MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

B.Tech –Computer and Communication Engineering | Academic Year: 2020-21

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] 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.

Vision

Inculcate academic excellence and research aptitude for social development

Mission

To nurture technical skillset of students to enable them create new India.
To sharpen their problem solving skills through project-based learning.
To provide a conducive research environment for addressing community development issues.
To serve society by inspiring young minds with innovation & 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 demonstrating technical competence in the field of computation.

PEO2: Graduates shall pursue higher education to upgrade their competency with effective communication skills.

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

PROGRAM ARTICULATION MATRIX

Course CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CC2101	3	2	1	0	0	0	0	0	0	0	0	2	2	1	2	1
CC2102	3	2	1	0	0	0	0	0	1	2	0	1	3	2	1	1
CC2103	3	3	2	2	0	0	0	0	0	0	0	2	2	1	1	0
CC2104	3	2	2	2	0	0	0	0	1	1	1	2	3	0	2	2
EO2001	0	0	0	0	0	1	0	0	2	0	2	3	0	0	0	0
MA2101	3	3	2	1	0	0	0	0	1	1	2	3	3	3	2	0
CC2130	3	2	2	2	2	2	0	0	3	0	0	3	3	2	1	1
CC2131	3	3	2	2	0	0	0	0	0	0	0	2	2	1	1	0
CC 2132	1	2	2	1	1	0	0	0	1	0	0	2	2	0	2	3
CS1501	3	3	2	1	1	1	0	0	2	2	2	1	1	3	3	1
CC1501	2	2	2	3	3	2	2	1	1	1	1	2	2	2	2	2
CC1502	3	3	3	2	0	0	0	0	0	0	0	2	1	2	1	1
IT1504	3	2	1	0	0	0	1	0	1	2	0	1	3	2	2	1
CC1551	2	2	3	3	3	1	2	2	2	2	3	3	3	2	2	2
CS1530	3	1	2	0	0	0	0	0	0	0	0	2	3	2	3	3
CC1530	3	2	2	2	2	1	0	0	3	0	0	3	3	2	1	1
CC1701	2	2	2	1	0	0	2	0	0	0	0	3	2	1	2	3
CC1702	3	3	3	3	2	3	1	2	2	0	2	1	3	2	2	3
CC1751	3	3	2	2	0	0	0	0	0	0	0	2	2	1	1	0
CC1753	3	1	3	3	3	0	0	0	0	0	0	3	3	1	3	2
CC1754	2	3	2	3	3	1	0	0	1	1	0	1	1	1	1	1
CC1755	3	2	1	0	3	0	0	0	0	0	0	2	2	2	2	1
CC1756	3	2	1	1	1	0	1	2	1	3	0	1	3	2	3	1
CC1730	1	1	1	2	2	0	0	0	0	0	0	0	2	2	2	1
CC1731	2	2	3	2	2	2	1	0	3	1	2	0	0	2	3	2

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT

Department of Computer and Communication Engineering
Course Hand-out

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

Session: July 20 – Nov. 20 | 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].** Describe digital components and digital logic circuits for computer system
- **[2101.2].** Describe various data representations and analyse the design of fast arithmetic circuits.
- **[2101.3].** Formulate assembly language programs for a given high level language construct.
- **[2101.4].** Describe various parts of a system memory hierarchy and caching techniques.
- **[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:

[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	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
	Quizzes and Assignments (Accumulated and Averaged)	Regularly	20
End Term Exam (Summative)	End Term Exam (Closed Book)	Nov 29 – Dec 13	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

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; Memory unit: Von-Neumann model for computer/ Von-Neumann architecture, performance; 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, microoperation and their RTL specification, memory hierarchy, main memory, types and interfacing; Cache Memory: organization and operations, levels of caches; memory management module: paging and segmentation, virtual memory, disk memory, raids, back-up memory; 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: introduction to interconnection network and practical 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.

H. Lecture Plan:

Lectures	Major Topics	Topics	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1	**Digital logic circuits** **Lecture 1-4**	Boolean algebra, logic gates,	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
2		map simplification, combinational circuits	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
3-4		sequential circuits, flip-flops	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
5	**Digital components:** **Lecture 5-9**	Integrated circuits, decoders,	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
6		Multiplexers	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
7		Registers, shift registers, binary counters	**Lecture**	**2101.1**	Mid Term I, Quiz & End Term
8		Von-Neumann architecture	**Lecture**	**2101.1& 1301.3**	Mid Term I, Quiz & End Term
9		Performance	**Lecture**	**2101.1& 2101.3**	Mid Term I, Quiz & End Term
10		Numbers, Arithmetic Operations And Characters	Flipped Class	**2101.2**	Mid Term I, Quiz & End Term

11	Machine Instructions and Programs (Lecture 10-14)	Memory Locations and Addresses, Memory Operations	Lecture	**2101.2**	Mid Term I, Quiz & End Term
12		Instructions and Instruction Sequencing	Lecture	**2101.2**& **2101.3**	Mid Term I, Quiz & End Term
13		addressing modes	Lecture	**2101.2**& **2101.3**	Mid Term I, Quiz & End Term
		MID TERM I			
14		assembly language, additional instructions, encoding of machine instructions		**2101.2**	
15	Arithmetic (Lecture 15-29)	Addition and Subtraction of Signed Numbers	Flipped Class	**2101.2**	Mid Term I, Quiz & End Term
16		Design of Fast Adders	Lecture	**2101.2**& 1301.6	Mid Term II, Quiz & End Term
17		Carry Look Ahead Adders- Bit Stage Cell,4 Bit CLA	Lecture	**2101.2**& 1301.5	Mid Term II, Quiz & End Term
18		Carry Look Ahead Adders 16 Bit	Lecture	**2101.2**& 1301.5	Mid Term II, Quiz & End Term
19		Tutorial	Activity	**2101.2**	Mid Term II, Quiz & End Term
20		Multiplication of Positive Numbers-Array Sequential Circuit	Flipped Class	**2101.2**& 1301.5	Mid Term II, Quiz & End Term
21		Signed Operand Multiplication-Booth Algorithm	Lecture	**2101.2**	Mid Term II, Quiz & End Term
22		Fast Multiplication-Bit Pair Recoding Of Multipliers	Lecture	**2101.2**	Mid Term II, Quiz & End Term
23		Carry-save addition of summands	Flipped Class	**2101.2**	Mid Term II, Quiz & End Term

24		Integer Division-Restoring	Lecture	**2101.2**	Mid Term II, Quiz & End Term
25		Integer Division- Nonrestoring	Lecture	**2101.2**	Mid Term II, Quiz & End Term
26		Floating Point Numbers & Operation-Standards Exceptions, check to uncheck Exception	Lecture	**2101.2**	Mid Term II, Quiz & End Term
27		Arithmetic Operations on Floating Point Numbers	Lecture	**2101.2**	Mid Term II, Quiz & End Term
28		Examples on Arithmetic Operation on Floating Point Numbers	Lecture	**2101.2**	Mid Term II, Quiz & End Term
		MIDTERM II			
29		Tutorial	Activity	**2101.2**	Mid Term II, Quiz & End Term
30	Memory Systems (Lecture 30- 38)	Memory Systems: Basic Concepts	Flipped Class	**2101.4**	Mid Term II ,Quiz & End Term
31		Speed, Size & Cost	Lecture	**2101.4**& **2101.5**	Mid Term II ,Quiz & End Term
32		Cache Memories- Mapping Functions	Lecture	**2101.4**& **2101.5**	Mid Term II ,Quiz & End Term
33		Replacement Algorithms	Lecture	**2101.4**& **2101.5**	Mid Term II ,Quiz & End Term
34		Example Of Mapping Techniques	Flipped Class	**2101.4**	Mid Term II , Quiz & End Term
35		Performance Considerations: Hit Rate & Miss Penalty, Caches on Processor Chip	Lecture	**2101.4**& **2101.5**	Mid Term II , Quiz & End Term
36		Virtual Memories	Lecture	**2101.4**& **2101.6**	Mid Term II , Quiz & End Term
37		Address Translation	Lecture	**2101.4**	Mid Term II , Quiz & End Term

38		Tutorial	Activity	**2101.4**	Mid Term II , Quiz & End Term
39	Input / Output Processing (Lecture 39-42)	Accessing I/O Devices, Interrupts	Lecture	**2101.5**	Quiz & End Term
40		Interrupt H/W, Enabling Disabling Interrupts	Lecture	**2101.5**	Quiz & End Term
41		Handling Multiple Devices, Controlling Device Requests, Exceptions	Lecture	**2101.5**	Quiz & End Term
42		Use of interrupts in Operating Systems, Direct Memory Access	Lecture	**2101.5**	Quiz & End Term
43	Instructional Level Parallelism (Lecture 43-49)	Flynn Classification, Multi-Core Architecture	Lecture	**2101.5**&**2101.6**	Quiz & End Term
44		Pipelining	Flipped Class	**2101.5**	Quiz & End Term
45		Data Hazards	Lecture	**2101.5**	Quiz & End Term
46		Instruction Scheduling: Static and Dynamic	Lecture	**2101.6**& **2101.6**	Quiz & End Term
47		Control Hazard	Lecture	**2101.5**	Quiz & End Term
48		Branch Prediction	Lecture	**2101.5**	Quiz & End Term
49		Tutorial	Activity	**2101.5**	Quiz & End Term
		ENDTERM			

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	PSO4
2101.1	Describe the interconnection between various functional units of a computer system and able to assess the performance of a computer.	2	1										1	2	1		
2101.2	Describe various data representations and analyse the design of fast arithmetic circuits.	3	2										1	1	1		
2101.3	Formulate assembly language programs for a given high level language construct.	2	2	1									1	1			
2101.4	Describe various parts of a system memory hierarchy and caching techniques.	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

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

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

Session: July 2020-Dec 2020 | Faculty: Dr Gulrej Ahmed, Mr Vidhyadhar Ask | Class: B.Tech III SEM

A. Introduction: This course is offered by Department of Computer & Communication Engineering which provides students with the fundamental concepts and techniques used for communicating data in efficient and reliable manner. The student will be able to gain 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] Define the significance of relevant terminologies, explain the transmission of digital & analog signals over different types of transmission media and outline the effects of various transmission impairments on analog & digital transmission.

[CC 2102.2] Describe 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 in order to find and overcome error encountered during transmission and discuss flow control and error control techniques.

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

[CC 2102.5]Identify and compare various IEEE 802.X LAN Standards.

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] 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.

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 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.	

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. I. 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 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	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	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - I End Term
18.		Atmospheric Absorption, Multipath, Refraction	Lecture	[2102.2]	Class Quiz Mid Term - I End Term
FIRST SESSIONAL EXAM					
19.	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 - I End Term
20.		NRZ & Bipolar – AMI	Lecture & Problem Solving Practice	[2102.2]	Class Quiz Mid Term - I End Term
21.		Biphase – Manchester &	Lecture &	[2102.2]	Class Quiz Mid Term - I

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

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

49.		Performance Consideration – FHSS and DSSS	Lecture	[2102.4]	End Term
50.		Code Division Multiple Access (CDMA)	Lecture & Problem Solving Practice	[2102.4]	End Term
51.	IEEE 802.X LAN Standards	Introduction,	Lecture	[2102.5]	End Term
52.		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												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
[CC 2102.1]	Define the significance of relevant terminologies, explain the transmission of digital &analog signals over different types of transmission media and outline the effects of various transmission impairments on analog& digital transmission.	1	1							1	2		1	2	1		
[CC 2102.2]	Describe the principles of signal encoding techniques used for digital data to digital signal conversion and analog data to digital signal conversion and compare them.	2	2	1							1			3	1		
[CC 2102.3]	Apply the knowledge of various error detection and correction techniques in order 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								1	2			2	1		
[CC 2102.5]	Identify and compare various generations of IEEE 802.X LAN Standards	2						1					1	1	1		1

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

MANIPAL UNIVERSITY JAIPUR
School of Computing and IT
Department of Computer and Communication Engineering
Course Hand-out
Data Structures and Algorithms | CC2103 | 4 Credits | 3 1 0 4
Session: August – December 2020 | Faculty: Dr. Hemlata Goyal, Mr. Prashant Hemrajani, Mr. Nitesh Pradhan Class: III CCE

A. Introduction: This course is offered by Department of 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 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

[2103.1] Explain basic concepts of various data structures.

[2103.2] Illustrate arrays, linked lists, stacks, queues, trees, and graphs are represented in memory and their operations.

[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.

[2103.4] Demonstrate and interpret various sorting and searching algorithms and their applications in real scenario.

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 Assignments , 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: 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 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. LECTURE PLAN

Lec No	Major Topics	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Introduction	Introduction to data structures, Algorithm Specifications, How to Write Algorithms	Define data structure and list various data structure.	Lecture	2103.1	Class Quiz End Term
2.		Performance Analysis- Time and Space Complexity, Asymptotic Analysis	Analyze time complexity of simple algorithms.	Lecture	2103.1 2103.1	Class Quiz Home Assignments I Sessional End Term
3.	A quick tour of C Language	Loops, Functions in 'C', Example Programs on Functions	Brushing the concept of functions	Lecture	2103.1 2103.1	Class Quiz Home Assignments I Sessional End Term
4.	Arrays	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	2103.1 2103.2	Class Quiz Home Assignments I Sessional End Term
5.		Searching in Single Dimensional Arrays – Selection Sort, Linear and Binary Search	Construct searching and sorting algorithms and write programs using single dimensional arrays.	Lecture	2103.2	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	2103.1 2103.2	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	2103.2 2103.3	Class Quiz Home Assignments I Sessional End Term
8.	Pointers	Pointers: Introduction, Example Programs on Pointers, Pointers and Arrays, Dynamic Memory Allocation	Illustrate dynamic memory allocation using pointers in solving problems requiring list of values.	Lecture	2103.1 2103.2	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	2103.1 2103.2	Class Quiz Home Assignments I Sessional End Term
10.		Problems solving by students on array	analyze the applicability of array as appropriate Data Structure to solve the problem and develop an algorithm/program to provide the solution to a given problem through it and model a given real world problem into array.	Tutorial	2103.3	Class Quiz Home Assignments I Sessional End Term
11.	Linked List	Linked List : Introduction, Basic Terminologies, Advantages over Arrays, Applications, Structures in 'C',	describe linked list data structure, disadvantages of array based storage and need of linked list data structure,	Lecture	2103.1 2103.2	Class Quiz Home Assignments I Sessional End Term

		Example Programs on Structures and pointer to Structure	develop structures in 'C' and dealing it with pointers.			
12.		Passing Structures to Functions, Singly Linked List : Introduction , Operations	pass structures to functions, to explain self-referential structures and functions, describe linked list storage structure and basic operations.	Lecture	2103.1 2103.2	Class Quiz Home Assignments I Sessional End Term
13.		Singly Linked List : Operations (Continued)	implement singly linked list storage structure and basic operations (insertion, deletion and searching) defined over it.	Lecture	2103.1 2103.2	Class Quiz Home Assignments I Sessional End Term
14.		Circular Linked List : Introduction, Operations	understand and implement circular linked list storage structure and basic operations (insertion, deletion and searching) defined over it.	Lecture	2103.1 2103.2	Class Quiz Home Assignments I Sessional End Term
15.		Doubly Linked List : Introduction, Operations	understand and implement circular linked list storage structure and basic operations (insertion, deletion and searching) defined over it.	Lecture	2103.1 2103.2	Class Quiz Home Assignments I Sessional End Term
16.		Some Example Programs on Linked List	implement linked list operations like reversing a linked list, finding middle of the list, sorting a list etc.	Lecture	2103.3	Class Quiz Home Assignments I Sessional End Term
17.		Problems solving by students on linked list	analyze the applicability of linked list as appropriate Data Structure to solve the problem and develop an algorithm/program to provide the solution to a given problem through it.	Tutorial	2103.3	Class Quiz Home Assignments I Sessional End Term

18.		Problems solving by students on linked list	structuring, mapping and model a given real world problem into linked list.	Tutorial	2103.3	Class Quiz Home Assignments I Sessional End Term
19.	Stacks	Recursive Functions, Example Programs on Recursive Functions, Stack : About, Applications	explain the working philosophy of stack and how the system stack stores local function calls.	Lecture	2103.1 2103.3	Class Quiz Home Assignments II Sessional End Term
20.		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 linked list and compare their implementations.	Lecture	2103.1 2103.2	Class Quiz Home Assignments II Sessional End Term
21.		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	2103.3	Class Quiz Home Assignments II Sessional End Term
22.		Evaluation of Expression written in Reverse Polish Notation Evaluation of Expression written in Infix Notation	evaluate the postfix(infix) expression using stacks	Lecture	2103.3	Class Quiz Home Assignments II Sessional End Term
23.		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	2103.3	Class Quiz Home Assignments II Sessional End Term
24.		Conversion of Expression from one Notation to Another	convert an infix expression to prefix notation using stack	Lecture	2103.3	Class Quiz Home Assignments

						II Sessional End Term
25.		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	2103.3	Class Quiz Home Assignments II Sessional End Term
26.	Queues	Linear Queue : Introduction, Applications, Operations, Implementation using Array and Linked List	explain Queue Data structure, its application in real world and its operations enqueue and dequeue, to implement queue data structure using array and linked list.	Lecture	2103.1 2103.2	Class Quiz Home Assignments II Sessional End Term
27.		Circular Queue : About, Applications, Operations, Implementation using Array and Linked List	explain Circular Queue Data structure, its application in real world and its operations enqueue and dequeue	Lecture	2103.1 2103.2	Class Quiz Home Assignments II Sessional End Term
28.		Priority Queue and Deques : About, Applications, Operations, Implementation using Array and Linked List	explain Priority Queue Data structure and Deques, its application in real world and its operations enqueue and dequeue.	Lecture	2103.1 2103.2	Class Quiz Home Assignments II Sessional End Term
29.		Problems solving by students on queue applications	analyze the applicability of queue as appropriate Data Structure to solve the problem, to develop an algorithm/program to provide the solution to a given problem through it.	Tutorial	2103.3	Class Quiz Home Assignments II Sessional End Term
30.	Trees	Trees : Introduction , Basic Terminology, Types of Trees, Binary	describe about binary tree (BT), tree-terminology, types of BT, creation of Binary Search Tree, search operations	Lecture	2103.1 2103.2	Class Quiz Home Assignments II Sessional

		Search Tree : Creation, : Searching an Element , Insertion of Node				End Term
31.		Binary Search Tree : Deletion of Node, Determining Height	describe about deletion of a node in BST and computing height	Lecture	2103.2	Class Quiz Home Assignments II Sessional End Term
32.		Binary Search Tree : Traversal (In-order, Pre-order and Post- order)	explain different traversal in BST	Lecture	2103.2	Class Quiz Home Assignments II Sessional End Term
33.		Threaded Binary tree : Introduction, Creation , Insertion of Node, Deletion of Node and Traversal of Tree	describe about Threaded Binary tree, its applications and operations	Lecture	2103.1 2103.2	Class Quiz Home Assignments 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	2103.1 2103.2	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	2103.2	Class Quiz Home Assignments End Term
36.		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	2103.1 2103.2	Class Quiz Home Assignments End Term
37.		Problems solving by students on tree and its use	Applications of B and B+ Trees, Construction of B and B+ Trees, Insertion and Deletion of nodes in B and B+ Trees	Tutorial	2103.3	Class Quiz Home Assignments End Term

38.		Problems solving by students on tree and its use	construct BST and AVL tree from given sequence of values	Tutorial	2103.3	Class Quiz Home Assignments End Term
39.	Graphs	Graphs : Introduction, Basic Terminology, Applications, Representation of Graphs : Adjacency Matrix Representation	construct heap from given sequence of values and implement priority queue	Lecture	2103.1 2103.2	Class Quiz Home Assignments End Term
40.		Representation of Graphs : Adjacency List Representation	describe representation of graph in term of adjacency matrix with their complexity	Lecture	2103.1 2103.2	Class Quiz Home Assignments End Term
41.		Graph Traversal : Breadth First Traversal, Depth First Traversal	describe representation of graph in term of adjacency list with their complexity	Lecture	2103.2	Class Quiz Home Assignments End Term
42.		Minimum Spanning Tree, Prims Algorithm, Kruskal's Algorithm	conceptualize on the various methods of graph traversal and understand the concept of Queue and Stack data structure	Lecture	2103.2	Class Quiz Home Assignments End Term
43.		Shortest Path Algorithms: Dijkstra's Algorithm, Floyd's Algorithm	understand the application of graph such as TSP problem	Lecture	2103.2	Class Quiz Home Assignments End Term
44.		Problems solving by students on graph algorithms	understand the application of graph such as computer networking(Routing System)	Tutorial	2103.3	Class Quiz Home Assignments End Term
45.		Problems solving by students on graph algorithms	find shortest path using Dijkstra's Algorithm and Floyd's Algorithm for a given graph	Tutorial	2103.3	Class Quiz Home Assignments End Term

46.	Searching & Sorting	Sorting : Introduction, Bubble Sort, Insertion Sort	find MST using Prims Algorithm and Kruskal's Algorithm for a given graph	Lecture	2103.1	Class Quiz Home Assignments End Term
47.		Sorting (Continued) : Quick Sort, Merge Sort	describe the concept of sorting with various sorting algorithm	Lecture	2103.1 2103.4	Class Quiz Home Assignments End Term
48.		Sorting (Continued) : Radix Sort , Heap Sort	describe the application of sorting such as medical monitoring	Lecture	2103.1 2103.4	Class Quiz Home Assignments End Term
49.		Hashing : Introduction, Applications, Hash Functions	describe the concept of priority queue with the help of heap sort	Lecture	2103.1 2103.2 2103.4	Class Quiz Home Assignments End Term
50.		Hash Collisions, Collision Resolution : Open Addressing, Chaining	describe different hashing techniques/functions	Lecture	2103.1 2103.2	Class Quiz Home Assignments End Term
51.		Problems solving by students on sorting and its application	describe different collision resolving techniques with examples	Tutorial	2103.3	Home Assignments End Term
52.		Problems solving by students on sorting and its application	develop program for searching and sorting	Tutorial	2103.3	Home Assignments End Term

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	PSO 4
2103.1	Explain basic concepts of various data structures	3	2	1	1								2	2	1		
2103.2	Illustrate arrays, linked lists, stacks, queues, trees and graphs are represented in memory and their operations		3	2	1									2	1		
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		3	2	2									1		1	
2103.4	Demonstrate and interpret various sorting and searching algorithms and their applications in real scenario.	1	1	2	2											1	

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

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

Session: Aug 20-Dec 20 | Faculty: Dr. Punit Gupta, Dr. Sourabh Singh Verma and Dr. Ghanshyam Raghuwanshi | Class: BTech CCE III SEM | Sec: A|B|C

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 covers the programming aspects related with 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 presentation and via live debugging and execution demonstrations of several programming problems using 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

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.

[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
	Sessional Exam I (Closed Book)	15
	Sessional Exam II (Closed Book)	15

Internal Assessment (Summative)	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	30
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.	

E. 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;

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	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

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	PSO 4
[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**	**S 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**	**-**	**2**	**3**
[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**	**-**	**3**	**3**

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

MANIPAL UNIVERSITY
JAIPUR

School of Humanities and Social Sciences
Department of Economics
Course Handout

Economics | EO 2001 | 3 Credits | 3003

Session: July 20 – Dec 20 | Faculty: Dr Monika Mathur | Class: B. Tech, IT | Semester III

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

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

[2001.1] Describe the basic principles of micro and macroeconomic analysis to relate with real world
[2001.2] Interpret and illustrate decision making process in practical life and hence enhance employability
[2001.3] Aware of the tools and techniques of economics for real world to prepare the budget
[2001.4] Recognize the problems and give solutions which in turn will create employability
[2001.5] Recall the assumptions that underpin the Micro/Macro model

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 program, the student:

[PSO1]. Should 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

[PSO2]. Should be able to nail down the issues prevalent in the field of computer -based Engineering.

[PSO3]. Should be able to identify the existing open problems in the field of computing and propose the best possible solutions.

[PSO4]. Should be able to apply the contextual knowledge in the field of computer -based Communication Engineering 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	15
	Sessional Exam II	15
	Assignments , Activity, etc.	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

Introduction: Definition, nature and scope of economics, introduction to micro and macro-economics ; **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, Indifference curve, properties, consumer equilibrium, Price and income effect; Production: Law of production, production function, SR and LR production function, law of returns, Isoquant curve, characteristics, Iso-cost, producer's equilibrium; Cost and revenue analysis: Cost concepts, short run and long- run cost curves, TR,AR,MR; Various market situations: Characteristics and types, Break-even analysis; **Macro Economics:** National Income, Monetary and Fiscal Policies, Inflation, demand and supply of money, consumption function and business cycle.

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	To acquaint and clear the overview of the course	Lecture	NA	NA
2	Objective of the course	Discussion of the objective of the course for the engineers	Lecture	NA	NA
3,4	Definition, nature and scope of economics, introduction to micro and macroeconomics	Describe the concept given by different economists, its scope, differences between micro and macro economics	Lecture	2001.1	Class Test Mid Term I
5,6,7,	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
8,9,10,11	Law of demand and supply, elasticity of demand and supply	Describe the concept of demand, supply, elasticity of demand and supply with examples, conceptual questions	Lecture	2001.1	Class Test Mid Term I
12	Revision of previous lectures	Recall all the concepts discussed in previous classes	Lecture	2001.5	Class Test Mid Term I End Term
13	Discussion of the topics related to assignment	Discussion about the assignment topics	Lecture, Activity		Home Assignment Mid Term I End term
14,15,16	Ordinal approaches of utility	Recall of the differences between the concept of the cardinal approach and ordinal approach of utility , IC analysis, Consumers equilibrium, IE,SE,PE	Lecture	2001.5	Class Test Mid Term I End Term
17,18,19	Production, laws of production	Discussion of the concept of production, recognize production function,	Lecture	2001.4	Class Test Mid Term II End Term

		producers equilibrium, RTS			
20,21	Cost and revenue analysis	Discussion of the concept of cost and cost function, recognize SR and LR cost curves, revenues	Lecture	2001.4	Class Test Mid Term II End Term
22,23	Various market situations; Break even analysis	Aware of market morphology with examples, Interpret and illustrate BEA	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	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
27,28,29	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
30,31	Inflation	Concept of monetary and fiscal policies, Aware of its instruments, importance and limitations	Lecture	2001.3	Home Assignment Class Test End Term
32,33	Demand and Supply of money	Concept of inflation, Aware of demand pull and cost push inflation	Lecture	2001.3	Home Assignment Class Test End Term
34,35	Consumption Function	Aware of the concept of BOP, Business cycles	Lecture	2001.3	Home Assignment Class Test End Term
36	Business Cycle	Recall the discussion about the assignment topics	Lecture	2001.5	End Term
37	Conclusion and Course Summarization	Recall all the concepts discussed in previous classes	Lecture	2001.5	End Term
38	Quiz-I	Microeconomics	Quiz	NA	Internal Assessment
39	Quiz-II	Macroeconomics	Quiz	NA	Internal Assessment

H. 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
EO2001.1	Describe the basic principles of micro and macroeconomic analysis									1		2	2				
EO2001.2	Interpret and illustrate decision making process in practical life and hence enhance employability						1			2			2				
EO2001.3	Aware of the tools and techniques of economics for real world to prepare the budget									2		2	2				
EO2001.4	Recognize the problems and give solutions which in turn will create employability									2		2	2				
EO2001.5	Recall the assumptions that underpin the Micro/Macro model.									2			3				

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

MANIPAL UNIVERSITY
JAIPUR

School of Basic Sciences

Department of Mathematics and Statistics

Course Hand-out

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

Session: Aug. 2020 – Dec. 2020 | Faculty: Dr. Reema Jain| Class: B. Tech. III Sem. (CCE)

A. Introduction: This course is offered by Dept. 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 & 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

[MA2101.1] Describe the concept of Partial Order Relations, lattices and their applications.

[MA2101.2] Describe the concepts of Graph Theory and apply the graph algorithms to evaluate and analyse the problems, which enhance the analytical and logical skills.

[MA2101.3] Describe the concepts of Trees and apply the tree algorithms to analyse the shortest path problems, which enhance the analytical and logical skills.

[MA2101.4] Describe basic counting techniques and their applications to evaluate the relevant problems.

[MA2101.5] Describe the concept of Predicates, logics, and their properties which enhance the logical and programming skills and make them employable in the relevant industry

[MA2101.6] 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 CSE 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 CSE 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 CSE 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, 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] 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 (Online)	20
	Sessional Exam II (Online)	20
	In class Quizzes and/or Assignments, Activity feedbacks	20
End Term Exam (Summative)	End Term Exam (online)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance (online) 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

Boolean Algebra: Partial ordering relations, Poset, Lattices, Basic Properties of Lattices. Distributive and complemented lattices, Boolean lattices and Boolean Algebra. Propositional and Predicate Calculus: Wellformed 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:

Lecture Number	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.	Partial ordering relations, Poset	To understand the special kind of Relations	Lecture	2101.1	Mid Term I, Quiz & End Term
4.	Hasse diagram of posets	Understanding of diagrammatic presentation of Posets.	Lecture	2101.1	Mid Term I, Quiz & End Term
5.	Lattices, Basic Properties of Lattices	Understanding of Lattices and the properties	Lecture	2101.1	Mid Term I, Quiz & End Term
6.	Distributive and complemented lattices	Understand the concept of different lattices	Lecture	2101.1	Mid Term I, Quiz & End Term
7.	Graphs, digraphs, Simple graph, multi graph, pseudo graph	Basic knowledge of Graph formation	Lecture	2101.2	Mid Term I, Quiz & End Term
8.	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
9.	Some basic properties, Subgraphs	Properties of graph	Lecture	2101.2	Mid Term I, Quiz & End Term
10.	Complete graphs Regular graph, bipartite graphs	Knowledge of different types of graphs	Lecture	2101.2	Mid Term I, Quiz & End Term
11.	Graph isomorphism	Equivalence of two graphs	Lecture	2101.2	Mid Term I, Quiz & End Term

12.	Walk, path, cycle in a graph	Knowledge of different properties of graphs	Lecture	2101.2	Mid Term I, Quiz & End Term
13.	Eulerian and Hamiltonian Graphs	Application of graph theory using two important graphs	Lecture	2101.2	Mid Term I, Quiz & End Term
14.	Trees and Properties - 1	Extended concept of graphs	Lecture	2101.3	Mid Term II, Quiz & End Term
15.	Trees and Properties -2	Extended concept of graphs	Lecture	2101.3	Mid Term II, Quiz & End Term
16.	Centre, radius and diameter of a graph	Basic knowledge of properties of tree	Lecture	2101.3	Mid Term II, Quiz & End Term
17.	Rooted and binary trees	Knowledge of different types of trees and related properties	Lecture	2101.3	Mid Term II, Quiz & End Term
18.	Matrices associated with graphs	Representation of graphs in matrix form	Lecture	2101.3	Mid Term II, Quiz & End Term
19.	Algorithms for finding shortest path : Dijkstra's algorithm	Understand the concept of shortest path algorithm and their uses.	Lecture	2101.3	Mid Term II, Quiz & End Term
20.	Algorithms for finding shortest path: Dijkstra's algorithm	Understand the concept of shortest path algorithm and their uses.	Lecture	2101.3	Mid Term II, Quiz & End Term
21.	Basic Principle of Counting- Product rule, Sum rule	Understanding of basic principles of counting	Lecture	2101.4	Mid Term II, Quiz & End Term
22.	Review on Permutations and Combinations	Review of fundamental concepts of permutation and combination	Lecture	2101.4	Mid Term II, Quiz & End Term
23.	Problems under Permutations and Combinations, Ordering of permutations Lexicographical	Exercise new problems	Lecture	2101.4	Mid Term II, Quiz & End Term
24.	Principle of inclusion and exclusion, Partitions	Understand a new concept of counting	Lecture	2101.4	Mid Term II, Quiz & End Term
25.	Definition of Generating Function, examples	Understand the concept of generating function	Lecture	2101.4	Mid Term II, Quiz & End Term
26.	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
27.	Propositions, conjunction and disjunction of propositions,	Basics of propositions	Lecture	2101.5	Mid Term II, Quiz & End Term

	negation of a proposition, implications,				
28.	converse, contrapositive and inverse of a proposition, contradiction and tautology	Knowledge of variations in conditional statement	Lecture	2101.5	Mid Term II, Quiz & End Term
29.	contradiction and tautology, logical equivalences	Identification of nature of proposition	Lecture	2101.5	Mid Term II, Quiz & End Term
30.	Predicates - ways of expressing sentences using predicates	Understand the concept of predicates and their uses to express sentences.	Lecture	2101.5	Mid Term II, Quiz & End Term
31.	Quantifiers - expressing sentences using predicates and quantifiers and quantified express into sentences	Understand the concept of quantifiers and their uses to express sentences.	Lecture	2101.5	Mid Term II, Quiz & End Term
32.	Inference theory of propositional and predicate calculus	Knowledge of Rules of inferences to find validity of arguments.	Lecture	2101.5	Mid Term II, Quiz & End Term
33.	Semi-groups, monoids definition and examples	Basics of Algebraic structure	Lecture	2101.6	Quiz & End Term
34.	Group definition and examples, some basic theorems	Basic concepts of Group theory and properties.	Lecture	2101.6	Quiz & End Term
35.	subgroups, Normal Subgroups,	Knowledge of extended properties of the group	Lecture	2101.6	Quiz & End Term
36.	Cosets, Lagrange's Theorem, Cyclic groups	Knowledge of extended properties of the group	Lecture	2101.6	Quiz & End Term
37.	Axiomatic definition of Boolean Algebra and examples	Understanding of basic concepts of Boolean Algebra	Lecture	2101.6	Quiz & End Term
38.	Boolean lattices	Understand the concept of Boolean Lattices	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	PSO 4
MA2101.1	Describe the concept of Partial Order Relations, lattices and their applications.	3	2	1							1	2	1	2	1	2	
MA2101.2	Describe the concepts of Graph Theory and apply the graph algorithms to evaluate and analyze the problems, which enhance the analytical and logical skills.	3	3	3	2	1				1	1	1	2	2	1	1	
MA2101.3	Describe the concepts of Trees and apply the tree algorithms to analyze the shortest path problems, which enhance the analytical and logical skills.	3	2	3	1	2				1			3	3	1	1	
MA2101.4	Describe basic counting techniques and their applications to evaluate the relevant problems	3	3	3	2	1							2	1	1	1	
MA2101.5	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	1	1	1	
MA2101.6	Describe the concept of Algebraic structure and Group theory, Boolean Algebra which helps to increase the logical skills.	2	2	2	1	1							2	3	3	2	

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

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

Session: July 2020-Dec 2020 | Faculty: Dr Gulrej Ahmed, Mr. Vidyadhar Jinnappa Aski | 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)

On successful completion of B.Tech. in Computer and Communication Engineering (CCE), the student:

[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.

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	PSO4
CC 2130.1	Analyze and interpret signals and working of basic equipment (Function Generator and Digital Storage Oscilloscope (DSO)).	**3**				**3**	**2**			**3**			**3**	**3**		**1**	
CC 2130.2	Demonstrate various digital modulation, demodulation techniques in data communications.	**3**	**2**	**2**	**2**	**2**	**2**			**3**			**2**	**2**		**1**	
CC 2130.3	Identify multiplexing and multiple accessing techniques and trace the corresponding waveforms.	**3**	**2**	**2**						**3**			**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**	**3**	**2**	**1**	**1**

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

MANIPAL UNIVERSITY JAIPUR
School of Computing and IT
Department of Computer and Communication Engineering
Course Hand-out

Data Structures and Algorithms LAB| CC2131 | 4 Credits | 3 1 0 4

Session: August – December 2020 | Faculty: Dr. Hemlata Goyal, Mr. Prashant Hemrajani, Mr. Nitesh Pradhan Class: III CCE

A. Introduction: This course is offered by Department of 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 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

[2103.1] Explain basic concepts of various data structures.

[2103.2] Illustrate arrays, linked lists, stacks, queues, trees, and graphs are represented in memory and their operations.

[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.

[2103.4] Apply and interpret various sorting and searching algorithms and their applications in real scenario.

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)	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

Array: application using arrays (1-D, 2-D), string operations; Linked list: applications (singly, doubly, circular, etc) like polynomial addition and multiplications, etc, Stack and queue: applications of stacks (like arithmetic expression conversion and evaluation, etc), applications of queue; Binary tree: creation, deletion and traversal techniques, Binary search tree operations, AVL tree; sorting and searching techniques.

F. REFERENCE BOOKS

R1. A. M. Tenenbaum, Y. Langsam, M. J. Augenstein, Data Structures using C, (1e), Pearson Education, 2008.3.

R2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "*Fundamentals of Data Structures in C*", University Press (India) Pvt. Ltd., 2014.

R3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "*Data Structures and Algorithms*", Pearson Education, 2012

R4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "*Introduction to algorithms*", PHI, Third Edition, 2009

R5. Seymour Lipschutz, "*Data Structures with C* (Schaum's Outline Series)", McGraw Hill Education Private Limited, 2011.

R6. Mark Allen Weiss, "*Data structures and Algorithm Analysis in C*", Pearson, Second edition, 2014.

A. LAB PLAN

Lec No	**Major Topics**	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode Of Assessing CO**
1.	**Arrays**	Programs based on 1-D array operations	describe and implement various operations on 1-D array	Lab	2131.1 2131.3	Internal Evaluation Home Assignments External Evaluation
2.		Programs based on 2-D array operations	describe and implement various operations on 2-D array	Lab	2131.1 2131.3	Internal Evaluation Home Assignments External Evaluation
3.		Programs based on 2-D array operations with pointer notations	describe and implement various operations on 2-D array using pointers and functions.	Lab	2131.1 2131.2	Internal Evaluation Home Assignments External Evaluation
4.	**Linked List**	Programs to implement singly linked-list list operations	describe and implement various operations on one way linked list	Lab	2131.2 2131.3	Internal Evaluation Home Assignments External Evaluation
5.		Programs to implement Circular Linked list and Doubly-linked list operations	describe and implement various operations on circular and two way linked list	Lab	2131.1 2131.2	Internal Evaluation Home Assignments External Evaluation
6.	**Stacks**	Programs to implement stack and its operations	describe and simulate stack and its operations	Lab	2131.2 2131.3	Internal Evaluation Home Assignments External Evaluation
7.		Programs based on implementation of stack	describe and implement various application programs on stack	Lab	2131.1 2131.2	Internal Evaluation Home Assignments External Evaluation

8.	**Queue**	Programs based on implementation of queue and its operations	describe and implement various application programs on queue, and priority queue	Lab	2131.2 2131.3	Internal Evaluation Home Assignments External Evaluation
9.	**Tree**	Programs to implement tree and its operations	describe and implement various operations on Binary search tree	Lab	2131.1 2131.2 2131.3	Internal Evaluation Home Assignments External Evaluation
10.		Programs based on implementation of trees	describe and implement various operations on Binary search tree	Lab	2131.3	Internal Evaluation Home Assignments External Evaluation
11.	**Graph**	Programs to implement graph and its operations	describe and implement various operations on graph	Lab	2131.1 2131.2	Internal Evaluation Home Assignments External Evaluation
12.		Programs based on implementation of graphs	describe and implement programs on application of graph	Lab	2131.2 2131.3	Internal Evaluation Home Assignments External Evaluation
13.	**Sorting and Searching**	Programs to perform sorting using different sorting techniques over data	describe and implement various sorting and searching techniques	Lab	2131.2 2131.4	Internal Evaluation Home Assignments External 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	PSO 4
2131.1	Explain basic concepts of various data structures	3	2	1	1								2	2	1		
2131.2	Illustrate arrays, linked lists, stacks, queues, trees, and graphs are represented in memory and their operations		3	2	1									2	1		
2131.3	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.		3	2	2									1		1	
2131.4	Apply and interpret various sorting and searching algorithms and their applications in real scenario.	1	1	2	2											1	

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Object Oriented Programming using Java Lab | CC 2123 | 1 Credit | 0 0 2 1

Session: Aug 20-Dec 20 | Faculty: Dr. Punit Gupta, Dr. Sourabh Singh Verma and Dr. Ghanshyam Raghuwanshi | Class: BTech CCE III SEM | Sec: A|B|C

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

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

[CC 2123.1] Apply to compile and execute Java Application using Command Based Interface as well as using Eclipse Tool.

[CC 2123.2] 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.

[CC 2123.3] Identify and develop different classes based on real world scenario.

[CC 2123.4] Analyze and experiment with different class to demonstrate polymorphism and inheritance and exception handling model

[CC 2123.5] Apply Multi-threading Model and built classes to demonstrate multi-threading programming.

[CC 2123.6] Visualize a real world problem in the form of various collaborating classes and objects for enhancing employability.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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.

[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
Criteria	**Description**	**Maximum Marks**
Internal Assessment (Summative)	Weekly evaluation (record+execution+viva+Mini Project)	70
End Term Exam (Summative)	End Term Exam	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.	
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: 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;

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 Eclipse IDE and Java Basics	Understand project structure of eclipse and learn how to compile and run java program.	Lecture	CO 1	Continuous Evaluation, Project
3-4	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
5-6	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
7-8	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, End Term
9-10	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, End Term
11-12	Collections Framework in Java	Analyze real world scenario and develop GUI and event handler to solve problem	Lecture Demonstration	CO 2, CO 3 and CO 5	Continuous Evaluation, project, 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	PSO 4
[CC 2123.1]	Learn to compile and execute Java Application using Command Based Interface as well as using Eclipse Tool.	1				1								1			
[CC 2123.2]	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								1			
[CC 2123.3]	Identify and develop different classes based on real world scenario.	1	2	2	1	1								2		2	3
[CC 2123.4]	Analyze and experiment with different class to demonstrate polymorphism and inheritance and exception handling model	1	2	2	1	1								2			
[CC 2123.5]	Apply Multithreading Model and built classes to demonstrate multi-threading programming.	1	2	2	1	1								2			
[CC 2123.6]	Visualize a real world problem in the form of various collaborating classes and objects for enhancing employability	1	2	1	1	-	-	-	-	1	-	-	2	2	-	2	3

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer and Communication Engineering
Course Hand-out

Design and Analysis of Algorithms | CS1501| 4 Credits | 4 0 0 3

Session: Aug 2020 – Dec2020 | Faculty: Dr. Manoj Kumar Sharma & Dr. Geeta Rani | Class: V CCE

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:

[CS1501.1] Analyse the running times of algorithms using asymptotic analysis.
[CS1501.2] Demonstrate and Design algorithms using divide-and-conquer paradigm to solve business problems hence enhance skills.
[CS1501.3] Illustrate the concept of greedy and dynamic-programming approach to solve real life problems to enhance entrepreneurship capabilities.
[CS1501.4] Demonstrate the concept of backtracking and branch & bound algorithms.
[CS1501.5] 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]. Should 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.

[PSO2]. Should be able to nail down the issues prevalent in the field of Computer and Communication Engineering.

[PSO3]. Should be able to identify the existing open problems in the field of computing and propose the best possible solutions.

[PSO4]. Should 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	As per Academic Calendar	15
	Sessional Exam II	As per Academic Calendar	15
	Quizzes and Assignments	Regularly	30
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 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. References

1. E. Horowitz, S. Sahni and S. Rajasekaran, *"Computer Algorithms"*, 2nd Edition, University Press, 2007.
2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, "*Introduction to Algorithms*", 3rd Edition, MIT press, 2009.
3. V. Aho, J. E. Hopcroft and J. D. Ullman, "*The Design and Analysis of Computer Algorithms*", 1st Edition, Pearson Education, 1999.

G. 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	1501.1	Quiz 1 and Sessional-I and End-Sem

2.	Asymptotic Notation-Analysis of Algorithm,	Analyse running times of algorithms using asymptotic analysis	Slides / Black Board	1501.1	Quiz 1 and Sessional-I and End-Sem
3.	Time & Space Complexity – Hands-on	Analyse running times of algorithms using asymptotic analysis	Slides / Black Board	1501.1	Quiz 1 and Sessional I and End-Sem
4.	Insertion Sort and Analysis, QA-Discussions	Analyse running times of algorithms using asymptotic analysis	Slides / Black Board	1501.1	Quiz 1 and Sessional-I and End-Sem
5.	Selection Sort and Bubble Sort Analysis, QA-Discussions	Analyse running times of algorithms using asymptotic analysis	Slides / Black Board	1501.1	Quiz 1 and Sessional-I and End-Sem
6.	Divide and Conquer: Merge Sort and Analysis, QA-Discussions	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it	Slides / Black Board	1501.2	Quiz 1 and Sessional-I and End-Sem
7.	Quick Sort and Analysis,	Analyse algorithm using Recurrence relation	Slides / Black Board	1501.2	Quiz 1 and Sessional-I and End-Sem
8.	Master Theorem and its cases	Analyse algorithm using Recurrence relation	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
9.	Randomized Quick sort Analysis	Analyse algorithm using Recurrence relation	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
10.	Heap Sort - Insertion, Deletion – Analysis	Analyse algorithm using Recurrence relation	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
11.	Heap Sort- Priority Queue	Analyse algorithm using Recurrence relation	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
12.	Heap - Insertion, Deletion – Analysis	Analyse algorithm using Recurrence relation	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
13.	Strassen's Matrix Multiplication	Adaptation of different matrix multiplication strategies	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
14.	Greedy Paradigm - Introduction, Coin Change Problem	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	1501.4	Quiz 3 and Sessional-I 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	1501.4	Quiz 3 and Sessional-I and End-Sem
16.	Knapsack-problem,	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	1501.4	Quiz 3 and Sessional-I and End-Sem
17.	Optimal Merge tape, Huffman Encoding	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	1501.4	Quiz 3 and Sessional-I and End-Sem
18.	Spanning Trees - MST	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	1501.4	Quiz 3 and Sessional-I and End-Sem
19.	Prim's, Algorithm	Design and Analyze different path finding strategies	Slides / Black Board	1501.4	Quiz 3 and Sessional-2 and End-Sem
20.	Kruskal's Algorithm	Design and Analyze different path finding strategies	Slides / Black Board	1501.4	Quiz 3 and Sessional-2 and End-Sem
21.	Dijkstra's Algorithm-SSSP	Design and Analyze different path finding strategies	Slides / Black Board	1501.4	Quiz 3 and Sessional-2 and End-Sem
22.	Graph Search Algorithm - BFS/ DFS	Design and Analyze different path finding strategies	Slides / Black Board	1501.4	Quiz 4 and Sessional-2 and End-Sem
23.	Topological Sort,	Design and Analyze different path finding strategies	Slides / Black Board	1501.4	Quiz 4 and Sessional-2 and End-Sem
24.	Bellman Ford Algorithm	Design and Analyze different path finding strategies	Slides / Black Board	1501.4	Quiz 4 and Sessional-2 and End-Sem
25.	Connected Components, Bi-connected Components	Synthesize efficient greedy algorithms in common engineering design situations	Slides / Black Board	1501.4	Quiz 4 and Sessional-2 and End-Sem
26.	Introduction to Dynamic Programming-	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
27.	Top Down Fibonacci, Binomial Coefficient	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem

28.	Bottom up Binomial Coefficient, Dynamic Knapsack,	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
29.	Longest Integer Sequence, Longest Common Subsequence	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
30.	Multi-Stage Graph	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
31.	Floyd Warshal Algorithm – All pair of shortest path	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
32.	Matrix Chain Multiplication	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 6 and Sessional-2 and End-Sem
33.	TSP- DP method	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 6 and Sessional-2 and End-Sem
34.	OBST-Optimal Binary Search Tree	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 6 and Sessional-2 and End-Sem
35.	Backtracking Intro – Problems	Design and analysis of dynamic-programming algorithms	Slides / Black Board	1501.3	Quiz 6 and Sessional-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	1501.5	Quiz 6 and Sessional-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	1501.5	Quiz 6 and End-Sem
38.	N-Queen Problem	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	1501.5	Quiz 6 and End-Sem
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	1501.5	Quiz 6 and End-Sem
40.	Branch & Bound – Knapsack	Synthesize new graph algorithms and algorithms that	Slides / Black Board	1501.5	Quiz 6 and End-Sem

		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	1501.5	End-Sem
42.	15 Puzzle Problem (Given as an assignment)	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	1501.5	End-Sem
43.	Branch & Bound – TSP	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	1501.5	End-Sem
44.	String Matching – Meaning and Application	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	1501.5	End-Sem
45.	Naïve String Matching, Rabin Karp Algorithm	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	1501.5	End-Sem
46.	Knuth-Morris-Pratt (KMP) Algorithm	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	1501.5	End-Sem
47.	Randomization & Approximation Algorithm	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	1501.5	End-Sem
48.	Randomization & Approximation Algorithm	Synthesize new graph algorithms and algorithms that employ graph computations as key components,	Slides / Black Board	1501.5	End-Sem

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

Course Out-Comes	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	PSO 4
CS1501.1	Analyse the running times of algorithms using asymptotic analysis.		3		2								1		3	2	
CS1501.2	Demonstrate and Design algorithms using divide-and-conquer paradigm to solve business problems hence enhance skills.		2	2								2			2	2	
CS1501.3	Illustrate the concept of greedy and dynamic-programming approach to solve real life problems to enhance entrepreneurship capabilities.			2	1	1									2	3	
CS1501.4	Demonstrate the concept of backtracking and branch & bound algorithms.			3	2					2					3	2	
CS1501.5	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

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

MANIPAL UNIVERSITY JAIPUR

School of Computing & Information Technology

DEPARTMENT OF COMPUTER & COMMUNICATION ENGINEERING

Course Hand-out

Cryptography and Security| CC1501| 4 Credits | 3 1 0 4

Session: Aug 20-Dec 20 | Faculty: Dr. Vaishali| Class: V SEM

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:

[CC1501.1] Explain the basic concept of Cryptography & Security with importance on mathematical background of number theory with its usage in the field of computing.

[CC1501.2] Identify the usage of tools in understanding and performing the security attacks.

[CC1501.3] Examine and acquire appropriate skills to solve real time problems in real world.

[CC1501.4] Analyze the performance and applicability of learned cryptographic algorithms.

[CC1101.5] Identify the research trends and to propose their own design for 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 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	Maximum Marks
Internal Assessment (Summative)	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 (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: Number theory and finite fields, Shannon ciphers and perfect security, computational ciphers and semantic security: Computer Security Concepts: the OSI security architecture, security attacks, security services and mechanisms; Block Cipher: DES, triple-DES; Block Cipher AES: AES structure, AES transformation functions, AES key expansions, AES implementation; electronic codebook mode, cipher block chaining mode, cipher feedback mode, output feedback mode, counter mode; Pseudorandom Number Generation: Principles of pseudorandom number generation, pseudorandom number generators, pseudorandom number generation using block ciphers and stream ciphers, stream ciphers, cryptographic hash functions, message authentication codes, digital signatures; Public-Key Cryptography: Components of public-key cryptography, RSA algorithm, Diffee-Hellman key exchange, ElGamal cryptographic system, Elliptic curve arithmetic, Elliptic curve cryptography, pseudorandom number generation based on a public-key cryptosystem; Operating Systems. Security capabilities of different platforms, Identification and authentication. Passwords, choosing, managing, and spoofing attacks. User accounts, file permissions, backups, Access Control and Firewalls, ownership, Assessing and Securing a system , Information Warfare, Security Administration, Insider Threat; Corporate Espionage

F. REFERENCE BOOKS

1. W. Stallings, "Cryptography and Network Security, Principles and Practices", 6th Edition, Pearson Education, 2013.
2. B. A. Forouzan, "Cryptography and Network Security", 3rd Edition, McGraw Hill, 2015.
3. R2. Pieprzyk, T. Hardjono, J. Seberry, "Fundamentals of Computer Security", springer- Verlag Berlin Heidelberg, 2013.
4. R3. C. P. Pfleeger, "Security in Computing", 4th Edition, Prentice Hall, 2014.

G. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Correspond-ing Course Outcome	Mode of Assessing the Outcome
1-2	Introduction and Course Hand-out briefing	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
1-5	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	CC1501.1	Class Quiz Mid Term1
6-12	Cryptography: Introduction, Symmetric ciphers, Symmetric Key, cryptography, Different types of Encryption	Identify different classical encryption technique with their drawbacks	Lecture Gaming activity	CC 1501.1 CC 1501.2	Class Quiz End Term Mid Term1 Assignment
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	CC 1501.3 CC 1501.4	Class Quiz End Term Mid Term I Assignment
21-25	Block Cipher AES: AES structure, AES transformation functions, AES key expansions, AES implementation;	Advance encryption scheme and its working and applications	Lecture	CC1501.3, CC1501.4 CC1501.5, CC1501.1	Class Quiz Mid Term I End Term Assignment
FIRST SESSIONAL 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	CC1501.5, CC1501.1	Class Quiz Mid Term II End Term Assignment
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	CC1501.3 CC1501.4 CC1501.5	Class Quiz Mid Term II End term Assignment
38-43	Key Management, Diffee-Hellman key exchange, Certification Authority, Digital Certificate.	Key exchange relevance and its application	Lecture	CC1501.3 CC1501.4	Class Quiz Mid Term II End Term Assignment

SECOND SESSIONAL EXAM					
44-48	Basics of Hash, MAC, working of it, Digital signature and authentication protocols	Working of Hash, Mac	Activity (Think Pair Share)	CC1501.3 CC1501.1	Class Quiz End Term Assignment
48-52	Security Attacks :Different types of attack and its existing Solutions	Possible attacks and its solution	Activity (Think Pair Share)	CC1501.2, CC1501.5 CC1501.1	Class Quiz, End Term Assignment
52-56	Operating Systems. Security capabilities of different platforms, Identification and authentication. Passwords, choosing, managing, spoofing attacks. User accounts, file permissions, backups, Access Control and Firewalls.	Operating system attacks	Self-study	CC1501.1, CC1501.2 CC1501.4 CC1501.5	Class Quiz, End Term Assignment
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	PSO 1	PSO 2	PSO 3	PSO4
[CC1501.1]	Explain the basic concept of Cryptography & Security with importance on mathematical background of number theory with its usage in the field of computing	2						1			1		2	2		1	1
[CC1501.2]	Identify the usage of tools in performing and understanding the security attacks	1	2		1	3		1		1		1	1	1	1	1	1
[CC1501.3]	Examine and acquire appropriate skills to solve real time problems in real world.		2					2	1	1	1	1	1		2	2	1
[CC1501.4]	Analyze the performance and applicability of learned cryptographic algorithms.		1	2	3			1	1	1		1	1		2	2	2
[CC1501.5]	Identify the research trends and to propose their own design for different security issues to have safer environment for computation in order to acquire more employability options.		1	1	1		2	2	1	1		1				2	2

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGG.

Course Hand-out

Formal Language and Automata Theory | CC1502| 4 Credits | 3 1 0 4

Session: Jul - Dec 2020 | Faculty: Dr. Deepak Sinwar| Class: B. Tech V SEM

A. Introduction: This course is offered by Dept. of Computer and Communication Engineering as a core course, targeting students who wish to pursue research & development or higher studies in field of theory of computation. Automata Theory is an exciting, theoretical branch of computer and communication engineering. It established its roots during the 20th Century, as mathematicians began developing - both theoretically and literally - machines which imitated certain features of man, completing calculations more quickly and reliably. The word automaton itself, closely related to the word "automation", denotes automatic processes carrying out the production of specific processes. Simply stated, automata theory deals with the logic of computation with respect to simple machines, referred to as automata. Through automata, computer scientists are able to understand how machines compute functions and solve problems and more importantly, what it means for a function to be defined as computable or for a question to be described as decidable.

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

[CC 1502.1] Compare, analyse and develop abstract models such as finite automata, pushdown automata, and Turing machines based on any problem specified in formal language.

[CC 1502.2] Interpret and apply the characteristics of different types of formal languages, grammars and automata to prove their properties.

[CC 1502.3] Determine the type of computational problems and examine the decidability of them by constructing Turing machines.

[CC 1502.4] Developing skills to construct algorithms for solving different computational problems and test their validity on abstract models.

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] 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 (Closed Book)	15
	Sessional Exam II (Closed Book)	15
	In class Quizzes (Accumulated and Averaged)	10
	Assignments, Activity feedbacks	15
	Video assignment	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.	

E. SYLLABUS

Mathematical Preliminaries and Notation: Three basic concepts, Some Applications, Deterministic Finite Accepters, Nondeterministic Finite Accepters, Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata, Regular Expressions, Identifying Non-regular Languages; Context-Free grammars: Parsing and Ambiguity, Context-Free Grammars and Programming Languages, Methods for Transforming Grammars, Two important Normal Forms, Nondeterministic Pushdown Automata, Pushdown Automata and Context–Free Languages, Deterministic Pushdown Automata and Deterministic Context-Free Languages; The Standard Turing Machine: Linear Bounded Automata, Recursive and Recursively Enumerable Languages, Unrestricted Grammars, Context Sensitive grammars and Languages, The Chomsky Hierarchy.

REFERENCE BOOKS

1. An Introduction to Formal Languages and Automata – Peter Linz, Jones and Bartlett Student Edition, Fifth Edition, 2010.
2. Introduction to Automata Theory, Languages and Computations - J. E. Hopcroft, R. Motwani, J. Ullman, Pearson Education, Third Edition, 2006.
3. Introduction to the Theory of Computation – Michael Sipser, Cengage Learning, Third Edition, 2012.
4. Introduction to Languages and the Theory of Computation – John Martin, Tata McGraw Hill, Fourth Edition, 2010.
5. Formal Language and Automata Theory – C. K. Nagpal, Oxford University Press, Sixth Impression, 2013.

G. Lecture Plan:

Class Number	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	Mathematical Preliminaries and Notation	Understand basics of set theory, groups, relations, functions.	Lecture	1502.1	In Class Quiz Mid Term I End Term
3	Three Basic Concepts (Languages, Grammars and Automata)	Understand basics of Automata Theory i.e., languages, grammars etc.	Lecture	1502.1	In Class Quiz Mid Term I End Term
4	Some Applications	Understanding the applications of Automata	Lecture	1502.1 **1502.4**	In Class Quiz Mid Term I End Term
5-6	Deterministic Finite Automata/ Accepters (DFA)	Introduction to DFA and its designing	Lecture, Practice questions	1502.1	Home Assignment Mid Term I End Term
7	Nondeterministic Finite Accepters (NFA)	Construction of NFA using different approaches for different type of problems	Lecture, Practice questions	1502.1	In Class Quiz Home Assignment Mid Term I End Term
8-9	Equivalence of DFA and NFA	Understanding the basic difference between DFA and NFA and realising the importance of NFA	Lecture, Practice questions	1502.1	In Class Quiz Home Assignment Mid Term I End Term
10	Reduction of the number of states in Finite Automata	Understanding the algorithm for minimizing the DFA	Lecture, Practice questions	1502.1	In Class Quiz Home Assignment Mid Term I

					End Term
11-13	FA with output: Mealy and Moore machine	Understand the design principles of Mealy and Moore machines	Lecture, Practice questions	1502.1	In Class Quiz Home Assignment Mid Term I End Term
14-15	Equivalence between Mealy machine and Moore machine	Compare Mealy machines with Moore machines and understand the algorithm to convert Mealy machine into Moore machine and vice-versa.	Lecture, Flipped class room	1502.1	In Class Quiz Home Assignment Mid Term I End Term
16	Grammar and Formal Languages	Understand the notations and properties of formal languages and grammar	Lecture	1502.2	In Class Quiz Home Assignment Mid Term I End Term
17	Chomsky Hierarchy	Understand the properties of formal languages and to compare properties of different languages of Chomsky Hierarchy	Lecture	1502.2	In Class Quiz Home Assignment Mid Term I End Term
18	Regular Expressions and Finite Automata	Construct regular expressions	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term I End Term
FIRST SESSIONAL EXAM					
19	Regular Grammar	Construct regular grammar	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term I End Term
20	Properties of Regular Languages	Study the properties of regular languages	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term II End Term
21	Identifying Non-Regular Languages	Compare and identify the non-regular languages	Flipped Classroom	1502.2	In Class Quiz Home Assignment Mid Term II End Term
22	Pumping Lemma for Regular Languages	Understand Pumping lemma for regular languages and applying this lemma to prove a given language is not regular	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term II End Term
23	Context Free Languages	Study the properties of context free languages	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term II End Term

24	Leftmost and Rightmost Derivations	Deriving a string from CFL using either leftmost or rightmost derivations	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term II End Term
25	Derivation trees	Deriving language from CFGs and constructing derivation trees from it	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term II End Term
26	Parsing and Ambiguity	Determine whether a grammar is ambiguous or not by deriving a parse tree from CFL	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term I End Term
27-28	Context Free Grammars	Understanding the concept of CGF, designing of CFG for CFL	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term II End Term
29-30	Simplification of Context Free Grammars and Normal Forms, Methods for Transforming Grammars	Simplify a given CFG using three transformation method	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term II End Term
31	Chomsky Normal Form (CNF)	Normalize a CFG into CNF	Flipper Classroom	1502.2	In Class Quiz Home Assignment Mid Term II End Term
32-33	Greibach Normal Form (GNF)	Normalize a CFG into GNF	Lecture, Practice questions	1502.2	In Class Quiz Home Assignment Mid Term II End Term
34-35	Pushdown Automata (PDA) and Context–Free Languages	Construction of PDA using different approaches for different type of problems	Lecture	1502.1	In Class Quiz Home Assignment Mid Term II End Term
36	Deterministic Pushdown Automata, Nondeterministic Pushdown Automata	Understanding acceptability of PDAs and categorizing the PDAs into DPDA and NPDA	Lecture, Practise questions	1502.1	In Class Quiz Home Assignment Mid Term II End Term
37-39	Design of DPDA, NPDA, Conversion between PDA and CFG	Differentiate DPDA from NPDA and understanding equivalence of them	Flipped Classroom	1502.1 **1502.4**	In Class Quiz Home Assignment Mid Term II End Term
SECOND SESSIONAL EXAM					

40-41	Linear Bounded Automata and Context-Sensitive Languages	Understanding basic concepts of LBA and CSL	Flipped Classroom	1502.1	In Class Quiz Home Assignment Mid Term II End Term
42	Turing Machine and Recursive, Recursive Enumerable Languages	Understanding principles of Turing machines, halting problems and the languages of Turing machine	Lecture, Practise questions	1502.1 1502.3	In Class Quiz Home Assignment Mid Term II End Term
43-44	The Standard Turing Machine and variants of Turing Machine, Solving Some Problems by using Turing Machine, Problems that cannot be solved by Turing Machine. Halting Turing machine, PCP Problem, etc.	Understanding variants of Turing machine and applying these to solve problems	Flipped Classroom	1502.1 1502.3	In Class Quiz Home Assignment End Term
45-48	Design of DTM, NTM	Design different DTM, NTM for different problems	Lecture, Practise questions	1502.1 1502.3 **1502.4**	In Class Quiz Home Assignment End Term
49	Recursive and Recursively Enumerable Languages, Unrestricted Grammars, Context Sensitive Grammars and Languages, The Chomsky Hierarchy revisited	Understanding the Chomsky hierarchy in detail and revision of the same	Lecture, Practise questions	1502.3 1502.4	In Class Quiz Home Assignment End Term
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**)			
		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
[CC1502.1]	Compare, analyse and develop abstract models such as finite automata, pushdown automata, and Turing machines based on any problem specified in formal language.	**3**	**2**	**2**									**2**	**1**			
[CC1502.2]	Interpret and apply the characteristics of different types of formal languages, grammars and automata to prove their properties.	**1**	**2**	**2**									**2**		**1**	**1**	
[CC1502.3]	Determine the type of computational problems and examine the decidability of them by constructing Turing machines.	**2**	**3**	**3**	**2**								**2**		**2**	**1**	
[CC1502.4]	Developing skills to construct algorithms for solving different computational problems and test their validity on abstract models.	**2**	**3**	**3**	**2**								**2**				**1**

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER & COMMUNICATION ENGINEERING

Course Hand-out

Data Communications| IT 1504| 4 Credits | 3 1 0 4

Session: Aug 2020 -Dec 2020 | Faculty: Dr Anshuman Kalla, Dr Arvind Dhaka | Class: B. Tech V SEM

A. Introduction: This course is offered by Department of Information Technology which provides students with the fundamental concepts and techniques used for communicating data in efficient and reliable manner. The student will be able to gain 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 & Mobile Communication and Network security.

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

[IT 1504.1] Define the significance of relevant terminologies, transmission media and various transmission impairments on analog & digital transmission.

[IT 1504.2] Describe the principles of signal encoding techniques used for digital data to digital signal and analog data to digital signal conversion.

[IT 1504.3] Apply the various flow control protocols, error detection and correction techniques to maintain the flow control and overcome the error encountered during transmission.

[IT 1504.4] Distinguish between different types of multiplexing techniques, spread spectrum techniques and various generations of wireless cellular networks.

C. Program Outcomes (POs):

[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):

On successful completion of B.Tech. in Computer and Communication Engineering, the student:

[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.

E. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	15
	Sessional Exam II (Close Book)	15
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	30
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.	

F. Syllabus:

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), Code-Division Multiple Access (CDMA); Space Division Multiplexing.
Spread Spectrum: The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS).
Cellular Wireless Communication Techniques: Introduction, Generations: 1G, 2G, 3G, 4G, and 5G.

G. Reference Books

1. Stallings, W.: Data and Computer Communications (9th Edition), Pearson Education, 2010

2. Forouzan, B.: Data communication & networking (5th Edition), TMH, 2012.

3. Peterson, L. and Davie, T.: Computer Networks: A Systems Approach (5th Edition), Morgan Kaufmann Publishers, 2012.

4. Stevens, R.: TCP/IP Illustrated, Addison-Wesley Publication, 2011.

H. Lecture Plan:

Lecture No.	Major Topics	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Introduction to Data Communication	Data, Data Communication, Data Network, Internet	Lecture	NA	NA
2.		Need of Layered Protocol Architecture (OSI &TCP/IP)	Lecture	NA	NA
3.		TCPIP - Layers and its Functioning	Lecture & Activity	NA	NA
4.	Data Transmission: Concepts and Terminology	Concepts and Terminology – Simplex, Half-Duplex, Full-Duplex, Frequency, Bandwidth	Lecture	[1504.1]	Class Quiz Mid Term - I End Term
5.		Time Domain and Frequency Domain Concepts, Data Rate	Lecture & Problem Solving Practice	[1504.1]	Class Quiz Mid Term - I End Term
6.	Analog and Digital Data Transmission	Analog and Digital Data and Signals,	Lecture	[1504.1]	Class Quiz Mid Term - I End Term
7.		Analog and Digital	Lecture	[1504.1]	Class Quiz

		Transmission			Mid Term - I End Term
8.	Transmission Impairments	Attenuation, Delay Distortion, Noise	Lecture & Problem Solving Practice	[1504.1]	Class Quiz Mid Term - I End Term
9.	Channel Capacity	Data Rate and Nyquist Bandwidth	Lecture	[1504.2]	Class Quiz Mid Term - I End Term
10.		Shannon Capacity Formula	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
11.	Transmission Media: Guided Transmission Media	Twisted Pair & CAT Types	Lecture & Activity	[1504.2]	Class Quiz Mid Term - I End Term
12.		Coaxial Cable, Optical Fiber	Lecture	[1504.2]	Class Quiz Mid Term - I End Term
13.	Wireless Transmission	Antennas , Terrestrial Microwave	Lecture	[1504.2]	Class Quiz Mid Term - I End Term
14.		Satellite Microwave, Broadcast Radio, Infrared	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
15.	Wireless Propagation	Ground Wave Propagation, Sky Wave Propagation	Lecture & Activity	[1504.2]	Class Quiz Mid Term - I End Term
16.		Line-of-Sight Propagation	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
17.	Line-of-sight Propagation	Free Space Loss	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
18.		Atmospheric Absorption, Multipath,	Lecture	[1504.2]	Class Quiz Mid Term - I End Term

		Refraction			
FIRST SESSIONAL EXAM DATE:					
19.	Signal Encoding Techniques: Digital-To-Digital Conversion	Analog and Digital Signals, Line Coding Schemes: Unipolar, Polar	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
20.		NRZ & Bipolar – AMI	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
21.		Biphase – Manchester & Differential Manchester	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
22.		Modulation Rate and Scrambling Techniques	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
23.	Digital Data – Analog Signal	ASK & FSK	Lecture	[1504.2]	Class Quiz Mid Term - I End Term
24.		PSK – BPSK	Lecture	[1504.2]	Class Quiz Mid Term - I End Term
25.		MFSK	Lecture	[1504.2]	Class Quiz Mid Term - I End Term
26.		QAM	Lecture	[1504.2]	Class Quiz Mid Term - I End Term
27.	Analog-To-Digital Conversion	Pulse Code Modulation	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
28.		Delta Modulation	Lecture	[1504.2]	Class Quiz Mid Term - I End Term
29.	Digital Data Communication Techniques	Asynchronous and Synchronous Transmission	Lecture	[1504.3]	Class Quiz Mid Term - I End Term

30.		Type of Error, Redundancy, Detection Vs Correction	Lecture	[1504.3]	Class Quiz Mid Term - II End Term
31.		Cyclic Redundancy Check	Lecture	[1504.3]	Class Quiz Mid Term - II End Term
32.		Polynomials & CRC Architecture	Lecture & Problem Solving Practice	[1504.3]	Class Quiz Mid Term - II End Term
33.		Error Correction and Block Code Principle	Lecture & Problem Solving Practice	[1504.3]	Class Quiz Mid Term - II End Term
34.		Line Configurations	Lecture	[1504.3]	Class Quiz Mid Term - II End Term
35.	Data Link Control Protocols	Framing	Lecture	[1504.3]	Class Quiz Mid Term - II End Term
36.		Flow Control - Stop-and-Wait Protocol	Lecture & Problem Solving Practice	[1504.3]	Class Quiz Mid Term - II End Term
37.		Sliding Window	Lecture & Problem Solving Practice	[1504.3]	Class Quiz Mid Term - II End Term
38.		Error Control: Stop-and-Wait ARQ	Lecture & Problem Solving Practice	[1504.3]	Class Quiz Mid Term - II End Term
SECOND SESSIONAL EXAM DATE:					
39.	Data Link Control Protocols	Go-Back-N ARQ	Lecture & Problem Solving Practice	[1504.3]	Class Quiz Mid Term - II End Term
40.		Selective Repeat ARQ	Lecture & Problem Solving Practice	[1504.3]	Class Quiz Mid Term - II End Term
41.		High-Level Data Link Control (HDLC)	Lecture	[1504.3]	Class Quiz Mid Term - II End Term

42.	Multiplexing	Introduction to Multiplexing	Lecture	[1504.4]	Class Quiz Mid Term - II End Term
43.		Frequency Division Multiplexing (FDM)	Lecture	[1504.4]	Class Quiz Mid Term - II End Term
44.		Time-Division Multiplexing (TDM)	Lecture & Activity	[1504.4]	Class Quiz Mid Term - II End Term
45.	Spread Spectrum	The Concept of Spread Spectrum	Lecture	[1504.4]	Class Quiz Mid Term - II End Term
46.		Frequency Hopping Spread Spectrum (FHSS)	Lecture	[1504.4]	Class Quiz Mid Term - II End Term
47.		Slow and Fast FHSS	Lecture & Problem Solving Practice	[1504.4]	Class Quiz Mid Term - II End Term
48.		Direct Sequence Spread Spectrum (DSSS)	Lecture & Problem Solving Practice	[1504.4]	Class Quiz Mid Term - II End Term
49.		Performance Consideration – FHSS and DSSS	Lecture	[1504.4]	End Term
50.		Code Division Multiple Access (CDMA)	Lecture & Problem Solving Practice	[1504.4]	End Term
51.	Cellular Wireless Communication Techniques	Introduction, Generations: 1G, 2G, 3G,	Lecture	[1504.5]	End Term
52.		4G, and 5G	Lecture	[1504.5]	End Term
END TERM EXAM DATE:					

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	PSO4
[IT 1504. 1]	Define the significance of relevant terminologies, explain the transmission of digital & analog signals over different types of transmission media and outline the effects of various transmission impairments on analog & digital transmission.	1	1							1	2		1	3			
[IT 1504. 2]	Describe the principles of signal encoding techniques used for digital data to digital signal conversion and analog data to digital signal conversion and compare them.	2	2	1							1			3			
[IT 1504. 3]	Apply the knowledge of various error detection and correction techniques in order to find and overcome error encountered during transmission and discuss flow control and error control techniques.	3	2	1							1			3			
[IT 1504. 4]	Distinguish between different types of multiplexing techniques and spread spectrum techniques.	2								1	2			2			
[IT 1504. 5]	Identify and compare various generations of wireless cellular networks.	2						1					1	2	2	2	1

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

MANIPAL UNIVERSITY
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INSPIRED BY LIFE

SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER & COMMUNICATION ENGG.

COURSE HAND-OUT

Web Technologies: CC1551 (DE) || 3 Credits||3 0 0 3

Session: JULY 20 – DEC 20 | Faculty Name: Dr V S Dhaka, Dr Lokesh Sharma, Dr. Ashish Kumar

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

[CC1551.1]: Recognize fundamentals and working principles of web technology and web programming.

[CC1551.2]: Design and implement client-side web programming using HTML, Java Script and CSS.

[**CC1551.3]:** Implement server-side programming using PHP and JSP and Database interactions.

[CC1551.4]: Web based applications development and deployment on web server and debugging.

[CC1551.5]: Developing skills for designing websites leads to entrepreneurship opportunities.

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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 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] 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	Maximum Marks
Internal Assessment (Summative)	**Sessional Exam I** **Sessional Exam II**	**15** **15**
		30
	MOOC :2 **Project: 1**	MOOC: 2*10=20 Project : 1X* 10=10
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.**	

E. Syllabus:

Introduction: Overview of Internet and the sub network "the Web", History, and Other sub networks, Web System Architecture, Web Clients and Web Servers, Application Servers. HTTP– Basics of HTTP Request and Response, HTTP Methods, headers, content transport (PUSH and PULL), Drawbacks HTTP1.0, Introduction to HTTP1.1, HTTPS, SSL, and Generation of Dynamic Web pages, Extension Mechanisms;

Client side programming: Web application Design Life-cycle, Web Markup Languages – What is markup, why markup, Intro to HTML and Deficiencies of 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), Styling with CSS, Introduction to HTML5 and CSS3;

Scripting: Client side dynamic programming with JavaScript – Basics, Primitives, Loops, Decision Statements, Screen Output and Keyboard Input, Arrays and Functions, Event Handling, Pattern Matching and Form Validation with Regular Expressions;

Server side Programming: Three Tier Model, PHP –Basics, Form Validation, Sessions and Session Tracking techniques, ASP, JSP;

Advanced technologies*:* XML– Syntax and Semantics, Document Structure, DTDs, Need for Namespaces-e Commerce Basics, Models and Architecture; ecommerce - WAP and Mobile Agents.

F. Reference(s):

R 1. J. C. Jackson, "*Web Technologies: A Computer Science Perspective*", Pearson Education, 2007.

R 2. H. Chan, R. Lee, T. Dillon, E. Chang, "*E-commerce, Fundamentals and Applications*", John Wiley & Sons, 2007.

R 3. DT Editorial Services, "HTML 5 Black Book", 2nd Edition, Wiley India, 2016.

R4 .Treese, G. Winfield, L. C. Stewart, "*Designing Systems for Internet Commerce*", 2nd Edition, Addison-Wesley Professional, 2003.

R5. X. Bai, M. Ekedahl, *"The Web Warrior Guide to Web Programming",* 1st Edition, Course Technology Inc, 2003.

G. 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	1551.1	Class Quiz and Mid Term-1
2	Web System Architecture	Physical structure of Web system	Lecture	1551.1	Class Quiz and Mid Term-1
3,4	Web Clients and Web Servers	To store, process and deliver web pages to the users.	Lecture	1551.1	Class Quiz and Mid Term-1
5,6	Application Servers	Understanding the application servers	Lecture	1551.1	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	1551.1	Class Quiz and Mid Term-1
10	Introduction to HTTP1.1, HTTPS, SSL	Explanation and analysis of HTTP and SSL	Lecture	1551.1	Class Quiz Mid Term I End Term
11	Discussion of Project and Assignment	Case study on the project	Group Discussion	1551.4/5	Continuous Evaluation
12,13	Generation of Dynamic Web pages, Extension Mechanisms	Basics of Web development.	Lecture	1551.2	Class Quiz Mid Term 1 End term
14,15	Web application Design Life-cycle, Web Markup Languages	Website enhancement methods.	Lecture	1551.2	Home Assignment Class Quiz Mid Term 1 End Term

16	Project Study presentation by students	Project Discussion	Flip Class	1551.4/5	Continuous Evaluation
17,18	Intro to HTML and Deficiencies of HTML	Static approach of development	Lecture	1551.2	Class Quiz Mid Term 1 End Term
19	XHTML– Basic syntax and semantics, fundamental elements,	Introduction of XHTML	Lecture	1551.2	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	1551.2	Class Quiz Mid Term I End Term
21,22	HTML Document Object Model (DOM), Styling with CSS	Introduction of Web development	Lecture	1551. 2	Class Quiz Mid-Term II and End Term
23,24	Introduction to HTML5 and CSS3	Basic introduction of web design and development	Lecture	1551.2/4	Class Quiz Mid-Term II and End Term
25,26	Client side dynamic programming with JavaScript- Basics	Advance web designing and development	Lecture	1551.2/4	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	1551.2/4	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	1551.2/4	Class Quiz Mid-Term II and End Term

31	Midterm Project Presentation by the students and discussion	Project Discussion	Flip Class	1551.4/5	Continuous Evaluation
32	Three Tier Model	Analysis of Tier system	Lecture	1551.2/4	Class Quiz Mid-Term II and End Term
33	PHP –Basics, Form Validation	Dynamic programing –Through PHP	Lecture	1551.3/4	Class Quiz Mid-Term II and End Term
34,35	Sessions and Session Tracking techniques	Useful Methodology of PHP	Lecture	1551.3/4	Class Quiz Mid-Term II and End Term
36,37	ASP, JSP	Dynamic programing through ASP	Lecture	1551.3/4	Class Quiz Mid-Term II and End Term
38-39	XML – Syntax and Semantics	Introduction of XML	Lecture	1551.3/4	Class Quiz and End term
40	Document Structure, DTDs, Need for Namespaces	Explanation of Domain name server	Lecture	1551.4/5	Class Quiz and End term
41	eCommerce Basics	Introduction of business web development	Lecture	1551.5	Class Quiz and End term
42	Models and Architecture of eCommerce	Physical structure of eCommerce	Lecture	1551.4/5	Class Quiz and End term
43	Ecommerce - WAP and Mobile Agents.	analysis of agent applications	Lecture	1551.4/5	Class Quiz and End term
44	End Term Project Evaluation presentation	Project Evaluation	Flip Class	1551.4/5	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	PSO4
[CC1551.1]	Recognize fundamentals and working principles of web technology and web programming.	2				3		2	2			3		3	2		
[CS1515.2]	Design and implement client-side web programming using HTML, Java Script and CSS.			3	3	1							3		2	2	2
[CS1515.3]	Implement server-side programming using PHP and JSP and Database interactions.		2	3	2	1	1			2	2					3	
[CS1515.4]	Web based applications development and deployment on web server and debugging.					3			1	1				3		2	2
[CS1515.5]	Developing skills for designing websites leads to entrepreneurship opportunities.			3	2						1	3	1	2		2	2

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT

Department of Computer and Communication Engg.

Course Hand-out

Design & Analysis of Algorithm Lab | CS1530 | 1 Credit | 0 0 2 1

Session: July 19 – Nov 19 | Dr. Manoj Kumar Sharma & Dr Geeta Rani | Class: V CCE

1. Introduction**:** This course is offered by Computer Science and Engg. Dept., targeting students who wish to learn new technologies, idea and research in industries or higher studies in field of Computer Science, IT 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.

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

   [CS1530.1] Explain basic concepts of various Algorithm and Complexity.

   [CS1530.2] select and/or apply appropriate algorithm to solve problems and assess the trade-offs involved in the design choices also calculate the running time complexity.

   [CS1530.3] describe and analyze various Notations, Recurrences and DAC approach, also used in sorting algorithms like merge sort, heap sort and quick sort etc and analyses of different cases.

   [CS1530.4] describe how Greedy, Dynamic and Graph based techniques used and identify their classifications and operations using various approaches.

3. **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

4. Program Specific Outcomes (PSOs)

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

PSO1. Clearly identify 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.

PSO2. Nail down the issues prevalent in the field of Computer and Communication Engineering.

PSO3. Identify the existing open problems in the field of computing and propose the best possible solutions.

PSO4. 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.

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous Assessments	70
Exam(Summative)	Exam (Small Project/Exam)	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.	

5. **SYLLABUS**

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

6. Text Books:

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

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

7. **Reference Book:**

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

8. **LAB PLAN**

Lec No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
a)	**Searching**	Programs based on Iterative Binary Search	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
b)		Programs based on Recursive Binary Search	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
c)	**Sorting**	Programs to implement Insertion Sort	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
d)		Programs to implement Selection Sort	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
e)		Programs to implement Merge Sort	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
f)		Programs to implement Quick Sort	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
g)	**Heap**	Programs to implement sorting a given list of elements in ascending order using the following sorting methods. HeapSort – MAX Heap and MIN Heap	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation

h)		Programs based on Priority Queue	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
i)	**Greedy method**	Programs to implement knapsack problem using greedy method.	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation
j)		Programs to implement the single source shortest path problem using greedy method. (Dijkstra's).	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation
k)	**Spanning Trees**	Programs to implement following algorithms: a. Prim's b. Kruskal's	Lab	CS1530.4 CS1530.2	Internal Evaluation Home Assignments External Evaluation
l)	**Graph**	Programs to implement following algorithms: a. Breadth first search b. Depth first search	Lab	CS1530.4 CS1530.2	Internal Evaluation Home Assignments External Evaluation
m)	**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.	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation
n)		Write a program to implement longest integer sequence LIS.	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation

o)		Write a program to implement longest common subsequence LCS.	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation
p)		Write a program to implement Binomial Coefficient using Dynamic Programming.	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation
q)		Write a program for solving travelling sales person problem using dynamic programming.	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation
r)	**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.	Lab	CS1530.2	Internal Evaluation Home Assignments External Evaluation
s)	**Randomization**	Write a program to implement Randomized Quick sort.	Lab	CS1530.2	Internal Evaluation Home Assignments External Evaluation
t)		Write a program to implement Graph Coloring Problem.	Lab	CS1530.2	Internal Evaluation Home Assignments External Evaluation

9. 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	PSO 4
[CS1530.1]	Explain basic concepts of various Algorithm and Complexity.	3	1										2	1			
[CS1530.2]	Select and/or apply appropriate algorithm to solve problems and assess the trade-offs involved in the design choices also calculate the running time complexity.		1	2									2	3			2
[CS1530.3]	Describe and analyze various Notations, Recurrences and DAC approach, also used in sorting algorithms like merge sort, heap sort and quick sort etc and		1	2									2	2	1	2	2

	analyses of different cases. .																
[CS1530.4]	Describe how Greedy, Dynamic, MST and Graph based techniques used and identify their classifications and operations using various approaches.		1	2									2	3	2	3	3

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Data Communications Lab | CC 1530 | 1 Credit | 0 0 2 1

Session: Aug - Dec 2020 | Faculty: Dr Anshuman Kalla, Dr Arvind Dhaka| Class: B.Tech V 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 perform experiments related to Digital Modulation techniques, analog data to digital signal encoding techniques, multiplexing techniques and multiple accessing techniques with the view to analyze and interpret the corresponding waveforms.

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

[CC 1530.1] Analyze and interpret signals and working of basic equipment (Function Generator and Digital Storage Oscilloscope (DSO))

[CC 1530.2] Demonstrate various modulation, demodulation techniques in data communication and trace the corresponding waveforms.

[CC 1530.3] Experiment with packet tracer and simulate basic topologies to understand the functioning of Data Link Layer

[CC 1530.4] Identify multiplexing and multiple accessing techniques and trace the corresponding waveforms.

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)

On successful completion of B.Tech. in Computer and Communication Engineering (CCE), the student:

[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.

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

PC to PC and PC to Peripherals Communication: Serial communication using RS-232C, RS-485, Parallel Communication using 8-bit parallel cable; LAN topologies: Star, Token bus and Token ring;
Signal Encoding Techniques: Analog and Digital Signals, Analog -To-Digital Conversion: Line Coding Schemes; Signal Modulation Techniques: ASK, PSK, FSK, Pulse Code Modulation and Delta Modulation;
Medium Access Control protocols: Aloha, Slotted Aloha, CSMA, CSMA/CD, CSMA/CA, Wireless LAN-IEEE 802.11, BLUETOOTH; Network Devices configuration: Hub, Repeaters, Bridges, Switches, Gateways and Routers.

G. Reference Books

1. Stallings, W.: Data and Computer Communications (9th Edition), Pearson Education, 2010
2. Forouzan, B.: Data communication & networking (5th Edition), TMH, 2012.

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	CC1530.1	Internal Evaluation End Term Exam
3.	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	CC1530.4	Internal Evaluation End Term Exam
4.	To analyze a Sampling and reconstruction system and interpret the sampled and reconstructed waveforms.	To verify the correctness of sampling theorem and visualize the waveform of sampled signal and compare the original signal with reconstructed signal	Demonstration and Practically performing	CC1530.1	Internal Evaluation Project End Term Exam
5.	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	CC1530.2	Internal Evaluation Project End Term Exam
6.	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	CC1530.2	Internal Evaluation Project End Term Exam
7.	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	CC1530.2	Internal Evaluation Project End Term Exam
8.	To analyze a Delta modulation system and interpret the modulated and demodulated waveforms.	To comprehend the advantages of Delta modulation over PCM, plot the waveforms of delta modulated and demodulated signals and understand the issues involved in Delta modulation.	Demonstration and Practically performing	CC1530.2	Internal Evaluation Project End Term Exam
9.	To understand working of packet tracer and various networking devices.	To get acquainted with the simulated environment of software tool by Cisco	Demonstration and Practically performing	CC1530.3	Internal Evaluation End Term Exam

10.	To create star topology using switch and check its connectivity.	To test and verify the working of a network topology that uses layer -1 and layer – 2 connecting devices and check connectivity using PING command	Demonstration and Practically performing	CC1530.3	Internal Evaluation End Term Exam
11.	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 respectively.	Demonstration and Practically performing	CC1530.4	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	PSO4
CC 1530.1	Analyze and interpret signals and working of basic equipment (Function Generator and Digital Storage Oscilloscope (DSO)).	**3**				**3**	**2**			**3**			**3**	**3**		**1**	
CC 1530.2	Demonstrate various modulation, demodulation techniques in data communication and trace the corresponding waveforms.	**3**	**2**	**2**	**2**	**2**	**2**			**3**			**2**	**2**		**1**	
CC 1530.3	Experiment with packet tracer and simulate basic topologies to understand the functioning of Data Link Layer.	**3**	**1**	**2**		**3**	**2**			**3**			**2**	**3**	**2**	**1**	**1**
CC 1530.4	Identify multiplexing and multiple accessing techniques and trace the corresponding waveforms.	**3**	**2**	**2**	**2**	**2**	**2**			**3**			**2**	**2**		**1**	

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

MANIPAL UNIVERSITY JAIPUR
SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER & COMMUNICATION ENGG.
Course Hand-out

Network Security| CC1701 | Credits 4 | 3 1 0 4)

Session: Aug 20 – Dec 20 | Faculty: Dr.Arjun Singh & Mr.Gaurav Prasad | Class: B.Tech CCE (VII Sem)

A. Introduction: This course is offered by Dept. of Computer and Communication Engineering as an department core 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. 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 on cryptography for the better understanding of subject.

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

[CC1701.1] identify some of the factors driving the need for network security and classify particular examples of attacks.

[CC1701.2] Experiment different type of network security Applications and tools.

[CC1701.3] To analyse and deploy network security devices to stop the attacks on the network.

[CC1702.4] To design security applications in the field of Information technology

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.

[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 (Closed Book)	15
	Sessional Exam II (Closed Book)	15
	Video Assignment , Presentation and Quiz	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.	

E. Syllabus

Basics of Network Security: Attacks, services and mechanisms; **Network Security Applications:** Kerberos, IPSec, SSL, TLS and VPN; **Internet Security:** Digital Certificate, PKI, Secure Electronic Payment System and Protocols, iKP protocol; **Issues in Network Security and Tools:** Man in the middle attack, Replay, ARP poisoning, DNS poisoning, web based attacks ; **Firewalls and IDS:** Need of firewalls, firewall characteristics and access policy, type of firewall, firewall basing, firewall location and configuration, Types of Intrusion detection System, working of IDS and policies; **Malware, Virus, Worm, Trojan Horse:** Introduction and working of malwares, Identifications and remedies.

F. Text Books

T1: W. Stallings, *"Cryptography and Network Security Principles and Practice"*, 7th Edition, Pearson education, 2017

G.

Reference Books

R1: Y. Qian, D. Tipper, P. Krishnamurthy, J. Joshi, *"Information Assurance Dependability & Security in Networked Systems"*, 1st Edition, Morgan Kaufmann, 2010.

H. 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	Network Attacks, services and mechanism	Recall the network attacks and preventive Mechanism	Lecture	1701.1	MID term 1
4,5,6	Network Security Applications: Kerberos	Understanding of the Kerberos as KDC and Authentication protocol	Lecture	1701.2	Mid term-1, End Term, Video & Presentation
7,8,9	IPsec, Modes of IPSec	Understanding of IPSec architecture, operational modes	Lecture	1701.2	Video & Presentation Mid term-1
10,11,12	IPSec Security Protocol, AH vs ESP, Services provided by ESP	Understanding of two security protocols (AH & ESP)	Lecture	1701.2	Mid term-1 End Term Video & Presentation
13	Security Association, Security association database	Recall IPSec Security association and database	Lecture	1701.2	Mid Term 1 End Term Video & Presentation
14,15,16	SSL introduction , SSL Architecture, Key exchange algorithm, Cryptographic parameter generation	Understand the need of security at TL layer, Structure of SSL	Lecture	1701.2	Mid Term 1 End term Video & Presentation
17	SSL Handshake protocol	Recall the handshake protocol functionality	Self-learning	1701.2	Video & Presentation End term
18,19,20	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)	1701.2	Mid Term 1 End Term Video & Presentation
21,22,23,24	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	1701.2	Mid Term 1 End Term Video & Presentation
25,26,27	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	1701.2	Mid Term-1 End Term
28,29	Public key Infrastructure, PKI Tust model, Mesh Model, hijacking	Infer the concept of PKI and key distribution	Lecture	1701.2	Mid Term II End Term

30,31,32,33,34	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	1701.2	Mid Term-11, End Term Video & Presentation
35,36,37	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	1701.3	Mid Term II End Term Video & Presentation
38,39,40,41	ARP Poisoning, web based attacks (cryptography and Network Security, Prakash C Gupta)	Simulation of ARP poisoning and web attacks	Lecture, Activity	1701.3	Mid Term II End Term Video & Presentation
41,42,43	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	1701.4	Mid Term II End Term Video & Presentation
44,46	Intrusion Detection System, Signature based vs Anomaly based IDs (cryptography and Network Security, Prakash C Gupta)	Infer the knowledge of IDS and working	Activity	1701.4	End Term
47,48,49,51	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	1701.4	End Term
52	Conclusion and Course Summarization	NA	NA		NA

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	PSO4
CC 1701.1	Identify some of the factors driving the need for network security and classify particular examples of attacks.	2	2											2		1	1
CC1701.2	Experiment different type of network security Applications and tools.		2	2	1									1	1		1
CC1701.3	To analyse and deploy network security devices to stop the attacks on the network.				1			2						1		2	
CC1701.4	To design security applications in the field of Information technology												3		1		3

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

MANIPAL UNIVERSITY JAIPUR

School of Computing & Information Technology

Department of Computer & Communication Engineering
Course Hand-out

Machine Learning | CC 1702 | 4 Credits | 3 1 0 4

Session: Aug 20 – Dec 20 | Faculty: Sunil Kumar | Class: VII Sem

A. Introduction: This course is offered by Dept. of Computer & Communication Engineering as department core, targeting students who wish to pursue research & development in industries or higher studies in field of Artificial Intelligence, including supervised machine learning, unsupervised learning & reinforcement learning. It offers in-depth knowledge of Machine Learning concepts using supervised, unsupervised, and Reinforcement Learning. Concepts of Deep Learning, and Natural Language Processing are introduced. The course will enable students to choose and build a Machine Learning model and combine multiple models to solve any problem.

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

[CC1702.1] **Explain** the basic theory underlying machine learning algorithms.
[CC1702.2] **Apply** machine learning algorithm to data to enhance employability prospects.
[CC1702.3] **Compare** various learning algorithms and models.
[CC1702.4] **Evaluate** machine learning algorithms for performance.
[CC1702.5] **Build** machine learning models for different 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

Program Specific Outcomes (PSOs)

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

[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 (Open Book)	15
	Sessional Exam II (Open Book)	15
	Class Quizzes and Assignments (Accumulated and Averaged)	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.	
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

Introduction: Introduction and applications of machine learning; **Supervised learning:** perceptron network, Adaptive linear neuron, multiple Adaptive linear neuron, Back propagation network, Generative learning algorithms. Gaussian discriminant analysis, Naive Bayes, Support vector machine, KNN algorithm, basic/variance tradeoff, linear regression and feature selection; **Neural network**: forward/backward network, Deep learning; **Unsupervised learning**: clustering, K-means algorithm, Kohonen self-organizing map, learning vector quantization, Counter propagation network; Introduction to Reinforcement learning, Optimization technique, Gradient descent method**, Introduction to natural language processing**, **Decision making and Expert system.**

F. Refrences

1. M. Mohri, A. Rostamizadeh, A. Talwalker, “Foundations of Machine Learning”, MIT Press, Cambridge, MA, 2012.
2. T.M. Mitchell, “Machine learning”, 1 st Indian Edition, McGraw-Hill India, 2013.
3. T. Hastie, R. Tibshirani, J. Friedman, “The Elements of Statistical Learning”, 2nd Edition, Springer, 2009.
4. C.M. Bishop, “Pattern Recognition and Machine Learning”, 1st Edition, Springer Verlag, 2010.
5. S.N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, 2nd Edition, Wiley, 2011.

G. Lecture Plan:

	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Machine Learning – Introduction	Importance of Machine learning in the current scenario, convey teachers expectations and understand student expectations	Lecture	CC1702.1	Class Quiz
2	Data, pre-processing, Training & Testing of Machine Learning Model	Data pre-processing, Training and evaluating on a test dataset, cross validation, over fit and under fit, metrics	Lecture	CC1702.1	Home Assignment Class Quiz Mid Term I End Term
3-4	Linear Regression	To understand simple linear regression model and estimation of slope and intercept, gradient decent	Lecture	CC1702.1/2/4	Class Quiz Mid Term I End Term
5	Multivariate Regression	Multi variate regression	Lecture	CC1702.1	Class Quiz Mid Term I End Term
6	Logistic Regression	Regression, Estimating Probability, Decision Boundaries, Softmax regression	Lecture	CC1702.2/3	Class Quiz Mid Term I End Term
7	Naïve Bayes Classifier	Learning Classifiers based on Bayes Rule, Discrete Inputs, Continuous Input, Conditional independence Multinomial Naive Bayes	Lecture	CC1702.2/4/5	Class Quiz Mid Term I End Term
8-9	Belief Network	Gaussian Bayes classifiers, Document classification Bayesian belief Network	Lecture	CC1702.1	Class Quiz Mid Term I End Term
10-11	Decision Tree	Training & visualizing, making prediction, CART training algorithm, Computational Complexity, Entropy, Regularization hyper parameter.	Lecture	CC1702.3/4/5	Class Quiz Mid Term I End Term
12-13	Ensemble Learning & Random Forest	Voting Classifiers Bagging Random Forest Boosting	Lecture	CC1702.1/2	Class Quiz Mid Term I End Term
14 -16	Support Vector Machine	Linear SVM Soft Margin Classifier Non Linear SVM SVM Regression	Lecture	CC1702.1	Class Quiz Mid Term II End Term

17	Instance Based Learning	k-Nearest Neighbours KNN algorithm How do we choose the factor K	Lecture	CC1702.2/3/4	Class Quiz Mid Term II End term
18-19	Artificial Neural Network	Introduction, Neuron, Model, Perceptron	Lecture	CC1702.1/2	Class Quiz Mid Term II End Term
20-23	Multilayer Perceptron & Backpropagation.	Activation Function, Hidden Layers, Weights, Bias	Lecture	CC1702.1/2	Class Quiz Mid Term II End Term
24	Deep Learning	Concept of Deep Neural Networks, Requirements and challenges	Lecture	CC1702.1/2/5	Class Quiz Mid Term II End Term
25-27	Convolution Neural Network	Architecture Convolution Layer Pooling Layer CNN Architecture	Lecture	CC1702.1/2/5	Class Quiz Mid Term II End Term
28-30	Recurrent Neural Network	Recurrent Neurons Basic RNN Deep RNN LSTM GRU	Lecture	CC1702.1/3	Class Quiz End Term
31-33	Natural Language Processing	Introduction and application of NLP. Processing Raw text Learning to classify text	Lecture	CC1702.1/3	Class Quiz End Term
34-38	Unsupervised Learning	Concept of clustering with some example, K-means algorithm Kohonen Self-Organizing Feature Map with their architecture and algorithm Learning Vector Quantization (LVQ) architecture and algorithm Counter Propagation Networks (CPN) with their training and testing algorithm	Lecture	CC1702.1/2/3	Class Quiz End Term
39	Reinforcement Learning	Learning Task Markov Decision Process Learning to optimize rewards	Lecture	CC1702.1/3	Class Quiz End Term
40	Decision making and Expert Systems	Machine learning models vs expert systems	Lecture	CC1702.3	End Term

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

Course Out-Comes	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
CC1702.1	**Explain** the basic theory underlying machine learning algorithms.	3					2							3		1	
CC1702.2	**Apply** machine learning algorithm to data to enhance employability prospects.	3	2			2	3		2						2		3
CC1702.3	**Compare** various learning algorithms and models.		3	1	1										1		
CC1702.4	**Evaluate** machine learning algorithms for performance.	1	1	2	3								1		1		2
CC1702.5	**Build** machine learning models for different applications.	1	1	3	2			1		2		2		1		2	3

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGG.

Course Hand-out

Compiler Design | CC1751| 3 Credits | 3 0 0 3

Session: Aug - Dec 20 | Faculty: Dr. Manoj K Bohra | Class: B. Tech VII SEM

A. Introduction: This course is offered by Dept. of Computer and Communication Engineering as a program elective course, targeting students who wish to pursue research & development or higher studies in field of Compiler Design. The objective of this course is to make students familiar with core area of Compilers which will enable students to focus on abstract models of computation. The course exposes students to the computability theory, as well as to the complexity theory. The objective is to make students familiar with the Compiler Design as well as various phases of compilation process of any source code. Throughout the semester they will learn about lexical analysis, different types of parsing techniques, code generation and optimization. The goal is to allow them to understand in detail about compilers and how works.

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

[CC 1751.1] explain different phases of compiler designing
[CC 1751.2] illustrate the working of lexical, syntactical, and semantical structures of a compiler and relate them with the structure of a programming language
[CC 1751.3] apply knowledge to write front end of complier using lex and yacc.
[CC 1751.4] illustrate code generation and code optimization phases.

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.

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[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 (Closed Book)	15
	Sessional Exam II (Closed Book)	15
	In class Quizzes (Accumulated and Averaged)	10
	Assignments, Projects, etc	20
	Video assignment	
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. 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. These may be graded for marks.	

E. SYLLABUS

Computability and Complexity Theory, Introduction to Compilers: Analysis of the source program, phases of a compiler; Lexical Analysis: The role of lexical analyzer, specification and recognition of tokens; Syntax Analysis: Various types of parsing, Syntax Directed Translations and Type Checking; Runtime Environments: Storage organization and allocation strategies, Intermediate code generation; Code generation: Issues in design of a code generator; Code Optimization : The principle sources of optimization, optimization of basic blocks, loops in flow graphs, efficient data flow algorithms.

F. REFERENCE BOOKS

1. A. V. Aho, M. S. Lam, R. Sethi, J. D. Ullman, "Compilers – Principles, Techniques and Tools", 2e, Pearson Education, 2007
2. M. Sipser, "Introduction to the Theory of Computation", 3e, Cenage Learning, 2013.
3. A. I. Holub, "Compiler Design in C", 1e, Pearson Education, 2015.

G. Lecture Plan:

Lect. No.	Topics	Session Outcome	Mode of Delivery	Corresponding Couse 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	Analysis of the source program, phases of a compiler, Structure of a Compiler	Identification of needs and structure of compiler design	Lecture, Activity	CC1751.1	Class Quiz Mid Term-1 End Term
4-7	The Role of the Lexical Analyzer	Outline the role and working of lexical analysis and programming	Lecture, Activity	CC1751.2	Class Quiz Mid Term-1 End Term
8-11	Role of Parser, Error-Recovery Strategies, Context Free Grammars, Parse Tree and Derivations, Ambiguity, Elimination of Ambiguity/ Left Recursion/ Left Factoring, LEX Tool	Identifying the roles of syntax analysis in Compiler Design and its preliminaries	Lecture, Activity	CC1751.2 CC1751.3	Class Quiz Mid Term-1 End Term
FIRST SESSIONAL EXAM					
12-17	Top down parsers and their types – an overview, Recursive Descent Parsing – may involve backtracking, Predictive Parsing – does not involve backtracking, non-recursive Predictive Parsing: Computing FIRST and FOLLOW, Construction of LL(1) parsing table to identify LL(1) grammar, LL(1) Parsing Algorithm with examples.	Understanding about working of Top-Down parsers	Lecture, Problem based learning, Flipped Class	CC1751.2	Class Quiz Mid Term-2 End Term
18-24	Bottom-up parsing and its type – and Overview, Shift Reduce parsing, Operator Precedence Parsing – Operator grammar, LR(k) parsers: LR(0) item-set construction, LR(0) parsing technique, SLR parsing technique, LR(1) item-set construction, CLR and LALR parsing technique	Understanding about working of Bottom-up parsers	Lecture, Problem based learning, Flipped Class	CC1751.2	Class Quiz Mid Term-2 End Term
SECOND SESSIONAL EXAM					
25-33	Syntax Directed Definitions: Synthesized attributes, Inherited attributes, Dependency Graphs; Construction of syntax trees; Top-Down Translation; Type Checking, YACC tool	Knowledge of semantic analysis phase of compiler design and programming	Lecture, Problem based learning, Flipped Class	CC1751.2 CC1751.3	Class Quiz End Term Assignment

34	Storage Organization, Storage Allocation strategies: Static, Stack, Heap; of Space;	Understanding the storage allocation of run time environments of compilers	Lecture	CC1751.4	Class Quiz End Term
35	Graphical representations, Three-Address Code: Quadruples, Triples and Indirect Triples	Knowledge of various types of intermediate code representations	Lecture	CC1751.4	Class Quiz End Term
36	Issues in the Design of a Code Generator	Recall the general issues faced by code generation phase	Lecture	CC1751.4	Class Quiz End Term
37-38	The principle sources of optimization, optimization of basic blocks, loops in flow graphs, efficient data flow algorithms.	Identify the optimized code after code generation	Lecture	CC1751.4	Class Quiz End Term
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**)			
		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**
[CC1751.1]	explain different phases of compiler designing	**3**	**2**	**1**	**1**								**2**	**2**	**1**		
[CC1751.2]	illustrate the working of lexical, syntactical, and semantical structures of a compiler and relate them with the structure of a programming language		**3**	**2**	**1**									**2**	**1**		
[CC1751.3]	apply knowledge to write front end of complier in lex and yacc		**3**	**2**	**2**									**1**		**1**	
[CC1751.4]	illustrate code generation and code optimization phases	**1**	**1**	**2**	**2**											**1**	

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Principles of Web Services | CC 1753| 3 Credits | 3 0 0 0

Session: July 20-Dec 20 | Faculty: Dr. Punit Gupta and Dr. Rohit Verma | Class: VII SEM

A. Introduction: This course is offered by the Department of Computer and Communication Engineering as this course 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:

[CC 1753.1] To identify and describe various web services technologies like WSDL, UDDI, SOAP

[CC 1753.2] To practice xml technology and message passing

[CC 1753.3] To identify various web service models and messaging techniques

[CC 1753.4] To summarize SOA design implementation and managing SOA environment

[CC 1753.5] To evaluate and identify suitable service for a business model.

[CC 1753.5] To design and develop web service models using beans and spring framework

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.

[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 (Closed Book)	15
	Sessional Exam II (Closed Book)	15
	In class Quizzes and/or Assignments , Activity feedbacks (Accumulated and Averaged)	30
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

Evolution and Emergence of Web Services: Evolution of distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational 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 introduction, non-functional service description, WSDL1.1 Vs. WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL; Brief Over View of XML: XML technologies – XML, XML Document structure, XML namespaces, Defining structure in XML, documents, Reuse of XML schemes, Document navigation ,DTD, XSD, XSLT, X-Query-Path Web services technologies - Web services and SOA, WSDL, SOAP, UDDI Standards (WS-*) - Web services and Service- oriented enterprise (SOE), WS-Coordination and WS-Transaction, transformation WS-Security and the Web services security specifications, WS-Reliable Messaging, WSPolicy, WS-Attachments;

SOA Design implementation, Managing SOA Environment: service-oriented design process, design activities, determine services and tasks based on business process model, choosing appropriate standards, articulate architecture, mapping business processes to technology, designing service integration environment (e.g., ESB, registry), implementing SOA, security implementation, implementation of integration patterns, services enablement, quality assurance,impact of changes to services in the SOA lifecycle;

SOAP : Simple Object Access Protocol Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model, Error handling in SOAP.

F. REFERENCE BOOKS

1. Coyle, Frank P., "XML, Web services, and the data revolution", 1st Edition, Addison-Wesley,2002..
2. S. Graham "Building web Services with Java", 2nd Edition, Pearson Education, 2004.
3. McGovern, "Java web Services Architecture", 1st Edition, Morgan Kaufmann , 2005.
4. Ethan Cerami, "Web Services Essentials: Distributed Application with XML – RPC, SOAP, UDDI & WSDL", O' Reilly, 2000.
5. Thomas Erl, "Service-Oriented Architecture: A Field Guide to Integrating XML and Web Services", Prentice Hall, 2004.

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 to web services	understand web services	Lecture	CO I	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	CO I	Class Quiz Mid Term I

6,7	Emergence of Web Services and Service Oriented Architecture (SOA) fundamentals.	understand web services models using SOA	Lecture	CO 1	Class Quiz	Mid Term I
8	QoS, Web service interportability, SLA.	describe and identify various web service performance parameters	Lecture	CO 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	CO 2	Class Quiz	Mid Term I End Term
12,13	Brief Over View of XML: XML technologies	learn and design XML messages	Lecture	CO 2	Class Quiz	Mid Term I
14,15	XML DTD & XSD	design XML using XSD	Lecture	CO 2	Class Quiz	Mid Term I End Term
16,17	SOAP Protocol, communication protocol.	learn SOAP messaging protocol for web services	Lecture	CO 2	Class Quiz	Mid Term I
18,19	SOAP Message Structure, SOAP encoding	learn SOAP messaging protocol design and architecture	Lecture	CO 2	Class Quiz	Mid Term II End Term
20	Describing web services	understand need of WSDL in web services	Lecture	CO 2	Class Quiz	Mid Term II
21	WSDL services	learn WSDL protocol and its design	Lecture	CO 3	Class Quiz	Mid Term II
22	WSDL binding.	understand WSDL binding with soap protocol	Lecture	CO 3	Class Quiz	Mid Term II
23,24	Register and discovery services	learn various phases of deploying web services.	Lecture	CO 3	Class Quiz	Mid Term II
25,26	WSDL to UDDI, maping & services.	learn UDDI protocol	Lecture	CO 4	Class Quiz	Mid Term II
27-28	SOA, service composition	explain the complete layered architecture of web services.	Lecture	CO 4	Class Quiz	Mid Term II
29-30	WS- BPEL process	learn and design business models in web services	Lecture	CO 4	Class Quiz	Mid Term II End Term
31-32	Service Transactions, distributed transaction, nected transactions	design service transaction in SOAP	Lecture	CO 4	Class Quiz	Mid Term II

33	SOAP Scurity policies	understand need of security in services	Lecture	CO 4	Class Quiz	End Term
34-35	xml secuity standards	understand ways to implement security in XML	Lecture	CO 5	Class Quiz	End Term
36-37	service policies	understand various service policies	Lecture	CO 5	Class Quiz	End Term
38	Service transactions	describe transactions in web services and rollback	Lecture	CO 5	Class Quiz	End Term
39-40	EJB service architecture, Beans model	to design and deploy EJB based web services and its various model	Lecture	CO 6	Class Quiz	End Term
41-42	REST protocol	Design and deploy RESTful services on HTTP	Lecture	CO 6	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	PSO 4
[CC1753.1]	To identify and describe various web services technologies like WSDL, UDDI, SOAP	**2**		**2**	**2**								**2**	**1**			
[CC1753.2]	To practice xml technology and message passing	**2**			**3**								**2**		**1**		
[CC1753.3]	To identify various web service models and messaging techniques	**2**		**1**		**3**							**2**	**2**			
[CC1753.4]	To summarize SOA design implementation and managing SOA environment	**3**	**1**	**3**									**2**	**3**			
[CC1753.5]	To evaluate and identify suitable service for a business model.	**3**		**3**	**2**								**3**	**3**		**3**	**2**
[CC1753.6]	To design and develop web service models using beans and spring framework	**3**		**3**		**3**							**1**	**1**		**2**	**2**

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

MANIPAL UNIVERSITY JAIPUR

Department of Computer and Communication Course Hand-out

Software Testing | CC4158 | 3 Credits | 3 0 0 3

Session: Jul 29-Nov 30| 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]. Demonstrate the various software testing issues and solutions in software unit test; integration, regression, and system testing.

[4158.2]. Examine the test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.

[4158.3]. Illustrate advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions

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:

[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	Date	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	Sept 05 – Sept 09	15
	Sessional Exam II (Closed Book)	Nov 04 – Nov 06	15
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	Regularly	30
End Term Exam (Summative)	End Term Exam (Closed Book)	Nov 29 – Dec 13	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

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 Books:

1. R. Mall, Fundamentals of Software Engineering, (4e), Prentice Hall of India, 2014.
2. K. K. Aggarwal, Y. Singh, Software Engineering, (3e), New Age International Publication, 2008.
3. K. Perry, Effective Methods for Software Testing, (3e), Wiley, 2006.
4. B. Beizer, Software Testing Techniques, (2e), Wiley, 2008.
5. S. Desikan, G. Ramesh, Software Testing: Principles and Practices, Pearson Education, 2006.
6. P. C. Jorgenson, Software Testing: A Craftsman's Approach, (4e), CRC Press, 2014.
7. A. P. Mathur, Fundamentals of Software Testing, (2e), Pearson Education, 2014.

F. Lecture Plan:

LEC NO	TOPICS	Session Outcomes	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Basics of software testing: Introduction to software , Testing, Testing and debugging,	Discuss the Basics of software testing	Lecture	**4158.1**	Mid Term I, Quiz I End Term
2.	Test metrics and measurements	Discuss the various parameters of software	Lecture	**4158.1**	Mid Term I, Quiz & End Term
3.	Verification, Validation and Testing,	To Learn about software validity	Lecture	**4158.1**	Mid Term I, Quiz & End Term
4.	Types of testing,	Discuss the types	Lecture	**4158.1**	Mid Term I, Quiz & End Term
5.	Software defect tracking	Discuss the defects and tracking	Lecture	**4158.1**	Mid Term I, Quiz & End Term
6.	Structural Testing Techniques	Discuss the Structural testing	Lecture	**4158.2**	Mid Term I, Quiz & End Term
7	Path testing,	Demonstrate Path testing	Lecture	**4158.1**	Mid Term I, Quiz & End Term
8	Path testing,	Demonstrate Path testing	Lecture	**4158.3**	Mid Term I, Quiz & End Term
9	DD-Paths,	Demonstrate DD Path	Lecture	**4158.1**	Mid Term I, Quiz & End Term
10	Cyclomatic Complexity,	Calculate the Cyclomatic Complexity,	Lecture	**4158.2**	Mid Term I, Quiz & End Term
11.	Graph Metrics,	Demonstrate the data flow graph and testing	Lecture	**4158.2**	Mid Term I, Quiz & End Term

12.	Functional testing techniques	Demonstrate Functional testing techniques		**4158.1**	Mid Term I, Quiz & End Term
13.	Boundary Value Analysis	Demonstrate Boundary Value Analysis		**4158.1**	Mid Term I, Quiz & End Term
14.	Equivalence Class Testing,	Demonstrate Equivalence Class Testing,		**4158.2**	Mid Term I, Quiz & End Term
15.	Decision Table Based Testing	Demonstrate the n and identification of decision table		**4158.2**	Mid Term I, Quiz & End Term
16.	Cause Effect Graphing Technique	Demonstrate the graphing techniques	Lecture	**4158.2**	Mid Term I, Quiz & End Term
17	Ad hoc Testing;	Discuss and learn hoc testing Ad	Lecture	**4158.2**	Mid Term I, Quiz & End Term
18	Top down and Bottom up integration: Bi-directional integration,	Demonstrate about testing the	Lecture	**4158.2**	Mid Term II, Quiz & End Term
19	System integration, Scenario Testing,	Demonstrate system testing the	Lecture	**4158.2**	Mid Term II, Quiz & End Term
20	Defect Bash, Design/Archiecture verification,	Demonstrate scenario testing the	Lecture	**4158.2**	Mid Term II, Quiz & End Term
21.	Deployment testing, Deployment testing,	Demonstrate identify defect the	Lecture	**4158.2**	Mid Term II, Quiz & End Term
22.	Scalability testing, Reliability testing,	Demonstrate identify architecture the defect	Lecture	**4158.2**	Mid Term II, Quiz & End Term
23.	Stress testing; , Acceptance testing;	Demonstrate the testing techniques	Lecture	**4158.2**	Mid Term II, Quiz & End Term
24	Regression testing, Test Planning,	Demonstrate the testing techniques	Lecture	**4158.2**	Mid Term II, Quiz & End Term

25.	Software Test Automation: Scope of automation,	Demonstrate the testing techniques	Lecture	**4158.3**	Mid Term II, Quiz & End Term
26.	Design & Architecture for automation,	Demonstrate the testing techniques	Lecture	**4158.3**	Mid Term II, Quiz & End Term
27.	Generic requirements for test tool framework, Test tool selection,	Demonstrate the testing techniques	Lecture	**4158.3**	Mid Term II, Quiz & End Term
28.	Case Study on software testing;	Discuss case study	Lecture	**4158.3**	Quiz & End Term
29.	Advanced Topics on Testing:.	Discuss advanced topics	Lecture	**4158.3**	Quiz & End Term
30.	Priotizing the Test cases, Testing Web Applications,	Demonstrate the testing techniques	Lecture	**4158.3**	Quiz & End Term
31.		Demonstrate the testing techniques	Lecture	**4158.3**	Quiz & End Term
32.	Testing Off-the-shelf component, , Testing security, Testing security,	Demonstrate the testing techniques	Lecture	**4158.3**	Quiz & End Term
33.	Introduction to DevOps	Discuss testing warehouses	Lecture	**4158.3**	Quiz & End Term
34.	Introduction to DevOps	Discuss testing warehouses	Lecture	**4158.3**	Quiz & End Term
35-36.	Revision Class	Discussion	Lecture	**4158.3**	Quiz & End Term

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	PSO 4
[CC 4158.1]	Demonstrate the various software testing issues and solutions in software unit test; integration, regression, and system testing.	2			2	3								1			
[CC 4158.2]	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	1
[CC 4158.3]	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		1

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Wireless Sensors and Adhoc Networks | CC1755 | 3 Credits | 3 0 0 3

Session: Aug 2020 – Dec 2020 | Faculty: Dr. Gulrej Ahmed, Dr. Amit Bairwa| Class: VII Semester

(Department Elective)

A. Introduction: This course is offered by Dept. of Computer and Communication Engineering for seventh semester students as department elective course. The core objective of this course is to make the students understand the concepts of Ad Hoc Networks as well as Wireless Sensor Networks (WSN), their characteristics, novel applications, and technical challenges. The prerequisites are to have basic understanding of infrastructured networks, basic protocols used on computer networking.

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

[1755.1]- Describe the concept of wireless ad hoc networks and specialized ad hoc networks like sensor networks.

[1755.2]- Analyse different categories of routing protocols in ad hoc networks and main design issues.

[1755.3]- Analyse design issues of Wireless sensor networks such as Energy consumption, Clustering of Sensors, QoS and applications.

[1755.4]- Describe the basic concepts of MAC layer, routing layer and high level application layer in WSN.

[1755.5]- Illustrate Security issues in wireless ad hoc networks, cooperation in MANETs, Intrusion detection systems.

[1755.6]-

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

D. Program Specific Outcomes (PSOs)

[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.

E. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	15
	Sessional Exam II (Closed Book)	15
	Video Assignment , Presentation and Quiz	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.	

F. SYLLABUS

Introduction to Ad Hoc Wireless Networks: Characteristics of Mobile Ad-hoc Networks (MANETs), Applications of MANETs, Challenges; Routing in MANETs: Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols; Data Transmission in MANETs, TCP over Ad Hoc Networks. Basics of Wireless Sensors and Applications: Design issues, Energy consumption, Clustering of Sensors, Applications; Data Retrieval in Sensor Networks: Classification of WSNs, MAC layer, Routing layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs; Security: Security in Ad hoc Wireless Networks, Key Management, Secure Routing, Cooperation in MANETs, Intrusion Detection Systems; Sensor Network Platforms and Tools: Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms.

G. Reference Books

1. C.S.R. Murthy, B.S. Manoj, "Adhoc Wireless Networks — Architectures and Protocols", 1st Edition, Pearson Education, 2006.
2. C. M. Cordeiro, D. P. Aggarwal, "Ad Hoc and Sensor Networks — Theory and Applications", 2nd Edition, World Scientific Publications, 2011.
3. F. Zhao,L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", 1st Edition, Morgan Kauffman Publishers, 2004
4. F. Hu,X. Cao, "Wireless Sensor Networks — Principles and Practice", An Auerbach Publications, CRC Press, Taylor & Francis Group, 2010.
5. C.E. Perkins, "Ad hoc Networking", Addison-Wesley, 2008.

H. Lecture Plan:

Lecture No.	Major Topics	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Introduction to Ad Hoc Wireless Networks	Introduction and Course Hand-out briefing	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
2.		Introduction to basic of Ad Hoc Network	To acquaint infrasture-based and infrastructure-less network and fundamental concepts used in ad hoc networks	Lecture	1755.1	Mid Term I, Quiz & End Term
3.		Characteristics and Applications of MANETs	Describe the need of MANET, its characteristics and different applications of MANET and finding different scenarios of its applicability	Lecture	1755.1	Mid Term I, Quiz & End Term
4.		Challenges in Ad Hoc Networks	Identify different design issues of ad hoc networks in realistic environment	Lecture	1755.1	Mid Term I, Quiz & End Term
5.		Data Transmission in MANETs	Describe the process of data transmission in MANETs	Lecture	1755.1	Mid Term I, Quiz & End Term

6.	Routing in MANETs	Issues in Designing routing Protocols	Illustrate different design issues in routing of Ad hoc networks	Lecture	1755.2	Mid Term I, Quiz & End Term
7.		Classification of Routing Protocols	Describe various parameters for classification of routing protocols	Lecture	1755.2	Mid Term I, Quiz & End Term
8.		Distance vector and Link state routing protocols	Recall distance vector and link state routing protocols and their applications	Lecture	1755.2	Mid Term I, Quiz & End Term
9.		Destination Sequenced distance vector routing protocol	Describe Destination Sequenced distance vector routing protocol	Lecture	1755.2	Mid Term I, Quiz & End Term
10.		Destination Sequenced distance vector routing protocol	Describe working and applications of DSDV	Lecture	1755.2	Mid Term I, Quiz & End Term
11.		Wireless routing protocol, Cluster-head gateway switch routing protocol	Describe WRP and CGSR routing and applicability in real world	Lecture	1755.2	Mid Term I, Quiz & End Term
12.		On demand routing protocols	Recall on-demand routing protocols and its advantages over table-driven routing protocols	Flipped Class	1755.2	Mid Term I, Quiz & End Term
13.		Dynamic source routing protocol	Describe DSR routing protocol and its working and advantages	Lecture	1755.2	Mid Term I, Quiz & End Term
14.		Ad hoc on demand distance vector routing protocol	Describe AODV routing protocol and its working and advantages	Lecture	1755.2	Mid Term I, Quiz & End Term
15.		Location-aided routing	Describe LAR routing protocol and its working and advantages	Lecture	1755.2	Mid Term I, Quiz & End Term
16.		Hybrid routing protocols, Zone routing protocol	Describe Hybrid routing protocol and its working and advantages. Illustrate the trade-off among all routing protocols in realistic environment	Lecture	1755.2	Mid Term I, Quiz & End Term
17.	TCP over Ad Hoc Networks	Transport layer Design issues for Ad Hoc Networks	Describe different design issues at transport layer in ad hoc networks	Lecture	1755.4& 1755.6	Mid Term I, Quiz & End Term

18.		Transport layer Goals for Ad Hoc Networks	Describe design goals of transport layer protocol for ad hoc wireless networks.	Lecture	1755.4& 1755.6	Mid Term I, Quiz & End Term
19.		TCP performance in Ad Hoc	Revisit to traditional TCP and recount the performance of traditional TCP protocols in wireless ad hoc networks	Lecture	1755.4& 1755.6	Mid Term I, Quiz & End Term
20.		Feedback based TCP	Describe Feedback based TCP	Lecture	1755.4& 1755.6	Mid Term II, Quiz & End Term
21.		TCP –BUS , Ad Hoc TCP	Describe TCP- BUS, Ad Hoc TCP and compare with traditional TCP	Lecture	1755.4& 1755.6	Mid Term II, Quiz & End Term
22.		Ad Hoc TCP , Split TCP	Describe Split TCP and compare with traditional TCP	Lecture	1755.4& 1755.6	Mid Term II, Quiz & End Term
23.		Comparative study of various protocols	Analyse various transport layer protocols in Ad hoc environment	Lecture	1755.4& 1755.6	Mid Term II, Quiz & End Term
24.		Other Transport layer Protocols	Trade-off study of various protocols at transport layer	Lecture	1755.4& 1755.6	Mid Term II, Quiz & End Term
25.	Security	Issues and challenges in Security of Ad Hoc Networks	Describe the need of security in ad hoc networks due to its unique characteristics	Lecture	1755.5	Mid Term II, Quiz & End Term
26.		Security attacks	Describe issues and challenges in security provisioning in wireless ad hoc networks	Lecture	1755.5	Mid Term II, Quiz & End Term
27.		Key Management algorithms	Describe symmetric and Asymmetric kay algorithms	Lecture	1755.5	Mid Term II, Quiz & End Term
28.		Key Management approaches in Ad Hoc Networks	Describe various key management approaches used in Wireless Ad Hoc Networks	Lecture	1755.5	Mid Term II, Quiz & End Term
29.		Secure Routing	Describe the requirement of secure routing protocol for ad hoc network and elaborate security versions of studied routing protocols	Lecture	1755.5	Mid Term II, Quiz & End Term
30.		Cooperation in MANET	Describe the need of cooperation in security provisioning of mobile ad hoc networks	Lecture	1755.5	Mid Term II, Quiz & End Term
31.		Intrusion Detection System	Describe intrusion detection system for Ad hoc networks	Lecture	1755.5	Mid Term II, Quiz & End Term

32.	Basics of Wireless Sensors and Applications	Design issues, Clustering of Sensors	Describe different design issues and challenges of wireless sensor network	Lecture	1755.3 & 1755.6	Quiz & End Term
33.		Clustering of Sensors	Describe clustered architecture of wireless sensor network	Lecture	1755.3 & 1755.6	Quiz & End Term
34.		Energy consumption	Describe small minimum energy communication network	Lecture	1755.3 & 1755.6	Quiz & End Term
35.		Applications	Describe various applications of wireless sensor network	Lecture	1755.3 & 1755.6	Quiz & End Term
36.	Data Retrieval in Sensor Networks	Classification of WSNs	Classify Wireless Sensor Networks based on various parameters	Lecture	1755.3 & 1755.6	Quiz & End Term
37.		MAC layer, Routing layer	Describe MAC and routing layer design issues of Wireless Sensor Networks	Lecture	1755.3 & 1755.6	Quiz & End Term
38.		High-level application layer support	Describe application layer architecture of WSN	Lecture	1755.3 & 1755.6	Quiz & End Term
39.		Adapting to the inherent dynamic nature of WSNs	Identify the impact of different parameters on solutions designed for WSN	Lecture	1755.3 & 1755.6	Quiz & End Term
40.	Sensor Network Platforms and Tools	Sensor Network Hardware	Identify the hardware components required for WSN and their characteristics	Lecture	1755.3 & 1755.6	Quiz & End Term
41.		Sensor Network Programming Challenges, Node-Level Software Platforms.	Build solutions in WSN using node level software platforms	Lecture	1755.3 & 1755.6	Quiz & 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	PSO 4
[CC 1755.1]	Describe the concept of wireless ad hoc networks and specialized ad hoc networks like sensor networks.	2	1										1	2			
[CC 1755.2]	Analyse different categories of routing protocols in ad hoc networks and main design issues	3	2										1		2		
[CC 1755.3]	Analyze design issues of Wireless sensor networks such as Energy consumption, Clustering of Sensors, QoS and applications.	2	2	1		3							1	1			1
[CC 1755.4]	Describe the basic concepts of MAC layer, routing layer and high level application layer in WSN.	3	2			3							2			1	
[CC 1755.5]	Illustrate Security issues in wireless ad hoc networks, cooperation in MANETs, Intrusion detection systems.	3	2	1									2	1	1	1	1
[CC 1755.6]	Build the required skills to read and research the current literature in ad hoc and sensor networks.												2	1		1	1

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

MANIPAL UNIVERSITY JAIPUR

School of COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGG

Course Hand-out

HUMAN-COMPUTER INTERACTION| CC1756 | Credits [3 0 0 3]

Session: Aug-20 -Nov 20 | Faculty: Dr Saurabh Singh | Class 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 1756.1] Define the design principle, standard and guidelines to create human-centered systems

[CC 1756.2] discuss and develop typical human-computer interaction (HCI) models and styles

[CC 1756.3] device and plan interface design through critical assessment and solutions.

[CC 1756.4] 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] 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.

E. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	15
	Sessional Exam II (Closed Book)	15
	In class Quizzes (Accumulated and Averaged)	20
	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 HumanComputer 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	1756.1	In Class Quiz Home Assignment Mid Term I End Term
3	Introduction	To understand Computers in terms of HCI	Lecture	1756.1	In Class Quiz Home Assignment Mid Term I End Term
4	Introduction	To understand interaction between Human and Computer	Lecture	1756.1	In Class Quiz Home Assignment Mid Term I End Term
5	Human Perception and Cognition	Study human perception and cognitive models and issues	Lecture	1756.1	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	1756.2	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	1756.2	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,	1756.2	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	1756.3	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,	1756.3	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	1756.2	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	1756.2	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	1756.3	In Class Quiz Home Assignment Mid Term II End Term
21	Hypothesis testing	Forming hypothesis and comparing	Lecture	1756.3	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	1756.3	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	1756.2	In Class Quiz Home Assignment Mid Term II End Term
24	visual performance and graphics design	Evaluating and caompare visual interaction and design	Lecture	1756.2,1756.3	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	1756.2	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	1756.2	In Class Quiz Home Assignment Mid Term II End Term
27	Human Information Processing	To understand the information retrieval and processing interaction	Lecture	1756.2	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	1756.2,1756.3	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	1756.3	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	1756.4	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	1756.3,1756.4	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	1756.3,1756.4	In Class Quiz Home Assignment End Term
34	Models for Dynamic Learning in HCI;	To understand feedback and learning inclusions with interaction	Lecture	1756.2	In Class Quiz Home Assignment End Term
35	Bayesian Networks,	To implement and understand directed acyclic graph to evaluate the dependencies	Lecture	1756.3,1756.4	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	1756.3,1756.4	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	PSO 4
[CC1756.1]:	**Define the design principle, standard and guidelines to create human-centered systems**	2		1							1		1	**3**		1	
[CC1756.2]:	**discuss and develop typical human-computer interaction (HCI) models and styles**	3	2	1								3		1	1	2	
[CC1756.3]:	**device and plan interface design through critical assessment and solutions.**	3	2	1	1					1		1		2	2	**3**	1
[CC1756.4]:	**identify the current research and development in the field of HCI**	1	2	2	1	1	1		1	2	1	1		2	1	2	1

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

MANIPAL UNIVERSITY JAIPUR

SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER & COMMUNICATION ENGG.
COURSE HAND-OUT

NETWORK SECURITY LAB || CC1730|| 1 Credits|| [0 0 2 1]
Session: JULY-NOV-2020 | Faculty NAME: Dr.Arjun Singh & Mr. Gaurav Prasad|| CORE

A. Introduction:

This course is meant to offer to computer & communication engineering undergraduate students in their seventh semester to have a broad overview of the field of security. Students will learn the basic concepts in security like security attacks, scanning, analysis and defence, networking and wireless security with cryptography. Students will also learn the fundamental methodology for how to design and analyse security critical systems.

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

[CC1730.1]:	Identify basic factors driving the need for network security and identify physical points of vulnerability in simple networks
[CC1730.2]:	Identify and perform experiments on different security related algorithms and techniques.
[CC1730.3]:	Use of software tools for performing scanning, vulnerability analysis, attack and to mitigate the attacks.
[CC1730.4]:	To identify the depth of the problem and to propose the solution.

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] 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)	Weekly evaluation (record+execution+viva)	30
	Project	40
End Term Exam (Summative)	End Term Exam	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

Implementation of Symmetric Key Algorithms: SDES, DES, AES; Implementation of Asymmetric Key Algorithms: RSA, Elgamal; Implementation of Key Management Algorithms: Diffie Helman, Certification Authority; Implementation of Security Protocols: Mutual Authentication, Digital Signature, Hash Functions, MAC; Open Source Security Tools: Wireshark, Ethercap, Penetration Testing tools; Mini project Implementation.

F TEXT BOOK

T1. W. Stallings, "Cryptography and Network Security Principles and Practice", 6th Edition, Pearson Education, 2014

G REFERENCE

R1. D. Hook, “Beginning Cryptography with Java”, 1st Edition, John Wiley & Sons, 2005.

H . 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	Packet tracer	To identify different Protocols, Analyse packets flowing in real network and also to identify the structure, contents of packets, in the network.	Demonstration	CC1730.1 CC1730.2 CC1730.3	Internal Evaluation
2-6	Cryptographic Algorithms	To implement the Cryptographic Algorithms both Classical /Traditional & Modern	Lecture Demonstration	CC1730.1 CC1730.2 CC1730.3 CC1730.4	Internal Evaluation End Sem Exam
7-11	Security Tool	To install, analyse and perform different attacks using different tools available in Kali Linux	Lecture Demonstration	CC1730.1 CC1730.2 CC1730.3 CC1730.4	Internal Evaluation End Sem Exam
12-14	Firewall	Demonstrate the use of Firewall using iptables	Demonstration	CC1730.1 CC1730.2 CC1730.3 CC1730.4	Internal Evaluation End Sem 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	PSO 4
[CC1730.1]:	Identify basic factors driving the need for network security and identify physical points of vulnerability in simple networks	1		1	1									2			1
[CC1730.2]:	Identify and perform experiments on different security related algorithms and techniques.	1	1	1	1	2									1		
[CC1730.3]:	Use of software tools for performing scanning, vulnerability analysis, attack and to mitigate the attacks.	1	1		1	2								1		1	1
[CC1730.4]:	To identify the depth of the problem and to propose the solution.	1	1	1	2	2								1	2	2	1

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING

Course Hand-out

Machine Learning Lab | CC1731 | 1 Credits | 0 0 2 1

Session: Jul 20- Dec 20 | Faculty: Dr Sunil Kumar| Class: B Tech CCE VII SEM

A. Introduction: This course is designed to study and design the algorithms that allow computers to automatically learn from data or past 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:

[CC1731.1]: Identify the role of Machine Learning in problem solving.

[CC1731.2]: Apply algorithms and techniques focusing on strengths and weaknesses and appropriateness for learning problems.

[CC1731.3]: Make use of Software tools to design, implement, and evaluate Machine Learning algorithms.

[CC1731.4]: Evaluate the performance of machine learning algorithms to design the solution efficiently & effectively.

[CC1731.5]: Design the solution of the real world practical applications using Machine Learning for enhancing the 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.

[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 (Formative)	Fortnightly evaluation (Record + execution + viva)	40
	Mini project	30
End Term Exam (Summative)	End Term Exam	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

Implementation of 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; Implementation of deep neural network: Deep Convolutional Neural Network.

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	Write a program for data cleaning.	How to load a CSV file. How to convert strings from a file to floating point numbers. How to convert class values from a file to integers. How to normalize your data How to standardize your data When to normalize as opposed to standardize data.	Learn by doing	CC1731.1	Internal Evaluation
2-3	Write a program to Implement Machine Learning Algorithm Performance Metrics Write a program to Implement Simple Linear Regression.	How to implement classification accuracy. How to implement and interpret a confusion matrix. How to implement mean absolute error for regression. How to implement root mean squared error for regression. How to estimate statistical quantities from training data. How to estimate linear regression coefficients from data. How to make predictions using linear regression for new data.	Learn by doing	CC1731.2/3/4	Internal Evaluation
4-5	Write a program to implement the Logistic Regression Algorithm.	How to make predictions for multivariate linear regression. How to implement linear regression with stochastic gradient descent to make predictions on new data.	Learn by doing	CC1731.2/3/4	Internal Evaluation Project End Sem Exam
6-7	Write a program to implement the Bayes Classifier.	How to use Bayes Classifier.	Learn by doing	CC1731.2/3/4	Internal Evaluation Project End Sem Exam
8	Write a program to implement Decision Tree Algorithm	How to calculate and evaluate candidate split points in a data. How to arrange splits into a decision tree structure. How to apply the classification and regression	Learn by doing	CC1731.2/3/4	Internal Evaluation Project End Sem Exam

		tree algorithm to a real problem.			
9	Write a program to implement k-Nearest Neighbors	The implementation will be specific for classification problems and will be demonstrated using the Iris flowers classification problem.	Learn by doing	CC1731.2/3/4	Internal Evaluation Project End Sem Exam
10	Write programs to Implement the Perceptron Algorithm Write a program to implement the Backpropagation Algorithm.	How to implement Neural Networks	Learn by doing	CC1731.2/3/4/5	Internal Evaluation Project End Sem Exam
11	Implement CNN for object classification	Implementing Deep learning	Learn by doing	CC1731.2/3/4/5	Internal Evaluation Project End Sem Exam
12	Write a program to implement k-means algorithm	Implement unsupervised learning	Learn by doing	CC1731.2/3/4/5	Internal Evaluation Project End Sem Exam
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	PSO4
[CC1731.1]	Identify the role of Machine Learning in problem solving.	2	2	1	2							1	1	2		3	
[CC1731.2]	Apply algorithms and techniques focusing on strengths and weaknesses and appropriateness for learning problems.		1	1	2	2	2		2						1	2	2
[CC1731.3]	Make use of Software tools to design, implement, and evaluate Machine Learning algorithms.			2	2	3											
[CC1731.4]	Evaluate the performance of machine learning algorithms to design the solution efficiently & effectively.		1	2	1		1	2				1			2		
[CC1731.5]	Design the solution of the real world practical applications using Machine Learning for enhancing the employability prospects.	2	2	3	2	2		1		3	1	2			1	2	

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