development process models: waterfall model, prototyping model, spiral model, RAD model; agile modelling; Requirement engineering: problem analysis, requirement verification, requirement validation modularity; Software project management: cost estimation, project scheduling, risk management, quality assurance, project monitoring. Estimation techniques: size estimation- LOC estimation, function count, cost estimation, Halstead size estimation, Software design: analysis modeling, functional modeling, behavioral modeling; unified modeling language; Software architecture; Data design: data modeling, data structures; Software testing: white box (unit and integration), black box (system level, egression); Software maintenance: maintenances characteristics, maintainability, maintenances tasks, maintenances side effects; Current trends in software engineering

F. REFERENCE BOOKS

1. R. S. Pressman, “Software Engineering: A Practitioners Approach”, McGraw Hill,2015.
2. K.K. Aggarwal and Y. Singh, “Software Engineering”, New Age International Publishers, 2008
3. P. Jalote, “Software Engineering”, Wiley, 2010
4. I. Sommerville, “Software Engineering”, Addison Wesley, 2013

G. LECTURE PLAN

SN	TOPICS	SESSION OUTCOME	MODE OF DELIVERY	CORRESPONDING CO	MODE OF ASSESING THE OUTCOME
1-4	Introduction: Defining Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences From Conventional Engineering Processes, Software quality attributes	Identify the need of Software Engineering, Software Crisis and Software Quality Attributes	Lecture	CC3101.1	Quiz
5-10	Software Development Life Cycle (SDLC) Models: Water Fall Model, Evolutionary model Prototype Model, Spiral Model, Iterative Enhancement , Component based model ,RAD (rapid application development),Agile model.	To identify & apply the Software model for the appropriate Project	Lecture	CC3101.1	Quiz MTE 1,2 End semester
11-15	Models Basic Concept of Software Requirement Specifications (SRS):Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Documents	Identify the importance and relevance of Requirement Analysis To Draw the different diagrams which will lead to Design Development	Lecture	CC3101.1 CC3101.2 CC3101.3 CC3101.4	Quiz MTE1,2 End sem
16-18	Software Quality Assurance (SQA): Verification and Validation	Identify and apply the Quality Assurance	Lecture	CC3101.1 CC3101.2 CC3101.3 CC3101.4	Quiz MTE1,2 End sem
19-25	Basic Concept of Software Design: Architectural Design, Low Level Design Modularization, Coherence & coupling, Design Structure Charts, Pseudo Codes, Flow Chart. UML Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Design patterns, General process to be followed for quality of code understanding MVC architecture	Identify , Apply the design to the real time Application Project	Lecture	CC3101.1 CC3101.2 CC3101.3 CC3101.4	Quiz MTE2 End sem

26-30	Cost estimation: Product Metric and different estimation technique based on Functional Point, Loc and calculation time and cost based on size using COCOMO model.	To Calculate the Cost incurred to develop the software and their techniques	Lecture	CC3101.1 CC3101.2 CC3101.3	Quiz MTE2 End sem
31-36	Software Testing: Testing Objectives, Unit Testing, integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top Down and Bottom Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code inspection, Compliance with Design and Coding Standards.	Apply testing techniques and identify the bugs and importance of testing phase	Lecture	CC3101.1 CC3101.2 CC3101.3 CC3101.4	Quiz MTE2 End sem
37-41	Software Configuration Management: An SCM Scenario, Elements of a Configuration Management System, Baselines, Software Configuration, SCM Repository, SCM Process, Configuration Audit	Identify the need of Software Configuration and management	Lecture	CC3101.1 CC3101.3 CC3101.4	Quiz End sem
42-46	Software Maintenance: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance	To apply the techniques for Software Maintenance	Lecture	CC3101.1 CC3101.3 CC3101.4	Quiz End sem

H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO1 2	PS01	PS02	PSO3
[CC3101.1]	The basic knowledge and concept of Software Engineering and importance of requirement engineering to solve the real time problems	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1
[CC3101.2]	Usage of tools and utilities to create proper design document and also to check the quality of code.		1	1	1	1										
[CC3101.3]	Design and develop the software based on the requirements		2	2	2	1	1	1	1	1	1	2	2	2	1	1
[CC3101.4]	Identifying and applying appropriate technique to solve real time problems	2	2	2	1	1	1	1	1	1	2	2	2	1	1	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Updated COURSE OUTCOMES: At the end of the course, students will be able to:

[CC 3101.1] Enumerate and Define the concept of Software Engineering and importance of requirement engineering to solve the real time problems
[CC 3101.2] Demonstrate the Use of tools and utilities to create proper design document and also to check the quality of code.
[CC 3101.3] Design and develop the software based on the requirements.
[CC 3101.4] Identifying and applying appropriate technique to solve the real time problems.

All the CO's are updated after the OBE workshop and course learning and its mapping is confirmed.

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering

Course Hand-out

Design and Analysis of Algorithms | CC 3102 | 4 Credits | 3 1 0 4

Session: Aug'22 – Nov'22 | Couíse Cooídinatoí: Dí Geeta Rani | Class: 3nd Yeaí / 5th Semesteí

Faculty: 1. Dr. Geeta Rani, 2. Dí. Suman Bhakaí 3. Dí Amit Chauíasia

A. Introduction: This course aims to discuss techniques for designing efficient algorithms and to measure their complexity and performance. The course is intended to provide the students the experience in program algorithm design and to emphasize both the practical as well as the mathematical aspects of program efficiency including the mentioned points.

(i) Analyse the asymptotic performance of the designed algorithms.
(ii) Write correctness proofs for algorithms.
(iii) Demonstrate a familiarity with major algorithms and data structures.
(iv) Apply important algorithmic design paradigms and methods of analysis.
(v) Demonstrate efficient algorithms in common engineering design situations.

B. Course Outcomes: After completion of this course student will be able to:

[CS3102.1] Analyse the running times of algorithms using asymptotic analysis.
[CS3102.2] Demonstrate and Design algorithms using divide-and-conquer paradigm to solve business problems hence enhance skills.
[**CS3102.3]** Illustrate the concept of greedy and dynamic-programming approach to solve real life problems to enhance entrepreneurship capabilities.
[CS3102.4] Demonstrate the concept of backtracking and branch & bound algorithms.
[**CS3102.5]** Synthesize and analyse various advanced algorithms concept such as graphs, string matching, approximation algorithms and complexity classes to enhance employability.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1] **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2] **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3] **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4] **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5] **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6] **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7] **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8] **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9] **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10] **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11] Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12] Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change Program Specific Outcomes.

[PSO1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Rubrics:

Criteria	Description	Date	Maximum Marks
Internal Assessment (Summative)	MTE I	As per Academic Calendar	20
	MTE II	As per Academic Calendar	20
	Video Assignments	Two	10
	MOOC Course	One	8
	Implementation Assignment	Lect 39 (Sudoku)	2
End Term Exam (Summative)	End Term Exam	As per Academic Calendar	40
	Total		100

Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.

Make-up Policy: As per University Norms

Chamber Consultation: online/offline as per Instructor

Notice: Via email/ Teams/WhatsApp (Use University Microsoft Account) **Consultancy**

Hours: To be Announced later

E. Syllabus:

Algorithm Analysis: A priori and a posteriori Analysis, Time Space Trade-off, Asymptotic Notations, Properties of asymptotic notations, Recurrence equations, Solving recurrence equations using Substitution method and Master's method; **Divide and Conquer:** Binary Search, Finding Maximum and Minimum, Merge Sort, Quick Sort, Matrix Multiplication; **Greedy Algorithms:** Knapsack Problem, Job Sequencing with deadline, Optimal Merge Pattern, Single Source Shortest Path, Minimum Cost Spanning tree; **Dynamic Programming:** Multistage Graphs, Matrix Chain Multiplication, All-Pair shortest paths, Optimal binary search trees, 0/1 Knapsack, Travelling salesperson problem, Graph Traversals, Connected Components, Spanning Trees, Bi-connected components; **Complexity Classes**: Introduction to NP-Hard and NP-Completeness; **Approximation Algorithm & Randomized Algorithm.**

Pre-requisite(s): Programming in C [CS 1101] and Data Structures [CS 1301]

F. Text Books

T1. E. Horowitz, S. Sahni and S. Rajasekaran, *"Computer Algorithms"*, 2nd Edition, University Press, 2007.

T2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, *"Introduction to Algorithms*", 3rd Edition, MIT press, 2009.

G. Reference Books

R1. V. Aho, J. E. Hopcroft and J. D. Ullman, "*The Design and Analysis of Computer Algorithms"*, 1st Edition, Pearson Education, 1999.

H. Lecture Plan:

Lec. No.	TOPICS	Session Outcomes	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1.	Introduction to Algorithms, Specification of Algorithm, Complexity	Analyse growth of function	Slides / Black Board	3102.1	Video Assignment and MTE-1 and End-Sem
2.	Asymptotic Notation-Analysis of Algorithm,	Analyse running times of algorithms using asymptotic analysis	Slides / Black Board	3102.1	and MTE-1 and End-Sem
3.	Time & Space Complexity – Hands-on	Analyse running times of algorithms using asymptotic analysis	Slides / Black Board	3102.1	Video Assignment and MTE-1 and End-Sem
4.	Insertion Sort and Analysis, QA-Discussions	Analyse running times of algorithms using asymptotic analysis	Slides / Black Board	3102.1	Video Assignment and MTE-1 and End-Sem
5.	Selection Sort and Bubble Sort Analysis, QA-Discussions	Analyse running times of algorithms using asymptotic analysis	Slides / Black Board	3102.1	MTE-1 and End-Sem
6.	Divide and Conquer: Merge Sort and Analysis, QA-Discussions	Describe the divide-andconquer paradigm and explain when an algorithmic design situation calls for it	Slides / Black Board	3102.2	MTE-1 and End-Sem

7.	Quick Sort and Analysis,	Analyse algorithm using Recurrence relation	Slides / Black Board	3102.2	MTE-1 and End-Sem
8.	Master Theorem and its cases	Analyse algorithm using Recurrence relation	Slides / Black Board	3102.2	Video Assignment and MTE-1 and End-Sem
9.	Randomized Quick sort Analysis	Analyse algorithm using Recurrence relation	Slides / Black Board	3102.2	MTE-1 and End-Sem
10.	Heap Sort - Insertion, Deletion – Analysis	Analyse algorithm using Recurrence relation	Slides / Black Board	3102.2	MTE-1 and End-Sem
11.	Heap Sort- Priority Queue	Analyse algorithm using Recurrence relation	Slides / Black Board	3102.2	MTE-1 and End-Sem
12.	Heap - Insertion, Deletion – Analysis	Analyse algorithm using Recurrence relation	Slides / Black Board	3102.2	MTE-1 and End-Sem
13.	Strassen's Matrix Multiplication	Adaptation of different matrix multiplication strategies	Slides / Black Board	3102.2	MTE-1 and End-Sem
14.	Greedy Paradigm - Introduction, Coin Change Problem	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	3102.4	MTE-1 and End-Sem

15.	Job Sequencing with deadline, Interval Scheduling Problem (Given as Assignment)	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	3102.4	MTE-1 and End-Sem
16.	Knapsack-problem,	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	3102.4	MTE-1 and End-Sem
17.	Optimal Merge tape, Huffman Encoding	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	3102.4	MTE-1 and End-Sem
18.	Spanning Trees - MST	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	3102.4	MTE-1 and End-Sem
19.	Prim's, Algorithm	Design and Analyze different path finding strategies	Slides / Black Board	3102.4	Video Assignment 2 and MTE-1 and End-Sem
20.	Kruskal's Algorithm	Design and Analyze different path finding strategies	Slides / Black Board	3102.4	Video Assignment 2 and MTE-1 and End-Sem
21.	Dijkstra's Algorithm-SSSP	Design and Analyze different path finding strategies	Slides / Black Board	3102.4	MTE-2 and End-Sem
22.	Graph Search Algorithm - BFS/ DFS	Design and Analyze different path finding strategies	Slides / Black Board	3102.4	MTE-2 and End-Sem
23.	Topological Sort,	Design and Analyze different path finding strategies	Slides / Black Board	3102.4	MTE-2 and End-Sem

24.	Bellman Ford Algorithm	Design and Analyze different path finding strategies	Slides / Black Board	3102.4	MTE-2 and End-Sem
25.	Connected Components, Bi-connected Components	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	3102.4	Video Assignment4 and MTE-2 and End-Sem
26.	Introduction to Dynamic Programming-	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem
27.	Top Down Fibonacci, Binomial Coefficient	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem
28.	Bottom up Binomial Coefficient, Dynamic Knapsack,	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem
29.	Longest Integer Sequence, Longest Common Subsequence	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem
30.	Multi-Stage Graph	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem
31.	Floyd Warshal Algorithm – All pair of shortest path	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem
32.	Matrix Chain Multiplication	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem

33.	TSP- DP method	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem
34.	OBST-Optimal Binary Search Tree	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem
35.	Backtracking Intro – Problems	Design and analysis of dynamic-programming algorithms	Slides / Black Board	3102.3	MTE-2 and End-Sem
36.	Graph Coloring, M-Graph Coloring	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	MTE-2 and End-Sem
37.	Sum of Subset Problem	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	MTE-2, End-Term
38.	N-Queen Problem	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	MTE-2 and , End-Term
39.	Sudoku Game - Design & Implementation (Given as an assignment)	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	MTE-2, End-Term Implemntation Assignment

40.	Branch & Bound – Knapsack	Synthesize new graph algorithms and algorithms that	Slides / Black Board	3102.5	MTE-2, End-Term
		employ graph computations as key components,			
41.	Branch & Bound - Job Assignment	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	End-Term
42.	15 Puzzle Problem (Given as an assignment)	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	End-Term
43.	Branch & Bound – TSP	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	End-Term
44.	String Matching – Meaning and Application	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	End-Term
45.	Naïve String Matching, Rabin Karp Algorithm	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	End-Term

46.	Knuth-Morris-Pratt (KMP) Algorithm	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	End-Term
47.	Randomization & Approximation Algorithm	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	End-Term
48.	Randomization & Approximation Algorithm	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	3102.5	End-Term

I. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CC3102.1	Analyse the running times of algorithms using asymptotic analysis.		3		2								1		3	2
CC3102.2	Demonstrate and Design algorithms using divide and-conquer paradigm to solve business problems hence enhance skills.		2	2								2			2	2
CC3102.3	Illustrate the concept of greedy and dynamic programming approach to solve real life problems to enhance entrepreneurship capabilities.			2	1	1									2	3
CC3102.4	Demonstrate the concept of backtracking and branch & bound algorithms.			3	2					2					3	2
CC3102.5	Synthesize and analyse various advanced algorithms concept such as graphs, string matching, approximation algorithms and complexity classes to enhance employability.			2	2		1			1	2		1	1	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

J. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CC3102.1	Analyse the running times of algorithms using asymptotic analysis.															
CC3102.2	Demonstrate and Design algorithms using divide and-conquer paradigm to solve business problems hence enhance skills.															
CC3102.3	Illustrate the concept of greedy and dynamic programming approach to solve real life problems to enhance entrepreneurship capabilities.															
CC3102.4	Demonstrate the concept of backtracking and branch & bound algorithms.															
CC3102.5	Synthesize and analyse various advanced algorithms concept such as graphs, string matching, approximation algorithms and complexity classes to enhance employability.															

MANIPAL UNIVERSITY JAIPUR

School of Computers and Communication Engineering

Department of Computers and Communication Engineering

Course Hand-out

Foundation of Data Science | CC 3103 | 4 Credits | 3 1 0 4

Session: July 2022 – Dec., 2022 | Couíse Cooídinatoí: Manoj Kumaí Shaíma | Class: 3id Yeaí / 5th Semesteí

Faculty: 1. Dí Manoj Kumaí Shaíma, 2. Dí Abhay Shaíma, 3. Mí. Monu Bhagat

A. Introduction: This is a core course which provides understanding of mathematical foundation of the data science and machine learning. In this course student will be able to understanding the use of mathematical foundations like linear algebra, probability and statistics and some basic machine learning algorithms.

B. Course Outcomes: At the end of the course, students will be able to

[3103.1]. Describe with the illustration of mathematical concepts in the field of data science

[3103.2]. Discuss with illustration the techniques and methods related to the area of data science in variety of applications

[3103.3]. Understand and Apply logical thinking to understand and solve the problem in context

[3103.4]. Describe with examples, the basic machine learning algorithms with their applications.

[3103.5]. Recommend appropriate mathematical concept/ model to solve real world problems through machine learning and data science concepts which leads to employability.

C. Program Outcomes and Program Specific Outcomes

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Rubrics:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes (4) and Assignments (2), Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. Syllabus

Basics of Data Science: Introduction, Typology of problems, Importance of linear algebra, statistics and optimization from a data science perspective, Structured thinking for solving data science problems;

Linear Algebra: Matrices and their properties (determinants, traces, rank, nullity, etc.), Eigenvalues and eigenvectors, Matrix factorizations, Inner products, Distance measures, Projections, Notion of hyper planes, half-planes;

Probability, Statistics and Random Processes: Probability theory and axioms, Random variables, Probability distributions and density functions (uni-variate and multivariate), Expectations and moments, Covariance and correlation, Statistics and sampling distributions, Hypothesis testing of means, proportions, variances and correlations, Confidence (statistical) intervals, Correlation functions, White-noise process;

Optimization: Unconstrained optimization, Necessary and sufficiency conditions for optima, Gradient descent methods, Constrained optimization, KKT conditions, Introduction to non-gradient techniques, Introduction to least squares optimization, Optimization view of machine learning;

Introduction to Data Science Methods: Linear regression as an exemplar function approximation problem, Linear classification problems.

F. Text Books : NA

G. REFERENCE BOOKS

R1. *G. Strang, Introduction to linear algebra, Wellesley, (5e), MA: Wellesley-Cambridge Press, 2016.*

R2. *J. S. Bendat, A. G. Piersol, Random data: analysis and measurement procedures, (4e), John Wiley & Sons. 2010.*

R3. *D. C. Montgomery, G. C. Runger, Applied statistics and probability for engineers, (5e), John Wiley & Sons, 2011. 4. C. O'Neil, R. Schutt, Doing data science: Straight talk from the frontline, O'Reilly Media, Inc., 2016.*

H. Lecture Plan:

Lect. No	Topics	Session Objective	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Course handout discussion and Basics of Data Science	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
2-4	Linear Algebra for Data science, matrix, data representation in matrix, identification of independent attributes, linear relationship among attributes	Explain the basic concepts of data science for better understanding	Lecture	3103.1 3103.5	Class Quiz/ Sessional Exam / End Term Exam
5-8	Eigen Values and Eigen Vectors, Singular value decomposition, Pseudo Inverse, Line equation, plane equation,	Explain how to calculate line equation for regression	Lecture	3103.1	Sessional Exam/ End Term Exam
9-13	Hyperplanes and Halfspaces	Explain the distance matrices hyperplanes and halfspaces with their data science applications	Lecture/Flipped Classroom	3103.1	Class Quiz Sessional Exam/ End Term Exam
14-16	Distance measures	Explain different distance measuring matrices	Lecture	3103.1	Sessional Exam/ End Term Exam
17-21	Optimization techniques, Unconstrained optimization, Necessary and sufficiency conditions for optima	Explain need of optimization in data science, and different available techniques	Lecture	3103.1	Class Quiz Sessional Exam/ End Term Exam
22	Gradient descent methods	Explain gradient decent methods with examples	Lecture	3103.3 3103.5	Sessional Exam/ End Term Exam
23	Constrained optimization, KKT conditions	Explain constrained optimization and KKT conditions	Lecture/Flipped Classroom	3103.3	Class Quiz Sessional Exam/ End Term Exam
24	Introduction to non-gradient techniques	Explain non-gradient techniques	Lecture	3103.3	Class Quiz Sessional Exam/ End Term Exam
25	Introduction to least squares optimization	Explain least square optimization	Lecture	3103.3	Sessional Exam/ End Term Exam
26	Optimization view of machine learning	Explain the optimization of machine learning	Lecture/Flipped Classroom	3103.3	Class Quiz Sessional Exam/ End Term Exam
27-29	Probability theory and axioms, Random variables	Explain use of probability theory and axiom and random variables in data science	Lecture/Flipped Classroom	3103.1 3103.5	Home Assignment Sessional Exam/ End Term Exam
30-32	Probability distributions and density functions (uni-variate and multivariate)	Explain use of probability distribution and density function in data science	Lecture	3103.2 3103.5	Sessional Exam/ End Term Exam
33-34	Expectations and moments, Covariance and correlation	Explain variance, covariance and correlation of parameters in data science algorithms	Lecture	3103.2 3103.5	Home Assignment Sessional Exam/ End Term Exam
35-37	Statistics and sampling distributions	Explain sample distribution in machine learning	Lecture	3103.2	Sessional Exam/ End Term Exam
38-39	Hypothesis testing of means	Explain how to perform hypothesis testing with different methods	Lecture/Flipped Classroom	3103.2	Sessional Exam/ End Term Exam

40-41	Proportions, variances and correlations, Confidence (statistical) intervals, Correlation functions, White-noise process	Explain variances, correlation, confidence and while noise process in data science	Lecture	3103.2 3103.5	Class Quiz Sessional Exam/ End Term Exam
42	Unconstrained optimization, Necessary and sufficiency conditions for optima	Explain optimization and its applications in data science	Lecture	3103.2	Sessional Exam/ End Term Exam
43	Gradient descent methods	Explain gradient decent methods with examples	Lecture	3103.3 3103.5	Sessional Exam/ End Term Exam
44-45	Constrained optimization, KKT conditions	Explain constrained optimization and KKT conditions	Lecture/Flipped Classroom	3103.3	Class Quiz Sessional Exam/ End Term Exam
46-47	Linear regression as an exemplar function approximation problem	Explain linear regression with appropriate examples	Lecture	3103.3	Class Quiz Sessional Exam/ End Term Exam
48-50	Linear classification problems	Explain classification in linear manner	Lecture	3103.4 3103.5	Sessional Exam/ End Term Exam

I. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC 3103.1	Describe with the illustration of mathematical concepts in the field of data science	**2**	**1**	**1**											**1**	
CC 3103.2	Discuss with illustration the techniques and methods related to the area of data science in variety of applications	**2**	**1**	**1**			**2**	**2**							**1**	
CC 3103.3	Understand and Apply logical thinking to understand and solve the problem in context	**2**	**2**	**2**											**1**	
CC 3103.4	Describe with examples, the basic machine learning algorithms with their applications	**2**	**2**												**1**	
CC 3103.5	Recommend appropriate mathematical concept/ model to solve real world problems through machine learning and data science concepts which leads to employability.	**3**	**2**	**2**			**1**	**2**		**1**					**1**	

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering
Course Hand-out

Cryptography and Security | CC3104 | 4 Credits | 3 1 0 4

Session: Aug'22 – Dec'22 | Couíse Cooídinatoí: Dí Vaishali | Class: 3íd Yeaí / 5th Semesteí

Faculty: Dí Abhay Shaíma | Ms. Anshika Malsaíia

A. Introduction: The course is offered by the Department of Computer and Communication Engineering to familiarize students with cryptography and concepts of security and its importance. The course gives clear idea of different Symmetric/Asymmetric algorithms. It also discusses the application and need of cryptography in the field of computation. The course gives a brief introduction and helps to identify the direction and the current trends of the subjects in real time applications.

B. Course Outcomes: At the end of the course, students will be able to

[3104.1]. Explain the idea of Cryptography & Security with its importance and usage in the field of computing.
[3104.2]. Identify the usage of tools in understanding and performing the encryption & decryption.
[3104.3]. Examine and acquire appropriate skills to solve real time problems in real world.
[3104.4]. Analyze the performance and applicability of learned cryptographic algorithms.
[3104.5]. Identify the research trends and different security issues to have safer environment for computation in order to acquire more employability options.

C. Program Outcomes and Program Specific Outcomes

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Rubrics:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments, (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. Syllabus

Introduction: confidentiality, integrity, availability, OSI security architecture; Number theory: finite fields, Galois field, primes, primality testing, factoring algorithms; Probability and information theory: Shannon's theory, perfect security; Classical ciphers; Block ciphers: DES, AES, electronic codebook mode, cipher block chaining mode, cipher feedback mode, output feedback mode, counter mode; Pseudorandom number generation; Stream ciphers; Cryptographic hash functions; Message authentication codes; Public-key cryptography: computational security, computational assumptions, RSA, ElGamal, elliptic curve cryptography, digital signatures, DiffieHellman key exchange; Blockchain Technology: Introduction, Working, Role of Cryptography in Blockchain Technology, Applications, Limitations.

F. Text Books

T1. W. Stallings, "Cryptography and Network Security, Principles and Practices", 6th Edition, Pearson Education, 2013.

T2. B. A. Forouzan, "Cryptography and Network Security", 3rd Edition, McGraw Hill, 2015.

G. REFERENCE BOOKS

R1. Pieprzyk, T. Hardjono, J. Seberry, "Fundamentals of Computer Security", springer- Verlag Berlin Heidelberg, 2013.

R2. C. P. Pfleeger, "Security in Computing", 4th Edition, Prentice Hall, 2014.

H. Lecture Plan:

Lect. No	Topics	Session Objective	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction and Course Hand-out briefing	To acquaint and clear teacher's expectations and understand students' expectations	Lecture	NA	NA
2-5	Introduction to Security & Cryptography: Need for Computer Security, Basic concepts, Security Attributes, security attacks, Security services and mechanisms.	Identifying the Security attribute and its importance	Lecture	3104.1	Class Quiz/ Sessional Exam / End Term Exam
6-12	Cryptography: Introduction, Symmetric ciphers, Symmetric Key cryptography, Different types of Encryption Algorithms	Identify different classical encryption technique with their drawbacks	Lecture	3104.1 3104.2	Class Quiz/ Sessional Exam/ End Term Exam
13-20	Block Cipher: S-DES, DES, its rounds, strength of DES, triple DES; Modes: Electronic codebook mode, cipher block chaining mode, cipher feedback mode, output feedback mode, counter mode; Finite fields	Working and basics of modern encryption techniques and modes of Encryption	Lecture	3104.3 3104.4	Class Quiz/ Home Assignment Sessional Exam/ End Term Exam
21-25	Block Cipher AES: AES structure, AES transformation functions, AES key expansions, AES implementation;	Advance encryption scheme and its working and applications	Lecture	3104.3 3104.4 3104.5 3104.1	Class Quiz Sessional Exam/ End Term Exam
26-30	Pseudorandom Number Generation: Principles of pseudorandom number generation, pseudorandom number generators, pseudorandom number generation using block ciphers and stream cipher	Importance of Pseudo Random Numbers and its application	Lecture	3104.5 3104.1	Home Assignment Sessional Exam/ End Term Exam
31-37	Basics of Number theory, Public-key cryptography, RSA, its implementation, El Gamal cryptographic system, Elliptic curve arithmetic, Elliptic curve cryptography	Working of modern Cryptographic algorithms	Lecture	3104.3 3104.4 3104.5	Class Quiz Sessional Exam/ End Term Exam
38-41	Key Management, Diffee-Hellman key exchange, Certification Authority, Digital Certificate.	Key exchange relevance and its application	Lecture	3104.3 3104.4	Home Assignment/ Class Quiz/ Sessional Exam/ End Term Exam
42-45	Basics of Hash, MAC, working of it, Digital signature and authentication protocols	Working of Hash, Mac	Lecture	3104.3 3104.1	Class Quiz/ Sessional Exam/ End Term Exam
46-47	Security Attacks :Different types of attack and its existing Solutions	Possible attacks and its solution	Lecture	3104.2 3104.5 3104.1	Home Assignment/ Class Quiz/ Sessional Exam/ End Term Exam

48-49	Blockchain Technology: Introduction, Working, Role of Cryptography in Blockchain Technology, Applications, Limitations	Blockchain Technology Concept	Lecture	3104.3 3104.5	Class Quiz/ Sessional Exam/ End Term Exam

I. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC 3104.1	Explain the idea of Cryptography & Security with its importance and usage in the field of computing	**2**									**1**		**2**	**2**	**1**	**1**
CC 3104.2	Identify the usage of tools in understanding and performing the encryption & decryption.	**1**	**2**		**1**	**3**								**1**	**1**	**1**
CC 3104.3	Examine and acquire appropriate skills to solve real time problems in real world.		**2**					**1**		**1**		**1**		**2**	**2**	
CC 3104.4	Analyze the performance and applicability of learned cryptographic algorithms.		**1**	**2**	**3**								**1**	**2**	**2**	**2**
CC 3104.5	Identify the research trends and different security issues to have safer environment for computation in order to acquire more employability options.		**1**	**1**	**1**		**2**	**1**				**1**			**2**	**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

J. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**											ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC 3104.1	Explain the idea of Cryptography & Security with its importance and usage in the field of computing															
CC 3104.2	Identify the usage of tools in understanding and performing the encryption & decryption.															
CC 3104.3	Examine and acquire appropriate skills to solve real time problems in real world.															
CC 3104.4	Analyze the performance and applicability of learned cryptographic algorithms.															
CC 3104.5	Identify the research trends and different security issues to have safer environment for computation in order to acquire more employability options.															

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY
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SCHOOL OF COMPUTER AND COMMUNICATION ENGINEERING

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING
COURSE HAND-OUT

Software Engineering Lab| CC 3130| 1 Credit | 0 0 2 1

Session: Aug.22 – Nov 22
Faculty: **Dr. Dinesh Kumar Saini, Ms. Somya Goyal and Ms. Kundu**

|Class: B.Tech. IIIrd Year V Semester

A. Introduction:

The software Engineering lab will facilitate the students to develop a preliminary yet practical understanding of software development process and tools

B. Course Outcomes: At the end of the course, students will be able to

[CC3130.1]: Understand and able to apply different software development methodologies.
[CC3130.2]: Understanding of Requirement analysis and preparing the SRS.
[CC3130.3]: Implement and apply the UML diagrams for different systems.
[CC3130.4]: Design and implementation of test cases based on requirement and design.

C PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

PO2. **Problem analysis**: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

PO3. **Design/development of solutions**: Upon analysing, the B Tech graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

PO4. **Conduct investigations of complex problems**: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: The engineers are called society builders and transformers. B. Tech graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech IT should understand the impact of the professional

engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of the BTech CCE program, the student:

[PSO.1] **Analysis** to design, develop and implement efficient software for a given real life problem.

[PSO.2] **Develop** through practice apply knowledge of AI, Machine Learning and Data Mining in analyzing big data for extracting useful information from it and for performing predictive analysis.

[PSO.3] **Implement** to design, manage, and secure wired/ wireless computer networks for transfer and sharing of information.

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D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous evaluation (20 for Performance, 10 Lab file, 20 Viva, 20 Mini Project)	70
End Term Exam (Summative)	End Term Practical Exam (Performance and Viva)	30
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

CC3130: SOFTWARE ENGINEERING LAB [0 0 2 1]

Development of software requirements specification (SRS); Use of appropriate CASE tools and other tools such as configuration management tools, program analysis tools in the software life cycle; Flow of events and System modelling (DFD and ER); Use Case diagrams; Object-oriented design using UML; Class diagram; Object diagram; State transition diagram, State chart diagram; activity diagram; Sequence diagram; Collaboration diagrams; Component diagram; Deployment diagram; Designing test cases for white box and black box testing strategies; Introduction to DevOps; Mini project.

Guidelines for Mini Project-

1. Students must make groups of minimum 02 and maximum 04 members.
2. The group must freeze their project title in the beginning of the course.
3. All the students must perform all the lab experiments / activities for their selected project title only throughout the course.

Suggested Titles-

a. Student Result Management System

b. Library management system

c. Inventory control system

d. Accounting system

e. Fast food billing system

f. Bank loan system

g. Blood bank system

h. Railway reservation system

i. Automatic teller machine

j. Video library management system

k. Hotel management system

l. Hostel management system

m. E-ticking

n. Share online trading

o. Hostel management system

p. Resource management system

q. Court case management system

F. REFERENCES

1. R. S. Pressman, Software Engineering: A Practitioners Approach, (7e), McGraw Hill, 2016.
2. I. Sommerville, Software Engineering, (10e), Pearson, 2016.
3. R. Mall, Fundamental of Software Engineering, (5e), PHI, 2018.
4. P. Jalote, Software Engineering a Precise Approach, (1e), Wiley India, 2010.
5. L. Bass, DevOps: A Software Architect's Perspective, Pearson Education, 2016.

G . Lab Plan

Lab No.	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1	Write the complete problem statement.	Understand the Problem Definition	Lecture Demonstration at system	CC 3130.1	Continuous Evaluation End Term Examination
2	Write the software requirement specification document	Understand and demonstrate the SRS writing from Problem Definition	Lecture Demonstration at system	CC 3130.1 CC 3130.2	Continuous Evaluation End Term Examination
3	Draw the entity relationship diagram	Understand and demonstrate the E-R diagram	Lecture Demonstration at system	CC 3130.2	Continuous Evaluation End Term Examination
4	Draw the data flow diagrams at level 0 and level 1	Understand and demonstrate the DFD	Lecture Demonstration at system	CC 3130.2	Continuous Evaluation End Term Examination
5	Draw use case diagram	Understand and demonstrate the use case diagram	Lecture Demonstration at system	CC 3130.3	Continuous Evaluation End Term Examination
6	Draw activity diagram of all use cases.	Understand and demonstrate the activity diagram	Lecture Demonstration at system	CC 3130.3	Continuous Evaluation End Term Examination
7	Draw state chart diagram of all use cases	Understand and demonstrate the state chart diagram	Lecture Demonstration at system	CC 3130.3	Continuous Evaluation End Term Examination
8	Draw sequence diagram of all use cases	Understand and demonstrate the sequence diagram	Lecture Demonstration at system	CC 3130.3	Continuous Evaluation End Term Examination
9	Draw collaboration diagram of all use cases	Understand and demonstrate the collaboration diagram	Lecture Demonstration at system	CC 3130.3	Continuous Evaluation End Term Examination
10.	Assign objects in sequence diagram to classes and make class diagram.	Understand and demonstrate the class diagram	Lecture Demonstration at system	CC 3130.3	Continuous Evaluation End Term Examination

11.	Estimate test coverage metrics and structural complexity	Understand and compute structural complexity	Lecture Demonstration at system	CC 3130.4	Continuous Evaluation End Term Examination
12.	Design the test suite	Understand and demonstrate the test suite design	Lecture Demonstration at system	CC 3130.4	Continuous Evaluation End Term Examination

I Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC3130.1]:	Understand and able to apply different software development methodologies.	1	1	2	2	1	1		1	1		1				1
[CC3130.2]:	Understanding of Requirement analysis and preparing the SRS.	1	1	1			1	1	1							1
[CC3130.3]:	Implement and apply the UML diagrams for different systems.	1	1	1		2					2	1				1
[CC3130.4]:	Implement and apply the UML diagrams for different systems.	1		1		2			1	1	1	1	2			1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Justification for the Mapping

C. Course Outcomes: At the end of the course, students will be able to

[CC3130.1]: Understand and able to apply different software development methodologies.
[CC3130.2]: Understanding of Requirement analysis and preparing the SRS.
[CC3130.3]: Implement and apply the UML diagrams for different systems.
[CC3130.4]: Implement and apply the UML diagrams for different systems.

All the CO's are updated from the OBE workshop and course taught in the semester.

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School of Computer and Communication Engineering

Department of Computer and Communication Engineering
Course Hand-out

Design and Analysis of Algorithms Lab | CC 3131 | 1 Credits | 0 0 2 1
Session: July'22 – Dec'22 | Course Coordinator: Dr Geeta Rani | Class: 3nd Year / 5th Semester
Faculty: 1. Dr. Geeta Rani, 2. Dr. Suman Bhakar 3. Dr Amit Chaurasia

A. Introduction: This course is offered by Computer and Communication engineering, targeting students who wish to learn new technologies, idea and research in industries or higher studies in field of Computer and Communication Engineering. This course is designed to develop analytical skills to enable students design algorithms for various applications, and to analyze the algorithms. The mathematical analysis of algorithms is also discussed.

B. Course Outcomes: After completion of this course student will be able to:

[CC3131.1] Recognize the appropriate algorithm design strategy based on the type of problem.
[CC3131.2] Implement the divide, and conquer based algorithms, and compute their time complexity.
[CC3131.3] Implement the algorithms based on greedy approach, dynamic programming, backtracking, and branch and bound. Also, analyses their time complexity.
[CC3131.4] Strengthen the industry readiness, and entrepreneurship ability by completing a small project based on a real world problem.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1] **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2] **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3] **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4] **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5] **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6] **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7] **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8] **Ethics**: Apply ethical principles and commit to professional ethics_and responsibilities and norms of the engineering practices

[PO.9] **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10] **Communication**: Communicate effectively_on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11] **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12] **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change Program Specific Outcomes.

[PSO1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Rubrics:

Criteria	Description	Date	Maximum Marks
Internal Assessment (Summative)	Internal (Continuous Evaluation) Continuous evaluation (30, 3 marks each lab) Project (10 marks: 5 marks synopsis, 5 marks Mid term evaluation) File submission (5 marks) Internal test/viva(15 marks)		60
End Term Exam (Summative)	End Term Exam (End Term written exam and implementation 20 marks; viva 10 marks; Complete Project 10 marks)	As per Academic Calendar	40
	Total		100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.		

Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No
	extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.
Make-up Policy: As per University Norms **Chamber Consultation:** online as per Instructor **Notice:** Via email/ Teams/WhatsApp (Use University Microsoft Account) **Consultancy** **Hours:** To be Announced later	

E. Syllabus:

Review of Algorithm and write programs on Sorting Method, Greedy approach, Dynamic programming, Trees, Graphs, Branch & Bound using C language.

Pre-requisite(s): Programming in C [CS 1101] and Data Structures [CS 1301]

F. Text Books

T1. E. Horowitz, S. Sahni and S. Rajasekaran, *"Computer Algorithms"*, 2nd Edition, University Press, 2007.

T2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, *"Introduction to Algorithms*", 3rd Edition, MIT press, 2009.

G. Reference Books

R1. V. Aho, J. E. Hopcroft and J. D. Ullman, "*The Design and Analysis of Computer Algorithms"*, 1st Edition, Pearson Education, 1999.

H. Lab Plan:

Lec. No.	TOPICS	Session Outcomes	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1.	**Searching**	Programs based on Iterative Binary Search Programs based on Recursive Binary Search	Slides / Black Board	3131.1	Internal Evaluation Home Assignments External Evaluation
2.	**Sorting**	Programs to implement Insertion Sort Programs to implement Selection Sort Programs to implement Merge Sort Programs to implement Quick Sort	Slides / Black Board	3131.1	Internal Evaluation Home Assignments External Evaluation
3.	**Heap**	Programs to implement sorting a given list of elements in ascending order using the following sorting methods. HeapSort – MAX Heap and MIN Heap Programs based on Priority Queue	Slides / Black Board	3131.1	Internal Evaluation Home Assignments External Evaluation
4.	**Greedy method**	Programs to implement the single source shortest path problem using greedy method. (Dijkstra's).	Slides / Black Board	3131.1	Internal Evaluation

		Programs to implement knapsack problem using greedy method.			Home Assignments External Evaluation
5.	**Spanning Trees**	Programs to implement following algorithms: a. Prim's b. Kruskal's	Slides / Black Board	3131.1	Internal Evaluation Home Assignments External Evaluation
6.	**Graph**	Programs to implement following algorithms: a. Breadth first search b. Depth first search	Slides / Black Board	3131.2	Internal Evaluation Home Assignments External Evaluation
7,8	**Dynamic Programming**	Write a program to implement following algorithms: a. Fibonacci series dynamic programming using top-down approach. b. Fibonacci series dynamic programming using bottom-up approach.	Slides / Black Board	3131.2	Internal Evaluation Home Assignments External Evaluation
		Write a program to implement longest integer sequence LIS.			
		Write a program to implement longest common subsequence LCS.			
		Write a program to implement Binomial Coefficient using Dynamic Programming.			

		Write a program for solving travelling sales person problem using dynamic programming.			
9.	**Backtracking**	Consider the problem of eight queens on a chess board. Two queens are said to attack each other if they are on the same row, column or diagonal. Write a program that implements back tracking algorithm to solve the problem i.e., place eight non-attacking queens on the board.	Slides / Black Board	3131.2	Internal Evaluation Home Assignments External Evaluation
10.	**Randomization**	Write a program to implement Randomized Quick sort.	Slides / Black Board	3131.2	Internal Evaluation Home Assignments External Evaluation
		Write a program to implement Graph Coloring Problem.			
11	**Project**	Complete a small project based on a real world problem	Learning by doing	3131.4	Internal Evaluation Home Assignments External Evaluation

I. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CC3131.1	Recognize the appropriate algorithm design strategy based on the type of problem.		3		2								1		3	2
CC3131.2	Implement the divide, and conquer based algorithms, and compute their time complexity.		2	2								2			2	2
CC3131.3	Implement the algorithms based on greedy approach, dynamic programming, backtracking, and branch and bound. Also, analyses their time complexity.			2	1	1									2	3
CC3131.4	Strengthen the industry readiness, and entrepreneurship ability by completing a small project based on a real world problem.			3	2					2					3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

2-

J. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CC3131.1	Recognize the appropriate algorithm design strategy based on the type of problem.															
CC3131.2	Implement the divide, and conquer based algorithms, and compute their time complexity.															
CC3131.3	Implement the algorithms based on greedy approach, dynamic programming, backtracking, and branch and bound. Also, analyses their time complexity.															
CC3131.4	Strengthen the industry readiness, and entrepreneurship ability by completing a small project based on a real world problem.															

MANIPAL UNIVERSITY
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Department of Computer and Communication Engineering

School of Computer and Communication Engineering

Design and Analysis of Algorithms Lab
Course Code: CC 3131

List of Experiments

Semester-V

Language Flexibility: C/C++/Java/Python (without using inbuilt functions)

1. Write a Programme to implement Binary Search in both recursive and non-recursive manner.
2. Write a Programme to implement Selection Sort operation with suitable input.
3. Write a Programme to implement Quick Sort operation with suitable input.
4. Write a Programme to implement Insertion Sort operation with suitable input.
5. Write a Programme to implement Merge Sort operation with suitable input.
6. Write a Programme to implement sorting a given list of elements in ascending order using HeapSort – MAX Heap and MIN Heap.
7. Write a Programme to implement Priority Queue operation with suitable input.
8. Write a Programme to implement knapsack problem using dynamic programming.
9. Write a Programme to implement single source shortest path problem using greedy method. (Dijkstra's).
10. Write a Programme to implement to implement Prim's and Kruskal's with suitable input.
11. Write a Programme to implement to implement Breadth first search and Depth first search with suitable input.

12. Write a Programme to implement following problems with suitable input.
    a. Fibonacci series dynamic programming using top-down approach.
    b. Fibonacci series dynamic programming using bottom-up approach.
13. Write a Programme to implement to implement longest integer sequence LIS with suitable input.
14. Write a Programme to implement to implement longest common subsequence LCS with suitable input.
15. Write a Programme to implement Binomial Coefficient using Dynamic Programming with suitable input.
16. Write a Programme to implement travelling sales person problem using dynamic programming with suitable input.
17. Write a Programme by Consider the problem of N-queens on a chess board. Two queens are said to attack each other if they are on the same row, column or diagonal. Write a program that implements back tracking algorithm to solve the problem i.e., place eight non-attacking queens on the board.
18. Write a Programme to implement Randomized Quick sort with suitable input.
19. Write a Programme to implement Graph Coloring Problem with suitable input.

MANIPAL UNIVERSITY JAIPUR

School of Computer & Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

WEB PROGRAMMING | CC3140 | 3 Credits | 3 0 0 3

Session: Aug 22 – Dec 22 | Faculty: Dr V S Dhaka, Dr G L Saini | Class: V CCE

A. Introduction: Details about overall course. The main objective of this course is to familiarize students with the basics of Web, Web clients and servers with working of HTTP. It also gives the insight of developing static and dynamic Web pages to serve as front-end to client/server applications, and effective server side programming while introducing event -driven system programming. The course also covers basics of XML and recent trends in the area of web technology. The course also covers application areas of Introduction of web technology in Electronic Commerce**.**

B. Course Outcomes: At the end of the course, students will be able to

[CC3140.1]: Recognize fundamentals and working principles of web technology and web programming.

[CC3140.2]: Design and implement client-side web programming using HTML, Java Script, CSS, JSON, Angular JS and Node JS.

[CC3140.3]: Implement server-side programming using PHP and Database interactions.

[CC3140.4]: Web-based applications development and deployment on the webserver and debugging.

[CC3140.5]: Developing skills for designing websites leads to entrepreneurship opportunities

C. Program Outcomes and Program Specific Outcomes

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyses complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3], Design/development of solutions: Upon analyzing, the B Tech CCE, CSE, IT graduate will be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis

and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE, CSE and IT graduate will be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practiced in each action. Thus a B Tech CCE, CSE and IT will understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student will be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. Individual and team work: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student will be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	**Sessional Exam I** **Sessional Exam II**	**20** **20**
		20
	MOOC :2/Quizzes **Project: 1**	MOOC: 2*7=14 Project : 1* 6=6
End Term Exam (Summative)	**End Term Exam**	**40**
	Total	**100**
(Formative)	**A student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.**	

Coursera:

- Single Page Web Applications with AngularJS by Johns Hopkins University
- Building Web Applications in PHP by University of Michigan

E. Syllabus:

Introduction: overview of internet and "the web", web system architecture; HTTP: basics of HTTP request and response, HTTP methods, headers, content transport (push and pull), drawbacks HTTP1.0, introduction to HTTP1.1, HTTPS, SSL;

Client side programming: introduction to HTML, using XHTML – basic syntax and semantics, fundamental elements, URLs – inter-page and intra-page linking, lists, tables, frames and forms, html document object model (DOM), deficiencies of HTML, introduction to HTML5, styling with CSS4, CSS5;

JavaScript: fundamental, document object model, event handling, pattern matching and form validation with regular expressions, internal & external JavaScript, working with class, objects, constructors and inheritance, JSON;

Server side programming: three tier model, PHP –basics, form validation, sessions and session tracking techniques, ASP; XML: syntax and semantics, document structure, DTDs;

Angular JS: overview, MVC architecture, directives, controllers, modules; **Node JS**: modules, NPM modules, create, edit and publish NPM modules

F. Reference(s):

R1. D. Herron, Node.js Web Development: Server-side development with Node 10 made easy, (4e), Packet Publishing, 2018.

R2. S. Seshadri, Angular: Up and Running- Learning Angular, Step by Step, (1e), Shroff/O'Reilly, 2018.

R3. DT. E. Services, HTML 5 Black Book, (2e), Dreamtech Press, 2016.

R4. J. Sklar, Web Design Principles, (5e), Cengage, 2015.

R5. P. J. Deitel, H. M. Deitel, Internet and World Wide Web How to program, (5e), Pearson, 2011.

R7. R. Moseley, M. T. Savaliya, Developing Web Applications, (1e), John Wiley & Sons, 2007.

R8. J. C. Jackson, Web Technologies: A Computer Science Perspective, Pearson Education, 2007.

H. Lecture Plan:

Lecture No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1	Overview of Internet and the sub network	Introduction of Internet	Lecture	3140.1	Class Quiz and Mid Term-1
2	Web System Architecture	Physical structure of Web system	Lecture	3140.1	Class Quiz and Mid Term-1
3,4	Web Clients and Web Servers	To store, process and deliver web pages to the users.	Lecture	3140.1	Class Quiz and Mid Term-1
5,6	Application Servers	Understanding the application servers	Lecture	3140.1	Class Quiz and Mid Term-1
7,8,9	HTTP– Basics of HTTP Request and Response, HTTP Methods, headers, content transport (PUSH and PULL), Drawbacks HTTP1.0	Introduction of HTTP with Drawbacks	Lecture	3140.1	Class Quiz and Mid Term-1
10	Introduction to HTTP1.1, HTTPS, SSL	Explanation and analysis of HTTP and SSL	Lecture	3140.1	Class Quiz Mid Term I End Term
11	Discussion of Project and Assignment	Case study on the project	Group Discussion	3140.4/5	Continuous Evaluation
12,13	Generation of Dynamic Web pages, Extension Mechanisms	Basics of Web development.	Lecture	3140.2	Class Quiz Mid Term 1 End term
14,15	Web application Design Life-cycle, Web Markup Languages	Website enhancement methods.	Lecture	3140.2	Home Assignment Class Quiz Mid Term 1 End Term
16	Project Study presentation by students	Project Discussion	Flip Class	3140.4/5	Continuous Evaluation
17,18	Intro to HTML and Deficiencies of HTML	Static approach of development	Lecture	3140.2	Class Quiz Mid Term 1 End Term

19	XHTML– Basic syntax and semantics, fundamental elements,	Introduction of XHTML	Lecture	3140.2	Class Quiz Mid Term I End Term
20	URLs – Inter-page and Intra-page Linking, Lists, Tables, Frames and Forms	Designing of frames, lists, tables.	Lecture	3140.2	Class Quiz Mid Term I End Term
21,22	HTML Document Object Model (DOM), Styling with CSS	Introduction of Web development	Lecture	3140. 2	Class Quiz Mid-Term II and End Term
23,24	Introduction to HTML5,CSS4 and CSS5	Basic introduction of web design and development	Lecture	3140.2/4	Class Quiz Mid-Term II and End Term
25,26	Client side dynamic programming with JavaScript- Basics	Advance web designing and development	Lecture	3140.2/4	Class Quiz Mid-Term II and End Term
27,28	Primitives, Loops, Decision Statements, Screen Output and Keyboard Input .	Understanding of loops and decision statement.	Lecture	3140.2/4	Class Quiz Mid-Term II and End Term
29,30	Arrays and Functions, Event Handling, Pattern Matching and Form Validation with Regular Expressions	Verification and validation of web development.	Lecture	3140.2/4	Class Quiz Mid-Term II and End Term
31	Midterm Project Presentation by the students and discussion	Project Discussion	Flip Class	3140.4/5	Continuous Evaluation
32	JSON	Introduction to JavaScript Object Notation	Lecture	3140.2/4	Class Quiz Mid-Term II and End Term
33	Three Tier Model	Analysis of Tier system	Lecture	3140.2/4	Class Quiz Mid-Term II and End Term

34	PHP –Basics, Form Validation	Dynamic programing –Through PHP	Lecture	3140.3/4	Class Quiz Mid-Term II and End Term
35,36	Sessions and Session Tracking techniques	Useful Methodology of PHP	Lecture	3140.3/4	Class Quiz Mid-Term II and End Term
37,38	ASP	Dynamic programing through ASP	Lecture	3140.3/4	Class Quiz Mid-Term II and End Term
39-40	XML – Syntax and Semantics	Introduction of XML	Lecture	3140.3/4	Class Quiz and End term
41	Document Structure, DTDs, Need for Namespaces	Explanation of Domain name server	Lecture	3140.4/5	Class Quiz and End term
42	Angular JS	overview, MVC architecture, directives	Lecture	3140.4/5	Class, MOOC and End term
43	Angular JS	controllers, modules	Lecture	3140.4/5	Class, MOOC and End term
44	Node JS	modules, NPM modules,	Lecture	3140.4/5	Class, MOOC and End term
45	Node JS	create, edit and publish NPM modules	Lecture	3140.4/5	Class, MOOC and End term
44	End Term Project Evaluation presentation	Project Evaluation	Flip Class	3140.4/5	Continuous Evaluation

A. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC3140.1]	Recognize fundamentals and working principles of web technology and web programming.	2				3		2	2			3		2	2	3
[CC3140.2]	Design and implement client-side web programming using HTML, Java Script, CSS, JSON, Angular JS and Node JS.			3	3	1							3		2	2
[CC3140.3]	Implement server-side programming using PHP and Database interactions.		2	3	2	1	1			2	2			1	1	2
[CC3140.4]	Web based applications development and deployment on web server and debugging.					3			1	1				1		3
[CC3140.5]	Developing skills for designing websites leads to entrepreneurship opportunities.			3	2						1	3	1	1	2	3

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Soft Computing | CC 3141 | 3 Credits | 3 0 0 3

Session: Aug 22-Nov 22 | Faculty: Dr. Nitesh Pradhan/ Dr. Praveen Shukla | Class: BTech CCE V SEM | Sec: A|B

A. Introduction: This course is offered by Computer and Communication Engineering, targeting students who wish to pursue development and research in industries or higher studies in field of Computer Science, Information Technology and Communication Engineering. This course will form the concept of soft computing hence this course is introduced at this level to make the students understand concept of neural networks, fuzzy logic and genetic algorithm and use the type depending upon the application.

B. Course Outcomes: At the end of the course, students will be able to:

[CC 3141.1]	Learn about soft computing techniques and their applications.
[CC 3141.2]	Implement various supervised learning algorithms with their application.
[CC 3141.3]	Implement various unsupervised learning algorithms with their application.
[CC 3141.4]	Describe and Implement fuzzy systems for some real world problems.
[CC 3141.5]	Understand the genetic algorithm concepts and their applications.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

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[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work at home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

D. SYLLABUS

Introduction: Soft computing and its applications; **Neural networks:** Architectures, Transfer Functions; Learning models: supervised, unsupervised, reinforcement learning; Types of neural network: perceptron, backpropagation, multi-layer perceptron, radial basis function, recurrent neural network, self-organizing maps, Boltzmann machine; **Fuzzy logic and fuzzy systems**: introduction and applications, fuzzy versus crisp set, basic operations on fuzzy sets, relations, fuzzy rule based models, fuzzy classification, fuzzy arithmetic, fuzzy numbers, linguistic variables, arithmetic operations on intervals and numbers, lattice of fuzzy numbers, fuzzy equations, properties of membership functions, fuzzification and defuzzification, automated methods for fuzzy systems; **Genetic algorithms**: overview, applications, operators, fitness function, classifier systems, convergence; Hybrid soft computing approaches.

E. REFERENCE BOOKS

1. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, (3e), Wiley, 2018.
2. T. J. Ross, Fuzzy Logic with Engineering Applications, (2e), Wiley, 2016.
3. S. J. Russel, P. Norvig, Artificial Intelligence, (3e), Pearson, 2015.
4. J. –S Jang, R, C. – T Sun, E. Mizutani, Neuro-fuzzy and Soft Computing, Pearson, 2015.

F. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1	Introduction and Course Hand-out briefing		Lecture	NA	NA
2	Overview of Soft Computing and its applications	Introduction to soft-computing	Lecture	CO 1	Mid Term I, Quiz & End Term
3	Introduction to neural Network	Fundamental of neural network	Lecture	CO 2	Mid Term I, Quiz & End Term
4-5	McCulloch-Pitts Model with examples	Introduction of basic neuron model	Lecture	CO 1	Mid Term I, Quiz & End Term
6-7	Perceptron Network with examples	Understanding of Perceptron concept	Lecture	CO 2	Mid Term I, Quiz & End Term
8-10	Adaptive Linear Neuron with examples	Explanation of adaptive Linear Neuron model	Lecture	CO 2	Mid Term I, Quiz & End
11-13	Back Propagation Network with examples	Introduction of Back Propagation Network	Lecture	CO 1 & CO 2	Mid Term I, Quiz & End Term
14-16	Radial Basis Function Network with examples	Explanation of Radial Basis Function	Lecture	CO 2	Mid Term I, Quiz & End
		MTE 1			
17-19	Kohonen Self-Organizing Feature Map	Understanding of Kohonen Self organizing Feature Map	Lecture	CO 3	Mid Term II, Quiz & End Term

20-22	Learning Vector Quantization with examples	Understanding of Learning Vector Quantization Method	Lecture	CO 2 & CO 3	Mid Term II, Quiz & End Term
23-25	Counter propagation Network with examples	Basics of counter propagation network concept	Lecture	CO 2 & CO 3	Mid Term II, Quiz & End Term
26-27	Fuzzy logic and fuzzy systems: introduction and applications, fuzzy versus crisp set.	Introduction of Fuzzy logic and understanding the concept of fuzzy set and crips set	Lecture	CO 4	Mid Term II, Quiz & End Term
28-30	Basic operations on fuzzy sets, relations, fuzzy rule based models, fuzzy	Explanation of basic operation of fuzzy sets and fuzzy rules	Lecture	CO 4	Mid Term II, Quiz & End
31-33	Fuzzification and defuzzification, automated methods for fuzzy systems	Understanding the concept of Fuzzification and defuzzification	Lecture	CO 4	Mid Term II, Quiz & End Term
	MTE 2				
34	Overview and applications of Genetic Algorithm	Introduction of Genetic Algorithms	Lecture	CO 5	
35-37	Fitness function, classifier systems	Understanding of fitness function	Lecture	CO 5	
38-40	Hybrid soft computing approaches	Explanation of hybrid soft computing approach	Lecture	CO 5	

G. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	Correlation with Program Outcomes(POs)												Correlation with Program Specific Outcomes (**PSOs**)		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC 3141.1]	Learn about soft computing techniques and their applications.	**2**	**2**			**1**	**-**	**-**	**-**				**1**	**1**	**-**	**-**
[CC 3141.2]	Implement various supervised learning algorithms with their application.	**2**	**2**		**3**	**1**	**1**	**-**	**-**					**2**	**-**	**-**
[CC 3141.3]	Implement various unsupervised learning algorithms with their application.	**2**	**1**	**3**		**1**	**1**								**2**	
[CC 3141.4]	Describe and Implement fuzzy systems for some real world problems.	**1**			**3**	**2**	**2**						**2**	**1**		
[CC 3141.5]	Understand the genetic algorithm concepts and their applications.	**2**					**1**					**2**	**1**	**2**		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR
School of Computer and Communication Engineering
Department of Computer and Communication Engineering
Course Handout
[Organization and Management | BB0026 | 3 Credits |
Session: Jan-May 2023 | Faculty: Dr. Priyanka Sharma | Class: B Tech VI Semester|

A. Course Introduction: Today's world consists of many local, national, multinational and global organizations. Success of all business depends on their effective and efficient management. Therefore, management plays a most powerful and crucial role in the success and survival of the whole world. The significance of the course enlightens the dynamic life-giving element in every business. Consequently, it will emerge as a great resource as well an important 'discipline of learning' in the modern business world. The objective is to provide an understanding of basic concepts, principles and practices of organization and management. The aim is to inculcate the ability to apply multifunctional approach to organizational objectives. This course will enable students understand the basic concept of organization and management and various functions of it.

B. Course Outcomes: On completion of the course the students shall be able to:

[BB1540.1]. Understand theory and practice of organization and management.
[BB1540.2]. Build a comprehensive knowledge about marketing and personnel management
[BB1540.3]. Develop the skills of leadership and motivation.
[BB1540.4]. Illustrate the concept of entrepreneurship for developing skill for employability.
[BB1540.5]. Develop the knowledge of management information system (MIS).

C. Program Outcomes and Program Specific Outcomes

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Program Specific Outcome

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

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safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
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E. Syllabus

Unit 1: Meaning and definition of an organization, Necessity of Organization, Principles of Organization, Formal and Informal Organizations. Management: Functions of Management, Levels of Management, Managerial Skills, Importance of Management, Models of Management, Scientific Management, Forms of Ownership, Organizational Structures, Purchasing and Marketing Management, Functions of Purchasing Department, Methods of Purchasing, Marketing, Functions of Marketing, Advertising.

Unit 2: Introduction, Functions of Personal Management, Development of Personal Policy, Manpower Planning, Recruitment and Selection of manpower.

Unit 3: Motivation – Introduction, Human needs, Maslow's Hierarchy of needs, Types of Motivation, Techniques of Motivation, Motivation Theories, McGregor's Theory, and Herzberg's Hygiene Maintenance Theory. Leadership - Introduction Qualities of a good Leader, Leadership Styles, Leadership Approach, Leadership Theories.

Unit 4: Entrepreneurship – Introduction, Entrepreneurship Development, Entrepreneurial Characteristics, Need for Promotion of Entrepreneurship, Steps for establishing small scale unit.

Unit 5: Data and Information; Need, function and Importance of MIS; Evolution of MIS; Organizational Structure and MIS, Computers and MIS, Classification of Information Systems, Information Support for functional areas of management.

F. Text Books

T1. Koontz, Harold, Cyril O'Donnell, and Heinz Weihrich: Essentials of Management, Tata McGraw-Hill, New Delhi
T2. Robbins, Stephen P, and Mary Coulter: Management, Pearsonhyq jnnb, New Delhi
T3. E. S. Buffa and R. K. Sarin "Modern Production / Operations Management", 8th Edition, Wiley, 1987

G. Reference Books

R1. H. J. Arnold and D. C. Feldman "Organizational Behavior", McGraw – Hill
R2. Aswathappa K: Human Resource and Personnnel Management, Tata McGraw Hill
R3. William Wether& Keith Davis, Human Resource and Personnel Management, McGraw Hill

H. Lecture Plan

Lecture No.	PARTICULARS	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Meaning and definition of an organization, Necessity of Organization	Understands the importance and concepts of organization management.	Lecture PPT , Discussion	BB1540.1	Class Quiz Mid Term I End Term
2.	Principles of Organization, Formal and Informal Organizations	Learn and understand the process and principles as well learn types of organizations	Lecture PPT, Discussion	BB1540.1	Class Quiz Mid Term I End Term
3.	Management Function: Planning & Organizing	Learn the principles of management and administration as well how they are applicable in a business Organization	Lecture PPT, Discussion	BB1540.1	Class Quiz Mid Term I End Term
4.	Management Function: Leading & Controlling	Understand the basic process of various management functions and how they are applicable in the organization	Lecture PPT, Discussion	BB1540.1	Class Quiz Mid Term I End Term
5.	Managerial Skills, Importance of Management,	Understanding of different managerial skills	Lecture PPT, Discussion	BB1540.1	Class Quiz Mid Term I End Term
6.	Activity	Understanding of previous lectures	Class activity	BB1540.1	Quiz/ Case study
7.	Models of Management: Scientific and Administrative management	Students will gain the knowledge of different Scientific and Administrative management	Lecture , Discussion	BB1540.1	Class Quiz Mid Term I End Term
8.	Models of Management: Behavioral approach	Understand the approach of behavioral management	Lecture , Discussion	BB1540.1	Class Quiz Mid Term I End Term

9.	Activity	Understanding of previous lectures	Class activity	BB1540.1	Class Quiz/ case study
10.	Forms of Ownership and Organization Structures	Understanding of Ownership and Organization Structures	Lecture, Discussion	BB1540.2	Class Quiz Mid Term I End Term
11.	Activity	Understanding of previous lectures	Class activity	BB1540.2	Class Quiz/ case study
12.	Purchasing Function and Marketing Function	Understanding of purchasing function and marketing function	Lecture PPT ,Discussio n	BB1540.2	Class Quiz Mid Term I End Term
13.	Advertising and Changing Dynamics of Advertising	Students will gain knowledge of advertising and how advertising is changing with market	Lecture PPT, Discussion	BB1540.2	Class Quiz Mid Term I End Term
14.	Activity	Understanding of previous lectures	Class activity	BB1540.2	Class Quiz/ case study
15.	Introduction, Functions of Personnel Management, Development of Personnel Policy	Understanding of human resource function and policies of personnel management	Lecture PPT, Discussion	BB1540.2	Class Quiz Mid Term II End Term
16.	Manpower Planning	Students will gain the knowledge of manpower planning	Lecture, Discussion	BB1540.2	Class Quiz Mid Term II End Term
17.	Recruitment of Manpower	Students will gain the knowledge of various steps and process of recruitment in human resource	Lecture PPT, Discussion :	BB1540.2	Class Quiz Mid Term II End Term

18.	Selection of Manpower	Students will gain the knowledge of various steps and process of selection in human resource	Lecture PPT, Discussion	BB1540.2	Mid Term II End Term
19.	Activity	Understanding of previous lectures	Class activity	BB1540.2	Class Quiz/ case study
20.	Introduction to Motivation, Human needs, Maslow's Hierarchy of needs	Understand the meaning of the motivation, human needs and the Maslow's theory of motivation Students will learn various types of motivation.	Recap of previous lecture, Lecture PPT, Discussion	BB1540.3	Class Quiz Mid Term II End Term
21.	Types and techniques of Motivation	Understand different techniques of motivation and their uses.	Lecture PPT, Discussion	BB1540.3	Class Quiz Mid Term II End Term
22.	McGregor's Theory, Herzberg's Hygiene Maintenance Theory	Students will learn the popular theories of motivation.	Lecture PPT, Discussion	BB1540.3	Class Quiz Mid Term II End Term
23.	Activity	Understanding of previous lectures	Class activity	BB1540.3	Class Quiz/ case study
24.	Leadership - Introduction Qualities of a good Leader, Leadership Styles	Students will learn different approaches of leadership.	Lecture PPT, Discussion	BB1540.3	Class Quiz Mid Term II End Term
25.	Leadership Theories	Understand different theories of leadership	Lecture PPT, Discussion	BB1540.3	Class Quiz Mid Term II End Term
26.	Leadership Theories	Understand different theories of leadership	Class Activity, PPT	BB1540.3	Class Quiz Mid Term II End Term

27.	Activity	Understanding of previous lectures	Class activity	BB1540.3	Class Quiz/ case study
28.	Entrepreneurship – Introduction, Entrepreneurship Development	Students will learn about entrepreneurship and its development.	Lecture PPT, Discussion	BB1540.4	Class Quiz Mid Term II End Term
29.	Entrepreneurial Characteristics, Need for Promotion of Entrepreneurship	Understand the characteristics and need for promoting entrepreneurship unit.	Lecture, Discussion	BB1540.4	Class Quiz Mid Term II End Term
30.	Steps for establishing small scale unit	Analyze the various steps involved in establishing small scale.	Lecture PPT, Discussion	BB1540.4	Class Quiz Mid Term II End Term
31.	Activity	Understanding of previous lectures.	Class activity	BB1540.4	Class Quiz/ case study
32.	Data and Information; Need and Importance of MIS	Understand the difference between data and information and the importance of managerial information system in an organization.	Lecture, Discussion	BB1540.5	Class Quiz End Term
33.	Functions of MIS and Evolution of MIS	Understand different phases related to evolution of MIS.	Lecture PPT, Discussion	BB1540.5	Class Quiz End Term
34.	Activity	Understanding of previous lectures	Class activity	BB1540.5	Class Quiz/ case study
35.	Organizational Structure and MIS	Understand the use of managerial information system in organizational structure. Student will learn about management information system.	Lecture PPT, Discussion	BB1540.5	Class Quiz End Term

36.	Activity	Analyze the close ended case study related to the management.	Case study	BB1540.5	Case study analysis
37.	Computers and MIS	Understand the basic requirement of management and computers in business	Lecture PPT, Discussion	BB1540.5	Class Quiz End Term
38.	Classification of Information Systems and Information Support for functional areas of management	Learn the importance of Control and it is the fourth and final principle element of the managerial process.	Lecture PPT, Discussion	BB1540.5	Class Quiz End Term
39.	Classification of Information Systems and Information Support for functional areas of management	Lear the controlling that intends to ensure that everything occurs in conformity with the plans	Lecture PPT, Discussion	BB1540.5	Class Quiz End Term

I. Course Articulation Matrix: (Mapping of COs with POs)

		CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
CO	**STATEMENT**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	P10	P11	P12	PSO 1	PSO 2	PSO 3
BB 1540.1	Understand theory and practice of organization and management	2												2		2
BB 1540.2	Build a comprehensive knowledge about marketing and personnel management		1	2											1	
BB1540.3	Develop the skills of leadership and motivation.		2	2		2								2		
BB1504.4	Illustrate the concept of entrepreneurship.	2			1		1							1		
BB1504.5	Develop the knowledge of management information system.							1								2

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering
Course Hand-out

AI and Machine Learning | CC 3201 | 4 Credits | 3 1 0 4

Session: Jan'23 – May'24 | Course Coordinator: Dr. Sunil Kumar | Class: 3rd Year / 6th Semester

Faculty: 1. Dr Manoj Kumar Sharma, 2. Dr. Somya Goyal, 3. Dr. Praveen Shukla, 4. Mr. Arpit Sharma

A. Introduction: This is a core course which introduces, concepts of AI and Machine Learning algorithms. Important AI concepts like heuristic search, knowledge representation and planning are covered. Students will learn to design and use rule-based systems to solve the AI problems. The second half of the course familiarize the students to popular machine learning algorithms and their evaluation. Students will gain proper knowledge of traditional AI techniques and modern machine learning methods. They will be able to choose proper technique to solve modern day problems.

B. Course Outcomes: At the end of the course, students will be able to

[CC3201.1]: Apply search techniques to solve AI problems. (L3)
[CC3201.2]: Apply knowledge representation techniques like PL/FOPL to solve AI problems. (L3)
[CC3201.3]: Illustrate the concepts of optimization algorithms to solve the specific problems. (L2)
[CC3201.4]: Apply popular ML models (supervised/unsupervised) to toy datasets. (L3)
[CC3201.5]: Analyse ML models for real world applications using performance metrics to increase the employability prospects. (L4)

C. Program Outcomes and Program Specific Outcomes

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics_and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively_on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Rubrics:

Criteria	Description	Maximum Marks
Internal Assessment (Formative)	Sessional Exam I (Open Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments, MOOC, Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	

E. Syllabus

Artificial intelligence concepts: state space representation and search; Heuristic search techniques: hill climbing, best first search, A*, AO*, constraint satisfaction; Knowledge representation and reasoning; Formal logic and unification algorithms; Planning algorithms, goal stack planning, nonlinear planning using constraint posting, hierarchical planning; Case based reasoning; Optimization algorithms, genetic algorithm, ant colony optimization, particle swarm optimization, simulated annealing; Supervised machine learning algorithms: classification algorithms – KNN, decision tree, naïve bayes, support vector machine, regression, random forests; Un-supervised machine learning algorithms: principal component analysis, k-means; Machine learning performance evaluation metrics: classification accuracy, logarithmic loss, confusion matrix, area under curve, F1 score, mean absolute error, mean squared error.

References:

S. Russell, P. Norvig, Artificial Intelligence: A Modern Approach, (3e), Pearson Education, 2015.

T. M. Mitchell, Machine Learning, (1e), McGraw Hill, 1997.

D. Simon, Evolutionary optimization algorithms, (1e), Wiley, 2013.

D. Khemani, A First Course in Artificial Intelligence, (1e), McGraw Hill, 2015.

O. Richard, E. D. Peter, D. Hart, G. Stork, Pattern Classification, (2e), John Wiley, 2002.

C. Bishop, Pattern Recognition and Machine Learning, (1e), Springer, 2006.

F. Lecture Plan:

Lect. No	Topics	Session Objective	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction to the subject, course plan, course outcomes and assessment plan.	To acquaint and clear teacher's expectations and understand student expectations	Lecture	NA	NA
2	Artificial intelligence concepts: state space representation and search	To introduce concepts of AI and its use in problem solving	Lecture	CC3201.1	Class Quiz/ Sessional Exam / End Term Exam
3	Heuristic search techniques: hill climbing	To introduce concept of heuristic search and understand hill climbing algorithm. Apply hill climbing to a search problem.	Lecture	CC3201.1	Sessional Exam/ End Term Exam
4-5	Best first search, A*	Understand Best First Search/ A* algorithm and apply them to search problem.	Lecture	CC3201.1	Class Quiz Sessional Exam/ End Term Exam
6	AO*	To understand AND/OR graph and apply AO* to AND/OR graph.	Lecture	CC3201.1	Class Quiz Sessional Exam/ End Term Exam
7	Constraint satisfaction	Understand the concept of constrained satisfaction using Crypto-arithmetic problem.	Lecture	CC3201.1	Sessional Exam/ End Term Exam
8	Knowledge representation and reasoning	Understand the importance of knowledge representation and challenges.	Lecture	CC3201.2	Home Assignment Class Quiz Sessional Exam/ End Term Exam
9-13	Formal logic and unification algorithms	To understand Concepts of FOPL, Normal forms, WFF, and using unification for reasoning.	Lecture	CC3201.2	Home Assignment Sessional Exam/ End Term Exam
14	Planning algorithms, goal stack planning	Understand the importance of Planning and use of goal stack planning	Lecture	CC3201.2	Sessional Exam/ End Term Exam
15	Nonlinear planning using constraint posting, hierarchical planning	Understand the types of planning and their use.	Lecture	CC3201.2	Home Assignment Sessional Exam/ End Term Exam
16	Case based reasoning	Understand Learning and case-based reasoning.	Lecture	CC3201.2	Sessional Exam/ End Term Exam
17-18	Optimization algorithms, genetic algorithm	Introduce the concept of optimization as problem solving technique. Introduction of genetic algorithms as optimizers.	Lecture	CC3201.3	Sessional Exam/ End Term Exam

19	Ant colony optimization	Understand the concept and application of Ant colony optimization.	Lecture	CC3201.3	Sessional Exam/ End Term Exam
20	Particle swarm optimization	Understand the concept and application of Particle swarm optimization.	Lecture	CC3201.3	Sessional Exam/ End Term Exam
21	Simulated annealing	Understand the concept and use of Simulated annealing.	Lecture	CC3201.3	Class Quiz Sessional Exam/ End Term Exam
22	Supervised machine learning algorithms	Understand the concept of learning from data. Labelled and unlabelled data.	Lecture	CC3201.4	Class Quiz Sessional Exam/ End Term Exam
23-24	Regression	Understand and apply Linear regression to predict.	Lecture	CC3201.4	Class Quiz Sessional Exam/ End Term Exam
25	Classification algorithms – KNN	Apply KNN for classification	Lecture	CC3201.4	Sessional Exam/ End Term Exam
26	Decision tree	Apply Decision Tree for classification	Lecture	CC3201.4	Class Quiz Sessional Exam/ End Term Exam
27	Naïve bayes	Apply Naïve bayes for classification	Lecture	CC3201.4	Class Quiz Sessional Exam/ End Term Exam
28	Support vector machine	Apply Support vector machine for classification	Lecture	CC3201.4	Sessional Exam/ End Term Exam
29	Random forests	Understand the concept of Random Forests and its possible use.	Lecture	CC3201.4	Class Quiz Sessional Exam/ End Term Exam
30-31	Introduction to Neural Networks	Concept of back propagation and typical neural network architecture	Lecture	CC3201.4	Class Quiz Sessional Exam/ End Term Exam
32-33	Un-supervised machine learning algorithms: principal component analysis	Principal Component Analysis and its use as unsupervised learner	Lecture	CC3201.4	Class Quiz Sessional Exam/ End Term Exam
34	K-means Clustering	Clustering using K-Means	Lecture	CC3201.4	Class Quiz Sessional Exam/ End Term Exam
35-37	Machine learning performance evaluation metrics: classification accuracy, logarithmic loss, confusion matrix, area under curve, F1 score, mean absolute error, mean squared error.	Use the evaluation metrics to analyse the performance of different models and compare performance.	Lecture	CC3201.5	Class Quiz Sessional Exam/ End Term Exam
38-40	Case studies of real-world problems using different ML models	Analyse the performance of different models on real world applications e.g., Spam filtering, Sentiment analysis etc.	Lecture/ Assignment/MOOC	CC3201.5	Class Quiz/ Assignment/ End Term Exam

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC3201.1	Apply search techniques to solve AI problems. (L3)	3	1	1	0	0	0	0	1	1	2	0	1	**1**	0	0
CC3201.2	Apply knowledge representation techniques like PL/FOPL to solve AI problems. (L3)	3	1	1	0	0	0	0	1	1	2	0	1	**1**	0	0
CC3201.3	Illustrate the concepts of optimization algorithms to solve the specific problem. (L2)	2	1	0	0	0	0	0	1	1	2	0	1	**1**	1	0
CC3201.4	Apply popular ML models like (supervised/unsupervised) to toy datasets. (L3)	**3**	2	1	1	2	0	0	1	1	2	0	1	**1**	3	1
CC3201.5	Analyse ML models for real world applications using performance metrics to increase the employability prospects. (L4)	3	3	1	1	2	1	0	1	2	2	0	1	2	3	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering
Course Hand-out

Wireless Communications | CC 3202 | 4 Credits | 3 1 0 4

Session: Jan'23 – May'23 | Course Coordinator: Dr Gulrej Ahmed | Class: 3rd Year / 6th Semester

Faculty: 1. Kusum Lata Jain 2. Dr. Usha Choudhary

A. **Introduction:** The objective of this course is to introduce the concepts of wireless communication using cellular environment. The course is designed to impart in-depth understanding of technologies & contribution of wireless communication to overall scientific growth. The main objective of the course to provide the knowledge of the different types of wireless communication systems, requirements for the wireless services & cellular radio fundamental concepts, the analog/digital modulation & different types of signal processing techniques like equalization, diversity used in wireless communication, advanced transceiver schemes; Cellular Code Division Multiple Access systems, Orthogonal Frequency Division Multiplexing, 3rd , 4th & 5th Generation wireless networks & standards..

B. **Course Outcomes:** At the end of the course, students will be able to

[CC3202.1] Understand the underlying concepts and technical challenges in wireless communication systems and various types of wireless services.
[CC3202.2] Formulate the radio propagation models & path loss models of radio propagation.
[CC3202.3] Formulate mathematical relationships for frequency reuse, handoff, Co-channel interference and capacity of cellular systems.
[CC3202.4] Analyse modulation/demodulation, Diversity, Equalization & signal-processing techniques in wireless communication systems.
[CC3202.5] Understand the underlying concepts of cellular communications: 1G, 2G, 3G / LTE, 4G / LTE-A & 5G.

C. **Program Outcomes and Program Specific Outcomes**

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
[PO.9]. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Rubrics:

Criteria	Description	Maximum Marks
Internal Assessment (Formative)	Sessional Exam I (Closed Book)	15
	Sessional Exam II (Closed Book)	15
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	30
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. Syllabus

Introduction to Wireless Communications, Types of Wireless Services, Requirements for the Wireless services, Multipath propagation, Parameters of mobile multipath channels, Spectrum Limitations, Principles of Cellular networks, Multiple Access Schemes, Path Loss models, Signal Fading. Wireless Transceivers, Structure of a wireless communication link, Modulation and demodulation Schemes, Signal Processing in Wireless Systems, Principle of Diversity, Equalizers, Linear and Decision Feedback equalizers, Review of Channel coding and Speech coding techniques. Cellular Communications: 1G, 2G, 3G / LTE, 4G / LTE-A, 5G; New air interface and radio access virtualization.

References:

T. S. Rappaport, Wireless Communications - Principle and Practice, (2e), Prentice Hall of India, 2012.

A. F. Molisch, Wireless Communications, (2e), Wiley, 2011.

D. P. Agrawal, .A. Zeng, Introduction to Wireless and Mobile Systems, (3e), Thomson Press , 2012.

F. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1-5	Introduction to Wireless Communications, Types of Wireless Services, Requirements for the Wireless services, Multipath propagation	To find solutions for the technical challenges in wireless communication systems and various types of wireless services.	Lecture Interaction	[CC3202.1]	1st Sessional Exam, Quiz-1 End Term Exam
6-12	Parameters of mobile multipath channels, Spectrum Limitations, Principles of Cellular networks, Multiple Access Schemes, Path Loss models, Signal Fading.	To acquaint with the fundamentals of cellular systems and wireless fading	Lecture Interaction	[CC3202.2]	1st Sessional Exam, Quiz-1 End Term Exam
13-20	Wireless Propagation Models: Propagation Mechanisms (Qualitative treatment), Propagation effects with mobile radio, Channel Classification, Link calculations, Narrowband and Wideband models	To formulate mathematical models for radio propagation environment	Lecture Interaction	[CC3202.2], [CC3202.3]	2nd Sessional, Quiz-2 End Term Exam
21-25	Modulation and demodulation Schemes	To analyse modulation/demodulation & signal- processing techniques in wireless communication systems.	Lecture Interaction	[CC3202.4]	2nd Sessional, Quiz-3, End Term Exam
26-30	Wireless Transceivers, Structure of a wireless communication link	To Analyze Wireless Transceivers, Structure of a wireless communication link	Lecture Interaction	[CC3202.4], [CC3202.5]	2nd Sessional, Quiz-3, End Term Exam
31-37	Signal Processing in Wireless Systems, Principle of Diversity, Equalizers Linear and Decision Feedback equalizers, Review of Channel coding and Speech coding techniques.	To acquaint with signal processing principles, Diversity & Equalizers in wireless communication systems	Lecture Interaction	[CC3202.4], [CC3202.5]	2nd Sessional, Quiz-4, Assignment, End Term Exam
38-45	Cellular Communications: 1G, 2G, 3G / LTE, 4G / LTE-A, 5G; New air interface and radio access virtualization.	To acquaint with 1G, 2G, 3G / LTE, 4G / LTE-A, 5G; New air interface systems	Lecture Interaction	[CC3202.4], [CC3202.5]	Assignment, Quiz-5, End Term Exam

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC3202.1	Understand the underlying concepts and challenges of technical challenges in wireless communication systems and various types of wireless services.	3	2										2	3		
CC3202.2	Formulate the radio propagation models & path loss models of radio propagation.	3	2		2									3		
CC3202.3	Formulate mathematical relationships for frequency reuse, handoff, Co-channel interference and capacity of cellular systems.	3	2		2									3		
CC3202.4	Analyse modulation/demodulation, Diversity, Equalization & signal-processing techniques in wireless communication systems.	3	2		2								2	3	2	
CC3202.5	Understand the underlying concepts of cellular communications: 1G, 2G, 3G / LTE, 4G / LTE-A & 5G.	3	3	2	2	2							3	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

H. **Course Outcome Attainment Level Matrix:**

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC3202.1	Understand the underlying concepts and challenges of technical challenges in wireless communication systems and various types of wireless services.															
CC3202.2	Formulate the radio propagation models & path loss models of radio propagation.															
CC3202.3	Formulate mathematical relationships for frequency reuse, handoff, Co-channel interference and capacity of cellular systems.															
CC3202.4	Analyse modulation/demodulation, Diversity, Equalization & signal-processing techniques in wireless communication systems.															
CC3202.5	Understand the underlying concepts of cellular communications: 1G, 2G, 3G / LTE, 4G / LTE-A & 5G.															

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY JAIPUR

School of COMPUTER AND COMMUNICATION ENGG

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGG.

Course Hand-out

AUTOMATA THEORY AND COMPILER DESIGN | CC3203 | 3 Credits | 3 0 0 3

Session: Jan - May 2023 | Faculty: Prof. Manoj Kumar Bohra, Dr. Vijay Kumar Sharma, Dr. Amit Chaurasia| B.Tech VI SEM

A. INTRODUCTION

This course is offered by the Department of Computer and Communication Engineering as a core course. This course's objective is to familiarize students with core concepts of Automata Theory and Compilers which will enable students to focus on abstract models of computation. The word automaton itself, closely related to the word "automation", denotes automatic processes carrying out the production of specific processes. Computer scientists can understand how machines compute functions and solve problems through automata. This course exposes students to the computability theory, as well as to the complexity theory. The objective is to make students familiar with various phases of the compilation process of any source code. Students will learn about lexical analysis and differenttypes of parsing techniques. The goal is to allow them to understand in detail about compilers and their working.

B. COURSE OUTCOMES

At the end of the course, students will be able to:

[CC 3203.1] Interpret, analyze, and develop abstract models (such as finite automata, pushdown automata, etc) based on any problem that can be specified using formal language.

[CC 3203.2] Apply the characteristics of different types of formal languages, grammar, and abstract models to prove their properties.

[CC 3203.3] Identify the basic concepts, structure, and importance of compilers.

[CC 3203.4] Critically analyze the performances of each parser and determine the compilation process.

C. PROGRAM OUTCOMES (B.Tech) AND PROGRAM SPECIFIC OUTCOMES (B.Tech in CCE)

[PO. 1] **Engineering knowledge**: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO. 2] **Problem analysis**: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO. 3] **Design/development of solutions**: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO. 4] **Conduct investigations of complex problems**: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information toprovide valid conclusions.

[PO. 5] **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO. 6] **The engineer and society**: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO. 7] **Environment and sustainability:** The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus, a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO. 8] **Ethics:** Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO. 9] **Individual and team work:** United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO. 10] **Communication**: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO. 11] **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO. 12] **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

[**PSO.1**] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. ASSESSMENT PLAN

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid-Term Examination-I (Closed Book)	20
	Mid-Term Examination-II (Closed Book)	20
	Quizzes, Assignments, Activity feedback, etc	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who miss a class will have to report to the teacher about their absence. Amakeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work at home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction to abstract models of computers: Chomsky hierarchy; regular languages: deterministic finite automata (DFA) and nondeterministic finite automata (NFA), their equivalence, minimizing FA, regular expressions, identifying non-regular languages; Context-Free languages (CFLs): Context-Free grammars, push down automata (PDA), nondeterministic PDA and CFLs, deterministic PDA and CFLs; Introduction to compiler design: lexical analysis, recognition of tokens, lexeme and patterns; Syntax analysis: LL(1) parsing, SLR parsers, LR parsers, LALR parsers, parser generators (Flex and Bison), parsing and ambiguity; Runtime environments.

F. REFERENCE BOOKS

1. KLP MIshra, Theory of Computer Science: Automata, Languages and Computation, (3e), PHI, 2020
2. P. Linz, An Introduction to Formal Languages and Automata, (6e), Jones & Bartlett Learning, 2016
3. J.E. Hopcroft, R. Motwani, J.D. Ullman, Introduction to Automata Theory, Languages and Computation, (3e), Pearson Education, 2013.
4. M. Sipser, Introduction to the Theory of Computation, (3e), Cengage Learning, 2012
5. J. Martin, Introduction to Languages and the Theory of Computation, (4e), McGraw Hill, 2010.
6. A.V. Aho, M.S. Lam, R. Sethi, J.D. Ullman, Compiler Design: Principles, Techniques and Tools, (2e), Prentice Hall of India, 2006.

G. LECTURE PLAN

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding CO
1.	Introduction to the subject, course plan, course outcomes and assessment plan.	To acquaint and clear teacher's expectations and understand student expectations	Lecture	3203.1
2	Mathematical Preliminaries and Notation	Understand the basics of set theory,groups, relations, functions.	Lecture	3203.1
3	Three Basic Concepts (Languages, Grammars and Automata)	Understand the basics of Automata Theory i.e., languages, grammars etc.	Lecture	3203.1
4	Introduction to abstract models of computers and their applications	Understanding the applications of Automata	Lecture	3203.1
5	Chomsky hierarchy	Understanding the basics of formal languages using Chomsky hierarchy	Lecture	3203.1
6	Deterministic Finite Automata/ Accepters (DFA)	Introduction to DFA and its designing	Lecture, Practice questions	3203.1
7	Nondeterministic Finite Accepters (NFA)	Construction of NFA using different approaches for different type of problems	Lecture, Practice questions	3203.1
8	Equivalence of DFA and NFA	Understanding the basic difference between DFA and NFA and realising the importance of NFA	Lecture, Practice questions	3203.1
9	Minimizing Finite Automata	Understanding the algorithm for minimizing the DFA	Lecture, Practice questions	3203.1
10	Regular Expressions and Finite Automata	Construct regular expressions	Lecture, Practice questions	3203.1
11	Regular Grammar	Construct regular grammar	Lecture, Practice questions	3203.2

12	Properties of Regular Languages	Study the properties of regular languages	Lecture, Practice questions	3203.2
13	Pumping Lemma for Regular Languages and identifying Non-Regular Languages	Compare and identify the non-regular languages	Flipped Classroom	3203.2
14-	Context Free Languages	Study the properties of context free languages	Lecture, Practice questions	3203.2
15	Context Free Languages	Study the properties of context free languages	Lecture, Practice questions	3203.2
16	Leftmost/ Rightmost Derivations and derivation trees	Deriving a string from CFL using either leftmost or rightmost derivations	Lecture, Practice questions	3203.2
17	Context Free Grammars	Understanding the concept of CGF, designing of CFG for CFL	Lecture, Practice questions	3203.2
18	Simplification of Context Free Grammars and Normal Forms	Simplify a given CFG using three transformation method	Lecture, Practice questions	3203.2
19	Chomsky Normal Form (CNF)	Normalize a CFG into CNF	Flipper Classroom	3203.2
20	Greibach Normal Form(GNF)	Normalize a CFG into GNF	Lecture, Practice questions	3203.2
21	Pushdown Automata (PDA) and Context–Free Languages	Construction of PDA using different approaches for different type of problems	Lecture	3203.1
22	Deterministic Pushdown Automata, Non-deterministic PushdownAutomata	Understanding acceptability of PDAs and categorizing the PDAs into DPDA and NPDA	Lecture, Practise questions	3203.1
23	Turing Machine and Recursive/ Recursive Enumerable Languages	Understanding principles of Turing machines, halting problems and the languages of Turing machine	Lecture, Practise questions	3203.1
24	Introduction to compiler design: analysis of the source program, phases of a compiler, Structure of a Compiler	Identification of needs and structure of compiler design	Lecture, Activity	3203.3
25	Lexical analysis: The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens	Outline the role and working of lexical analysis	Lecture, Activity	3203.3
26	Lexical analysis: The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens	Outline the role and working of lexical analysis	Lecture, Activity	3203.3
27	Lexical analysis: The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens	Outline the role and working of lexical analysis	Lecture, Activity	3203.3
28	Syntax analysis: parsing and ambiguity	Identifying the roles of syntax analysis in Compiler Design and determine whether a grammar is ambiguous or not	Lecture, Practice questions	3203.4

29	Top-Down Parsing and its types	Understanding about working of Top-Down parsers	Lecture, Activity	3203.4
30	FIRST and FOLLOW, Construction of LL(1)parsing table	Computation of FIRST and FOLLOW, Construction of LL(1) parsing table	Lecture, Activity	3203.4
31	LL(l) parser	Understanding the working ofLL(l) parser	Lecture, Activity	3203.4
32	Bottom-up parsing and itstype – and Overview,	Understanding about working of Bottom-up parsers	Lecture, Activity	3203.4
33	LR(k) parsers: LR(0) item-set construction, LR(0) parsing technique, SLR parsing technique, LR(1) item-set construction, CLR and LALR	Understanding about working of Bottom-up parsers	Lecture, Activity	3203.4
34	LR(k) parsers: LR(0) item-set construction, LR(0) parsing technique, SLR parsing technique, LR(1) item-set construction, CLR and LALR	Understanding about working of Bottom-up parsers	Lecture, Activity	3203.4
35	LR(k) parsers: LR(0) item-set construction, LR(0) parsing technique, SLR parsing technique, LR(1) item-set construction, CLR and LALR	Understanding about working of Bottom-up parsers	Lecture, Activity	3203.4
36	Parser generators (Flex and Bison)	Understanding the working of parser generators	Lecture, Activity	3203.4
37	Runtime environments	Understanding the storage allocation of run time environments of compilers	Lecture, Activity	3203.4

H.

I. COURSE ARTICULATION MATRIX

CO	STATEMENT	Correlation with Program Outcomes **(POs)**												Correlation with Program Specific Outcomes (**PSOs**)		
		PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
[CC3203.1]	Interpret, analyze, and develop abstract models (such as finite automata, pushdown automata, and Turing machines) based on any problem that can be specified using formal language.	**3**	**1**	**1**	**1**								**2**		**2**	
[CC3203.2]	Apply the characteristics of different types of formal languages, grammars, and abstract models to prove their properties.	**1**	**2**	**2**		3							**1**		**1**	
[CC3203.3]	Identify the basic concepts, structure, and importance of compilers.	**3**	**1**	**1**	**1**								**2**	**1**	**1**	
[CC3203.4]	Critically analyze the performances of each parser and determine the compilation process.	**1**	**2**	**2**	**1**	**1**							**1**		**1**	

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Artificial Intelligence and Machine Learning Lab | CC3230 | 0 0 2 1

Session: Jan 23- May 23 | Coordinator: Dr Sunil Kumar| Class: B Tech CCE VI SEM

Faculty: Dr Manoj Kumar Sharma| Dr. Somya Goyal| Dr. Praveen Shukla| Mr. Arpit Sharma

A. **Introduction:** This course is designed to study and design the AI search algorithms and ML algorithms that allow computers to automatically learn from data or experience, how to improve their performance at some tasks (object classification etc). Students will also learn the fundamental methodology for how to design and analyse machine learning systems.

B. **Course Outcomes:** At the end of the course, students will be able to:

[CC3230.1]: Use Python/ Jupyter Notebook to implement AI/ML algorithms. (L3)

[CC3230.2]: Build Python programs to implement AI heuristic search techniques. (L3)

[CC3230.3]: Build ML models for publicly available datasets. (L3)

[CC3230.4]: Compare performance of ML models on performance metrics for improving employment prospects. (L4)

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Continuous Assessment (Formative)	Fortnightly evaluation (Record + execution + viva)	50
	Mini project	10
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

Heuristic search techniques, supervised learning Algorithms: Support vector machine, Naïve bayes, linear regression, decision tree, KNN algorithm; Implementation of neural network with basic concepts, with perceptron and with back propagation network; Implementation of unsupervised learning Algorithms: K-mean algorithm.

F. REFERENCE BOOKS

1. Andres C. Muller, Sarah Guido: Introduction to Machine Learning with Python. O'REILLY, 2016.
2. Aurelien Geron: Hands On Machine Learning with Scikit-Learn & TensorFlow. O'REILLY, 2017.

G. Lab Plan:

	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1-2	Introduction to Python	Use of Python constructs and libraries	Practical	CC3230.1	Continuous Evaluation
3	Write a program to implement hill climbing search algorithm	Using hill climbing to solve real world problem.	Practical	CC3230.2	Continuous Evaluation End Sem Exam
4	Write a program to implement A* search algorithm	Implementation may be done to solve any real-life problem such as 8-puzzle problem	Practical	CC3230.2	Continuous Evaluation End Sem Exam
5	Write a program to solve some real-world problem using constraint satisfaction	To solve some algebraic relations using constraint satisfaction	Practical	CC3230.2	Continuous Evaluation End Sem Exam
6-7	Write a program to Implement Simple Linear and Logistic Regression.	How to estimate linear regression coefficients from data and make predictions.	Practical	CC3230.3	Continuous Evaluation End Sem Exam
8	Write a program to implement the Bayes Classifier and SVM Classifier.	How to use Bayes and SVM classifier.	Practical	CC3230.3	Continuous Evaluation End Sem Exam
9	Write a program to implement Decision Tree Algorithm	How to apply the classification and regression tree algorithm to a real problem.	Practical	CC3230.3	Continuous Evaluation End Sem Exam
10	Write a program to implement k-Nearest Neighbours	The implementation will be specific for classification problems and will be demonstrated using the Iris flowers classification problem.	Practical	CC3230.3	Continuous Evaluation End Sem Exam
11.	Write a program to implement k-means algorithm	Implement unsupervised learning	Practical	CC3230.3	Continuous Evaluation End Sem Exam
12.	Write a Program to implement Principal Component Analysis for dimensionality reduction	Implementation of PCA using digit dataset	Practical	CC3230.3	
13.	Write programs to Implement the Perceptron Algorithm and to implement the Backpropagation Algorithm.	How to implement Neural Networks	Practical	CC3230.3	Continuous Evaluation End Sem Exam

14.	Mini Project	Apply ML models on real world problem and compare their performance.	Practical	CC3230.4	Project Evaluation
End Term Exam					

H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	Correlation with Program Outcomes **(POs)**												Correlation with Program Specific Outcomes (**PSOs**)		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
[CC3230.1]	Use Python/ Jupyter Notebook to implement AI/ML algorithms.	1	1	0	1	1	0	0	2	1	2	0	1	3	2	0
[CC3230.2]	Build Python programs to implement AI heuristic search techniques.	1	1	0	1	3	0	0	2	1	2	0	1	1	1	0
[CC3230.3]	Build ML models for publicly available datasets.	1	1	0	1	3	0	0	2	1	2	0	1	1	1	0
[CC3230.4]	Compare performance of ML models on performance metrics for improving employment prospects.	3	3	1	3	3	1	0	3	3	2	0	1	2	1	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

CO-PO Mapping (Refer to the AICTE Competencies and indicator table for CSE/IT)→

PO/PSO	No. of Competencies	Number of Related Competencies			
		CO1	CO2	CO3	CO4
PO1	4	1	1	1	3
PO2	4	2	1	1	3
PO3	4	0	0	0	2
PO4	3	2	2	2	3
PO5	3	3	3	3	3
PO6	2	0	0	0	1
PO7	2	0	0	0	0
PO8	2	1	1	1	2
PO9	3	1	1	1	3
PO10	3	2	2	2	2
PO11	3	0	0	0	0
PO12	3	1	1	1	1
PSO1	2	2	1	1	2
PSO2	2	1	1	1	1
PSO3	2	0	0	0	1

School of Computing and IT

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

List of Experiments

S. No.	Experiment
1	Introduction to Python
2	Write a program to implement hill climbing search algorithm
3	Write a program to implement A* search algorithm
4	Write a program to solve some real-world problem using constraint satisfaction
5	Write a program to Implement Simple Linear and Logistic Regression.
6	Write a program to implement the Bayes Classifier and SVM Classifier.
7	Write a program to implement Decision Tree Algorithm
8	Write a program to implement k-Nearest Neighbours
9	Write a program to implement k-means algorithm
10	Write a Program to implement Principal Component Analysis for dimensionality reduction
11	Write programs to Implement the Perceptron Algorithm. Write a program to implement the Backpropagation Algorithm.
12	Mini Project

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering Course Hand-out

Linux Shell Programming | CC3231| 1 Credits | 0 0 2 1

Session: Jan'23 – May'23 | Course Coordinator: Dr.Vijay Kumar Sharma | Class: 3rd Year / 6th Semester

Faculty: Dr.Vijay Kumar Sharma

A. **Introduction:** This course is offered by the Department of computer and communication engineering as lab for the students is to familiarize students with introduction to LINUX as a development platform. This course introduces the full range of LINUX user commands and utilities. It also discusses about the shell programming concept and deals with in detail about the shell programming in LINUX shell environment. Overall the course covers, through basic shell commands to shell programming.

B. **Course Outcomes:** At the end of the course, students will be able to

[3231.1]. Identify the concept of LINUX as a development platform with importance on basic commands with its usage in the field of computing.

[3231.2]. Use tools and utilities in LINUX, performing and analysing the working and usage of these tools for real world applications.

[3231.3]. Identifying and applying appropriate technique to solve real time problems.

[3231.4]. Perform experiments to analyse the performance and applicability of learned utilities and shell programming.

C. **Program Outcomes and Program Specific Outcomes**

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice

D. Assessment Rubrics:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	File/Record	30
	Viva/quiz	30
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. Syllabus

General LINUX Commands: Cal, date, echo, who, bc, script, passwd, who; File System & File Compression: file handling commands such as cat, cp, rm, mv, more, wc, cmp, diff, gzip, unzip, tar, zip, unzip, mkdir, rmdir, pwd, cd, File attribute: ownerships, permissions; The Process Basics, ps, Internal and external commands, Process states and zombies, nice, at, mesg, cron, time, top. VI Editor: The vi editor Basics, Input mode and The ex mode, Navigation, Editing text, I/O redirection, piping data. Regular Expressions: The period (.), dollar ($), caret(^), asterisk(*). cut, paste, sed, grep, sort, uniq. Shell and Shell programming: The Shell's interpretive cycle, Shell offering, Pattern Matching, Parameter substitution. Decisions: test: string, integer, file and logical operators, else, exit, elif and case. Loops: For, while until. Breaking out from loop, Executing loop in background. Reading and printing data: read, program to copy files, mycp, printf commands. Network Commands: Telnet, ipconfig, ping, netstat, firewalls, System configurations

F. Text Books

T1. *S. Das, "Unix Concepts and Applications", 4th Edition, McGraw Hill, 2006*

G. REFERENCE BOOKS

R1. P. Wood, S. G. Kochan, Shell Programming in Unix, Linux and OS X, (4e), AddisonWesley Professional, 2016.

R2. *W. R. Stevens, S. A. Rago, "Advanced Programming in the UNIX Environment", 3rd Edition, Addison-Wesley, 2013*

H. **Lecture Plan:**

LEC NO	TOPICS	Session Outcome Corresponding	Mode of Delivery	Corresponding CO	CO Mode of Assessing the Outcome
1	Basic Commands: cal, date, echo, who. Working with files: ls, cat, wc, cp, mv, rm. Working with Directories: pwd, cd, mkdir, rmdir.	Understand basic commands used for working in LINUX Environment	Lecture at Demonstration system	CC3231.1 CC3231.3	Viva File/Record Submission
	File Compression/Decompression: gzip, bzip2, zip, tar, gunzip, bunzip2, unzip	• Working of Compression & Un compression	Demonstration of Compression & compression Un	CC3231.2 CC3231.4	Viva File/Record Submission
2	File attributes: ownerships, permissions; The Process Basics, ps, Internal and external commands, Process states and zombies, nice, at, mesg, cron, time, top.	• To identify the processes running at foreground, background and to kill the process	Demonstration and explanation process about	CC3231.2 CC3231.3 CC3231.4	Viva End Term Examination File/Record Submission
3	Regular Expressions: The period(.), dollar($), caret(^), asterisk(*). cut, paste, sed, grep, sort, uniq.	• Identify the use of tools which isprovided by Unix environment	Experimental demonstration usage of the expression and regular	CC3231.2 CC3231.4	Viva End Term Examination File/Record Submission
4	Passing Arguments: The $#, $*, program to look up, add, remove entries in phonebook	• Understand passing of arguments	demonstration and usage of the parameter passing	CC3231.2 CC3231.3	Viva End Term Examination File/Record Submission
5-7	Parameter substitution: ${parameter}, ${parameter:-value}, ${parameter:=value} and ${parameter:?value}. pattern matching constructs: ${variable%%pattern} ${variable#pattern} and ${variable##pattern}	• Use of passing arguments in the function	demonstration and usage of the parameter passing	CC3231.3 CC3231.4	Viva End Term Examination File/Record Submission

8	Decisions: test: string, integer, file and logical operators, else, exit, elif and case.	• Understand working of decision making and if else statement in LINUX shell programming Environment	Program execution of logical operators and usage of the parameter passing	CC3231.3 CC3231.4	Viva End Term Examination File/Record Submission
9	Loops: For, while until. Breaking out from loop, Executing loop in background, I/O redirection, piping data into and out of loop.	• Usage of loops in LINUX shell programming and also redirection	Program execution of loops operators and usage of the parameter passing	CC3231.3 CC3231.4	Viva End Term Examination File/Record Submission
10	Reading and printing data: read, program to copy files, mycp, printf commands.	• Working on copy files and reading, writing on to the files	Demonstration of working with files	CC3231.3 CC3231.4	Viva End Term Examination File/Record Submission
11-13	Network Commands: Telnet, ipconfig, ping, netstat, firewalls, System configurations. The vi editor Basics, Input mode and The ex mode, Navigation, Editing text;	• Understand basic commands related to networking in LINUX Environment	Demonstration and experiments of usage of network utility tools	CC3231.2 CC3231.3 CC3231.4	Viva End Term Examination File/Record Submission

I. **Course Articulation Matrix: (Mapping of COs with POs)**

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	P O 12	PSO 1	PSO 2	PSO 3
[CC3231.1]:	Identify the basic of LINUX as a development platform with importance on basic commands with its usage in the field of computing.	2		1		1			1	2	1	1	1	2		1
[CC3231.2]:	Use tools and utilities in LINUX, performing and analyzing the working and usage of these tools for real world applications.	2	1	1	1	3								1		
[CC3231.3]:	Identifying and applying appropriate technique to solve real time problems.		2	1	1	1								1	2	3
[CC3231.4]:	Perform experiments to analyse the performance and applicability of learned utilities and shell programming.		2	2	3						1			1	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

J. **Course Outcome Attainment Level Matrix:**

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC3231.1]:	Identify the basic of LINUX as a development platform with importance on basic commands with its usage in the field of computing.															
[CC3231.2]:	Use tools and utilities in LINUX, performing and analyzing the working and usage of these tools for real world applications.															
[CC3231.3]:	Identifying and applying appropriate technique to solve real time problems.															
[CC3231.4]:	Perform experiments to analyse the performance and applicability of learned utilities and shell programming.															

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Advanced Internet Technology | CC 3240| 3 Credits | 3 0 0 3

Session: Jan 23-May 23 | Faculty: Prof. Dinesh Kumar Saini| Class: 3rd Year/6th Semester

A. **Introduction:** This course is offered by the Department of Computer and Communication Engineering as the main objective of this course is to familiarize students with the basics of Web, Web clients and servers with working of HTTP. It also gives the insight of developing static and dynamic Web pages to serve as front-end to client/server applications, and effective server side programming while introducing event-driven system programming. The course also covers basics of XML, Ajax, JavaScript, and recent trends in the area of web technology.

B. **Course Outcomes:** At the end of the course, students will be able to:

[3240.1] Identify and describe various basic concepts of Advanced Internet technology.

[3240.2] Design client /server program.

[3240.3] Identify and perform various kinds of data validation to foster the processing

[3240.4] Design and execute the web based solutions pertaining to any real life need.

[3240.5] Design and execute advanced web development techniques.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. **Individual and team work:** United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. **Communication:** Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

[PSO.1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Mid Term Exam I (Closed Book)	20
	Mid Term Exam II (Closed Book)	20
	In class Quizzes and/or Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Open Handwritten Notes)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work at home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction: Need for web, Basic concepts, web design fundamentals, website Strategy and planning, web testing tools, web server structure, maintenance, Criteria for navigation of web pages, development and development of the web pages, AJAX, Web sockets, WebRTC;

Client side technologies: Client Side Architecture, Browsers (IE, Mozilla, Firefox), Browser Extensions – Mime Types, Plugins, Controls, add-ons, XHTML, CSS, JavaScript, Generation and Handling of Dynamic Web pages, Action script, Silver light, HTML5 and CSS3, Ajax, Session Tracking Techniques on Client-side, Security issues, Rich Internet Applications;

XML: Xml basics, document object model, DTD and schemas, xml namespaces, xml for representation and for display – path and XSLT, xml DOM, XML manipulation, XML Ajax, xml DTD XSD schema XSD, complex XSD data;

Web/Application/Database Servers: Structure, Architecture of web servers with working (IIS , Apache) , Installation and configuration of Web Servers, Security Aspects, Deployment of Web Pages, Maintenance and monitoring of Web pages;

Case study: IIS / Apache / Tomcat / MSSQL/Apache/ LAMP/ WAMP/ MySQL Servers. App development issues, challenges, solutions, simulators, Tools for designing web applications;

Advanced topics: E-Commerce Basics, Models and Architecture; m-Commerce: WAP and Mobile Agents, Search Engines and Search Engine Optimization, Introduction to Web Services.

F. REFERENCE BOOKS

1. Jackson, Jeffrey C. "Web Technologies: a computer science perspective", Pearson Prentice Hall, 2006.
2. R. Kamal, "Web Technology", 2nd Edition, McGraw-Hill, 2001.

G. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1	Introduction and Course Hand-out briefing	To acquaint and clear teachers' expectations and understand student expectations	Lecture	NA	NA
2,3	Introduction of Web Development process: Need for web, Basic concepts, web design fundamentals, website Strategy and planning,	Understanding web development principal and basics	Lecture	3240.1	Class Quiz Mid Term I
4,5	Client side programming - Web application Design Lifecycle, Web page design and production, Web Markup Languages – What is markup, why markup,	describe and identify various web development platforms and programming languages	Lecture	3240.1	Class Quiz Mid Term I
6,7	Intro to HTML and Deficiencies of HTML, Using XHTML – Basic syntax and semantics, fundamental elements, URLs –Interpage and Intrapage	learn and design html pages	Lecture	3240.1	Class Quiz Mid Term I
8	Linking, Lists, Tables, Frames and Forms.,	learn html table and form tags	Lecture	3240.2	Class Quiz Mid Term I End Term
9,10,11	HTML Document Object Model (DOM), Styling with CSS, Introduction to HTML5 and CSS3,	Learn CSS for designing web pages	Lecture	3240.2	Class Quiz Mid Term I End Term
12,13	AJAX: Introduction, Ajax XMLHttp, AJAX request,	Learn dynamic web page design concepts.	Lecture	3240.2	Class Quiz Mid Term I

14,15	Client side dynamic programming with JavaScript – Basics, Primitives, Loops, ,	Understanding scripting language.	Lecture	3240.2	Class Quiz	Mid Term I	End Term
16,17	Decision making and event handling	Understanding scripting language for event handling.	Lecture	3240.2	Class Quiz	Mid Term I	
18,19	Screen Output and Keyboard Input, Arrays and Functions, Event Handling, Pattern Matching	Understanding scripting language and its various functionality	Lecture	3240.2	Class Quiz	Mid Term II	End Term
20	Java Script and event handling	Understanding scripting language for event handling.	Lecture	3240.2	Class Quiz	Mid Term II	
21	Form Validation with Regular Expressions, ajax with java script	learn and design form validation in javascript	Lecture	3240.3	Class Quiz	Mid Term II	
22	Server side programming - Three Tier Model, PHP – Basics, Form Validation,	Understanding scripting language for server side scripting	Lecture	3240.3	Class Quiz	Mid Term II	
23,24	PHP database connection validation	Learning php and data base	Lecture	3240.3	Class Quiz	Mid Term II	
25,26	Transactions in php	Understanding transaction in PHP	Lecture	3240.4	Class Quiz	Mid Term II	
27-28	looping & event handling	Design and execute the concept of looping	Lecture	3240.4	Class Quiz	Mid Term II	
29-30	Emailing Form Data Addressing the Stateless Nature of HTTP -Sessions and Session Tracking techniques	understanding session management using php	Lecture	3240.4	Class Quiz	Mid Term II	End Term
31-32	XML – Syntax and Semantics, Document Structure,	learn and design XML messages	Lecture	3240.4	Class Quiz	Mid Term II	
33	DTDs, Need for Namespaces, XML Schemas,	learn and design DTD for XML	Lecture	3240.4	Class Quiz		End Term
34-35	Navigating XML documents with XPath, Displaying XML documents with CSS and XSLT.	learn and design N documents XPath XML	Lecture	3240.5	Class Quiz		End Term

36-37	Jquery: Introduction	learn and design Jquery for dynamic cntent	Lecture	3240.5	Class Quiz	End Term
38	Jquery and its functioning	describe and identify jquery components	Lecture	3240.5	Class Quiz	End Term
39-40	Angular JSP, NodeJS, JSON	learn and design NodeJS	Lecture	3240.5	Class Quiz	End Term
41-42	Bootstrap	learn and design Bootstrap	Lecture	3240.5	Class Quiz	End Term

H. **Course Articulation Matrix: (Mapping of COs with POs & PSOs)**

CO	STATEMENT	Correlation with Program Outcomes (POs)												Correlation with Program Specific Outcomes (PSOs)		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC3240.1]	To identify and describe various basic concepts of Advanced Internet technology.	1												1		
[CC3240.2]	To practice client /server programming	2	2	2	1										1	
[CC3240.3]	To identify and perform various kinds of data validation to foster the processing		1												2	
[CC3240.4]	To design and execute the web based solutions pertaining to any real life need.			2	1							1	2		2	2
[CC3240.6]	To design and execute advanced web development techniques.	2	2	2	1	3							1	3	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

I. **Course Outcome Attainment Level Matrix:**

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC3240.1]	To identify and describe various basic concepts of Advanced Internet technology.															
[CC3240.2]	To practice client /server programming															
[CC3240.3]	To identify and perform various kinds of data validation to foster the processing															
[CC3240.4]	To design and execute the web based solutions pertaining to any real life need.															
[CC3240.6]	To design and execute advanced web development techniques.															

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering
Course Hand-out

Computer Vision | CC 3241 | 3 Credits | 3 0 0 3

Session: Jan'23 – May'23 | Course Coordinator: Mr. Arpit Kumar Sharma | Class: 3rd Year / 6th Semester

Faculty: 1. Mr. Arpit Kumar Sharma, 2. Dr. Praveen Shukla

A. Introduction: This is a programme elective course which introduces, concepts of computer vision. Important concepts of computer vision are image formation, filtering, segmentation, and classifiers. Students will understand the concept of image formation and filtering techniques applied over image. In the next half of the course student will be understanding and applying different image segmentation techniques and image classification algorithms. Students will gain proper knowledge of image formation to image classification processes and their applications. They will be able to customize the filtering, segmentation, classification techniques to solve modern day problems.

B. Course Outcomes: At the end of the course, students will be able to

[CC3241.1] Make use of the underlying concepts and application of Computer Vision.
[CC3241.2] Apply image filtering techniques in image formation.
[CC3241.3] Analyse different image segmentation and image classification techniques.
[CC3241.4] Evaluate different segmentation and classification models for real world applications to enhance employability prospects.

C. Program Outcomes and Program Specific Outcomes

[PO.1]. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. **Ethics**: Apply ethical principles and commit to professional ethics_and responsibilities and norms of the engineering practices

[PO.9]. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. **Communication**: Communicate effectively_on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Rubrics:

Criteria	Description	Maximum Marks
Internal Assessment (Formative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments, Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. Syllabus

Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing; Color early vision - single image: linear filters, edge detection; Texture early vision - multiple images: the geometry of multiple views, stereopsis, affine structure from motion, projective structure from motion; Mid-level vision: segmentation by clustering, segmentation by fitting a model, segmentation and fitting using probabilistic methods, Graph-Cut, Mean-Shift, Object detection.; Viola Jones face detection, Face representation: Eigen faces and 2D PCA. Deformable curves and surfaces, Snakes and active contours; High-level vision: finding templates using classifiers, recognition by relations between templates, geometric templates from spatial relations, introduction to 3D computer vision, recent trends and practical applications.

References:

1. D. A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, (2e), Pearson Education, 2008.

2. R. Hartley, A. Zisserman, Multiple View Geometry in Computer Vision, (2e), Cambridge University Press, 2004.

3. R. Szeliski, Computer Vision: Algorithms and Applications, Springer, 2011.

4. J. Leskovec, A. Rajaraman, J. D. Ullman, Mining of massive dataset, (2e), Cambridge university press, 2014.

5. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

F. Lecture Plan:

Lect. No	Topics	Session Objective	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction to the subject, course plan, course outcomes and assessment plan.	To acquaint and clear teacher's expectations and understand student expectations	Lecture	NA	NA
2	Image formation and Projection	To understand image formation	Lecture	CC3241.1	Class Quiz/ Sessional Exam / End Term Exam
3-4	Transformation: Orthogonal, Euclidean, Affine, Projective,	Understand the transformation and its type	Lecture	CC3241.1	Sessional Exam/ End Term Exam
5	Fourier Transform, Convolution and Filtering	Apply the Fourier transformation and Understand the filtering of the image.	Lecture	CC3241.1	Class Quiz Sessional Exam/ End Term Exam
6-8	Image Enhancement, Restoration, Histogram Processing	Understand the image enhancement and restoration concept	Lecture	CC3241.2	Class Quiz Sessional Exam/ End Term Exam
9-11	Color early vision - single image: linear filters, edge detection;	Understand and apply filtering and edge detection process over image	Lecture	CC3241.2	Sessional Exam / End Term Exam
12-14	Texture early vision - multiple images: the geometry of multiple views, stereopsis	Understand and apply texture vision on multiple images	Lecture	CC3241.2	Home Assignment Class Quiz Sessional Exam I / End Term Exam
15-16	Affine structure from motion, projective structure from motion	Apply and customize different image structures.	Lecture	CC3241.2	Home Assignment Sessional Exam/ End Term Exam
17-19	Mid-level vision: segmentation by clustering	Understand and apply image segmentation	Lecture	CC3241.3	Sessional Exam/ End Term Exam
20-21	Segmentation by fitting a model	Understand and apply image segmentation	Lecture	CC3241.3	Home Assignment Sessional Exam/ End Term Exam
22-24	Segmentation and fitting using probabilistic methods, Graph-Cut, Mean-Shift, Object detection	Understand and apply image segmentation	Lecture	CC3241.3	Sessional Exam/ End Term Exam
25-26	Viola Jones face detection, Face representation: Eigen faces and 2D PCA.	Apply different detection using Face and 2D PCA with example	Lecture	CC3241.3	Sessional Exam/ End Term Exam
27-28	Deformable curves and surfaces, Snakes and active contours	Apply different geometric methods in high level vision	Lecture	CC3241.4	Sessional Exam II / End Term Exam
29-30	High-level vision: probabilistic and Inferential methods	Apply different geometric methods in high level vision	Lecture	CC3241.4	Sessional Exam/ End Term Exam
31-32	Finding templates using classifiers	Understand and customize image classifiers	Lecture	CC3241.4	Class Quiz Sessional Exam/ End Term Exam
33-35	Recognition by relations between templates, Geometric templates from spatial relations	Understand and customize image classifiers and templates	Lecture	CC3241.4	Class Quiz Sessional Exam/ End Term Exam

36-38	introduction to 3D computer vision, recent trends and practical applications	Understand the concept of 3D computer vision fundamental	Lecture	CC3241.4	Class Quiz Sessional Exam/ End Term Exam

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CC3241.1	Make use of the underlying concepts and application of Computer Vision.	3	2	1	2	0	1	0	1	1	2	1	1	2	1	1
CC3241.2	Apply image filtering techniques in image formation.	3	2	1	2	0	1	0	1	1	2	1	1	3	1	1
CC3241.3	Analyse different image segmentation and image classification techniques.	3	3	1	2	0	1	0	1	1	2	1	1	2	2	1
CC3241.4	Evaluate different segmentation and classification models for real world applications to enhance employability prospects.	3	2	1	2	0	1	0	1	1	2	1	1	3	3	1

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

MANIPAL UNIVERSITY
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MANIPAL UNIVERSITY JAIPUR

School of Computing and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Minor Project | CC2270| 3 Credits | 0 0 6 6

Session: Jan - Jul 2023 | Faculty: Dr. Deepak Sinwar (Coordinator) and Dr. Rohit Mittal (Instructor)

Class: B. Tech VI SEM | CORE

A. Introduction:

In minor project course, each student is expected to develop/ design solutions to real-life problems related to industry, institutions, etc. The project work needs to be carried out internally at Manipal University Jaipur under the supervision of an internal guide. For an application-based project, it is recommended to utilize the software engineering paradigms i.e., software development life cycle model. If interested, a student may undergo a research-based work as well. The project work may be carried out individually or in a group of two students. A report on the minor project would be submitted for evaluation. A committee consisting of a minimum of three faculty members (including an internal guide) shall perform an assessment of the work submitted by the student. Project work would be presented and demonstrated before the panel of examiners.

B. Course Outcomes: At the end of the course, students will be able to

[CC3270.1]:	Determine the depth of the problem and propose a solution to the application-based or research-based problem.
[CC3270.2]:	Formulate solutions to the real-life problems by utilizing computer-based modern tools to contribute to the society.
[CC3270.3]:	Work individually or in a team with significant contribution and building the project with lifelong learning.
[CC3270.4]:	Develop effective presentation and acquire skills to present the project work.
[CC3270.5]:	Construct a comprehensive report on the project work by applying ethical values.

C PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

PO2. **Problem analysis**: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

PO3. **Design/development of solutions**: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

PO4. **Conduct investigations of complex problems**: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Synopsis	10
	Mid-Term Assessment	30
	Project completion and submission of final report (Including feedback from concerned external organization if the project is external)	20
End Term Exam (Summative)	End Term Exam	40
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

I Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC3270.1]:	Determine the depth of the problem and propose a solution to the application-based or research-based problem.	3	3	3	3	1	2	1		1		1	2	2	3	1
[CC3270.2]:	Formulate solutions to the real-life problems by utilizing computer-based modern tools to contribute to the society	2	2	1	2	3	2	2	2	1		1	2	2	1	1
[CC3270.3]:	Work individually or in a team with significant contribution and building the project with lifelong learning	2		3		1	2	1	2	3	2	2	3	1	1	2
[CC3270.4]:	Develop effective presentation and acquire skills to present the project work	1		1		3			2	2	3		3	1		
[CC3270.5]:	Construct a comprehensive report on the project work by applying ethical values	1				3			2	1	3		3	1		

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer & Communication Engineering

Department of Computer & Communication Engineering
Course Hand-out

Principles of Web Services: CC4140 | 3 Credits | 3 0 0 3

Session: Jul-Nov 2022 | Faculty: Dr. Rohit Mittal & Mr. Arpit Kr. Sharma | Class: B.Tech 4st Year

A. **Introduction:** Principles of Web Services focuses on propagate communication between the client and server applications on the World Wide Web. Principles of Web Services allows student to learn popular service protocols like SOAP, WSDL, REST and other standard languages and architecture of web service deployment. Web services provide a common platform that allows multiple applications built on various programming languages to have the ability to communicate with each other.

B. **Course Outcomes:** At the end of the course, students will be able to

CC4140.1: To identify and describe various web services technologies like WSDL, UDDI, SOAP
CC4140.2: To illustrate xml technology and message passing
CC4140.3: To infer and identify various web service models and messaging techniques
CC4140.4: To explain SOA design implementation, managing SOA environment
CC4140.5: To evaluate and identify suitable service for a business model as per entrepreneurship, real time world.
CC4140.6: To design and develop web service models using beans and spring framework to enhance the skills.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

PO2. **Problem analysis**: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

PO3. **Design/development of solutions**: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

PO4. **Conduct investigations of complex problems**: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

PSO1 Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.
PSO2 Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.
PSO3 Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	20
	Sessional Exam II (Close Book)	20
	In class Quizzes and/or Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Open Handwritten Notes)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these	

	assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.

E. SYLLABUS

Evolution and Emergence of Web Services: Emergence of web services and Service Oriented Architecture (SOA), introduction to web services –model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

Web Service Architecture: Web services Architecture and its characteristics, , web services communication, basic steps of implementing web services. Describing Web Services – WSDL, Brief Over View of XML

SOA Design implementation, Managing SOA Environment: service-oriented design process, design activities, determine services and tasks based on business process model, implementing SOA

SOAP : Simple Object Access Protocol SOAP as a messaging protocol, UDDI architecture and implementation, UDDI with WSDL, UDDI specification; REST(Representational State Transfer): messages, HTTP request and format, HTTP response and format, query parameters, protocol semantics of HTTP(GET, PUT, POST, DELETE, HEAD, OPTIONS, TRACE) , REST vs SOAP.

TEXT BOOKS

1. R. Nagappan, R. Skoczylas, R.P. Sriganesh , "Developing Java Web Services", 2nd Edition, Wiley India, 2005.
2. S. Chatterjee, J. Webber, "Developing Enterprise Web Services", 2nd Edition, Pearson Education, 2003.

REFERENCE BOOKS

1. R. Skoczylas, R.P. Sriganesh, Developing Java Web Services, (2e), Wiley India, 2008.
2. S. Chatterjee, J. Webber, Developing Enterprise Web Services, (2e), Pearson, 2003.
3. Coyle, F. Paul, XML, Web services, and the data revolution, (1e), Addison-Wesley,2008.
4. S. Graham, Building web Services with Java, (2e), Pearson, 2004.
5. B. M. Balachandar, RESTful Java Web Services, (3e), Packt Publishing Limited, 2017.
6. E. Cerami, Web Services Essentials: Distributed Application with XML – RPC, SOAP, UDDI & WSDL, (1e), O' Reilly, 2002.
7. M. Papazoglou, Web Services and SOA: Principles and Technology, (2e), Pearson, 2008.

F. Lecture Plan:

Lec No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction and Course Hand-out briefing	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
2,3	Introduction to web services	understand web services	Lecture	4140.1	Class Quiz Mid Term I
4,5	Type of Sevices & difference between distributed system and web services	describe and identify various web service models	Lecture	4140.1	Class Quiz Mid Term I
6,7	Emergence of Web Services and Service Oriented Architecture (SOA) fundamentals.	understand web services models using SOA	Lecture	4140.1	Class Quiz Mid Term I
8	QoS, Web service interportability, SLA.	describe and identify various web service performance parameters	Lecture	4140.2	Class Quiz Mid Term I End Term
9,10,11	Distributed computing Infrastructure and communication models.	distinguish between distributed model and web services.	Lecture	4140.2	Class Quiz Mid Term I End Term
12-13	Brief Over View of XML: XML technologies XML DTD & XSD	learn and design XML messages design XML using XSD	Lecture	4140.2	Class Quiz Mid Term I End Term
14-15	SOAP Protocol, communication protocol.	learn SOAP messaging protocol for web services	Lecture	4140.2	Class Quiz Mid Term I
Mid Term I					

16-17	SOAP Message Structure, SOAP encoding	learn SOAP messaging protocol design and architecture	Lecture	**4140**.2	Class Quiz	Mid Term II End Term
18	Describing web services	understand need of WSDL in web services	Lecture	**4140**.2	Class Quiz	Mid Term II
19	WSDL services, WSDL binding.	learn WSDL protocol and its design, binding with soap protocol	Lecture	**4140**.3	Class Quiz	Mid Term II
20,21	Register and discovery services	learn various phases of deploying web services.	Lecture	**4140**.3	Class Quiz	Mid Term II
22,23	WSDL to UDDI, maping & services.	learn UDDI protocol	Lecture	**4140**.4	Class Quiz	Mid Term II
24-25	SOA, service composition	explain the complete layered architecture of web services.	Lecture	**4140**.4	Class Quiz	Mid Term II
26-27	WS- BPEL process	learn and design business models in web services	Lecture	**4140**.4	Class Quiz	Mid Term II End Term
28-29	Service Transactions, distributed transaction, connected transactions	design service transaction in SOAP	Lecture	**4140**.4	Class Quiz	Mid Term II
Mid Term II						
30	SOAP Security policies, xml security standards	understand need of security in services, understand ways to implement security in XML	Lecture	**4140**.4	Class Quiz	End Term
31-32	service policies, Service transactions	understand various service policies, describe transactions in web services and rollback	Lecture	**4140**.5	Class Quiz	End Term
33-34	EJB service architecture, Beans model	to design and deploy EJB based web services and its various model	Lecture	**4140**.6	Class Quiz	End Term

35-37	REST Vs SOAP protocol	Design and deploy RESTful services on HTTP	Lecture	**4140**.6	Class Quiz	End Term

G. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	
CC 4140.1:	To identify and describe various web services technologies like WSDL, UDDI, SOAP	2		2	2								2				
CC 4140.2:	To illustrate xml technology and message passing	2			3								2		1		
CC 4140.3:	To infer and identify various web service models and messaging techniques	2		1		3							2	2			
CC 4140.4:	To explain SOA design implementation, managing SOA environment	3	1	3									2	3			
CC 4140.5:	To evaluate and identify suitable service for a business model as per entrepreneurship, real time world.	3		3	2								3	3			
CC 4140.6:	To design and develop web service models using beans and spring framework to enhance the skills.	3		3		3							1	1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

H. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	
CC 4140.1	To identify and describe various web services technologies like WSDL, UDDI, SOAP																
CC 4140.2	To illustrate xml technology and message passing																
CC 4140.3	To infer and identify various web service models and messaging techniques																
CC 4140.4	To explain SOA design implementation, managing SOA environment																
CC 4140.5	To evaluate and identify suitable service for a business model as per entrepreneurship, real time world.																
CC 4140.6	To design and develop web service models using beans and spring framework to enhance the skills.																

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

DEVOPS | CC 3141 | 3 Credits | 3 0 0 3

Session: Aug 22-Dec 22 | Faculty: Dr. Praveen Shukla/ Mr Rajender Singh | Class: BTech CCE VII SEM | Sec: A|B

A. Introduction: The main objective of designing this course is to brief the basics of DevOps. This course introduces to the culture of DevOps, inter team collaboration and its need in the current software development process. The course also introduces to the world of various DevOps tools like Docker, Puppet, Kubernetes, Ansible, Nagios. It covers continuous development, integration, testing, deployment, monitoring, automation of configuration management, and which ultimately improves IT service agility. The course provides exposure to the cloud computing, various AWS services, and DevOps using AWS.

B. Course Outcomes: At the end of the course, students will be able to:

[CC 3141.1] Understand and **apply** the concept of Devops Pipelining, Git and Version Control.

[CC 3141.2] Identify and **use** various tools for Devops Continuous Integration.

[CC 3141.3] Experiment with different Devops tools for continuous testing.

[CC 3141.4] Install and **utilize** puppet, ansible and Nagios tool for configuration management and continuous monitoring.

[CC 3141.5] Demonstrate and **apply** the Principal of Devops on cloud computing.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. Individual and team work: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
	MOOC :1 Quizzes Project Assignment: 1	MOOC: 1*10=10 Assignment 1* 5=5 Quizzes 1* 5=5
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work at home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

* MOOC Course: Introduction to DevOps by John Rofrano

D. SYLLABUS

Introduction: overview of DevOps, market trends, skills, delivery pipeline, ecosystem; Version Control: concept of Git, common commands, working with remote repositories;

Continuous Integration (CI): branching and merging in Git, workflows, Git cheat sheet, introduction to Jenkins, Jenkins management, adding a slave node to Jenkins, building delivery pipeline, pipeline as a code, introduction to Maven;

Continuous Testing (CT): need, Selenium and Webdriver, creating test cases, handling different controls on webpage, frameworks; Continuous Deployment: introduction to container, life cycle, sharing and copying, understanding images and containers, working with docker, publishing image; Docker ecosystem, compose, Swarm, managing and running containers, Docker networking, network types, Kubernetes;

Continuous Deployment (Configuration Management (CM)): Puppet installation and configuration, master and agent setup, puppet module, node classification, puppet environment and classes, automation and reporting; Ansible: installation and configuring, roles, write playbooks;

Continuous Monitoring: Nagios installing, Plugins (NRPE) and objects, Nagios commands and notification;

DevOps on Cloud: introduction to cloud computing, why DevOps on cloud, Introduction to AWS, various AWS services, DevOps using AWS.

E. REFERENCE BOOKS

1. L. Bass, DevOps: A Software Architect's Perspective, Pearson Education, 2016.
2. N. Felson, Effective DevOps with AWS, Packet Publishing Limited, 2017.
3. J. Davis, R. Daniels, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, O'Reilly Media 2016.

F. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1	Introduction and Course Hand-out briefing		Lecture	NA	NA
2	DevOps overview	Introduction of DevOps	Lecture	**3141.1**	Class Quiz and Mid Term-1
3	Discussion of Project and Assignment	Project Discussion	Group discussion	**3141.1**	Continuous Evaluation
4	DevOps pipeline	Introduction of Devops Pipeline	Lecture	**3141.1**	Class Quiz and Mid Term-1
5	Ecosystem, market trends, skills	Understanding of Devops, Ecosystem market trends, Skills	Lecture	**3141.1**	Class Quiz and Mid Term-1
6	GIT overview and remote repositories	Introduction of GIT Overview	Lecture	**3141.1**	Class Quiz, Mid Term I and End Term
7	GIT common commands and cheat sheet	Understanding GIT common command	Lecture	**3141.1**	Class Quiz, Mid Term I and End Term
8	GIT Workflow and merging strategy	Explaining of GIT Overflow and merging strategy	Lecture	**3141.1**	Class Quiz, Mid Term I and End Term
9	Jenkins overview	Introduction of Jenkins	Lecture	**3141.2**	Class Quiz, Mid Term I and End Term
10	Jenkins management and adding a slave node	Explaining Jenkins management and slave node	Lecture	**3141.2**	Home Assignment, Class Quiz, Mid Term I and End Term

11	Jenkins delivery pipeline	Understanding of Jenkins delivery pipeline	Lecture	**3141.2**	Class Quiz, Mid Term I and End Term
12	Jenkins pipeline as a code	Designing Jenkins pipeline code	Lecture	**3141.2**	Class Quiz, Mid Term I and End Term
13	Maven overview	Introduction of Maven Overview	Lecture	**3141.2**	Class Quiz, Mid Term I and End Term
14	Maven Project Object Model overview	Understanding Maven Project Model	Lecture	**3141.2**	Class Quiz, Mid Term I and End Term
15	Maven webapp structure, run, deploy	Analysis Maven webapp structure	Lecture	**3141.2**	Class Quiz, Mid Term I and End Term
16	Selenium overview	Introduction Selenium Overview	Lecture	**3141.3**	Class Quiz, Mid Term I and End Term
17	Selenium WebDriver	Understanding selenium WebDriver	Lecture	**3141.3**	Class Quiz, Mid Term I and End Term
18	Selenium test cases	Explaining Selenium test case	Lecture	**3141.3**	Class Quiz, Mid Term I and End Term
19	Selenium handling different controls on webpage	Understanding selenium control on webpage	Lecture	**3141.3**	Class Quiz, Mid Term I and End Term
20	Intermediate student's project progress validation - Jenkins integration with GIT, a sample maven-based java project	Project discussion	Group discussion	**3141.3**	Continuous Evaluation
21	Container overview	Introduction on Container	Lecture	**3141.3**	Class Quiz, Mid-Term II and End Term
22	Docker container life cycle management	Understanding Docker container life cycle management	Lecture	**3141.3**	Class Quiz, Mid-Term II and End Term
23	Docker installation and setup	Docker Installation	Lecture	**3141.3**	Class Quiz, Mid-Term II and End Term
24	Sharing and copying, understanding images and containers	Understanding sharing and copying images in container	Lecture	**3141.3**	Class Quiz, Mid-Term II and End Term

25	Docker ecosystem	Understanding Docker Ecosystem	Lecture	**3141.3**	Class Quiz, Mid-Term II and End Term
26	Docker compose and swarm	Explaining Docker compose	Lecture	**3141.3**	Class Quiz, Mid-Term II and End Term
27	Manging and running containers	Managing and running container	Lecture	**3141.3**	Class Quiz, Mid-Term II and End Term
28	Docker networking and network types	Docker networking and network	Lecture	**3141.3**	Class Quiz, Mid-Term II and End Term
29	Midterm Project Presentation by the students and discussion	Project Discussion	Flip class	**3141.3**	Continuous Evaluation
30	Kubernetes overview	Introduction Kubernetes	Lecture	**3141.3**	Class Quiz, Mid-Term II and End Term
31	Puppet overview, installation and configuration, master and agent setup	Introduction Puppet Overview	Lecture	**3141.4**	Class Quiz, Mid-Term II and End Term
32	Puppet module, node classification, puppet environment and classes, automation, and reporting	Understanding Puppet module	Lecture	**3141.4**	Class Quiz, Mid-Term II and End Term
33	Ansible overview, installation and configuring	Installation Ansible	Lecture	**3141.4**	Class Quiz, Mid-Term II and End Term
34	Ansible roles, write playbooks	Explaining Ansible roles	Lecture	**3141.4**	Class Quiz, Mid-Term II and End Term
35	Nagios overview and installing	Introduction of Nagios	Lecture	**3141.4**	Class Quiz and End term
36	Nagios Plugins (NRPE) and objects, commands and notification	Designing of Nagios Plugins	Lecture	**3141.4**	Class Quiz and End term
37	Introduction to cloud computing, DevOps on cloud	Introduction of cloud Computing	Lecture	**3141.5**	Class, MOOC and End term
38	Introduction to AWS	Basics of AWS	Lecture	**3141.5**	Class, MOOC and End term
39	AWS various services	AWS various services	Lecture	**3141.5**	Class, MOOC and End term
40	DevOps using AWS, AWS code pipeline	Understanding Devops Using	Lecture	**3141.5**	Class, MOOC and End term

41	End Term Project Evaluation presentation		Flip class		Continuous Evaluation

G. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	Correlation with Program Outcomes(POs)												Correlation with Program Specific Outcomes (**PSOs**)		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC 3141.1]	Understand and **apply** the concept of Devops Pipelining, Git and Version Control.	3				2		2	2			3		2	2	3
[CC 3141.2]	Identify and **use** various tools for Devops Continuous Integration.		3		2	3							3		2	2
[CC 3141.3]	**Experiment** with different Devops tools for continuous testing.		2	3	2	1	1			2	2			1	1	2
[CC 3141.4]	Install and **utilize** puppet, ansible and Nagios tool for configuration management and continuous monitoring.					3			1	1				1		3
[CC 3141.5]	Demonstrate and **apply** the Principal of Devops on cloud computing.			3	2						1	3	1	1	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering

Course Hand-out

Natural Language Processing | CC4142 | 3 Credits | 3 0 0 3

Session: July 22 – Nov. 22| Faculty: Dr. Renu Kumawat | Class: VII Semester

A. **Introduction:** This course is offered by Dept. of Computer and Communication Engineering as an elective subject, targeting students who wish to pursue development in industries or higher studies in field of Natural Language Processing. This course aims to make the students understand the models, methods, and algorithms of Natural Language Processing for common NLP tasks, such as speech recognition, machine translation, spam filtering, text classification, spell checking etc. After learning through this course, students will be able to understand and implement probabilistic models, estimate parameters for such models, and run meaningful experiments to validate such language models. The student will gain understanding of linguistic phenomena and will explore the linguistic features relevant to each NLP task. Prerequisite for the course is knowledge of fundamental mathematics including Linear algebra, Probability and Statistics, AI, and programming in any high-level language, preferably python.

B. **Course Outcomes:** At the end of the course, students will be able to

[CC4142.1] Recognize and identify the nature of the problems that are commonly encountered through the methods of Natural Language Processing;

[CC4142.2] Analyse the relation between parts of speech and grammatical structures used for any natural language with key concepts of NLP;

[CC4142.3] Analyse constituent words based on an underlying grammar and implement with NLP models;

[CC4142.4] Comprehend the NLP models for word sense and discourse analysis in terms of natural language expression;

[CC4142.5] Develop theoretical problem-solving skills and skills to apply such understanding into real life applications;

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1] Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2] Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3] Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4] Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5] Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6] The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7] Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8] Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9] Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10] Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11] Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12] Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Date	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	Sept 05 – Sept 09	20
	Sessional Exam II (Closed Book)	Nov 04 – Nov 06	20
	CWS**		20
End Term Exam (Summative)	End Term Exam (Closed Book)	Nov 29 – Dec 13	40
	Total		100

**Criteria for CWS	Tentative Date/Duration	Marks
Quizzes (best 2 of 3)	Quiz 1 before MTE 1 Exam, Quiz 2 before MTE II Exam, Quiz 3 after MTE II but before End Term Exam	2 x 4=8
Assignment 1 (Individual)	Before MTE 1	4
Assignment 2 (Group)	Before MTE 2	4

Coursera Certificate	Any one of the 4 weeks course from given list of courses	4

E. SYLLABUS

Introduction: Natural language processing tasks in syntax, semantics, and pragmatics, role of machine learning, probability basics, information theory, collocations, N-gram language models, estimating parameters and smoothing, evaluating language models; **Part of Speech (POS) tagging:** Rule-based Part of Speech tagging, Markov models, Hidden Markov Models, transformation-based models, maximum entropy models; **Parsing:** Parsing algorithms, grammar formalisms and treebanks, parsing with context free grammars, parser comparison, constituency, parse tree construction; **Semantic analysis:** Word-sense disambiguation, supervised, dictionary based and unsupervised approaches, compositional semantics, semantic role labeling and semantic parsing; **Machine translation:** Basic issues, statistical translation, phrase-based translation, phonetics and phonology.

References:

[1]. D. Jurafsky, J. H. Martin, Speech and Language processing, (3e), Prentice Hall of India, 2018.

[2]. J. Allen, Natural Language Understanding, (2e), Pearson Education, 2002.

[3]. C. D. Manning, H. Schuetze, Foundations of Statistical Natural Language Processing, (1e), MIT Press, 1999.

[4]. S. Bird, E. Klein, E. Loper, Natural Language Processing with Python, (1e) O'Reilly Media, 2009.

[5]. R. Hausser, Foundations of Computational Linguistics: Human- Computer Communication in Natural Language, (2e), Springer, 2012.

H. Lecture Plan:

Lectures	Major Topics	Topics	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1	**Introduction:** Natural language processing tasks in syntax, semantics, and pragmatics, role of machine learning,	Introduction to the course, discussion of course handout. Applications of NLP, Different levels of Language analysis	**Lecture**	**CC4142.1**	Mid Term I, Quiz & End Term
2		Natural language processing tasks in syntax, semantics, and pragmatics,	**Lecture**	**CC4142.1**	Mid Term I, Quiz & End Term
3-5		Role of machine learning – Logistic Regression for Sentiment analysis of Tweets	**Lecture**	**CC4142.1**	Mid Term I, Quiz & End Term
6-7	Probability basics, information theory,	Introduction to Probability Basics and Information Theory	**Lecture**	**CC4142.1**	Mid Term I, Quiz & End Term
8-9		Information Gain, Entropy, etc.	**Lecture**	**CC4142.1**	Mid Term I, Quiz & End Term
10	collocations, N-gram language models, estimating parameters and smoothing, evaluating language models;	**Collocation, N-gram,**	**Lecture**	**CC4142.1**	Mid Term I, Quiz & End Term
11		**Evaluating language models,**	**Lecture**	**CC4142.1**	Mid Term I, Quiz & End Term
12-13		**generalization, smoothing**	**Lecture**	**CC4142.1**	Mid Term I, Quiz & End Term

14-15	**Part of Speech (POS) tagging:** Rule-based Part of Speech tagging, Markov models, Hidden Markov Models, transformation-based models, maximum entropy models;	Part of Speech Tagging, English word classes, The Penn Treebank Part-of-speech Tag set	**Lecture**	**CC4142.2**	Mid Term I, Quiz & End Term
16-18		Markov Chains, Markov Models vs Hidden Markov Models, HMM Training	Lecture	**CC4142.2**	Mid Term I, Quiz & End Term
19-20		transformation-based models, maximum entropy models;	Lecture	**CC4142.2**	Mid Term I, Quiz & End Term
21-22		Part of Speech tagging for morphological Rich Language	**Lecture**	**CC4142.2**	Mid Term I, Quiz & End Term
23-24	**Parsing:** Parsing algorithms, grammar formalisms and treebanks, parsing with context free grammars, parser comparison, constituency, parse tree construction;	Parsing, Grammars and Sentence Structures, Grammar formalism and treebanks	**Lecture**	**CC4142.2**	Mid Term II, Quiz & End Term
25		Top-Down Chart Parser vs Bottom-up Chart Parser	Lecture	**CC4142.3**	Mid Term II, Quiz & End Term
26		Context free grammars	Lecture	**CC4142.3**	Mid Term II, Quiz & End Term
27-28		Parser comparison, constituency and parse tree construction	Lecture	**CC4142.3**	Mid Term II, Quiz & End Term
29	**Semantic analysis:** Word-sense disambiguation, supervised, dictionary based and unsupervised approaches, compositional semantics, semantic role labeling and semantic parsing;	Word Senses, Word net, disambiguation	**Lecture**	**CC4142.4**	Mid Term II, Quiz & End Term
30		Supervised, dictionary based and unsupervised approaches	**Lecture**	**CC4142.4**	Mid Term II, Quiz & End Term
30		compositional semantics, semantic role labeling	Lecture	**CC4142.4**	Mid Term II, Quiz & End Term
31-32		semantic parsing and numericals	Lecture	**CC4142.4**	Mid Term II, Quiz & End Term
33-34	**Machine translation:** Basic issues, statistical translation, phrase-based translation,	Basic issues of Machine Translation	**Lecture**	**CC4142.4**	Mid Term II, Quiz & End Term
35		Statistical Translation	**Lecture**	**CC4142.4**	Mid Term II, Quiz & End Term

36	phonetics and phonology.	phrase-based translation,	**Lecture**	**CC4142.4**	Mid Term II, Quiz & End Term
37		Phonetics and Phonology	**Lecture**	**CC4142.4**	Mid Term II, Quiz & End Term
38	Applications of NLP, case studies	Spell-checking	Lecture	**CC4142.5**	Mid Term II, Quiz & End Term
39		Text Summarization and Information Retrieval	Lecture	**CC4142.5**	Mid Term II, Quiz & End Term
40-41		Chatbot	Lecture	**CC4142.5**	Mid Term II ,Quiz & End Term
42		Practice Problems	Lecture	**CC4142.5**	Mid Term II ,Quiz & End Term

F. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC4142.1	Recognize and identify the nature of the problems that are commonly encountered through the methods of Natural Language Processing.															
CC4142.2	Analyse the relation between parts of speech and grammatical structures used for any natural language with key concepts of NLP;															
CC4142.3	Analyse constituent words based on an underlying grammar and implement with NLP models;															
CC4142.4	Comprehend the NLP models for word sense and discourse analysis in terms of natural language expression;															
CC4142.5	Develop theoretical problem-solving skills and skills to apply such understanding into real life applications;															

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering
Deep Learning | CC 4143 | 3 Credits | 3 0 0 3

Department of Computer & Communication Engineering
Course Hand-out
Session: Aug 22 – Nov 22 | Faculty: Sunil Kumar | Gulrej Ahmed| Class: VII Sem

A. Introduction: This course is offered by Dept. of Computer & Communication Engineering under minor specialization of Computational Intelligence. It target students who wish to pursue research & development in industries or higher studies in field of Deep learning. It offers in-depth knowledge of Deep Learning, convolution neural network, RNN, GAN, and popular deep learning architectures. The course will enable students to build deep learning models to solve problems in the field of computer vision and natural language processing.

B. Course Outcomes: At the end of the course, students will be able to

CC4143.1: Apply the back-propagation algorithm to a neural network architecture with one hidden layer.
CC4143.2: Apply the concepts of convolution, pooling, padding, striding to design convolution neural networks.
CC4143.3: Analyse the popular CNN architectures: AlexNet, VGG, Inception, ResNet.
CC4143.4: Demonstrate working of RNN, GAN, Auto encoders.
CC4143.5: Apply deep learning models to computer vision and natural language processing for improving development skills.

C. Program Outcomes, Program Specific Outcomes, and Program Educational Objectives

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.
[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.
[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

Program Educational Objectives (PEOs)

[PEO.1] Graduates shall exhibit leadership skills to foster academic excellence with productive research and social reforms engaging in lifelong learning with ethical practices.
[PEO.2] Graduates shall pursue higher education to upgrade technical competency in the field of computation.
[PEO.3] Graduates shall showcase industry readiness with a strong understanding of logical, analytical, critical thinking with teamwork.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Formative)	Sessional Exam I	20
	Sessional Exam II	20
	Class Quizzes/Assignments/ MOOC (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. Syllabus

CC4143: DEEP LEARNING [3 0 0 3]

Introduction: Neural networks; Training a network: Loss functions, back propagation and stochastic gradient descent, neural networks as universal function; Convolutional Neural Networks: Introduction to Convnet, training a Convnet, weights initialization, batch normalization, pooling, padding, dropouts, hyper parameter optimization, CNN Architectures- AlexNet, VGG, Inception, ResNet; Recurrent neural network: Recurrent networks, long short- term memory(LSTM), gated recurrent units(GRU), recurrent neural network language models; Deep unsupervised learning: Auto encoders, variation auto encoders, generative adversarial networks(GAN), maximum entropy distributions; Applications: Deep learning applications to computer vision and natural language processing(NLP).

References:

1. L. Deng & D. Yu, Deep Learning: Methods and Applications, (1e), Now Publishers, 2014.
2. Goodfellow, Y. Bengio, A. Courville, Deep Learning, (1e), MIT Press, 2016.
3. M. Nielsen, Neural Networks and Deep Learning, (1e), Determination Press, 2015.
4. C. R. Shalizi, Advanced Data Analysis from an Elementary Point of View, (1e) Cambridge University Press, 2015F.

G. Lecture Plan:

Lecture No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
0	Introduction to the course, Handout discussion	Background information and importance of course in the program	Discussion	NA	~~NA~~
1	Introduction: Neural networks	Understand the basic functioning of neural network	Lecture	CC4143.1	Class Quiz
2	Multi-layer perceptron	Understand the role of hidden layers with logic gates	Lecture	CC4143.1	Class Quiz Mid Term I End Term
3	Loss functions	Understand the theory behind popular loss functions	Lecture	CC4143.1	Class Quiz Mid Term I End Term
4	Activation functions	Understand different activation functions	Lecture	CC4143.1	Class Quiz Mid Term I End Term
5	Back-propagation: Introduction	Understand back-propagation algorithm	Lecture	CC4143.1	Class Quiz Mid Term I End Term
6	Back-propagation: Example	Apply back-propagation to given neural network architecture	Flip Class	CC4143.1	Home Assignment Class Quiz Mid Term I End Term
7	Gradient descent and other optimization methods	Minimize loss using Gradient descent	Lecture	CC4143.1	Class Quiz Mid Term I End Term
8	Neural networks as universal function	Understand concept of Neural networks as universal function theorem	Lecture	CC4143.1	Class Quiz Mid Term I End Term
9	Convolutional Neural Networks	Understand the typical architecture of CNN	Lecture/MOOC	CC4143.2	Class Quiz Mid Term II

					End Term
10	CNN: Pooling, Padding, stride	Apply CNN concepts on typical architecture	Lecture /MOOC	CC4143.2	Class Quiz Mid Term II End Term
11	CNN: Pooling, Padding, stride with example	Apply CNN concepts on typical architecture	Lecture /MOOC	CC4143.2	Class Quiz Mid Term II End Term
12	Training a Convnet, weights initialization, batch normalization	Understand concepts of normalization	Lecture /MOOC	CC4143.2	Class Quiz Mid Term II End Term
13	Regularization	Apply regularization techniques	Lecture /MOOC	CC4143.2	Class Quiz Mid Term II End Term
14	Hyper parameter optimization	Use of hyper parameters in fine tuning	Lecture /MOOC	CC4143.2	Class Quiz Mid Term II End Term
15	CNN Architectures: AlexNet	Analyse AlexNet	Lecture/Assignment	CC4143.3	Class Quiz Assignment Mid Term II End Term
16	VGG	Analyse VGG w.r.t. typical CNN concepts and toy program	Lecture/Assignment	CC4143.3	Class Quiz Assignment Mid Term II End Term
17	Inception	Analyse Inception w.r.t. typical CNN concepts and toy program	Lecture/Assignment	CC4143.3	Class Quiz Assignment Mid Term II End Term
18	ResNet	Analyse ResNet w.r.t. typical CNN concepts and toy program	Lecture/Assignment	CC4143.3	Class Quiz Assignment Mid Term II End Term
19	Recurrent Neural Network	Understand basic concepts of RNN	Lecture	CC4143.4	Class Quiz Mid Term II End term

20	RNN: Classification	Classify and compare different types of RNN architectures			
21-24	Recurrent networks, long short term memory(LSTM),	Explore Vanilla RNN limitations and LSTM relevance	Lecture	CC4143.4	Class Quiz Mid Term II End Term
22	LSTM architecture	Interpret the role of gates in LSTM	Lecture	CC4143.4	Class Quiz Mid Term II End Term
23	LSTM working	Understand the working of LSTM	Lecture	CC4143.4	Class Quiz Mid Term II End Term
24	LSTM types	Explore different LSM types	Lecture	CC4143.4	Class Quiz Mid Term II End Term
25-27	Gated recurrent units(GRU) Architecture	Interpret the role of gates in GRU	Lecture	CC4143.4	Class Quiz Mid Term II End Term
26	GRU working	Understand the working of GRU	Lecture	CC4143.4	Class Quiz Mid Term II End Term
27	recurrent neural network language models	Understand the RNNLM model	Lecture	CC4143.4	Class Quiz Mid Term II End Term
28	Deep unsupervised learning	Understand unsupervised learning	Lecture	CC4143.4	Class Quiz End Term
29	Auto encoders	Understand architecture of auto encoders	Lecture	CC4143.4	Class Quiz End Term
30	Generative adversarial networks(GAN)	Interpret the working of Generative adversarial networks(GAN)	Lecture	CC4143.4	Class Quiz End Term
31	Types of GAN	Select appropriate model for problem solving	Lecture	CC4143.4	Class Quiz End Term

32	Maximum entropy distributions	Understand Maximum entropy distributions	Lecture	CC4143.4	Class Quiz End Term
33	Deep learning applications to computer vision	Recognize the role of deep learning in computer vision	Lecture	CC4143.5	Class Quiz Assignment End Term
34	Object detection using DL-1	Apply DL for object detection	Hands on	CC4143.5	Class Quiz Assignment End Term
35	Object detection using DL-2	Apply DL for object detection	Hands on	CC4143.5	Class Quiz Assignment End Term
36	Face detection using DL-1	Apply DL for Face detection	Hands on	CC4143.5	Class Quiz Assignment End Term
37	Face detection using DL-2	Apply DL for Face detection	Hands on	CC4143.5	Class Quiz Assignment End Term
38	Deep learning applications to computer vision and natural language processing(NLP).	Understand use of DL in NLP	Lecture	CC4143.5	Class Quiz Assignment End Term
39	Sentiment Analysis using LSTM-1	Apply DL for sentiment analysis	Hands on	CC4143.5	Class Quiz Assignment End Term
40	Sentiment Analysis using LSTM-2	Apply DL for sentiment analysis	Hands on	CC4143.5	Class Quiz Assignment End Term

	Mid Term-I		Mid Term-II		End Term

G. Course Articulation Matrix: (Mapping of COs with POs/PSOs)

Course Out-Comes	STATEMENT	Domain specific POs					Domain Independent POs							PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CC4143.1	Apply the back-propagation algorithm to a neural network architectures with one hidden layer.	3	1	1					0	0			3	0	2	0
CC4143.2	Apply the concepts of convolution, pooling, padding, striding to design convolution neural networks.	3	1	1					0	0			2	0	3	0
CC4143.3	Analyse the popular CNN architectures: AlexNet, VGG, Inception, ResNet.	0	1	2					0	2			3	0	3	0
CC4143.4	Demonstrate working of RNN, GAN, Auto encoders.	3	1	0					0	0			3	0	3	0
CC4143.5	Apply deep learning models to computer vision and natural language processing for improving development skills.	2	1	2					0	2			2	0	3	0

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Justification:

Blooms Taxonomy Action verbs and Cognitive levels→

Level	Skill Demonstrated	Question cues / Verbs for tests
1. Remember	• Ability to recall of information like facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria • ability to recall methodology and procedures, abstractions, principles, and theories in the field • knowledge of dates, events, places • mastery of subject matter	list, define, tell, describe, recite, recall, identify, show, label, tabulate, quote, name, who, when, where
2. Understand	• understanding information • grasp meaning • translate knowledge into new context • interpret facts, compare, contrast • order, group, infer causes • predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss
3. Apply	• use information • use methods, concepts, laws, theories in new situations • solve problems using required skills or knowledge • Demonstrating correct usage of a method or procedure	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify
4. Analyse	• break down a complex problem into parts • Identify the relationships and interaction between the different parts of a complex problem • identify the missing information, sometimes the redundant information and the contradictory information, if any	classify, outline, break down, categorize, analyze, diagram, illustrate, infer, select
5. Evaluate	• compare and discriminate between ideas • assess value of theories, presentations • make choices based on reasoned argument • verify value of evidence • recognize subjectivity • use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate

6. Create	• use old ideas to create new ones • Combine parts to make (new) whole, • generalize from given facts • relate knowledge from several areas • predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

CO Designing→

CO Number	Cognitive Domain	Performance	Condition	Criteria
CC4143.1	**L3**	**Apply** the back-propagation algorithm to a neural network architectures with one hidden layer.	**Using a given architecture**	**Correctly updating learnable parameters**
CC4143.2	**L3**	**Apply** the concepts of convolution, pooling, padding, striding to design convolution neural networks.	**On given image and kernel size**	**Correctly calculating output**
CC4143.3	**L4**	**Analyse** the popular CNN architectures: AlexNet, VGG, Inception, ResNet.	**VGG16, Resnet, Alexnet**	**Identifying strengths and weaknesses**
CC4143.4	**L2**	**Demonstrate** working of RNN, GAN, Auto encoders.	**Under the given scenario**	**Explain underlying concepts**
CC4143.5	**L3**	**Apply** deep learning models to computer vision and natural language processing for improving development skills.	**On object detection, face detection and sentiment analysis**	**Working model to solve the problem**

MANIPAL UNIVERSITY JAIPUR

School of COMPUTER AND COMMUNICATION ENGG

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGG

Course Hand-out

HUMAN-COMPUTER INTERACTION| CC4149 | Credits [3 0 0 3]

Session: Aug-22 -Nov 22 | Faculty: Dr Sourabh SinghClass VII SEM

A. Introduction: This course is offered by the Department of computer and communication engineering as a theory subject for students to get familiarize students with an introduction to human-computer interactions. HCI is an interdisciplinary field that assimilates theories and methodologies from computer science, design, cognitive psychology and many other areas. The overall goal is to make students learn user-centered design by learning the fundamentals of human-computer interactions.

B. Course Outcomes: At the end of the course, students will be able to:

[CC 4149.1] Define the design principle, standard and guidelines to create human-centered systems

[CC 4149.2] discuss and develop typical human-computer interaction (HCI) models and styles

[CC 4149.3] device and plan interface design through critical assessment and solutions.

[CC 4149.4] identify the current research and development in the field of HCI

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem Analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniqu es and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the

professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. Individual and team work: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

D. Program Specific Outcomes (PSOs)

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.
[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.
[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

E. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	Research work	10
	Assignments/video assignment	10
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

F. SYLLABUS

Introduction, Human Perception and Cognition, Designing an HCI System, Methodology for designing user-computer interfaces, Prototyping user interfaces, Guidelines for designing user interfaces, Implementing and Evaluating an HCI System; User experience levels, Styles, tasks, techniques, and devices, Testing and evaluation of interfaces, Hypothesis testing, Statistical analysis, models and theories, visual performance and graphics design, online documentation and help systems, HCI and the World Wide Web, Human Information Processing; Designing to fit human capabilities; Groupware, ubiquitous computing, collaborative systems, groupware, and coordination technology, Research Trends in human-computer Interaction; Voice, Gesture, Wearable and mobile, tactile and non-tactile interfaces, Concepts of Virtual and Augmented Reality, Models for Dynamic Learning in HCI; Bayesian Networks, Hidden Markov Model.

G. Reference Books

Text Book(s):

1. B. Shneiderman, C. Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", Addison-Wesley, 6th Edition, 2017.

2. J. Preece, H. Sharp, Y. Rogers, "Interaction Design: Beyond Human-Computer Interaction", John Wiley & Sons, 4th Edition, 2015.

3. T.M. Mitchell, "Machine learning", McGraw-Hill India, 2014.

Reference(s):

1. A. Dix, J. Finlay, G. Abowd,R. Beale, "Human Computer Interaction", Pearson Education, 3rd Edition, 2004.

2. J. M. Carroll, "HCI Models, Theories, and Frameworks: Toward a Multidisciplinary Science", Elsevier, 1st Edition, 2003.

3. R. Duda, P. Hart, D. Stork, "Pattern Classification", John Willey and Sons, 2nd Edition, 2001.

H. Lecture Plan

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	**Introduction overall**	**Expecation and learning from the subject**	Lecture		
2.	Introduction	To understand human in terms of HCI	Lecture	4149.1	In Class Quiz Home Assignment Mid Term I End Term
3	Introduction	To understand Computers in terms of HCI	Lecture	4149.1	In Class Quiz Home Assignment Mid Term I End Term
4	Introduction	To understand interaction between Human and Computer	Lecture	4149.1	In Class Quiz Home Assignment Mid Term I End Term
5	Human Perception and Cognition	Study human perception and cognitive models and issues	Lecture	4149.1	In Class Quiz Home Assignment Mid Term I End Term
6-8	Designing an HCI System, Guidelines for designing user interfaces	Introduce with HCI designing principles and basics .	Lecture, Practice questions	4149.2	In Class Quiz Home Assignment Mid Term I End Term
9-10	Methodology for designing user-computer interface	User centered design and GUI	Lecture, Practice questions	4149.2	In Class Quiz Home Assignment Mid Term I End Term
11-12	Prototyping user interfaces	To understand need and usage of various type of prototypes available	Lecture,	4149.2	In Class Quiz Home Assignment Mid Term I End Term

13-14	Implementing and Evaluating an HCI System	Understanding different interactive models for s/w development and determine why, what, where and when evaluation. Types of evaluation etc	Lecture, Case study	4149.3	In Class Quiz Home Assignment Mid Term I End Term
		1st Sessional Exam			
15-16	Implementing and Evaluating an HCI System	Evaluation strategies and issues	Lecture,	4149.3	In Class Quiz Home Assignment Mid Term II End Term
17-18	User experience levels, Styles, tasks,	To understand user models and involvement in the interaction process and also to analyze styles available and task perform by user	Lecture, Flipped class room	4149.2	In Class Quiz Home Assignment Mid Term II End Term
19	techniques, and devices	To study and compare techniques and devices available for interactions	Lecture	4149.2	In Class Quiz Home Assignment Mid Term II End Term
20	Testing and evaluation of interfaces	To understand various testing technique and evaluation techniques	Lecture	4149.3	In Class Quiz Home Assignment Mid Term II End Term
21	Hypothesis testing	Forming hypothesis and comparing	Lecture	4149.3	In Class Quiz Home Assignment Mid Term II End Term
22	Statistical analysis	To learn and compute imperical method to evaluate interface designs	Lecture, Question	4149.3	In Class Quiz Home Assignment Mid Term II End Term
23	models and theories	To understand models and theories of interactions. Such as communication	Lecture	4149.2	In Class Quiz Home Assignment Mid Term II End Term
24	visual performance and graphics design	Evaluating and caompare visual interaction and design	Lecture	4149.2,4149.3	In Class Quiz Home Assignment Mid Term II End Term
25	online documentation and help systems	To understand the need and implementation od documentation and manual system for users	Lecture	4149.2	In Class Quiz Home Assignment Mid Term II End Term

26	HCI and the World Wide Web	To discover and improve human effective interaction with www	Lecture	4149.2	In Class Quiz Home Assignment Mid Term II End Term
27	Human Information Processing	To understand the information retrieval and processing interaction	Lecture	4149.2	In Class Quiz Home Assignment Mid Term II End Term
28	Designing to fit human capabilities;	Associate synching of human cognition with computers	Lecture, Case studies	4149.2,4149.3	In Class Quiz Home Assignment Mid Term II End Term
29	Groupware, ubiquitous computing, collaborative systems, groupware, and coordination technology,	To understand the interaction designs and basics for groupware and any computing device	Lecture	4149.3	In Class Quiz Home Assignment Mid Term II End Term
2nd Sessional Exam					
30	Research Trends in HumanComputer Interaction;.	Analyze various research area and probable future of HCI	Lecture, Case studies	4149.4	In Class Quiz Home Assignment End Term
32	Voice, Gesture, Wearable and mobile, tactile and non-tactile interfaces,	Analyze HCI in various hand-held computing devices.	Lecture	4149.3,4149.4	In Class Quiz Home Assignment End Term
33	Concepts of Virtual and Augmented Reality,	Understanding the application of HCI in virtual and augmented reality. Analyze replacement of physical world by virtual world	Lecture	4149.3,4149.4	In Class Quiz Home Assignment End Term
34	Models for Dynamic Learning in HCI;	To understand feedback and learning inclusions with interaction	Lecture	4149.2	In Class Quiz Home Assignment End Term
35	Bayesian Networks,	To implement and understand directed acyclic graph to evaluate the dependencies	Lecture	4149.3,4149.4	In Class Quiz Home Assignment End Term
36	Hidden Markov Model	Usage and purpose of hidden Markov Model for HCI. And Understanding what is it.	Lecture, Practise questions	4149.3,4149.4	In Class Quiz Home Assignment End Term
END TERM EXAM					

I. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC4149.1]:	Define the design principle, standard and guidelines to create human-centered systems	2		1							1		1	1	2	1
[CC4149.2]:	discuss and develop typical human-computer interaction (HCI) models and styles	3	2	1								3		2	1	1
[CC4149.3]:	device and plan interface design through critical assessment and solutions.	3	2	1	1					1		1		2	3	3
[CC4149.4]:	identify the current research and development in the field of HCI	1	2	2	1	1	1		1	2	1	1		3	2	2

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Engineering

Course Hand-out

Mobile Computing |**CC4150**| [3 Credits] [3003]

Session: July-Nov. 2022 | Faculty: Dr Amita Nandal | Class: VII (DE)

Introduction: This course aims providing in-depth coverage on mobile/wireless networking, the characteristics of wireless radio channels, propagation models, architectures and protocols of mobile/wireless networks, wide-area and local-area wireless network, cellular networks and Bluetooth.

A. Course Objectives: At the end of the course, students will be able to:

[CC4150.1]: Explain the basic fundamentals of Mobile Communications.
[CC4150.2]: Analyze transmission fundamentals and various propagation and modulation techniques.
[CC4150.3]: Apply the cellular radio concepts and developments.
[CC4150.4]: Compare and Contrast the concept of WLAN and Bluetooth.
[CC4150.5]: Describe the functionality of Mobile IP and WWWW.

B. Program Outcomes and Program Specific Outcomes

PROGRAM OUTCOMES

[PO.1]. **engineering knowledge**: Demonstrate and apply knowledge of Mathematics, Science and Engineering to classical and recent problems of electronic design & communication system.

[PO.2]. **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. **Design/development of solutions**: Design a component system, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

[PO.4]. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding_of the limitations

[PO.6]. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environment.

[PO.12]. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES

[PSO.1] Clearly imbibe the basic principles, concepts and applications of computer based Communication/networking, information sharing, signal processing, web based systems, smart devices and communication technology.

[PSO.2] Investigate problematic areas prevalent in the field of Computer and Communication Engineering to find acceptable solutions.

[PSO.3] Identify the existing open problems in the field of computing and propose the best possible solutions.

[PSO.4] Apply the contextual knowledge in the field of computing and communication to assess social, health, safety and cultural issues and endure the consequent responsibilities relevant to the professional engineering practice.

C. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Open Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

D. Syllabus:

Syllabus: Evolution of mobile radio communication, Transmission fundamentals; **Modulation techniques:** Signal encoding criteria, Overview of ASK, PSK, FSK, MSK, Spread spectrum modulation; **Cellular concepts:** Frequency reuse, Channel assignment strategies, Handoff strategies; **Wireless LAN:** Overview of Wireless LAN Technology; Infrared LANS, Spread Spectrum LANs, Narrowband microwave LANS; IEEE 802 Protocol Architecture, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control and IEEE 802.11 Physical Layer. **Bluetooth:** Radio Specification; Baseband Specification; Link Manager Specification; Logic Link Control and Adaptation Protocol; HiperLAN 1 and HiperLAN 2; Wireless Sensor Networks. **Mobile Computing:** Mobile IP,

ubiquitous and nomadic computing; Wireless LANS & the wireless world wide web; Mobile agent technology and standards; **Case studies**: Agent TCL, aglets, PMADE, system design.

E. Text / Reference Books:

1. T.S. Rappaport, "*Wireless Communications - Principle and Practice*", Second Edition, PHI, 2005.
2. 2. W. Stallings, "*Wireless Communication and Network",*' Second Edition, PHI, 2004.
3. R. Pandya "*Mobile and Personal Communication systems and services*", PHI, 2001.
4. M. Ciampa, "*Guide to Designing and Implementing wireless LANs*", Thomson learning, Vikas Publishing House, 2001.

F. Lecture Plan:

Lecture no.	Major Topics	Topic to be covered	Correspondin g CO	Mode of Delivery	Mode of Assessing CO
L-1	**Evolution of Mobile Communication & Propagation**	Introduction and Evolution to Mobile Communication	CO1	Lecture	In class Quiz Mid Term I End Term Exam
L-2		Basics of Propagation	CO2	Lecture	In class Quiz Mid Term I End Term Exam
L-3		Propagation Models	CO2	Lecture	In Class Quiz, Mid Term I End Term
L-4		Free-Space Propagation Model, Large-Scale Path Loss	CO2	Lecture	In Class Quiz Mid Term I End Term
L-5		Small Scale Multipath Propagation	CO2	Flipped Class	In Class Quiz Mid Term I End Term
L-6 to L-7	**Modulation techniques**	Modulation Techniques	CO2	Flipped Class	Class Quiz, Mid Term I End Term
L-8 to L10		Liner Modulation Techniques - ASK, PSK, FSK, MSK	CO2	Lecture	Class Quiz Mid Term I End Term

L-11 to L-12		Spread spectrum modulation	CO2	Flipped Class	Class Quiz Mid Term I End Term
L-13	**Cellular concepts**	Cellular Concepts	CO3	Lecture	Class Quiz Mid Term I End Term
L-14		Frequency reuse	CO3	Lecture	Class Quiz Mid Term I End Term
L-15		Channel assignment strategies	CO3	Tutorial	Class Quiz Mid Term I End Term
L-16		Handoff strategies: Prioritizing Handoffs and practical handoff consideration	CO3	Tutorial	Class Quiz Mid Term I End Term
L-17		Interference and System Capacity	CO3	Lecture	Class Quiz Mid Term I End Term
L-18		Trunking and Grade of Service	CO3	Lecture	Class Quiz Mid Term I End Term
L-19	**Wireless LAN**	Overview of Wireless LAN Technology	CO4	Lecture	Class Quiz Mid Term II End Term
L-20		Challenges in Wireless LAN	CO4	Lecture	Class Quiz Mid Term II End Term
L-21 to L-23		Infrared LANS, Spread Spectrum LANs , Narrowband microwave LANS	CO4	Lecture	Class Quiz Mid Term II End Term
L-24		WLAN applications	CO4	Lecture	Class Quiz Mid Term II End Term

L-25		Introduction to IEEE 802	CO4	Lecture	Class Quiz Mid Term II End Term
L-26 to L-28		IEEE 802.11 Protocol Introduction, IEEE 802.11 Architecture, IEEE 802.11 Services	CO4	Lecture	Class Quiz Mid Term II End Term
L-29		IEEE 802.11 MAC and Physical Layer	CO4	Lecture	Class Quiz Mid Term II
L-30	**Bluetooth**	**Bluetooth:** Radio Specification	CO4	Flipped Class	Class Quiz Mid Term II End Term
L-31		Baseband Specification	CO4	Lecture	Class Quiz End Term
L-32		Link Manager Specification	CO4	Lecture	Class Quiz End Term
L-34		Logic Link Control and Adaptation Protocol	**CO4**	Tutorial	Class Quiz End Term
L-35		**HiperLAN & WSN**	CO4	Lecture	Class Quiz End Term
L-36	**Mobile Computing, WWWW and its applications**	**Introduction to Mobile Computing**	CO5	Lecture	Class Quiz End Term
L-37 to L-39		Mobile IP Introduction and architecture	CO5	Lecture	Class Quiz End Term
L-40		**Introduction to WWWW & Mobile Agent** Applications and architecture of wireless world wide web Mobile agent technology and standards	CO5	Lecture	End Term
L-41		Case Study 1 & 2	CO5	Lecture	

A. Course Articulation Matrix: (Mapping of COs with POs and PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CC4150.1	Explain the basic fundamentals of Mobile Communications.	2	2	2						2	2		3	2	2	2	
CC4150.2	Analyze transmission fundamentals and various propagation and modulation techniques.	3	3	3						2	2		3	2	2	2	
CC4150.3	Apply the cellular radio concepts and developments.	3	3	3	3					2	2		3	2	2	2	
CC4150.4	Compare and Contrast the concept of WLAN and Bluetooth.	2	2	3	3	3				2	2		3	2	2	2	
CC4150.5	Describe the functionality of Mobile IP and WWWW.	2	2	3	3	3				2	2		3	2	2	2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer & Communication Engineering

Department of Computer & Communication Engineering
Course Hand-out

Information Retrieval | CC4151 | 3 Credits | 3 0 0 3

Session: Aug 2022 – Dec 2022

| Faculty: Dr Sandeep Kumar Sharma|

Class: CCE 7th Semester (Program Elective)

A. Introduction: This course is offered by Dept. of Computer & Communication Engineering as program elective, targeting students who wish to pursue research & development in industries or higher studies in field of Engineering, including search engines optimization and document retrieval. The objective of the course is to explorer the scientific support in the field of information search/retrieval and define fundamental relationship between information retrieval, hypermedia architectures, and semantic models. This course offers knowledge of various retrievals techniques using concepts of clustering, classification, and indexing.

B. Course Outcomes: At the end of the course, students will be able to

[CO 4151.1] Apply information retrieval principles to retrieve the relevant records in large collections of data and hence enhance the employability skills.

[CO 4151.2] Elaborate the techniques of indexing in retrieval i.e., Boolean retrieval and probabilistic retrieval.

[CO 4151.3] Analyse information retrieval algorithms i.e., classification, clustering and feedback of wild card queries, free text queries & representation of queries.

[CO4151.4] Analyse and apply the concepts of distributed and parallel IR for documents collection, structuring, and query processing.

[CO 4151.5] Analyse search strategies of different types of IR models.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.

[PO.9]. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

[PO.12]. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

[PSO.1]. Will be able to clearly understand the basic principles, concepts and applications in the field of computer based Communication/networking, information sharing, signal processing, web based systems, smart devices and communication technology.

[PSO.2]. Will be able to nail down the issues prevalent in the field of Computer and Communication Engineering.

[PSO.3]. Will be able to identify and devise solutions for the existing open problems in the field of computing and propose the best possible solutions.

[PSO.4]. Will be able to apply the contextual knowledge in the field of computing and communication to assess social, health, safety and cultural issues and endure the consequent responsibilities relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Date	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	As per academic calendar	15
	Sessional Exam II (Closed Book)	As per academic calendar	15
	Quizzes (4) and Assignments (3) (Accumulated and Averaged)	Regularly	30
End Term Exam (Summative)	End Term Exam (Closed Book)	As per academic calendar	40
	Total		**100**
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.		
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.		

E. SYLLABUS

Basic concepts of IR: data retrieval and information retrieval, IR system block diagram, automatic text analysis, Luhn's ideas, conflation algorithm, indexing and index term weighing, probabilistic indexing, automatic classification. measures of association, different matching coefficient, classification methods, cluster hypothesis, clustering algorithms, single pass algorithm, single link algorithm, Rochhio's algorithm and dendograms; Distributed and Parallel IR: relationships between documents, identify appropriate networked collections, multiple distributed collections simultaneously, parallel MIMD architectures, distributed IR – collection partitioning, source selection, query processing, file structures, inverted file, suffix trees and suffix arrays, signature files, ring structure, IR models, basic concepts, Boolean model, vector model; Fuzzy set model: search strategies, Boolean search, serial search, and cluster based retrieval, matching function. References:

F. REFERENCE BOOKS

1) Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008

2) B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, The MIT Press, 2010.

3) K. Sparck Jones & P. Willett, Readings in Information Retrieval. Morgan Kaufmann, 1997.

4) B. Ricardo, B.Neto Modern Information Retrieval, (2e), Addison-Wesley, 2011.

5) S. Buttcher, C. Clarke, G. Cormack, Information Retrieval: Implementing and Evaluating search Engines, Addison Wesley, 2010

6) R. Baeza-Yates & B. Ribeiro-Neto, Modern Information Retrieval. Addison Wesley, 1999, 2nd Edition, 2011

G. Lecture Plan:

Sr.No.	Topics to be covered	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Course overview, objective of the course, scope of the course	To familiarise about course objectives and scope.	Lecture	NA	NA
2.	Basic concepts of IR: data retrieval and information retrieval,	Understanding of difference b/w IR and DR	Lecture/PPT	4151.1	Class Quiz Sessional 1 End Term
3.	IR system block diagram	Understanding of basic components IR	Lecture/PPT	4151.1	Class Quiz Sessional 1 End Term
4.	Automatic text analysis, Luhn's ideas	Understand ideas of Luhn's for IR.	Lecture/PPT	4151.1	Class Quiz Sessional 1 End Term
5.	Conflation algorithm	Understanding the conflation process	Lecture/PPT	4151.1	Class Quiz Sessional 1 End Term
6.	Examples of Conflation algorithm	Knowledge about applications of conflation process	Lecture and Flipped Class	4151.1	Class Quiz Sessional 1 End Term
7.	Indexing and index term weighing	Knowledge of measuring the importance of an index term in a document or a query	Lecture/PPT	4151.2	Class Quiz Sessional 1 End Term
8.	Probabilistic indexing	Knowledge of measure of the probability that the document will satisfy the given request	Lecture/PPT	4151.2	Class Quiz Sessional 1 End Term

9.	Automatic classification.	Understand to managing text and unstructured information	Lecture/PPT	4151.2	Class Quiz Sessional 1 End Term
10.	Measures of association	Knowing about relationship between information	Lecture/PPT	4151.2	Class Quiz Sessional 1 End Term
11.	Different matching coefficient	Understand the of identifying similarity and diversity	Lecture/PPT	4151.2	Class Quiz Sessional 1 End Term
12.	Classification methods	Understand the concepts of subtask processing	Lecture / Flipped Class	4151.3	Class Quiz Sessional 1 End Term
13.	Cluster hypothesis, clustering algorithms	Know about nature of data	Lecture/PPT	4151.3	Class Quiz Sessional 1 End Term
14.	Examples of clustering	Know about data mining techniques	Lecture/PPT	4151.3	Class Quiz Sessional 2 End Term
15.	Single pass algorithm	Understand clustering without unbounded buffering	Flipped Class	4151.3	Class Quiz Sessional 2 End Term
16.	Single link algorithm	Understand clustering in hierarchical manner	Lecture/PPT	4151.3	Class Quiz Sessional 2 End Term
17.	Rochhio's algorithm and dendograms;	Understanding Relevance feedback information retrieval	Lecture/PPT	4151.3	Class Quiz Sessional 2 End Term
18.	Distributed and Parallel IR: relationships between documents	Understanding how multiple techniques brings together for information retrieval	Lecture/PPT	4151.4	Class Quiz Sessional 2 End Term
19.	Identify appropriate networked collections	Understanding of documents collection methods	Lecture	4151.4	Class Quiz Sessional 2 End Term
20.	Multiple distributed collections simultaneously	Understanding of documents collection methods	Lecture	4151.4	Class Quiz Sessional 2 End Term

21.	Parallel MIMD architectures, distributed IR – collection partitioning	Understanding multitasking approach for information retrieval	Lecture/PPT	4151.4	Class Quiz Sessional 2 End Term
22.	Source selection, query processing	Understanding to select a specific source and apply a query for IR	Lecture/PPT	4151.4	Class Quiz Sessional 2 End Term
23.	File structures	Knowing different file structures for IR system	Lecture/PPT	4151.4	Class Quiz Sessional 2 End Term
24.	Inverted file	Understanding fast full-text searching	Lecture/PPT	4151.4	Class Quiz Sessional 2 End Term
25.	Suffix trees	Know the concept of pattern searching	Lecture/PPT	4151.4	Class Quiz Sessional 2 End Term
26.	suffix arrays	Know the concept of pattern searching	Lecture/PPT	4151.4	Class Quiz Sessional 2 End Term
27.	Signature files	Understanding how to obtain query results.	Lecture/PPT	4151.4	Class Quiz Sessional 2 End Term
28.	Ring structure	Understanding the concept of Text classification	Lecture/PPT	4151.4	Class Quiz Sessional 2 End Term
29.	IR models, basic concepts,	Know classification of IR models	Lecture/PPT	4151.5	Class Quiz Sessional 2 End Term
30.	Boolean model,	Understanding set theory based IR	Lecture/PPT	4151.5	Class Quiz Sessional 2 End Term

31.	vector model;	Understanding linear algebra-based IR	Lecture/PPT	4151.5	Class Quiz Sessional 2 End Term
32.	Fuzzy set model:	Understanding flexibilities in IR models	Lecture/PPT	4151.5	Class Quiz Sessional 2 End Term
33.	Differences b/w IR models	Understanding differences with example	PPT	4151.5	Class Quiz End Term
34.	search strategies, Boolean search-based retrieval	Know to find documents, which are true for queries	Lecture/PPT	4151.5	Class Quiz End Term
35.	Serial search, and cluster-based retrieval	Understand implementation best searching technique	Lecture/PPT	4151.5	Class Quiz End Term
36.	matching function.	Understanding to search matched query on web	Lecture/PPT	4151.5	Class Quiz End Term
37.	Examples on search strategies	Understanding examples of search strategies	Lecture/PPT	4151.5	Class Quiz End Term
38.	Examples on search strategies	Understanding examples of search strategies	Lecture/PPT	4151	Class Quiz End Term
39.	Problems Discussion	Problems solving	Flipped Class	NA	Class Quiz End Term
40.	Problems Discussion	Problems solving	Flipped Class	NA	Class Quiz End Term

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO4151.1	Apply information retrieval principles to retrieve the relevant records in large collections of data and hence enhance the employability skills.															
CO4151.2	Elaborate the techniques of indexing in retrieval i.e., Boolean retrieval and probabilistic retrieval.															
CO4151.3	Analyse information retrieval algorithms i.e., classification, clustering and feedback of wild card queries, free text queries & representation of queries.															
CO4151.4	Analyse and apply the concepts of distributed and parallel IR for documents collection, structuring, and query processing.															
CO4151.5	Analyse search strategies of different types of IR models.															

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

I. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO4151.1	Apply information retrieval principles to retrieve the relevant records in large collections of data and hence enhance the employability skills.															
CO4151.2	Elaborate the techniques of indexing in retrieval i.e., Boolean retrieval and probabilistic retrieval.															
CO4151.3	Analyse information retrieval algorithms i.e., classification, clustering and feedback of wild card queries, free text queries & representation of queries.															
CO4151.4	Analyse and apply the concepts of distributed and parallel IR for documents collection, structuring, and query processing.															
CO4151.5	Analyse search strategies of different types of IR models.															

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Big Data Analytics | CC 4155 | 3 Credits | 3 0 0 3

Session: Aug 22-Nov 22 | Faculty: Dr. Vijay Shankar Sharma and Ms. Anshika Malsaria | Class: BTech CCE VII SEM | Sec: A, B

A. **Introduction:** This course is offered by the Department of Computer and Communication Engineering as Big Data Analytics that helps businesses and organizations make better decisions by revealing information that would have otherwise been hidden. Meaningful insights about the trends, correlations and patterns that exist within big data can be difficult to extract without vast computing power. But the techniques and technologies used in big data analytics make it possible to learn more from large data sets. This includes data of any source, size and structure. The course is designed to give students an in-depth understanding of the basic concepts of Big Data Analytics such as data analysis techniques, descriptive statistics, data measurement, data classification, regression & clustering, Hadoop, Map-Reduce & Spark and case studies. This course will cover fundamental algorithms and techniques used in Data Analytics. The statistical foundations will be covered first, followed by various machine learning and data mining algorithms. Technological aspects like data management, scalable computation and visualization will also be covered. The course curriculum and structure has been divided into five basic modules which covers the covers the data analysis techniques along with techniques to manage the big data in the current scenario. The course will be taught with the help of several teaching aides such as power point presentation and via live case studies of the business enterprises that how they are using the big data analytics to grow their business.

B. **Course Outcomes:** At the end of the course, students will be able to:

[CC 4155.1] Explain the building block of the big data and overview of the data analysis techniques.

[CC 4155.2] Understand and apply the concepts of descriptive statistics for data analysis.

[CC 4155.3] Analysing un-supervised learning techniques along with data classification and clustering techniques.

[CC 4155.4] Understand and apply the concepts of Hadoop, Map-Reduce and Spark for big data analysis.

[CC 4155.5] Apply, Learn, and finally implement the live case studies of the big data analytics and its role in the growth of business.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. Design/development of solutions: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.9]. Individual and team work: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes, Assignments and One Coursera Online Course on Big Data Analytics (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work at home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

D. SYLLABUS

Data definitions and analysis techniques: Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing. **Descriptive Statistics**: Measures of central tendency, Measures of location of dispersions, Basic analysis techniques: Relationship analysis, Correlation analysis Statistical hypothesis generation and testing, z-test, t-test, chi-square test, f-test, Analysis of variance, Maximum likelihood test. **Data analysis techniques**: Regression analysis, Classification techniques, Clustering, Association rules analysis. Unsupervised Learning, Recommendation Systems. Streaming Algorithms, **Hadoop**: Distributed Architecture, HDFS, MapReduce, Spark, Similarity Search, Link Analysis. **Case studies and projects**: Understanding business scenarios, Feature engineering and visualization, Sensitivity Analysis.

E. REFERENCE BOOKS

1. R. E. Walpole, R. H. Myers, S. L. Myers, K. Ye, Probability and statistics for engineers and scientists, (9e), Pearson Education, 2014.

2. G. James, D. Witten D, T. Hastie, R. Tibshirani, Statistical Learning. In: An Introduction to Statistical Learning. Springer Texts in Statistics, vol 103, Springer, New York, 2013.

3. H. Trevor, T. Robert, F. Jerome, The elements of statistical learning: data mining, inference, and prediction, (2e), Springer-Verlag New York, 2009.

4. J. Leskovec, A. Rajaraman, J. D. Ullman, Mining of massive datasets, (2e), Cambridge university press, 2014.

F. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1	Introduction and Course Hand-out briefing	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
2-3	Data definitions and analysis techniques	Understanding types of data and overview of data analysis technique	Lecture	CO 1	Mid Term I, Quiz & End Term
4-5	Elements, Variables, and Data categorization	Describe the concept of data categorization	Lecture	CO 1	Mid Term I, Quiz & End Term
6-8	Levels of Measurement, Data management and indexing	Describe the concepts of Data management & indexing and Data Measurement Levels	Flipped Class	CO 1	Mid Term I, Quiz & End Term
9	Descriptive Statistics: Introduction	Describe role statistics in Big Data.	Lecture	CO 2	Mid Term I, Quiz & End Term
10-11	Measures of central tendency, Measures of location of dispersions	Apply and describe the concept of central tendency and dispersions	Lecture	CO 2	Mid Term I, Quiz & End Term
12-15	Basic analysis techniques: Relationship analysis, Correlation analysis Statistical hypothesis generation and testing, z-test, t-test, chi-square test, f-test, Analysis of variance, Maximum likelihood test.	Recall role of statistics in Big Data and explain basic analysis techniques	Flipped Class	CO 2	Mid Term I, Quiz & End Term
16	Data analysis techniques: Introduction	Describe the overview of the Data analysis techniques	Lecture	CO 3	Mid Term I, Quiz & End Term
17-20	Regression analysis, Classification techniques, Clustering, Association rules analysis	Apply and describe the concepts of the classification and clustering techniques	Lecture, activity	CO 3	Mid Term II, Quiz & End Term

21-24	Unsupervised Learning, Recommendation Systems. Streaming Algorithms,	Recall association rules and explain unsupervised learning and streaming algorithms	Lecture	CO 3	Mid Term II, Quiz & End Term
25	Hadoop and Big Data: Introduction	Describe overview of Hadoop and Big Data	Flipped Class	CO 4	Mid Term II, Quiz & End Term
26-30	Distributed Architecture, HDFS, MapReduce, Spark, Similarity Search, Link Analysis	Recall Hadoop and Explain the concept of HDFS, MapReduce, Spark along with practical implementation	Lecture	CO 4	Mid Term II, Quiz & End Term
31-36	Case studies and projects: Understanding business scenarios, Feature engineering and visualization, Sensitivity Analysis.	Implement and apply the case studies of big data analytics	Lecture	CO 5	End Term

G. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	Correlation with Program Outcomes(POs)												Correlation with Program Specific Outcomes (**PSOs**)		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC 4155.1]	Explain the building block of the big data and overview of the data analysis techniques	**1**	**1**	**1**	**1**	**2**	**1**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**-**	**-**
[CC 4155.2]	Understand and apply the concepts of descriptive statistics for data analysis.	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**
[CC 4155.3]	Analysing un-supervised learning techniques along with data classification and clustering techniques.	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**
[CC 4155.4]	Understand and apply the concepts of Hadoop, Map-Reduce and Spark for big data analysis.	**2**	**1**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**1**	**-**	**-**
[CC 4155.5]	Apply, Learn, and finally implement the live case studies of the big data analytics and its role in the growth of business.	**1**	**2**	**2**	**3**	**3**	**1**	**-**	**-**	**3**	**2**	**3**	**3**	**1**	**1**	**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Computer and Communication Engineering

Department of Computer and Communication Course Hand-out

Software Testing | CC 4158 | 3 Credits | 3 0 0 3

Session: Jul 22-Nov 22| Faculty: Dr. Kusum Lata Jain | Class: Departmental Elective Course

A. **Introduction:** This course presents the knowledge about testing background such introduction of Bug, cause of Bug, how it effects on cost of project, role of STLC cycle realities of software testing. This subject also gives the knowledge software testing fundamentals, under the study of types of testing this subject enlighten the Configuration testing, Compatibility testing, Foreign language testing, Usability testing, Testing the documentation, testing for software security, Web site testing and more.

B. **Course Outcomes:** At the end of the course, students will be able to:

[4158.1]. Understand the basic concepts of testing, metrics, and Measurement of Testing

[4158.2]. Understand the concepts of structural testing and functional testing.

[4158.3]. Illustrate advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions

[4158.4]. Demonstrate various working Off-the-shelf tools for the testing automation

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of basic science and fundamental computing in solving complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

[PO.3]. Design/development of Computing solutions: Design solutions for complex IT engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the Information oriented public health and safety, and the cultural, societal, and environmental considerations

[PO.4] Conduct investigations of complex problems: Use IT domain research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5] Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6] The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse IT teams, and in multidisciplinary settings.

[PO.10]. Communication: Communicate effectively on complex computing engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

PSO1: Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

PSO2: Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

PSO3: Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Open Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Open Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. Syllabus

Software Metrics: Basics of software testing: Introduction to software Testing, Testing and debugging, Test metrics and measurements, Verification, Validation and Testing, Types of testing, Software defect tracking; Structural testing techniques: Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing; Functional testing techniques: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique, Ad hoc Testing; Top down and Bottom up integration: Bi-directional integration, System integration, Scenario Testing, Defect Bash, Design/Architecture verification, Deployment testing, Beta testing, Scalability testing, Reliability testing, Stress testing; Acceptance testing; Regression testing, Test Planning; Software Test Automation: Scope of automation, Design & Architecture for automation, Generic requirements for test tool framework, Test tool selection, Testing in Object Oriented Systems, Case study on software testing; Advanced Topics on Testing: Prioritizing the Test-cases, Testing event driven applications, Testing Off-the-shelf component, Testing security, Testing Data-warehouse; Introduction to DevOps.

Reference

1. S. Desikan, G. Ramesh, *"Software Testing: Principles and Practices"*, Pearson Education, 2006.
2. A. P. Mathur, *"Fundamentals of Software Testing"*, Pearson Education, 2008.
3. K. K. Aggarwal, Y. Singh, "*Software Engineering*", Third Edition, New Age International Publication, 2008.
4. R. Mall,*" Fundamentals of Software Engineering"*, PHI, India 2004

F. Lecture Plan:

LEC NO	TOPICS	Session Outcomes	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Course Plan and Lesson Plan Discussion	NA	Lecture	NA	NA
1.	Introduction to software Testing, Testing and debugging,	Discuss the Basics of software testing	Lecture	CC 4158.1	Mid Term I, Quiz I
2.	Test Metrics and Measurement	Discuss the various parameters of software	Lecture	CC 4158.1	Mid Term I, Quiz & End Term
3.	Validation and verification	Discuss various Validation and verification methods	Lecture	CC 4158.1	Mid Term I, Quiz & End Term
4.	Types of testing, Software defect tracking	Understand the types of Testing	Lecture	CC 4158.1	Mid Term I, Quiz & End Term
5.	Structure testing: Path Testing	Understand the path testing	Lecture	CC 4158.1	Mid Term I, Quiz & End Term
6.	DD Path Testing	Demonstrate path testing	Lecture	CC 4158.2	Mid Term I, Quiz & End Term
7.	DD Path Testing	Demonstrate path testing	Lecture	CC 4158.2	
8.	Cyclomatic Complexity	Calculate cyclomatic Complexity	Lecture	CC 4158.2	Mid Term I, Quiz & End Term
9.	Graph Metrics	Demonstrate graph metrics	Lecture	CC 4158.2	Mid Term I, Quiz & End Term
10.	Data Flow Testing	Demonstrate Data flow testing	Lecture	CC 4158.2	Mid Term I, Quiz & End Term
11.	Boundary Value Analysis	Demonstrate the boundary values	Lecture	CC 4158.2	Mid Term I, Quiz & End Term
12.	Equivalence Class Testing	Demonstrate the equivalence classes in software	Lecture	CC 4158.2	Mid Term I, Quiz & End Term
13.	Decision Table Based Testing	Demonstrate the Decision Table	Lecture	CC 4158.1	Mid Term I, Quiz & End Term

14.	Cause Effect Graphing Technique	Demonstrate the Cause Effect graph	Lecture	CC 4158.3	Mid Term I, Quiz & End Term
15.	Ad hoc Testing	Demonstrate the Ad hoc testing	Lecture	CC 4158.1	Mid Term I, Quiz & End Term
16.	Top down and bottom up integration	Understand Integration and	Lecture	CC 4158.2	Mid Term I, Quiz & End Term
17.	Bi-directional integration, System integration,	Demonstrate the equivalence classes in software	Lecture	CC 4158.2	Mid Term I, Quiz & End Term
MTE-1					
18.	Top down and bottom up integration:	Demonstrate the graphing techniques	Lecture	CC 4158.2	Mid Term II, Quiz & End Term
19.	Bi-directional integration, System integration,	Discuss and Ad learn hoc testing	Lecture	CC 4158.2	Mid Term II, Quiz & End Term
20.	Defect Bash,	Demonstrate the about testing	Lecture	CC 4158.3	Mid Term II, Quiz & End Term
21.	Design/Archiecture verification,	Demonstrate the bidirectional integration	Lecture	CC 4158.3	Mid Term II, Quiz & End Term
22.	Deployment testing,	Demonstrate the scenario testing	Lecture	CC 4158.3	Mid Term II, Quiz & End Term
23.	Beta testing,	Demonstrate the identify defect architecture	Lecture	CC 4158.3	Mid Term II, Quiz & End Term
24.	Scalability testing, Reliability testing,	Demonstrate the testing for scalability	Lecture	CC 4158.3	Mid Term II, Quiz & End Term
25.	Stress testing; Acceptance testing; Regression testing,	Demonstrate the testing techniques	Lecture	CC 4158.3	Mid Term II, Quiz & End Term

26.	Test Planning,	Demonstrate the testing techniques	Lecture	CC 4158.4	Mid Term II, Quiz & End Term
27.	Software Test Automation: Scope of automation,	Demonstrate the testing techniques	Lecture	CC 4158.4	Mid Term II, Quiz & End Term
28.	Design & Architecture for automation,	Demonstrate the testing techniques	Lecture	CC 4158.4	Mid Term II, Quiz & End Term
29.	Design & Architecture for automation,	Demonstrate the testing techniques	Lecture	CC 4158.4	Mid Term II, Quiz & End Term
30.	Generic requirements for test tool framework,	Demonstrate the testing techniques	Lecture	CC 4158.4	Mid Term II, Quiz & End Term
MTE-11					
31.	Test tool selection	Discuss the methods for tool selection techniques	Lecture	CC 4158.4	Quiz & End Term
32.	Testing in Object Oriented Systems,	Demonstrate the testing techniques for Object oriented software	Lecture	CC 4158.4	Quiz & End Term
33.	Case Study on software testing.	Discuss case study	Flip Class	CC 4158.5	Quiz & End Term
34.	Advanced Topics on Testing:	Discuss advanced topics	Lecture	CC 4158.5	Quiz & End Term
35.	Testing, Priotizing the Test cases,	Demonstrate prioritization of cases	Lecture	CC 4158.5	Quiz & End Term
36.	Testing Web Applications, Testing	Demonstrate the testing techniques for web Applications	Lecture	CC 4158.5	Quiz & End Term
37.	Off-the-shelf component,	Demonstrate the testing techniques for off the self-components	Lecture	CC 4158.5	
38.	Testing security, Testing Data warehouse	Demonstrate the testing techniques	Lecture	CC 4158.5	Quiz & End Term
39.	Revision Class-I	Discussion	Lecture	CC 4158.5	Quiz & End Term
END TERM EXAMINATION					

G. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC 1754.1]	Demonstrate the various software testing issues and solutions in software unit test; integration, regression, and system testing.	2			2	3								1		
[CC 1754.2]	Examine the test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.		2		3	2							1		1	1
[CC 1754.3]	Illustrate advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions	2	3	2		1	1			1	1			1	1	
[CC 1754.3]	Demonstrate various working Off-the-shelf tool for the testing automation	2	2	2	1							1			1	

MANIPAL UNIVERSITY JAIPUR

School of Computing and Communication Engineering

Department of Computer and Communication Engineering

Course Hand-out

CC4159: CLOUD COMPUTING [3 0 0 3]

| Class: B. Tech. CCE VII SEM |

Program Elective

A. Introduction: This course is designed in a way so that students will be able to know current cloud computing technologies such as Infrastructure as a Service, Platform as a Service, Software as a Service, and Systems as a Service. For different layers of the cloud technologies, practical solutions such as Google, Amazon, Microsoft, SalesForce.com, etc. as well as theoretical solutions (covered by a set of papers) are introduced The main objective of this course is to introduce cloud computing concepts and technology , to understand the different service model and deployment model, to understand the different technologies that enable cloud computing, to understand difference between the Grid Computing and Cloud Computing, to understand different cloud computing architectures/frameworks, to understand the cloud infrastructure components and service management processes, to understand the cloud security concerns and solutions.

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B Course Outcomes

Upon completion of this course, the student will be able to

CC4159.1: Define the technical foundations of cloud systems architectures.
CC4159.2: Identify virtualization technology at compute, storage, network, desktop, and application layers.
CC4159.3: Illustrate the service level management and resource management.
CC4159.4: Explain migration process and fault tolerance schemes.

c. Program Outcomes and Program Specific Outcomes

[PO.1]. **Engineering knowledge**: Apply the knowledge of basic science and fundamental computing in solving complex engineering problems

[PO.2]. **Problem analysis**: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

[PO.3]. **Design/development of Computing solutions**: Design solutions for complex IT engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the Information oriented public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. **Conduct investigations of complex problems**: Use IT domain research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

[PO.6]. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. **Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse IT teams, and in multidisciplinary settings.

[PO.10]. **Communication**: Communicate effectively on complex computing engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

d. <u>Program Specific Outcomes</u>

[PSO.1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

e. **Assessment Plan:**

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	20
	Sessional Exam II (Close Book)	20
	Class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Close Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination.	

	The allowance of 25% includes all types of leaves including medical leaves.
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.

f. Syllabus

Pre-requisite(s): Fundamentals of Computers, Operating System, Application Software and System software.

Introduction: Distributed computing and enabling technologies, cloud fundamentals: cloud definition, evolution, architecture, applications, deployment models, service models and FOG computing; Virtualization: issues with virtualization, virtualization technologies and architectures, internals of virtual machine monitors/hypervisors, virtualization of data centers, and issues with multi-tenancy; Implementation: study of cloud computing systems like Amazon EC2 and S3, Google App Engine, and Microsoft Azure, build private/hybrid cloud using open source tools, deployment of web services from inside and outside a cloud architecture, Map-Reduce and its extensions to cloud computing, HDFS, and GFS; Interoperability and service monitoring: issues with interoperability, vendor lock-in, interoperability approaches, SLA management, metering issues, and report generation; Resource management and load balancing: distributed management of virtual infrastructures, server consolidation, dynamic provisioning and resource management, resource optimization, resource dynamic reconfiguration, scheduling techniques for advance reservation, and load balancing, various load balancing techniques; Migration and fault tolerance: broad aspects of migration into cloud, migration of virtual machines and techniques; Fault tolerance mechanisms: grid of clouds, green cloud, mobile cloud computing.

References:

1. R. Buyya, J. Broberg, A. Goscinski, Cloud Computing Principles and Paradigms, (1e), Wiley, 2013.
2. B. Sosinsky, Cloud Computing Bible, (1e), Wiley, 2011.
3. M. L. Miller, Cloud Computing: Web-based Applications that change the way you work and collaborate online, (1e), Pearson Education, 2008.
4. D. S. Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-byStep Guide, (1e), Addision Wesley Information Technology Series, 2010.
5. T. Velte, A. T. Velte, R. Elsenpeter, Cloud Computing: A Practical Approach, (1e), McGraw Hill, 2017.

Lec No.	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Distributed computing and enabling technologies,	Lecture	CC4159.1	Mid Term1. Quiz/ Assignment, End term
2	Cloud fundamentals: cloud definition,.	Lecture	CC4159.1	Mid Term1. Quiz/ Assignment, End term
3	Evolution, architecture, applications,	Lecture	CC4159.1	Mid Term1. Quiz/ Assignment, End term
4	Deployment models, service models	Lecture	CC4159.1	Mid Term1. Quiz/ Assignment, End term
5	FOG computing; Virtualization	Lecture	CC4159.2	Mid Term1. Quiz/ Assignment, End term
6	Virtualization: issues with virtualization,	Lecture	CC4159,2	Mid Term1. Quiz/ Assignment, End term
7	Virtualization technologies and architectures	Lecture	CC4159.2	Mid Term1. Quiz/ Assignment, End term
8	Internals of virtual machine monitors/hypervisors	Lecture	CC4159.2.	Mid Term1. Quiz/ Assignment, End term
9	Virtualization of data centers, and issues with multi-tenancy;	Lecture	CC4159.2.	Mid Term1. Quiz/ Assignment, End term
10	Google App Engine,	Lecture	CC4159.2	Mid Term1. Quiz/ Assignment, End term
11	Microsoft Azure, build private/hybrid cloud using open source tools	Lecture	CC4159.2	Mid Term1. Quiz/ Assignment, End term
12	Deployment of web services from inside and outside a cloud architecture	Lecture	CC4159.2	Mid Term1. Quiz/ Assignment, End term
Midterm Examination-1				
13	Map-Reduce and its extensions to cloud computing	Lecture	CC4159.2	Mid Term2. Quiz/ Assignment, End term
14	HDFS, and GFS	Lecture	CC4159.2	Mid Term2. Quiz/ Assignment, End term
15	Interoperability and service monitoring	Lecture	CC4159.3	Mid Term2. Quiz/ Assignment, End term
16	Issues with interoperability,	Lecture	CC4159.3	Mid Term2. Quiz/ Assignment, End term
17	Vendor lock-in	Lecture	CC4159.3	Mid Term2. Quiz/ Assignment, End term
18	Interoperability approaches, SLA management,	Lecture	CC4159.3	Mid Term2. Quiz/ Assignment, End term
19	Metering issues, and report generation;	Lecture	CC4159.3	Mid Term2. Quiz/ Assignment, End term

20	Resource management and load balancing	Lecture	CC4159.3	Mid Term2, Quiz End term
21	Distributed management of virtual infrastructures	Lecture	CC4159.3	Mid Term2, Quiz, Assignment End term
22	Server consolidation,	Lecture	CC4159.3	Mid Term2, Quiz, Assignment End term
23	Dynamic provisioning and resource management	Lecture	CC4159.3	Mid Term2, Quiz, Assignment End term
24	Resource optimization,	Lecture	CC4159.3	Mid Term2, Quiz, Assignment End term
25	Resource dynamic reconfiguration,	Lecture	CC4159.3	Mid Term2, Quiz, Assignment End term
26	Scheduling techniques for advance reservation	Lecture	CC4159.3	Mid Term2, Quiz, Assignment End term
27	Load balancing, various load balancing techniques	Lecture	CC4159.3	Mid Term2, Quiz, Assignment End term
28	Migration	Lecture	CC4159.4	Mid Term2, Quiz, Assignment End term
29	Fault tolerance	Lecture	CC4159.4	Mid Term2, Quiz, Assignment End term
Midterm Examination-2				
30	Broad aspects of migration into cloud,,	Lecture	CC4159.4	Quiz, Assignment End term
31	Migration of virtual machines	Lecture	CC4159.4	Quiz, Assignment End Term Examination
32	Migration of virtual techniques	Lecture	CC4159.4	Quiz, Assignment End Term Examination
33	Fault tolerance mechanisms	Lecture	CC4159.4	Quiz, Assignment End Term Examination
34	Grid of clouds	Lecture	CC4159.4	Quiz, Assignment End Term Examination
35	Green cloud	Lecture	CC4159.4	Quiz, Assignment End Term Examination
36	Mobile cloud computing.	Lecture	CC4159.4	Quiz, Assignment End Term Examination
Total No. of Lectures		**36**		

Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC4159.1	Define the technical foundations of cloud systems architectures.	2	2	2						2		2		3	2	2
CC4159.2	Identify virtualization technology at compute, storage, network, desktop, and application layers	1	2	2	2	3					1			3	1	2
CC4159.3	Illustrate the service level management and resource management.	1		2								2		2	2	2
CC4159.4	Explain migration process and fault tolerance schemes.		3											1		2

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment

Dr. Suman Bhakar **Dr. Vijaypal Singh Dhaka** **Mr. Vivek Sharma**

Course Coordinator **Head of Department** **Course Instructor** **Class Representative/s**

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

MANIPAL UNIVERSITY JAIPUR

School of Computers and Communication Engineering
Department of Computer and Communication Engineering
Course Hand-out
Data Mining and Data Warehousing | CC4156 | 3 Credits | 3 0 0 3
Session: Jul – Dec 22 | Faculty: Dr. Deepak Sinwar/ Mr. Monu Bhagat | Class: VIII Semester

A. **Introduction:** The main objective of this course is to familiarize students with the basic concepts of Data Mining and Data Warehousing. It gives an introduction to methods and theory for development of data warehouses and data analysis using data mining. It describes principles, architectures, applications, design and implementation of data mining and data ware housing concepts.

B. **Course Outcomes:** At the end of the course, students will be able to

[4156.1]: Interpret various data mining and data warehousing components.

[4156.2]: Develop multidimensional data models and make use of OLAP.

[4156.3]: Experiment with different data mining techniques.

[4156.4]: Analyze data, choose relevant models and algorithms for respective applications.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. **Engineering knowledge**: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

[PO.2]. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

[PO.3]. **Design/development of solutions**: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

[PO.4]. **Conduct investigations of complex problems**: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

[PO.5]. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

[PO.6]. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

[PO.8]. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

[PO.**9]. Individual and team work**: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

[PO.10]. **Communication**: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	20
	Sessional Exam II (Close Book)	20
	Class Work Sessional (CWS): Assignment, Quiz, Presentations/ Video Assignment	20
End Term Exam (Summative)	End Term Exam (Close Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who miss a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction to data, information, knowledge and wisdom; Data objects and attribute types; KDD process; Introduction to data warehouse; Data pre-processing: data cleaning, integration, reduction and transformation; Data discretization and concept hierarchy generation; Comparison of OLAP with OLTP systems, ROLAP, MOLAP and DOLAP; Data cube computation methods; Multi-dimensional modeling; Data warehouse architecture and implementation : Parallel execution, materialized views; Data mining: introduction to data mining, classification of data mining systems, integration of a data mining system with a data warehouse; Classification: association rule mining (mining frequent patterns, mining various kinds of association Rules), decision tree induction, rule-based classification, back-propagation, associative classification; Clustering methods: basic statistical descriptions of data, measuring data similarity and dissimilarity, partition based clustering, hierarchical based clustering, model-based clustering; Application trends in data mining; Cluster analysis; Case study on data mining with data sets.

References:

1. J. Han, M. Kamber, Data Mining: Concepts and Techniques, (3e), Elsevier Publications, 2011.
2. I. Witten, E. Frank, M. Hall, C.Pal, Data Mining: Practical Machine Learning Tools and Techniques, (4e), Elsevier Publications, 2016.
3. P.N. Tan, M. Steinbach, V. Kumar, Introduction to Data Mining, (1e), Pearson Education, 2016.
4. S. Sumathi, S.N. Sivanandam, Introduction to Data Mining and its Applications, (1e), Springer, 2006.

F. Lecture Plan:

Lect.	Topics	Session Outcome	Corresponding CO	Mode of delivery	Mode of Assessing CO
1	Introduction of course and course handout	Understanding of course, objectives, evaluation	NA	lecture	NA
2	Introduction to data, information, knowledge, and wisdom	Understanding about data, information, knowledge, and wisdom	CC4156.1	lecture	MTE-I, Quiz & ETE
3	KDD process	Understanding of KDD process	CC4156.1	lecture	MTE-I, Quiz & ETE
4-5	Data objects and attribute types	Interpretation of different data objects and attribute types	CC4156.1	lecture	MTE-I, Quiz & ETE
6	Basic Statistical Descriptions of Data: Measuring the Central Tendency	Knowing basic statistical descriptions of data like mean, median and mode	CC4156.1		MTE-I, Quiz & ETE
7	Basic Statistical Descriptions of Data: Measuring the Dispersion of Data	Understanding Range, Quartiles, and Interquartile Range	CC4156.1		MTE-I, Quiz & ETE
8	Graphic Displays of Basic Statistical Descriptions of Data	Understanding various plots i.e., boxplots, quantile plot, histograms, etc.	CC4156.1		MTE-I, Quiz & ETE
9	Measuring Data Similarity and Dissimilarity	Understanding of data similarity and dissimilarity among different types of attributes	CC4156.1		MTE-I, Quiz & ETE
10-12	Data pre-processing: data cleaning, integration, reduction and transformation	Interpretation of various data pre-processing techniques	CC4156.1	lecture	MTE-I, Quiz & ETE
13	Data pre-processing: Data discretization and concept hierarchy generation	Understanding of Data discretization and concept hierarchy generation	CC4156.1	lecture	MTE-I, Quiz & ETE
14	Introduction to data warehouse	Understanding of basics of data warehouse	CC4156.1	lecture	MTE-I, Quiz & ETE
15	Comparison of OLAP with OLTP systems	Interpretation of OLAP and OLAP systems	CC4156.2	lecture	MTE-I, Quiz & ETE
Mid Term Examination – I					
16-18	Data Warehouse Modeling: Data Cube and OLAP	Analysis of data cubes and their operations	CC4156.2	lecture	MTE-II, Quiz & ETE

19	Data Warehouse Implementation	Understanding of how to implement a data warehouse	CC4156.2	lecture	MTE-II, Quiz & ETE
20	Data mining: introduction to data mining	Understanding of basics of data mining	CC4156.3, CC4156.4	lecture	MTE-II, Quiz & ETE
21	Classification of data mining systems, integration of a data mining system with a data warehouse	Understanding about classification of data mining systems and their integration with DWH	CC4156.3, CC4156.4	lecture	MTE-II, Quiz & ETE
22	Classification: basic concepts	Understanding the basic concepts of classification	CC4156.3, CC4156.4	lecture	MTE-II, Quiz & ETE
23-24	Decision tree induction	Understanding about working of decision trees	CC4156.3, CC4156.4	lecture	MTE-II, Quiz & ETE
25-26	Rule-based classification	Understanding about working of rule-based classification	CC4156.3, CC4156.4	lecture	MTE-II, Quiz & ETE
27	Classification by Backpropagation	Understanding of classification by backpropagation	CC4156.3, CC4156.4	lecture	MTE-II, Quiz & ETE
28	Classification Using Frequent Patterns: Associative Classification	Understanding classification using frequent patterns	CC4156.3, CC4156.4	lecture	MTE-II, Quiz & ETE
29	Association rule mining: basics	Understanding the basics of association rule mining	CC4156.3, CC4156.4	lecture	MTE-II, Quiz & ETE
30-32	Frequent Itemset Mining Methods (Apriori, FP-Growth)	Understanding of frequent itemset mining methods	CC4156.3, CC4156.4	lecture	MTE-II, Quiz & ETE
Mid Term Examination - II					
33	Clustering: basic clustering methods	Understanding the basics of clustering methods	CC4156.3, CC4156.4	lecture	Quiz & ETE
34	Partitioning Methods: k-Means	Understanding of partitioning methods i.e., k-means	CC4156.3, CC4156.4	lecture	Quiz & ETE
35	Hierarchical Methods: BIRCH	Understanding of hierarchical clustering methods	CC4156.3, CC4156.4	lecture	Quiz & ETE
36	Application trends in data mining	Experiment with application trends of data mining	CC4156.3, CC4156.4	lecture	Quiz & ETE
37	Case study on data mining with data sets	Examination of data sets and applying appropriate models	CC4156.3, CC4156.4	lecture	Quiz & ETE
End Term Examination					

G. Course Articulation Matrix: (Mapping of COs with POs and PSOs)

CO	Statement	Correlation with Program Outcomes														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
4156.1	Interpret various data mining and data warehousing components	1	2	1		2	1		1				2		1	
4156.2	Develop multidimensional data models and make use of OLAP	1	1	3	2	2	2			1		1	1	2	1	
4156.3	Experiment with different data mining techniques	2	2	2	2	3	2		1	2	1	1	2	1	1	2
4156.4	Analyze data, choose relevant models and algorithms for respective applications	1	3	1	2	2		1	1	1		1	2	1	2	3

1: Low Correlation 2: Moderate Correlation 3: Substantial Correlation

H. Course Outcome Attainment Level Matrix:

CO	Statement	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
4156.1	Interpret various data mining and data warehousing components															
4156.2	Develop multidimensional data models and make use of OLAP															
4156.3	Experiment with different data mining techniques															
4156.4	Analyze data, choose relevant models and algorithms for respective applications															

1: Low Correlation 2: Moderate Correlation 3: Substantial Correlation

MANIPAL UNIVERSITY JAIPUR
SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY
DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

COURSE PLAN

CC 4161 NETWORK SECURITY [3 0 0 3]

Semester & branch : **B.Tech. 7th Semester CCE**

No of contact hours/week : 3 Hrs. /Week

A. Introduction: This course is offered by Dept. of Computer and Communication Engineering as a department elective subject for the students who wish to pursue research & development in Network Security or higher studies in the field of Information Security, Network Security, and Cryptography. The course offers in-depth knowledge of Network attacks, network Security applications, internet security, issues in network security, and the techniques to mitigate these attacks. Students are expected to have background knowledge of cryptography for a better understanding of the subject.

B. Course Outcomes

[CC4161.1] Identify factors driving the need for network security and categorize them into different types of attacks based on security attributes for the given application.

[CC4161.2] Analyse and deploy appropriate network security devices and techniques to defend against different attacks on the network to reduce the damage using the existing techniques.

[CC4161.3] Design security applications to prevent and mitigate attacks based on the given predefined scenario in an optimized way.

C. Program Outcomes and Program Specific Outcomes

PO1. Engineering knowledge: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

PO2. Problem analysis: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

PO3. Design/development of solutions: Upon analyzing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

PO4. Conduct investigations of complex problems: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and

research methods including design of experiments, analysis, and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: The zero effect and zero defect is not just a slogan, it is to be practiced in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

PO9. Individual and teamwork: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

[PSO.1]. Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2]. Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3]. Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	**20**
	Sessional Exam II	**20**
	Video Assignment, Home assignments and Quizzes	**20**
End Term Exam (Summative)	End Term Exam	**40**
	Total Marks	**100**
Attendance	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. Syllabus

Basics of network security: attacks, IP spoofing, packet sniffing, services, and mechanisms; Network security applications: Kerberos, key management, man-in-the-middle attack, replay attack, digital certificate, PKI, IPSec, IKE, SSL, TLS, PGP, MIME, SSH, entity authentication; Network defense: firewalls, VPN, IDS, need of firewalls, firewall characteristics, access policy, type of firewall, firewall location and configuration, types of IDS, working of IDS and policies; Malicious software: virus, worm, Trojan horse, identification and remedies; Internet security; Secure electronic payment system and protocols.

Reference Books:

1. W. Stallings, Cryptography and Network Security-Principles and Practice, (7e), Pearson Education, 2017.
2. W. Stallings, Network Security Essentials: Applications and Standards, (6e), Pearson Education, 2018.
3. B. A. Forouzan, D. Mukhopadhyay, Cryptography and Network Security, (3e), McGraw Hill, 2015.
4. Y. Qian, D. Tipper, P. Krishnamurthy, J. Joshi, Information Assurance Dependability & Security in Networked Systems, (1e), Morgan Kaufmann, 2010.
5. A. Sadeghi, M. Schneider, Electronic Payments Systems, (1e), Springer, 2003.
6. R. D. Pietro, L. V. Mancini, Intrusion Detection Systems, (1e), Springer, 2010.

1. **Lecture Plan:**

Lec No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**	**Reference**
1	Introduction and Course Hand-out briefing	To acquaint and clear teachers' expectations and understand the student expectations	Lecture	NA	NA	Handout
2-3	Network Attacks, services, and mechanism	Recall the network attacks and preventive Mechanism	Lecture	4161.1	MID term 1	R1.
3,4	Integrity, Authentication, and Key Management: Message Integrity (message and message digest, checking integrity, Cryptographic hash function criteria)	Discuss how message integrity works.	Lecture	4161.2	Mid term-1, End Term, Video & Presentation	R3
5-6	Random Oracle Model, pigeonhole principle, birthday problems,	Describe the function of the Random oracle model, and its role in evaluating the security of cryptographic hash functions	Lecture	4161.2	Video & Presentation Mid-term-1	R3
7-9	Message Authentication: Modification detection code (MDC), MAC, Security of MAC, nested MAC, HMAC, CMAC	Differentiate between the codes used for the message authentication	Lecture	4161.2	Mid-term-1 End Term Video & Presentation	
13	Security Association, Security association database	Recall IPSec Security association and database	Lecture	4161.2	Mid Term 1 End Term Video & Presentation	

14,15	introduction , SSL Architecture, Key exchange algorithm, Cryptographic parameter generation	Understand the need of security at TL layer, Structure of SSL	Lecture	4161.2	Mid Term I End term Video & Presentation	
16	SSL Handshake protocol	Recall the handshake protocol functionality	Self-learning	4161.2	Video & Presentation End term	
17, 18	TLS version, cipher suite, generation of cryptographic secrets	Highlight the general structure of TLS and difference between SSL and TLS	Lecture and Activity (Think Pair Share)	4161.2	Mid Term I End Term Video & Presentation	
19,20, 21	Digital Certificate: Hash function, MD hash Family, whirlpool, SHA-512	Understand the process of creating Hash function, illustration of structure of whirlpool with example	Group Discussion	4161.2	Mid Term I End Term Video & Presentation	
22. 23,	Digital Signature, differences between conventional signature and digital signature Refer the below link- https://www.coursera.org/lecture/iot-connectivity-security/digital-signatures-digital-certificates-wGVU2	Compare between conventional signature and digital signature, understand the process of digital signature	Flipped class	4161.2	Mid Term-I End Term	
24, 25	Public key Infrastructure, PKI Tust model, Mesh Model, hijacking	Infer the concept of PKI and key distribution	Lecture	4161.2	Mid Term II End Term	
26, 27	Secure Electronic Transaction (SET), SET participants, SET Process, SET Internals, Payment Authorization, Payment Capture, SET model Note: Refer cryptography and Network Security, Atul Kahate, chapter-6	Describe the SET process and issues	Lecture	4161.2	Mid Term-11, End Term Video & Presentation	

28, 29	Issues in Network Security: Man in middle attack, Replay Attack (cryptography and Network Security, William stalling and handouts)	Describe the working of MIM attack in different environment.	Lecture, Activity	4161.3	Mid Term II End Term Video & Presentation	
30, 31	ARP Poisoning, web based attacks (cryptography and Network Security, Prakash C Gupta)	Simulation of ARP poisoning and web attacks	Lecture, Activity	4161.3	Mid Term II End Term Video & Presentation	
32	Firewalls, type of firewalls, Firewall configurations, DMZ zones (cryptography and Network Security, Prakash C Gupta)	Describe working of firewall and its deployment process	Lecture, activity	4161.3	Mid Term II End Term Video & Presentation	
33	Intrusion Detection System, Signature based vs Anomaly based IDs (cryptography and Network Security, Prakash C Gupta)	Infer the knowledge of IDS and working	Activity	4161.3	End Term	
34, 35	Introduction and working of malwares, warms, viruses , Identifications and remedies	Understanding the difference among various type of malicious code, and their neutralization process	Flipped Class	4161.3	End Term	
36	Conclusion and Course Summarization	NA	NA		NA	

CO	STATEMENT	Correlation with Program Outcomes(POs)														
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CC 4161.1	Identify factors driving the need for network security and categorize them into different types of attacks based on security attributes for the given application.	1		1	1									2		1
CC 4161.2	Analyse and deploy appropriate network security devices and	1	1	1	1	2									1	

	techniques to defend against different attacks on the network to reduce the damage using the existing techniques.															
CC 4161.3	Design security applications to prevent and mitigate attacks based on the given predefined scenario in an optimized way.	1	1	1	1	2								2	2	1

2. Course Evaluation:

Component		Duration	Date	Syllabus	Weightage
MTE I		1 hour	As per Academic Calendar	Will be informed a week before (Closed Book)	**20%**
MTE II		1 hour	As per Academic Calendar	Will be informed a week before (Closed Book)	**20%**
Internal Evaluation	Video Assignment	7-10 mins(length of the video)	Given in the following table	Explanation of tools/concepts/ideas related to the field	**5%**
	Quiz	5-10 mins	Given in the following table	Topics related to course Syllabus	**10%**
	Assignment	NA	Given in the following table	Topics related to course Syallabus or field	**05%**
ETE		2 hours	As per Academic Calendar	Complete	**40%**

Deadlines

S.I.N.O	Task	
1	Video Assignment Group Formation: List of student group with names & reg.no(minimum 1 & maximum 3 students in a group) for Video Assignment	On or by 9st September 2022 4 PM Submit the name to the CR by the above mentioned date who will send it to the Instructor in form of excel sheet before 12nd September 2022 4 PM
2	Topic of video assignment of each group	Soft copy On or by 13th September 2022 4 PM. Submit the topic to the CR by the above mentioned date who will send it to the Instructor in form of excel sheet before 15th September 2020 4 PM
3	Submission of video assignment	By 5th October 2022 4 PM Students are supposed to upload in the drive and share this link to CR who will collect it through google form.CR has to share the excel sheet with the links of the video by 7th October 2020 to the instructor.

Note: If students do not follow the deadline Zero marks will be awarded

Evaluation Criteria

S.I.N.O	Task	Evaluation Criteria
1	**Video Assignment**	**1. Content 10 M 2.Creativity 10 M** **3.Presentation 05 M 4.Noise/error free 05 M** **The total 30 Marks will be reduced to 5 Marks** ✓ **Change of topic will be awarded Zero Marks** ✓ **Everyone in the team has to do the presentation in Video.** ✓ **Marks will be awarded on individual basis not for the Team**
2	Quiz	✓ **Online Quiz will be taken,** ✓ **Totally 3 quizzes will be taken.** ✓ **The best of three quiz marks will be considered.** ✓ **Extra quiz will not be taken at any cost and if you miss it and zero marks will be awarded.** ✓ **No excuses will be entertained for missing the quiz.**
3	Assignment	✓ **The assignment will be in soft copy.** ✓ **Two assignment will be given for 5 marks.** ✓ **Please avoid copying content, if found, appropriate marks will be deducted which is left to the concern of the instructor.**

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School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGG.

Course Hand-out

Spatial Data Analytics| CC4162 | 3 Credits | 3 0 0 3

Session: August – December 2022 |IV Year-VII Sem| Faculty: Dr. Hemlata Goyal

A. Introduction: This course is offered by Dept. of Computer and Communication Engineering as an elective subject, targeting students who wish to pursue development in industries or higher studies in field of Geoinformatics-Spatial Data Analytics. This course challenges students with existing skills in data manipulation and analysis using Geographical Information Systems (GIS) to expand their knowledge of spatial information science and GIS procedures. Students will develop and apply advanced data analysis techniques to propose, construct in an area of interest. This course aims to make the students understand the models, methods, spatial data handling techniques and algorithms of Geoinformatics-Spatial Data Analytics for GIS tasks, georeferencing, spatial database, GIS opensource software, etc. After learning through this course, students will be able to understand and implement spatial data models, estimate analysis for such models, and run meaningful experiments to validate such geospatial models.

B. Course Outcomes: At the end of the course, students will be able to

[CC4162.1]. Understand GIS concepts and spatial analysis techniques in an interdisciplinary area;

[CC4162.2]. Apply open-source GIS Software for spatial data preparation, analysis and visualisation with sophisticated skills of vector and raster processing;

[CC4162.3]. Apply proficiency in integrating GIS data analysis with simple statistical analysis;

[CC4162.4]. Apply ability to conduct a GIS project in the area of their choice;

[CC4162.5]. Identify and source data for use in evidence-based decision making;

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1] Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2] Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3] Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with

appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4] **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5] **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6] **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7] **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8] **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9] **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10] **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11] **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12] **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1] Clearly imbibe the basic principles, concepts and applications of computer based Communication/networking, information sharing, signal processing, web based systems, smart devices and communication technology.

[PSO.2] Investigate problematic areas prevalent in the field of Computer and Communication Engineering to find acceptable solutions.

[PSO.3] Identify the existing open problems in the field of computing and propose the best possible solutions.

[PSO.4] Apply the contextual knowledge in the field of computing and communication to assess social, health, safety and cultural issues and endure the consequent responsibilities relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	20
	Sessional Exam II	20
	In class Quizzes and Project , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction to Geospatial data: spatial data modeling, spatial registration, modes of geographic information. **Geospatial Data Processing:** Data extraction, vector and raster data handling and transformation. Spatial referencing using coordinates and geographic identifiers, metadata; Aerial Photo and Image Interpretation. **Spatial Database:** Spatial Query SQL, NoSQL, and Graph. Geo-processing Vector and Raster, **Exploratory Spatial Data Analysis:** geo-statistics, and spatial uncertainty, Quality of spatial data; GIS analysis functions: Retrieval, classification, measurement, neighborhood, topographic, interpolation, overlay, buffering, spatial join and query, connectivity, network functions, spatial pattern analysis, spatial autocorrelation, trend surface analysis; **Spatial Data Mining:** Classification, patterns, and rules. **Introduction to Remote Sensing:** Sensors and their characteristics on board IRS, LANDSAT, SPOT, NOAA, IKONOS, Quickbird satellites. Spectral reflectance of soil, water, vegetation and rock types. **GIS open source software:** QGIS, SAGA. Data Interoperability, Extensibility, Data Visualization and Case Studies using open source software.

References:

F. TEXT BOOKS

T1. Lloyd, C. Spatial data analysis: an introduction for GIS users (1e). Oxford university press, 2010.

G. REFERENCE BOOKS

R1. DeMers, M. N., Fundamentals of geographic information systems, (4e). John Wiley & Sons, 2008.

R2. Burrough, P. A., McDonnell, R., McDonnell, R. A., & Lloyd, C. D., Principles of geographical information systems (11e). Oxford university press, 2015.

R3. Lloyd, C. Spatial data analysis: an introduction for GIS users,(1e). Oxford university press, 2010.

R4. Jensen, J. R., Introductory digital image processing: a remote sensing perspective, Prentice Hall Press, 2015

R5. Joseph, G., Fundamentals of remote sensing, (2e). Universities Press, 2005.

R6. Lillesand, T., Kiefer, R. W., & Chipman, J., Remote sensing and image interpretation, (28e). John Wiley & Sons, 2014.

H. Lecture Plan

Lec No	Major Topics	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Course Handout	Discuss the Course Handout to successful execution of the course	Understand the execution of the course	Lecture	-	Class Quiz Home Assignments I Sessional End Term
2.	Introduction	Introduction to geospatial data	Understand GIS Concepts	Lecture	4162.1	Class Quiz Home Assignments I Sessional End Term
3.		Spatial Data Storage, Representation in various formats	Understand GIS Concepts and spatial data	Lecture	4162.1	Class Quiz Home Assignments I Sessional End Term
4.		modes of information with image interpretation	Understand GIS Concepts and spatial data	Lecture	4162.1	Class Quiz Home Assignments I Sessional End Term
5.	Geospatial Data Processing	Introduction to open source software of QGIS for vector data understanding	Understanding of QGIS to interpret the vector data	Lecture	4162.1 4162.2 4162.4	Class Quiz Home Assignments I Sessional End Term

6.		Introduction to open source software SAGA for raster data understanding	Understanding of SAGA to interpret the raster data	Lecture	4162.1 4162.2 4162.4	Class Quiz Home Assignments I Sessional End Term
7.		Data extraction using QGIS and SAGA	Hands on experience on raster and vector data	Lecture	4162.1 4162.2 4162.4	Class Quiz Home Assignments I Sessional End Term
8.		vector and raster data handling; transformation.	Hands on experience on raster and vector data transformation techniques	Lecture	4162.1 4162.2 4162.5	Class Quiz Home Assignments I Sessional End Term
9.		Spatial referencing using coordinates and geographic identifiers, metadata;	Apply Geo-referencing to simulate the earth data	Lecture	4162.1 4162.2 4162.5	Class Quiz Home Assignments I Sessional End Term
10.		Aerial Photo and Image Interpretation	Understanding the different images with spectral signature	Lecture	4162.1 4162.2 4162.5	Class Quiz Home Assignments I Sessional End Term
11.	Spatial Database Handling	Introduction of PostGIS	Apply the DBMS Concepts with PostGIS	Lecture	4162.1 4162.2	Class Quiz Home Assignments I Sessional End Term
12.		Connection of PostGIS and QGIS	QGIS Plugin understanding	Lecture	4162.1	Class Quiz

					4162.2	Home Assignments I Sessional End Term
13.	GIS analysis functions	Retrieval and classification	How to retrieve and classify spatial data	Lecture	4162.1 4162.3	Class Quiz Home Assignments I Sessional End Term
14.		measurement, neighbourhood function	How to measure the area and neighbor pixels	Lecture	4162.1 4162.3	4162.1 4162.3
		topographic, interpolation,	How to interpolate the topographic data	Lecture	4162.1 4162.3	Class Quiz Home Assignments I Sessional End Term
15.		overlay, buffering,	How to apply overlay and buffer in spatial data	Lecture	4162.1 4162.3	Class Quiz Home Assignments I Sessional End Term
16.	Spatial Query Processing	spatial join and query, connectivity,	Illustration of spatial join and query, connectivity,	Lecture	4162.1 4162.2	Class Quiz Home Assignments II Sessional End Term
17.		network functions, spatial pattern analysis,	Illustration of network functions, spatial pattern analysis,	Lecture	4162.1 4162.2	Class Quiz Home Assignments II Sessional End Term

18.		spatial autocorrelation,	Illustration of spatial autocorrelation,	Lecture	4162.1 4162.2	Class Quiz Home Assignments II Sessional End Term
19.		trend surface analysis;	Illustration of trend surface analysis;	Lecture	4162.1 4162.2	Class Quiz Home Assignments II Sessional End Term
20.		Spatial Indexing	Illustration of Spatial Indexing	Lecture	4162.1 4162.2	Class Quiz Home Assignments II Sessional End Term
21.		Spatial Networks	Illustration of Spatial Networks	Lecture	4162.1 4162.2	Class Quiz Home Assignments II Sessional End Term
22.		Spatial Analysis	Illustration of Spatial Analysis	Flip class	4162.1 4162.2	Class Quiz Home Assignments II Sessional End Term
23.	Spatial Data Mining	Classification	Apply Classification on spatial data	Lecture	4162.1 4162.3	Class Quiz Home Assignments II Sessional End Term
		Clustering	Apply Clustering on spatial data	Lecture	4162.1	Class Quiz

					4162.3	Home Assignments II Sessional End Term
		Patterns and rules	Apply spatial Patterns and rules	Lecture	4162.1 4162.3	Class Quiz Home Assignments II Sessional End Term
24.	Introduction to remote sensing	Remote sensing and GIS	Ability to understand the need of remote sensing and GIS to handle spatial data	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments II Sessional End Term
25.		Sensors and characteristics	Understand the sensor nature of data	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments II Sessional End Term
26.		Sensors and characteristics	Understand the sensor nature of data	Flip class	4162.1 4162.4 4162.5	Class Quiz Home Assignments II Sessional End Term
27.		On board remote sensing satellite	Recognize the sensor data according to application nature	Flip class	4162.1 4162.4 4162.5	Class Quiz Home Assignments II Sessional End Term
28.		Spectral signature of satellite data	Ability to understand the nature of image, composite image	Lecture	4162.1 4162.4	Class Quiz

					4162.5	Home Assignments II Sessional End Term
29.		Data Visualization using python libraries	Ability to Image Visualization	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments II Sessional End Term
30.		Data Visualization using python libraries	Ability to Image Visualization	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments II Sessional End Term
31.	Problem solving and GIS Projects tools	Google Maps Data	Data extraction with geo-referencing	Flip class	4162.1 4162.4 4162.5	Class Quiz Home Assignments End Term
32.		Street Map Data	Data extraction with geo-referencing	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments End Term
33.		Toposheets Data	Data extraction with geo-referencing	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments End Term
34.		Digital Elevation	Data extraction with geo-referencing	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments End Term
35.		Geospatial repositories Data Extraction	Data extraction with geo-referencing	Lecture	4162.1	Class Quiz

					4162.4 4162.5	Home Assignments End Term
36.	Application Areas of GIS	Landsat Landuse Application	Landsat Landuse Application	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments End Term
37.		Hydrological Application	Hydrological Application	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments End Term
38.		Disaster Application	Disaster Application	Lecture	4162.1 4162.4 4162.5	Class Quiz Home Assignments End Term

I. Course Articulation Matrix: (Mapping of COs with POs)

CO with STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
[CC4162.1]. Understand GIS concepts and spatial analysis techniques in an interdisciplinary area;	3	2	1	1								2	2	1		
[CC4162.2]. Apply open-source GIS Software for spatial data preparation, analysis and visualisation with sophisticated skills of vector and raster processing;		3	2	1									2	1		
[CC4162.3]. Apply proficiency in integrating GIS data analysis with simple statistical analysis;		3	2	2									1		1	
[CC4162.4]. Apply ability to conduct a GIS project in the area of their choice;	1	1	2	2											1	
[CC4162.5]. Identify and source data for use in evidence-based decision making;	1	1	2	2											1	

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

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School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGG.

Course Hand-out

Industrial Training | CC4170 | 1 Credits | 0 0 2 1

Session: Jul - Dec 2022 | Faculty: Dr. Deepak Sinwar & Arpit Kumar Sharma | Class: B. Tech VI SEM | CORE

A. Introduction:

In this industrial training, each student is expected to do training in the industry (preferably IT sector). The theoretical knowledge, principles, and practices gained during internship would help students in developing effective solutions to various complex computer engineering problems. Structured/ Object Oriented design techniques may be utilized during the industrial training project. Software Requirements Specification (SRS), Modelling Techniques, and Design and Testing strategies would be part of the document of the work. A committee consisting of a panel of examiners (2-3) shall perform an assessment on the industrial training work done by the student during internship duration (summer 2021). Industrial training work would be presented and demonstrated before the panel of examiners.

B. Course Outcomes: At the end of the course, students will be able to

[CC4170 .1]:	Identify the basic concepts related to the project development and its life cycle.
[CC4170 .2]:	Determine the skills and technology required to devise the solution to a complex engineering problem.
[CC4170 .3]:	Solve real-life problems and contribute to an open community with ethical values by undergoing systematic study and communicating the proposed solution.
[CC4170 .4]:	Work in a team with proper contribution from individuals and build the project with lifelong learning as a team-member.

C PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

PO2. **Problem analysis**: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

PO3. **Design/development of solutions**: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

PO4. **Conduct investigations of complex problems**: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

Program Educational Objectives

PEO1: Graduates shall exhibit leadership skills to foster academic excellence with productive research and social reforms engaging in lifelong learning with ethical practices.

PEO2: Graduates shall pursue higher education to upgrade technical competency in the field of computation.

PEO3: Graduates shall showcase industry readiness with a strong understanding of logical, analytical, critical thinking with teamwork.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Assessment (Summative)	Presentation	30
	Internship report	30
	Viva-voce (Q&A)	20
	Quality of work done	20

1 Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC4170 .1]	Identify the basics concepts related to the project development and its life cycle.	2	2		2	2	2	1		1	1	2	2	2	3	1
[CC4170.2]	Determine the skills and technology required to devise the solution to a complex engineering problem.	1	3	1	3	2	2			1		2	1	2	1	2
[CC4170.3]	Solve real-life problems and contribute to an open community with ethical values by undergoing systematic study and communicating the proposed solution.	1	2	3	2	3	3	1	3	1	2	2	3	1	2	2
[CC4170.4]	Work in a team with proper contributions from individuals and build the project with lifelong learning as team member.			3	2	2	1		1	3	2	1	1			1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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School of Computer and Communication Engineering

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Major Project | CC4270 | Credits: 12

Session: Jan - Jul 2023 | Faculty: Dr. Deepak Sinwar (Coordinator) and Dr. Amit Chaurasia (Instructor)

Class: B. Tech VIII SEM | CORE

A. Introduction:

In this practical course, each student is expected to design and develop practical solutions to real-life problems related to industry, institutions, and computer science research. The project work can be carried out internally at Manipal University Jaipur under the supervision of an internal guide or externally (outside Manipal University Jaipur) under the supervision of an external guide. The software life cycle should be followed during the development. The theoretical knowledge, principles, and practices gained from various subjects would be applied to develop effective solutions to various computing problems. The project work can be an application-based project or a research-based work. A report on the major project would be submitted for evaluation. Project work would be presented and demonstrated before the panel of examiners. A committee consisting of a minimum of three faculty members (including an internal guide) shall perform an assessment of the major project submitted by the student.

B. Course Outcomes: At the end of the course, students will be able to

[CC4270.1]:	Identify the basics of the concepts related to the selected topic of the project and identify the open issues.
[CC4270.2]:	Determine the depth of the problem and propose a solution.
[CC4270.3]:	Solve real-time problems and contribute to an open community with ethical values by undergoing systematic study and communicating the proposed solution.
[CC4270.4]:	Work in a team with proper contribution from individuals and build the project with lifelong learning.

C PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, computer science, and communication engineering fundamentals to the solution of complex engineering problems.

PO2. **Problem analysis**: The sophisticated curriculum would enable a graduate to identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using basic principles of mathematics, computing techniques and communication engineering principles.

PO3. **Design/development of solutions**: Upon analysing, the B Tech CCE graduate should be able to devise solutions for complex engineering problems and design system components or processes that meet the specified requirements with appropriate consideration for law, safety, cultural & societal obligations with environmental considerations.

PO4. **Conduct investigations of complex problems**: To imbibe the inquisitive practices to have thrust for innovation and excellence that leads to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: The engineers are called society builders and transformers. B. Tech CCE graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: The zero effect and zero defect is not just a slogan, it is to be practised in each action. Thus a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Protection of IPR, staying away from plagiarism are important. Student should be able to apply ethical principles and commit to professional ethics, responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: United we grow, divided we fall is a culture at MUJ. Thus an outgoing student should be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively for all engineering processes & activities with the peer engineering team, community and with society at large. Clarity of thoughts, being able to comprehend and formulate effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in varied environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

At the end of the B Tech CCE program, the student:

[PSO.1] Imbibe the basic concepts and applications of computer-based Communication or networking, information sharing, signal processing, web-based systems, smart devices, and communication technology.

[PSO.2] Investigate prominent areas in the field of Computer and Communication Engineering to provide feasible solutions.

[PSO.3] Apply the contextual knowledge in the field of Computing and Communication to assess social, health, safety, and security issues relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Synopsis	10
	Mid-Term Assessment	30
	Project completion and submission of final report (Including feedback from concerned external organization if the project is external)	20
End Term Exam (Summative)	End Term Exam	40
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

I Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CC4270.1]	Identify the basics of the concepts related to the selected topic of the project and identify the open issues.	2	2		2	2	2	1		1	1	2	2	2	3	1
[CC4270.2]	Determine the depth of the problem and propose a solution.	1	3	1	3	2	2			1		2	1	2	1	2
[CC4270.3]	Solve real-time problems and contribute to an open community with ethical values by undergoing systematic study and communicating the proposed solution.	1	2	3	2	3	3	1	3	1	2	2	3	1	2	2
[CC4270.4]	Work in a team with proper contribution from individuals and build the project with lifelong learning.			3	2	2	1		1	3	2	1	1			1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation