MANIPAL UNIVERSITY JAIPUR

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING

PROGRAMME OUTCOMES & PROGRAM SPECIFIC OUTCOMES

ACADEMIC YEAR – 2020-2021

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 modernengineering 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 indiverse 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 leaderin 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 inindependent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSO)

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

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

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

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Program Articulation Matrix 2020-21																
SEMESTER	Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
III SEM	CS2101	3	3	3	1	1	0	0	0	0	0	0	1	2	1	1
	CS2102	3	3	3	1	1	0	0	0	0	0	0	1	2	1	1
	CS2103	3	3	3	0	2	0	1	0	0	0	0	2	3	1	1
	CS2104	2	3	3	2	1	0	0	0	1	0	0	1	3	0	0
	CS2130	2	3	2	2	2	0	0	0	0	0	0	1	1	1	0
	CS2131	1	2	2	1	1	0	0	0	0	0	0	0	2	0	0
IV SEM	MA2201	3	2	1	2	1	2	3	3	2	1	2	1	3	3	2
	CS2201	3	2	3	0	1	0	0	0	1	1	0	2	1	0	2
	CS2202	2	3	3	2	3	2	0	0	2	2	2	0	2	2	0
	CS2203	1	3	2	3	3	0	0	0	3	3	3	3	3	0	0
	CS2230	3	0	2	0	3	0	0	0	1	1	1	2	2	2	2
	CS2231	1	1	2	2	1	1	0	1	1	1	1	0	1	1	1
V SEM	CS1501	2	3	3	2	1	0	1	2	0	0	2	2	3	2	2
	CS1505	3	3	3	1	1	0	0	0	0	0	0	2	3	0	0
	CS1530	2	1	2	0	0	0	0	0	0	0	0	2	3	0	0
	CS1535	3	3	3	2	2	0	0	0	0	0	0	0	3	0	0
	CS1551	2	1	1	1	1	0	0	0	1	1	1	2	1	0	1
	CS1553	2	2	2	3	2	1	1	0	1	3	1	3	3	3	1
	CS1593	3	3	3	3	2	0	1	0	1	1	3	0	3	2	3
	CS1532	1	3	3	1	3	0	0	0	0	0	0	0	3	0	0
	BB 1540	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
VI SEM	CS1602	2	0	3	0	1	0	2	0	2	0	0	0	0	0	1
	CS1604	3	3	0	0	3	0	0	0	0	0	1	3	3	0	0
	CS1631	1	1	2	2	1	1	0	1	1	1	1	0	0	0	1
	CS1633	3	1	0	0	2	0	0	0	0	0	3	3	3	0	0
	CS1634	1	1	1	2	2	1	0	1	1	1	2	2	1	2	1
	CS1650	2	3	3	2	1	2	1	1	1	1	1	2	1	1	3
	CS1653	3	0	2	1	0	0	0	0	0	0	1	1	2	0	0
VII SEM	CS1704	3	3	3	3	2	0	0	0	1	1	3	0	3	2	3
	CS1756	2	2	2	2	2	0	0	0	0	0	0	0	0	1	1
	CS1757	3	3	3	3	2	1	0	1	1	0	3	2	2	2	1
	CS1758	3	2	3	0	3	3	0	2	1	2	2	3	3	3	3
	CS1760	2	2	2	2	2	0	0	0	0	0	0	0	0	1	1
VIII SEM	CS1881	2	2	1	2	3	2	0	1	0	0	0	0	3	3	1

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Attainment Matrix 2020-21																
SEMESTER	Course CODE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
III SEM	CS2101	3	3	3	1	1	0	0	0	0	0	0	1	2	1	1
	CS2102	3	3	3	1	1	0	0	0	0	0	0	1	2	1	1
	CS2103	3	3	3	0	0	0	1	0	0	0	0	2	3	0	1
	CS2104	2	3	3	2	1	0	0	0	1	0	0	1	3	0	0
	CS2130	2	3	2	2	0	0	0	0	0	0	0	1	1	0	0
	CS2131	1	2	2	1	1	0	0	0	0	0	0	0	2	0	0
IV SEM	MA2201	3	2	1	2	1	2	3	3	2	1	2	1	3	3	2
	CS2201	3	2	3	0	1	0	0	0	1	1	0	2	1	0	2
	CS2202	2	3	3	2	3	2	0	0	2	2	2	0	2	2	0
	CS2203	1	3	2	3	3	0	0	0	0	3	3	0	3	0	0
	CS2230	3	0	2	0	3	0	0	0	1	1	1	2	2	2	2
	CS2231	1	1	2	2	1	1	0	1	1	1	1	0	1	1	1
V SEM	CS1501	2	3	3	2	1	0	1	2	0	0	2	2	3	2	2
	CS1505	3	3	3	1	1	0	0	0	0	0	0	2	3	0	0
	CS1530	2	1	2	0	0	0	0	0	0	0	0	2	3	0	0
	CS1535	3	3	3	2	2	0	0	0	0	0	0	0	3	0	0
	CS1551	1	1	1	1	1	0	0	0	1	1	1	1	1	0	1
	CS1553	2	2	2	3	2	1	1	0	1	2	1	3	3	3	1
	CS1593	3	3	3	3	1	0	1	0	1	1	3	0	3	2	3
	CS1532	1	3	3	1	3	0	0	0	0	0	0	0	3	0	0
	BB1540	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
VI SEM	CS1602	2	0	3	0	1	0	2	0	2	0	0	0	0	0	1
	CS1604	3	3	0	0	3	0	0	0	0	0	1	3	3	0	0
	CS1631	1	1	2	2	1	1	0	1	1	1	1	0	0	0	1
	CS1633	3	1	0	0	2	0	0	0	0	0	3	3	3	0	0
	CS1634	1	1	1	2	2	1	0	1	1	1	2	2	1	2	1
	CS1650	1	1	1	0	0	2	2	0	0	2	0	0	1	2	2
	CS1653	3	0	2	1	0	0	0	0	0	0	1	1	2	0	0
VII SEM	CS1704	3	3	3	3	2	0	0	0	1	1	3	0	3	2	1
	CS1756	2	1	2	1	0	0	0	0	0	0	0	0	0	0	1
	CS1757	3	3	3	3	2	1	0	1	1	0	3	2	2	2	3
	CS1758	3	2	3	0	3	3	0	2	1	2	2	3	3	3	1
	CS1760	2	1	2	1	0	0	0	0	0	0	0	0	0	0	0
VIII SEM	CS1881	2	2	1	2	3	2	0	1	0	0	0	0	3	3	1

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Course Hand-out

Problem Solving Using Computers | CS 1001 | 3 Credits | 3 0 0 3

Session: Oct 2020 – Jan 2021 | Faculty: Dr Ashish Jain | Dr Shashank Sharma | Mr Anurag Bhatnagar | Dr Ankit Shrivastava | Mr Jaya Krishna | Mr Manoj R | Ms Anjana Syamala | Dr Manoj Bohra | Dr Vijay Kumar Sharma | Mr Prashant Hemrajani

Class: B. Tech 1st Year

A. **Introduction:** Problem solving using computers course focuses on basic computer fundamentals, number system and programming in C fundamentals. By means of C language students learn to write set of instructions to create a program so that desire output can be generated by computer.

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

[CS1001.1]. Understand number system and their conversions and describe basic knowledge of translators, i/o devices, programming languages.

[CS1001.2]. Illustrate the basic programming concepts such as tokens (data types, operators, etc) and control statements.

[CS1001.3]. Design and develop flow chart, algorithms and pseudo code to solve real life problems.

[CS1001.4]. Understand the concepts array data type (1D and 2D), functions, structure and union.

[CS1001.5]. Illustrate the concept of pointers and file handling.

C. 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

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	20
	Sessional Exam II (Close Book)	20
	Quizzes (03) and Assignment (03)	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.	
Quizzes	3 Quizzes (Close Book)	

E. SYLLABUS

Digital computer fundamentals: Algorithms and flowcharts, the von Neumann architecture, programs, assembly language, high level programming languages; Number System: binary, decimal, octal, hexadecimal; Imperative programming (Using C): data types, variables, operators, expressions, statements, control structures, functions, arrays and pointers, recursion, records (structures), files, input/output, some standard library functions and some elementary data structures.

F. Text Books

T1. E. Balagurusamy, "Programming in ANSI C", 7th Edition, McGraw Hill Publication, 2016.

T2. Y. P. Kanetkar, "Let us C", 12th Edition, BPB Publication, 2014.

G. Reference Books

R1. B. W. Kernighan, D. M. Ritchie, "The C Programing Language", 2nd Edition, Prentice Hall of India, 2014.

R1. B. Gottfired, "Schaum's Outline Series: Programming with C", 3rd Edition, McGraw Hill Publication, 2012.

H. Lecture Plan:

lecture	Topics	Session Outcome	Mode of Delivery ONLINE	Corresponding CO	Mode of Assessing CO
1	Number systems: decimal, binary, octal, hexadecimal, base-r conversions	To acquaint knowledge about basics of number system	Lecture	1001.1	Mid Term I, Quiz & End Term
2	Number systems: decimal, binary, octal, hexadecimal, base-r conversions	To acquaint knowledge about basics of number system	Activity	1001.1	Mid Term I, Quiz & End Term
3	Basic architecture of computers and its building block	Describing basic architecture of computer	Lecture	1001.1	Mid Term I, Quiz & End Term
4	Computer languages: machine language, assembly language, high level language; translators: assembler, compiler, interpreter	Differentiate between machine language and high-level language	Lecture	1001.1	Mid Term I, Quiz & End Term
5	Short history, character set, tokens	Different characters and tokens	Guided Self-Study	1001.2	Mid Term I, Quiz & End Term
6	Constants (integer, real, character, string); variables, keywords	Describe and implementation of various constant type	Lecture	1001.2	Mid Term I, Quiz & End Term
7	Data types (table including range, memory and format specifier)	Implementation of various data type	Lecture	1001.2	Mid Term I, Quiz & End Term
8	Operators: arithmetic, relational, logical, assignment	Implementation of various arithmetic operations	Lecture	1001.2	Mid Term I, Quiz & End Term
9	Bitwise, conditional, type-cast, sizeof, comma	Implementation of various operators	Lecture	1001.2	Mid Term I, Quiz & End Term
10	Operator precedence and associativity, type conversion	Implementation of precedence in programming	Activity (Think Pair Share)	1001.2	Mid Term I, Quiz & End Term
11	Operator precedence and associativity, type conversion	Implementation of precedence in programming	Lecture	1001.2	Mid Term I, Quiz & End Term
12	Input and output statements (formatted and unformatted) : printf, scanf	Implementation of input and output statements	Lecture	1001.2	Mid Term I, Quiz & End Term

13	Gets, puts, getchar, putchar	Implementation of input and output statements using system functions	Activity	1001.2	Mid Term I, Quiz & End Term
14	Decision statements: if, if-else, nested if-else, if-else ladder	Implementation of decision statements	Lecture	1001.3	Mid Term I, Quiz & End Term
15	Decision statements: if, if-else, nested if-else, if-else ladder	Implementation of decision statements	Lecture	1001.3	Mid Term I, Quiz & End Term
16	Switch, break statement	Learning the implementation of switch and break	Lecture	1001.3	Mid Term I, Quiz & End Term
17	Switch, break statement	Learning the implementation of switch and break	Lecture	1001.3	Mid Term I, Quiz & End Term
18	Repetitive structures: for, while, do-while	Learning the implementation of looping	Lecture	1001.3	Mid Term II, Quiz & End Term
19	Repetitive structures: for, while, do-while	Learning the implementation of looping	Lecture	1001.3	Mid Term II, Quiz & End Term
20	Nested loops	Learning the implementation of looping	Activity (Think Pair Share)	1001.3	Mid Term II, Quiz & End Term
21	Nested loops	Learning the implementation of looping	Lecture	1001.3	Mid Term II, Quiz & End Term
22	Continue and break statements	Describe the usage of continue and break	Lecture	1001.3	Mid Term II, Quiz & End Term
23	Continue and break statements	Describe the usage of continue and break	Lecture	1001.3	Mid Term II, Quiz & End Term
24	1-D array: definition, declaration, initialization, input array, output array	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
25	1-D array: definition, declaration, initialization, input array, output array	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
26	1-D character array: character array, string, string standard function	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
27	1-D character array: character array, string, string standard function	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
28	Use of 1D array: Linear Search and Bubble Sort	Describe use of linear array	Activity	1001.4	Mid Term II, Quiz & End Term

29	2-D array: definition, declaration, initialization, input array, output array, one simple program	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
30	2-D array: definition, declaration, initialization, input array, output array, one simple program	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
31	2-D array: definition, declaration, initialization, input array, output array, one simple program	Describe and define array of various data type	Lecture, Activity	1001.4	Mid Term II, Quiz & End Term
32	Pointers: introduction	Describe functionality of pointers in programming	Lecture	1001.4	Mid Term II, Quiz & End Term
33	1-D Array and pointer	Implementation of ID array with pointer	Lecture	1001.4	Mid Term II, Quiz & End Term
34	Functions: introduction to functions	Describe importance of function and modular programming	Lecture, Activity	1001.4	Mid Term II, Quiz & End Term
35	Function prototype, call, definition	Describe importance of function and modular programming	Lecture	1001.4	Mid Term II, Quiz & End Term
36	Storage classes	Describe usage of storage classes	Lecture	1001.4	Mid Term II, Quiz & End Term
37	Structures: definition, declaration, initialization, array of structures	Describe usage of structures	Lecture	1001.4	Quiz & End Term
38	Structures: definition, declaration, initialization, array of structures	Describe usage of structures	Lecture	1001.4	Quiz & End Term
39	Union, difference between union and structures	Describe usage of union	Lecture	1001.4	Quiz & End Term
40	File handling: introduction, operations on files, opening modes	Describe usage of file handling with various operations and modes	Lecture	1001.5	Quiz & End Term
41	File handing function	Describe usage of file handling with various operations and modes	Lecture	1001.5	Quiz & End Term
42	File handing function	Describe usage of file handling with various operations and modes	Lecture	1001.5	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
CS 1001.1:	Understand number system and their conversions and describe basic knowledge of translators, i/o devices, programming languages.	3											1	3		
CS 1001.2:	Illustrate the basic programming concepts such as tokens (data types, operators, etc) and control statements.	2		1									2	2		
CS 1001.3:	Design and develop flow chart, algorithms and pseudo code to solve real life problems.	3													1	
CS 1001.4:	Understand the concepts array data type (1D and 2D), functions, structure and union.	2	1	2									2	1		
CS 1001.5:	Illustrate the concept of pointers and file handling	1		1									1	1		

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

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School of Computing and Information Technology

Department of Computer Science and Engineering
Course Hand-out

Data Communications | CS 2101 | 4 Credits | 3104

Session: Aug 2020 – Dec 2020 | Faculty: Dr. Rohit Verma | Dr. Sandeep Joshi | Mr. Manoj R. | Class: III Semester

A. Introduction: This course is to provide students with the fundamental concepts and techniques used for communicating data in efficient and reliable manner. The student will be able to understand and describe various encoding techniques, flow & error control mechanisms and 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

CS2101.1: Describe components of data communication (e.g. layering architecture, types of transmission media, impairments, and network performance) in computer networks.

CS2101.2: Classify different signal encoding techniques for digital-analog transmission in various transmission media.

CS2101.3: Develop skills to apply error detection and correction techniques in the data transmission.

CS2101.4: Interpret error and flow control protocols at Data Link Layer.

CS2101.5: Illustrate multiplexing and multiple access techniques in data transmission.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Program Outcomes:

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

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

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

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

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

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

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

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

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

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

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

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

Program Specific Outcomes (PSOs)

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

[PSO.1] Will be able to identify the existing open problems in the field of computing Science and propose the best possible solutions.

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	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.	
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: Data communications, Networks, Network types, Standards. ***Protocol Layering***: 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.

Multiplexing: Frequency-division multiplexing, Time-division multiplexing, Code-division multiple access. Space division multiplexing.
Multiple Access: Random access, Aloha, Carrier sense multiple access, Carrier sense multiple access with collision detection, Carrier sense multiple access with collision avoidance, Code-division multiple access.

TEXTBOOKS:

1. B. Forouzan, Data Communication & Networking, (5e), McGraw Hill Education, 2013.
2. W. Stallings, Data and Computer Communications, (10e), Pearson Education,2018.

REFERENCE BOOK:

1. W.R. Stevens, TCP/IP illustrated, Volume 1: The Protocols, 2nd Ed., Addison-Wesley, 2015.
2. D E. Comer, Internetworking with TCP/IP Principles, Protocols and Architecture, 6th Ed., Pearson, 2013.
3. L. Peterson and T. Davie "Computer Networks: A Systems Approach" Fifth Edition, Morgan Kaufmann Publishers, 2012.

F. Lecture Plan:

lecture	Major Topics	Topics	Session Outcome	Corresponding CO	Mode of delivery	Mode of Assessing CO
1	Introduction	Introduction to Course, Course Outcome. Introduction to Data Communication: Components, Data Representation, Data Flow,	Describing Course Objectives, Data Communication Components	CS2101.1	lecture	
2		Physical Structure of Network,	Explain network types,	CS2101.1	lecture	Mid Term I, Quiz & End Term

		Network Types, Internet, Standard	Internet standards			
3	Protocol Layering	Need for Layered Protocol Architecture, OSI Model	Recognize layering architecture and OSI model in Internet	CS2101.1	lecture	Mid Term I, Quiz & End Term
4		TCP/IP – Layers and Functioning	Illustrate TCP/IP model	CS2101.1	lecture	Mid Term I, Quiz & End Term
5		**Tutorial** – Network Overview, Protocol Layering,	Understand networking and layering concepts	CS2101.1	Tutorial/Flipped Class	Mid Term I, Quiz & End Term
6	Data Transmission	Analog and digital data, Signals, Periodic and Non-periodic	Classify analog and digital data	CS2101.1	lecture	Mid Term I, Quiz & End Term
7		Periodic analog Signals: Sine wave, Phase, Wavelength, Time and Frequency Domain	Analyze periodic analog signals	CS2101.1	lecture	Mid Term I, Quiz & End Term
8		Composite signal, Bandwidth, Digital Signal: Bit Rate, Bit Length, Digital signal as a composite Analog Signal	Analyze composite signal	CS2101.1	lecture	Mid Term I, Quiz & End Term
9		Transmission Impairment: Attenuation, Distortion, Noise	Identify transmission impairment	CS2101.1	lecture	Mid Term I, Quiz & End Term
10		**Tutorial** – Data and Signals, Digital Signal, Transmission Impairment	Practice data, signal transmission impairment	CS2101.1	Tutorial/ Flipped Class	Mid Term I, Quiz & End Term
11		Data Rate Limits: Nyquist Bit Rate	Infer data rate limits	CS2101.1	lecture	Mid Term I, Quiz & End Term
12		Shannon Capacity	Describe Shannon capacity	CS2101.1	lecture	Mid Term I, Quiz & End Term
13		Performance: Bandwidth, Throughput, Latency, Delay, Jitter	Analyze performance in communication	CS2101.1	lecture	Mid Term I, Quiz & End Term

14		**Tutorial** – Data Rate, Shannon Capacity, Performance	Practice data rate, Shannon capacity and performance	CS2101.1	Tutorial/ Flipped Class	Mid Term I, Quiz & End Term
15	Transmission Media	TRANSMISSION MEDIA: Introduction, Twisted Pair Cable, Coaxial Cable, Fiber Optic Cable	Identify transmission media	CS2101.2	lecture	Mid Term I, Quiz & End Term
16		Radio Waves, Microwaves, Infrared	Identify transmission media	CS2101.2	lecture	Mid Term I, Quiz & End Term
17	Signal Encoding Techniques	DIGITAL TRANSMISSION AND ANALOG TRANSMISSION: Line Coding, Line Coding Scheme	Interpret line coding	CS2101.2	lecture	Mid Term I, Quiz & End Term
18		Block Coding, Scrambling	Interpret block coding	CS2101.2	lecture	Mid Term I, Quiz & End Term
19		PCM, DM	Analyze PCM, DM	CS2101.2	lecture	Mid Term I, Quiz & End Term
20		**Tutorial** – Transmission media, line coding, PCM	Analyze the concept learnt	CS2101.2	Tutorial/ Flipped Class	Mid Term I, Quiz & End Term
21		Parallel Transmission, Serial Transmission	Outline parallel and serial transmission	CS2101.2	lecture	Mid Term I, Quiz & End Term
22		Digital-to-Analog Conversion - Amplitude Shift Keying	Illustrate ASK	CS2101.2	lecture	Mid Term I, Quiz & End Term
23		Frequency Shift Keying, Phase Shift Keying	Illustrate FSK, PSK	CS2101.2	lecture	Mid Term I, Quiz & End Term
24		QAM, AM, FM, PM	Illustrate AM,FM,PM	CS2101.2	lecture	Mid Term I, Quiz & End Term
First Session Exam						
25		ERROR DETECTION AND CORRECTION: Introduction, Types of Errors, Redundancy, Detection versus	Analyze error types	CS2101.3	lecture	Mid Term II, Quiz & End Term

		correction, Coding				
26	Digital Data Communication	Cyclic Redundancy Check, Polynomials,	Apply CRC and error correction mechanism	CS2101.3	lecture	Mid Term II, Quiz & End Term
27		Cyclic Code Encoder Using polynomials, Cyclic code analysis, Advantages of Cyclic Codes	Apply Cyclic code	CS2101.3	lecture	Mid Term II, Quiz & End Term
28		Checksum	Apply checksum	CS2101.3	lecture	Mid Term II, Quiz & End Term
29		**Tutorial** – Cyclic code, Checksum	Apply cyclic code and checksum in communication	CS2101.3	Tutorial/ Flipped Class	Mid Term II, Quiz & End Term
30	Data Link Control	DLC Framing, Flow and Error Control,	Analyze flow and error control	CS2101.3	lecture	Mid Term II, Quiz & End Term
31		Connectionless and Connection Oriented, Data Link Simple Protocol	Interpret data link protocol	CS2101.4	lecture	Mid Term II, Quiz & End Term
32		Flow Control: Stop-and-Wait Protocol, Piggybacking, Sliding Window	Identify flow control in data link layer	CS2101.4	lecture	Mid Term II, Quiz & End Term
33		Error Control: Stop-and-wait ARQ, Go-back-N ARQ, SR ARQ	Identify error control in data link layer	CS2101.4	lecture	Mid Term II, Quiz & End Term
34		**Tutorial** – Flow and Error Control	Apply flow and error control mechanism	CS2101.4	Tutorial/ Flipped Class	Mid Term II, Quiz & End Term
35		HDLC, Configurations and Transfer Modes, Framing	Summarize HDLC and framing	CS2101.4	lecture	Mid Term II, Quiz & End Term
36	Multiplexing	Introduction, FDM, WDM	Infer FDM, WDM	CS2101.5	lecture	Mid Term II, Quiz & End Term
37		Time-Division Multiplexing (TDM)	Infer TDM	CS2101.5	lecture	Mid Term II, Quiz & End Term
38		Spread Spectrum, FHSS and DSSS	Summarize FHSS and DSSS	CS2101.5	lecture	Mid Term II, Quiz & End Term

39		SDM	Illustrate SDM	CS2101.5	lecture	Mid Term II, Quiz & End Term
40		**Tutorial** - Multiplexing	Analyze multiplexing concepts	CS2101.5	Tutorial/ Flipped Class	Mid Term II, Quiz & End Term
41	Media Access	Media Access Control - ALOHA	Illustrate MAC protocol ALOHA	CS2101.5	lecture	Mid Term II, Quiz & End Term
42		CSMA, CSMA/CD	Illustrate MAC protocol – CSMA, CSMA/CD	CS2101.5	lecture	Mid Term II, Quiz & End Term
43		CSMA/CA	Illustrate MAC protocol – CSMA/CA	CS2101.5	lecture	Mid Term II, Quiz & End Term
Second Sessional Examination						
44	Media Access	Controlled Access – Reservation, Polling,	Analyze reservation and polling	CS2101.5	lecture	Quiz & End Term
45		Token Passing	Analyze token passing	CS2101.5	lecture	Quiz & End Term
46		FDMA	Interpret FDMA	CS2101.5	lecture	Quiz & End Term
47		TDMA	Interpret TDMA	CS2101.5	lecture	Quiz & End Term
48		CDMA	Interpret CDMA	CS2101.5	lecture	Quiz & End Term
49		**Tutorial** – Media Access Control	Apply MAC concepts in communciation	CS2101.5	Tutorial/ Flipped Class	Quiz & End Term

G. 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
CS2101.1	Describe components of data communication (e.g. layering architecture, types of transmission impairments, and network performance) in computer networks.	3	-	1	1	-	-	-	-	-	-	-	2	2	-	3
CS2101.2	Classify different signal encoding techniques for digital-analog transmission in various transmission media.	1	1	1	2	-	-	-	-	-	-	-	1	-	-	2
CS2101.3	Develop skills to apply error detection and correction techniques in the data transmission.	-	3	2	1	-	-	-	-	-	-	-	1	1	-	2
CS2101.4	Interpret error and flow control protocols at Data Link Layer.	-	3	2	1	-	-	-	-	-	-	-	1	1	-	2
CS2101.5	Illustrate multiplexing and multiple access techniques in data transmission.	1	2	-	1	-	-	-	-	-	-	-	1	1	-	2

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT

Department of Computer Science and Engineering
Course Hand-out

Computer System Architecture | CS 2102 | 4 Credits | 3 0 1 4

Session: Aug 21 – Dec 21 | Faculty: Dr. Umashankar Rawat, Dr. Vijander Singh, Ms. Anjana, Dr. Kusumlata, Ms. Aditya Sinha, Mr. Vidhyadhar, Ms. Anubha Parashar | Class: III Semester

A. **Introduction:** This course is offered by Dept. of Computer Science and 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.

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

[2102.1]. Discuss interconnection between functional units of a computer system and various factors that effects the performance of a computer.

[2102.2]. Apply Boolean algebra and K map to obtain simpler Boolean expression that will require fewer logic gates.

[2102.3]. Illustrate combinational and sequential logic circuits for designing digital components.

[2102.4]. Write assembly language programs for a given high level language construct using various addressing modes.

[2102.5]. Examine the design of fast arithmetic circuits for various arithmetic operations on signed and unsigned numbers.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. Assessment Plan:

Criteria	Description	Date (Tentative)	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	Oct 7 to Oct 12	20
	Sessional Exam II (Closed Book)	Nov 12 to Nov 17	20
	Quizzes and Assignments (Accumulated and Averaged)	Regularly	20
End Term Exam (Summative)	End Term Exam (Closed Book)	Dec 13 to Dec 24	40
	Total		100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.		
Make up Assignments (Formative)	Students who miss a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that 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

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; **Basic Structure of Computers**: Computer Types, Functional Units, Basic Operational Concepts, Software, 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

F. TEXTBOOKS

T1. C. Hamacher, Z. Vranesic, S. Zaky, *"Computer Organization",* Tata McGraw Hill (TMH), 5th Edition, 2011.

T2. M. Morris Mano, *"Computer System Architecture"*, Pearson, 3rd Edition Revised, 2017.

G. REFERENCE BOOKS

R1. W. Stallings, *"Computer Organization and Architecture –Designing for Performance",* PHI, 2009.

R2. David A. Patterson, John L. Hennessy, *"Computer Organization and Design: The Hardware/Software Interface",* Morgan Kauffmann, 4th Edition, 2010.

R3. John P. Hayes, *"Computer Architecture and Organization",* TMH, 3rd Edition, 1998.

H. Lecture Plan:

Lectures	Major Topics	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1.	Basic Structure of Computers	Introduction to basic structure of computers	Lecture	2102.1	Mid Term I, Quiz & End Term
2.		Functional units	Lecture	2102.1	Mid Term I, Quiz & End Term
3.		Basic operational concepts	Lecture	2102.1	Mid Term I, Quiz & End Term
4.		Bus structures, software	Lecture	2102.1	Mid Term I, Quiz & End Term
5.		Performance	Lecture	2102.1	Mid Term I, Quiz & End Term
6.		Tutorial	Activity	2102.1	Mid Term I, Quiz & End Term
7.	Digital Logic Circuits	Introduction	Lecture	2102.2	Mid Term I, Quiz & End Term
8.		Logic Gates	Lecture	2102.2	Mid Term I, Quiz & End Term
9.		Boolean Algebra	Lecture	2102.2	Mid Term I, Quiz & End Term
10.		Map Simplification	Lecture	2102.2	Mid Term I, Quiz & End Term
11.		Tutorial	Flipped Class	2102.2	Mid Term I, Quiz & End Term
12.		Combinational Circuits	Lecture	2102.2,2102.3	Mid Term I, Quiz & End Term
13.		Flip-flops	Lecture	2102.2,2102.3	Mid Term I, Quiz & End Term
14.		Sequential Circuits	Lecture	2102.2,2102.3	Mid Term I, Quiz & End Term
15.		Tutorial	Activity	2102.2,2102.3	Mid Term I, Quiz & End Term
16.	Digital Components	Integrated Circuits	Lecture	2102.3	Mid Term I and II, Quiz & End Term
17.		Decoders	Lecture	2102.3	Mid Term I and II, Quiz & End Term
18.		Multiplexer	Lecture	2102.3	Mid Term I and II, Quiz & End Term
19.		Registers	Lecture	2102.3	Mid Term I and II, Quiz & End Term
20.		Tutorial	Flipped Class	2102.3	Mid Term I and II, Quiz & End Term

21.		Shift-Register	Lecture	2102.3	Mid Term I and II, Quiz & End Term
22.		Binary Counters	Lecture	2102.3	Mid Term I and II, Quiz & End Term
23.		Memory Unit	Lecture	2102.3	Mid Term I and II, Quiz & End Term
24.		Tutorial	Flipped Class	2102.3	Mid Term I and II, Quiz & End Term
25.	Machine Instructions and Programs	Numbers and Characters	Lecture	2102.5	Mid Term I and II, Quiz & End Term
26.		Arithmetic Operations	Lecture	2102.5	Mid Term I and II, Quiz & End Term
27.		Memory Locations and Addresses, Memory Operations	Lecture	2102.4	Mid Term I and II, Quiz & End Term
28.		Instructions and Instruction Sequencing	Lecture	2102.4	Mid Term I and II ,Quiz & End Term
29.		Register Transfer Notation	Lecture	2102.4	Mid Term I and II ,Quiz & End Term
30.		Assembly Language Notation	Lecture	2102.4	Mid Term I and II,Quiz & End Term
31.		Tutorial	Flipped Class	2102.4,2102.5	Mid Term I and II,Quiz & End Term
32.		Basic Instruction Types, Instruction Execution and Straight-Line Sequencing	Lecture	2102.4	Mid Term I and II, Quiz & End Term
33.		Branching, Condition Codes, Generating Memory Addresses methods	Lecture	2102.4	Mid Term I and II, Quiz & End Term
34.		Addressing Modes-I	Lecture	2102.4	Mid Term I and II , Quiz & End Term
35.		Addressing Modes-2	Lecture	2102.4	Mid Term I and II, Quiz & End Term
36.		Implementation of Variables and Constants, Indirection and Pointers	Lecture	2102.4	Mid Term I and II, Quiz & End Term
37.		Indexing and Arrays, Relative Addressing	Lecture	2102.4	Mid Term I and II , Quiz & End Term
38.		Additional Instructions, Encoding of Machine Instructions	Lecture	2102.4	Mid Term I and II , Quiz & End Term
39.		Tutorial	Flipped Class	2102.4	Mid Term I and II, Quiz & End Term
40.		Addition and Subtraction of Signed Numbers	Lecture	2102.5	Mid Term II Quiz & End Term
41.		Design of Fast Adders	Lecture	2102.5	Mid Term II, Quiz & End
42.		Multiplication of Positive Numbers	Lecture	2102.5	Mid Term II, Quiz & End Term

43.	Arithmetic	Signed Operand Multiplication	Lecture	2102.5	Mid Term II Quiz & End Term
44.		Fast Multiplication	Lecture	2102.5	Mid Term II Quiz & End
45.		Tutorial	Flipped Class	2102.5	Mid Term II Quiz & End
46.		Integer Division	Lecture	2102.5	Mid Term II Quiz & End
47.		Floating Point Numbers and Operations-I	Lecture	2102.5	Mid Term II Quiz & End Term
48.		Floating Point Numbers and Operations-2	Lecture	2102.5	Mid Term II Quiz & End Term
49.		Tutorial	Flipped Class	2102.5	Mid Term II End Term Exam

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[2102.1]	Discuss interconnection between functional units of a computer system and various factors that effects the performance of a computer.	3	1	1									1	1		1
[2102.2]	Apply Boolean algebra and K map to obtain simpler Boolean expression that will require fewer logic gates.	3	1	1									1	1		1
[2102.3]	Illustrate combinational and sequential logic circuits for designing digital components.	3	1	1									1	1		1
[2102.4]	Write assembly language programs for a given high level language construct using various addressing modes.	3	1	1		1							1	1		1
[2102.5]	Examine the design of fast arithmetic circuits for various arithmetic operations on signed and unsigned numbers.	3	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 Science and Engineering
Course Hand-out
Data Structures and Algorithm | CS 2103 | 4 Credits | 3 1 0 4
ssion: July 20 – Nov 20 | Faculty: Ms. Shikha Mundra| Dr. Prakash Ramani |
Mr. Harish sharma | Dr. Mahesh Jangid Class: III Semester

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

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

[2103.1] Illustrate use of various linear data structures
[2103.2] Illustrate use of various non-linear data structures like Trees and Graph.
[2103.3] Select and Apply appropriate data structures to solve a specified problem
[2103.4] Build and Compare various standard techniques of searching, sorting and hashing.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work 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; pointer declaration and definition, memory allocation functions, array of pointers; The type definition, enumerated types, accessing structures, complex structures, arrays of structures, structures and functions; Recursive definition & processes, Recursion in C, writing recursive programs efficiency of recursion, Examples: Tower of Hanoi, GCD, Fibonacci Definition and examples, Representing **Stacks** in C, Evaluation of expressions, multiple stacks and queues; Applications: infix, postfix and prefix and their conversions. **Linked lists** representations, Singly, doubly, header node, circular, Applications: linked stacks and queues, polynomial and long integer arithmetic, union, intersection, Basic terminologies, binary tree representation, recursive/ non recursive, Binary search tree, AVL trees; **Applications**: Expression **Trees**, inserting, deleting, searching, height of BST Terminology and representations, **Graph** operations, spanning trees, minimum cost spanning tree, shortest path and transitive closure, Binary and linear search, insertion, quick, merge, heap, radix sort Static Hashing.

F. TEXT BOOKS

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	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Introduction to data structures, Algorithm Specifications, How to Write Algorithms	define data structure and list various data structure.	Lecture	CS2130.1	Class Quiz End Term
2.	Performance Analysis- Time and Space Complexity, Asymptotic Analysis, Example , Functions in 'C', Example Programs on Functions	analyze time complexity of simple algorithms.	Lecture	CS2130.1 CS2130.1	Class Quiz Home Assignments I Sessional End Term
3.	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	CS2130.1 CS2130.2	Class Quiz Home Assignments I Sessional End Term
4.	Sorting Algorithms – Selection Sort, Bubble Sort and Insertion Sort	construct searching and sorting algorithms and write programs using single dimensional arrays.	Lecture	CS2130.2	Class Quiz Home Assignments I Sessional End Term

5.	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	CS2130.1 CS2130.2	Class Quiz Home Assignments I Sessional End Term
6.	Example Programs on Two Dimensional Arrays, Row Major and Column Major Representation	apply knowledge on two dimensional arrays in writing programs.	Lecture	CS2130.2 CS2130.3	Class Quiz Home Assignments I Sessional End Term
7.	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	CS2130.1 CS2130.2	Class Quiz Home Assignments I Sessional End Term
8.	Dynamic Memory Allocation: Dynamic Array creation, Dynamic structure creation.	apply knowledge on pointers in writing programs.	Lecture	CS2130.1 CS2130.2	Class Quiz Home Assignments I Sessional End Term
9.	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.	Tutorial	CS2130.3	Class Quiz Home Assignments I Sessional End Term
10.	Problems solving by students on array	structure mapping and model a given real world problem into array.	Tutorial	CS2130.3	Class Quiz Home Assignments I Sessional

					End Term
11.	Linked List : Introduction, Basic Terminologies, Advantages over Arrays, Applications, Structures in 'C', Example Programs on Structures and pointer to Structure	describe linked list data structure, disadvantages of array based storage and need of linked list data structure, develop structures in 'C' and dealing it with pointers.	Lecture	CS2130.1 CS2130.2	Class Quiz Home Assignments I Sessional End Term
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	CS2130.1 CS2130.2	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	CS2130.1 CS2130.2	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	CS2130.1 CS2130.2	Class Quiz Home Assignments I Sessional End Term
15.	Doubly Linked List : Introduction, Operations	understand and implement doubly linked list storage structure and basic operations (insertion, deletion and searching) defined over it.	Lecture	CS2130.1 CS2130.2	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	CS2130.3	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	CS2130.3	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	CS2130.3	Class Quiz Home Assignments I Sessional End Term
19.	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/ Expert-Lecture	CS2130.1 CS2130.2	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/ Expert-Lecture	CS2130.1 CS2130.2	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	CS2130.3	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	CS2130.3	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	CS2130.3	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	CS2130.3	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	CS2130.3	Class Quiz Home Assignments II Sessional End Term
26.	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	CS2130.1 CS2130.2	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	CS2130.1 CS2130.2	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	CS2130.1 CS2130.2	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	CS2130.3	Class Quiz Home Assignments II Sessional End Term
30.	Trees : Introduction , Basic Terminology, Types of Trees, Binary Search Tree : Creation, : Searching an Element , Insertion of Node	describe about binary tree (BT), tree-terminology, types of BT, creation of Binary Search Tree, search operations	Lecture	CS2130.1 CS2130.2	Class Quiz Home Assignments II Sessional End Term
31.	Binary Search Tree : Deletion of Node, Determining Height	describe about deletion of a node in BST and computing height	Lecture	CS2130.2	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	CS2130.2	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	CS2130.1 CS2130.2	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	CS2130.1 CS2130.2	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	CS2130.2	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	CS2130.1 CS2130.2	Class Quiz Home Assignments End Term
37.	B and B+ Trees	Applications of B and B+ Trees, Construction of B and B+ Trees, Insertion and Deletion of nodes in B and B+ Trees	Lecture	CS2130.1 CS2130.2	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	CS2130.3	Class Quiz Home Assignments End Term
39.	Problems solving by students on tree and its use	construct heap from given sequence of values and implement priority queue	Tutorial	CS2130.3	Class Quiz Home Assignments End Term
40.	Graphs : Introduction, Basic Terminology, Applications,	describe representation of graph in term of adjacency matrix with their complexity	Lecture	CS2130.1 CS2130.2	Class Quiz

	Representation of Graphs : Adjacency Matrix Representation				Home Assignments End Term
41.	Representation of Graphs : Adjacency List Representation	describe representation of graph in term of adjacency list with their complexity	Lecture	CS2130.1 CS2130.2	Class Quiz Home Assignments End Term
42.	Graph Traversal : Breadth First Traversal, Depth First Traversal	conceptualize on the various methods of graph traversal and understand the concept of Queue and Stack data structure	Lecture	CS2130.2	Class Quiz Home Assignments End Term
43.	Minimum Spanning Tree, Prims Algorithm, Kruskal's Algorithm	understand the application of graph such as TSP problem	Lecture	CS2130.2	Class Quiz Home Assignments End Term
44.	Shortest Path Algorithms: Dijkstra's Algorithm, Floyd's Algorithm	understand the application of graph such as computer networking(Routing System)	Lecture	CS2130.2	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	CS2130.3	Class Quiz Home Assignments End Term
46.	Problems solving by students on graph algorithms	find MST using Prims Algorithm and Kruskal's Algorithm for a given graph	Tutorial	CS2130.3	Class Quiz Home Assignments End Term
47.	Sorting : Introduction, Bubble Sort, Insertion Sort	describe the concept of sorting with various sorting algorithm	Lecture	CS2130.1 CS2130.4	Class Quiz Home Assignments

					End Term
48.	Sorting (Continued) : Quick Sort, Merge Sort	describe the application of sorting such as medical monitoring	Lecture	CS2130.1 CS2130.4	Class Quiz Home Assignments End Term
49.	Sorting (Continued) : Radix Sort , Heap Sort	describe the concept of priority queue with the help of heap sort	Lecture	CS2130.1 CS2130.4	Class Quiz Home Assignments End Term
50.	Hashing : Introduction, Applications, Hash Functions	describe different hashing techniques/functions	Lecture	CS2130.1 CS2130.5	Class Quiz Home Assignments End Term
51.	Hash Collisions, Collision Resolution : Open Addressing, Chaining	describe different collision resolving techniques with examples	Lecture	CS2130.1 CS2130.5	Class Quiz Home Assignments End Term
52.	Problems solving by students on soring and its application	develop program for searching and sorting	Tutorial	CS2130.3	Home Assignments 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
CS2130.1	Illustrate use of various linear data structures	3	2										2	2		
CS2130.2	Illustrate use of various non-linear data structures like trees and graph.	3	1	2									2	2		
CS2130.3	Select and Apply appropriate data structures to solve a specified problem		1	3									2	3		
CS2130.4	Compare various standard techniques of searching, sorting, and hashing.	1	3	2									2	3		

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT
Department of Computer Science and Engineering
Course Hand-out
Data Structures and Algorithm Lab | CS 2130 | 1 Credit | 0 0 2 1
ssion: July 20 – Nov 20 | Faculty: Ms. Shikha Mundra | Dr. Prakash Ramani
| Mr. Harish Sharma | Dr. Mahesh Jangid | Class: III Semester

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

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

[2130.1] Recall basic concepts required to implement data structures.
[2130.2] Apply linear and nonlinear data structures to solve a specified problem.
[2130.3] Experiment with various standard techniques for searching and sorting.
[2130.4] Build various application using appropriate data structure.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. Assessment Plan:

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

E. SYLLABUS

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

F. TEXT BOOKS

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

G. REFERENCE BOOKS

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

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

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

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

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

H. LAB PLAN

Lec No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1.	**Arrays**	Programs based on 1-D array operations	Lab	CS2130.1 CS2130.2 CS2130.3	Internal Evaluation Home Assignments External Evaluation
2.		Programs based on 2-D array operations	Lab	CS2130.1 CS2130.2 CS2130.3	Internal Evaluation Home Assignments External Evaluation
3.		Programs based on 2-D array operations with pointer notations	Lab	CS2130.1 CS2130.2	Internal Evaluation Home Assignments External Evaluation
4.	**Linked List**	Programs to implement singly linked-list list operations	Lab	CS2130.2	Internal Evaluation Home Assignments External Evaluation
5.		Programs to implement Circular Linked list and Doubly-linked list operations	Lab	CS2130.2	Internal Evaluation Home Assignments External Evaluation
6.	**Stacks**	Programs to implement stack and its operations	Lab	CS2130.2 CS2130.4	Internal Evaluation Home Assignments External Evaluation
7.		Programs based on implementation of stack	Lab	CS2130.2 CS2130.4	Internal Evaluation Home Assignments External Evaluation
8.	**Queue**	Programs based on implementation of queue and its operations	Lab	CS2130.2 CS2130.4	Internal Evaluation Home Assignments External Evaluation
9.	**Tree**	Programs to implement tree and its operations	Lab	CS2130.2	Internal Evaluation Home Assignments External Evaluation
10.		Programs based on implementation of trees	Lab	CS2130.4	Internal Evaluation Home Assignments External Evaluation
11.	**Graph**	Programs to implement graph and its operations	Lab	CS2130.2	Internal Evaluation Home Assignments External Evaluation

12.		Programs based on implementation of graphs	Lab	CS2130.4	Internal Evaluation Home Assignments External Evaluation
13.	**Sorting and Searching**	Programs to perform sorting using different sorting techniques over data	Lab	CS2130.3 CS2130.4	Internal Evaluation Home Assignments External Evaluation

Course Articulation Matrix: (Mapping of COs with POs)

CO	**STATEMENT**	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS2130.1	Recall basic concepts required to implement data structures.	3											2	3		
CS2130.2	Apply linear and nonlinear data structures to solve a specified problem.	1	2	3									2	2		
CS2130.3	Experiment with various standard techniques for searching and sorting.		3	2									2	3		
CS2130.4	Build various application using appropriate data structure.	1	1	3									3	3		

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science and Engineering

Course Hand-out

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

Session: August – December_20

Faculty: Manu Srivastava

Class: B.Tech III Semester

A. Introduction: 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 are as follows:

- 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 paradigm 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
- To educate students how to provide various types of inheritance and polymorphism using classes and interfaces
- To introduce students about the role of modern programming constructs such as exceptions in modern programming languages
- To teach students about the basic of Multithreading and Event handling

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

[2104.1]. Explain the concepts of object-oriented programming such as encapsulation, abstraction, and inheritance

[2104.2]. Describe classes and interface to demonstrate the concepts of encapsulation and abstraction.

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

[2104.4]. Recall and operate various collection data structure using Java's collection framework

[2104.5]. Define, apply, and illustrate the use of advanced programming constructs/features such as [2104.6] exception handling, multithreading, and event handling in real-life programming domains.

[2104.6]. Student will be able to reconstruct a real world problem in the form of various collaborating classes and objects.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM OUTCOMES

[PO.1]. **Engineering knowledge**: : Apply the knowledge of basic science and fundamental computing in solving complex engineering problems

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

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

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

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

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

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

[PO.8]. 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

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

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

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

D. Assessment Plan:

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

E. SYLLABUS

The History and Evolution of object-oriented technology: benefits of object-oriented programming (OOP), application of object-oriented programming (OOP), introduction to object-oriented programming language like Java, C# and C++. **Programming Fundamentals**: Control flow statements, operators, datatypes, Type conversion, Wrapper Classes, Arrays. **Introduction to classes**: Class fundamentals, declaring objects, Assigning Object reference variables, Introduction to methods, Constructors, Method Overloading, objects as parameters, argument passing, returning objects, recursion, access control, final, nested and inner classes. **I/O Basics**: Reading Console Input, Writing Console Output, Files handling. **Inheritance**: base and derived class, multilevel hierarchy, access modifier in inheritance, method overriding, abstract classes. **Exception Handling**: Exception types, creating exception, Try Catch construct, Throw and throws keyword. **Multithreaded programming**: Creating and running threads, synchronise methods, inter thread communication, suspending, resuming and stopping thread.

F. TEXT BOOKS

- Core Java Volume I—Fundamentals (11th Edition), By Cay Horstmann, Prentice Hall, ISBN-, 9780135167199 Year(8|18)

G. REFERENCE BOOKS

1. Object-Oriented Programming in Java: A Graphical Approach (Preliminary Edition), By KE Sanders and AV Dam, Pearson Education, ISBN-10:0321245741, ISBN-13:978-0321245748, Year 2015
2. Java Concepts (6th Edition), Bt Cay horstmann, Wiley India, ISBN- 78-0-470-50947-0, (Year:2010)
3. Java**:** The Complete Reference (11th Edition), By Herbert Schildt, McGraw Hill Education, ISBN-9781260440249

H. Lecture Plan:

Lectures	Topics	Session Outcome	Mode of	Corresponding	Mode Of
1.	Introduction and Course Hand-out briefing			NA	
2.	C, C++ and Java Comparison, Java Byte Code ,Java Buzzwords, Java SE 8	Recall the concept of C and understand advantage of java		1304.1	Mid Term I, Quiz & End Term
3.	Lexical issues, java keywords	Explain different java keyword and their purpose	Lecture	1304.1	Mid Term I, Quiz & End Term
4.	OOP Programming, First Simple program	Illustrate simple programming construct and run simple java program	Lecture, Practice questions	1304.1	Mid Term I, Quiz & End Term
5.	Control Statements	Compare and Construct different control flow statements	Lecture, Practice questions	1304.1	Mid Term I, Quiz & End Term
6.	Operators	Define different operators and their working	Lecture, Practice questions	1304.1	Mid Term I, Quiz & End Term
7.	Tutorial	Apply the concept of control flow statements and loops in programming	Practice questions	1304.1	Mid Term I, Quiz & End Term
8.	Primitive Types, Floating point, Characters, Booleans	Explain different data types	Lecture	1304.1	Mid Term I, Quiz & End Term
9.	Literals, Variables, Type Conversion and casting, wrapper classes , Boxing and Unboxing	Demonstrate the conversion of one data type to other	Lecture, Practice questions	1304.1	Mid Term I, Quiz & End Term
10.	1D Arrays, 2D Array, multi dimension Array, Variable Length Array	Illustrate the use of array and varag methods	Lecture, Practice questions	1304.1	Mid Term I, Quiz & End Term
11.	Tutorial	Built different type of array and solve programming problem using arrays	Activity	1304.1	Mid Term I, Quiz & End Term
12.	Class Fundamentals, Declaring Objects	Demonstrate the use of class and relationship between class and real world object	Lecture, Practice questions	1304.2 & 1304.6	Mid Term I, Quiz & End Term
13.	Methods in Classes, returning values, parameterized methods	Illustrate the use of methods and develop different kind of function	Lecture, Practice questions	1304.2 & 1304.6	Mid Term I, Quiz & End Term
14.	Constructors, parameterized constructors	Show the working of constructor	Lecture, Practice questions	1304.2 & 1304.6	Mid Term I, Quiz & End Term

15.	This keyword, This Constructor, Constructor Chaining	Explain flow of control among constructor and summarize variable hiding	Lecture, Practice questions	1304.2	Mid Term I, Quiz & End Term
16.	Tutorial	Analyse real world scenario and experiment with different classes	Activity	1304.2	Mid Term I, Quiz & End Term
17.	Garbage Collection, finalize() method	Understand how memory is freed from object	Lecture	1304.2	Mid Term I, Quiz & End Term
18.	Overloading Methods, Using Objects as parameters, Argument passing, Returning Objects	Understand polymorphism and experiment with different scenario of overloading	Lecture, Practice questions	1304.2	Mid Term I, Quiz & End Term
19.	Recursion, Access Control	Illustrate the working of different access modifier	Lecture, Practice questions	1304.2 & 1304.3	Mid Term I, Quiz & End Term
20.	Tutorial	Analyse real world scenario and experiment with different classes	Practice questions	1304.2	Mid Term I, Quiz & End Term
21.	Static, final keyword	Explain static and final keywords	Lecture, Practice questions	1304.2 & 1304.3	Mid Term II, Quiz & End Term
22.	Nested and Inner class	Demonstrate the use of inner class and relationship with real world object	Lecture, Practice questions	1304.2 & 1304.3	Mid Term II, Quiz & End Term
23.	Tutorial	Experiment with different access modifier and inner class	Practice questions	1304.2 & 1304.3	Mid Term II, Quiz & End Term
24.	Using Command line arguments ,I/O Basics, reading Console Input and Writing Console Output	Illustrate different input mechanism	Flipped classroom	1304.1 & 1304.2	Mid Term II, Quiz & End Term
25.	PrintWriter Class, Scanner Class			1304.1 & 1304.2	Mid Term II, Quiz & End Term
26.	reading and Writing Files, Closing files			1304.1 , 1304.2 &1304.5	Mid Term II, Quiz & End Term
27.	Inheritance Basics, Using Super, Creating multilevel Hierarchy	Demonstrate the concept of generalization and specialization	Lecture, Practice questions	1304.3	Mid Term II, Quiz & End Term
28.	Method overriding, Dynamic method dispatch, Using Abstract class, using final with Inheritance			1304.3	Mid Term II, Quiz & End Term
29.	Tutorial			1304.3	Mid Term II, Quiz & End Term

30.	Packages, Access protection, Importing packages, static import	Built their own package show how to use predefine package	Lecture, Practice questions	1304.3	Mid Term II, Quiz & End Term
31.	Interfaces, default Interface methods	Demonstrate the use of interface and relationship between interface and real world object	Lecture, Practice questions	1304.3	Mid Term II, Quiz & End Term
32.	Comparator and comparable interface			1304.3	Mid Term II, Quiz & End Term
33.	static methods in interfaces			1304.3	Mid Term II, Quiz & End Term
34.	Tutorial			1304.3	Mid Term II, Quiz & End Term
35.	Fundamentals, Exception types, Uncaught Exceptions, check uncheck Exception	Understand the concept of exception and demonstrate different handling mechanism	Lecture, Practice questions	1304.2 & 1304.6	Mid Term II, Quiz & End Term
36.	Using try and catch, multiple catch clauses, nested try statements			1304.2 & 1304.6	Mid Term II, Quiz & End Term
37.	Throw, throws, finally, built-in exceptions, creating own exception Sub classes			1304.2 & 1304.6	Mid Term II, Quiz & End Term
38.	Tutorial			1304.5	Mid Term II,
39.	Thread Model: thread priorities, synchronization, messaging	Understand the concept of parallel programming and Experiment with multi thread model	Lecture, Practice questions	11304.2 & 1304.6	Quiz & End Term
40.	main thread, creating single thread and multiple threads, using isAlive(), join()			1304.2 & 1304.6	Quiz & End Term
41.	Interthread communication, suspending, resuming and stopping threads, using multithreads			1304.2 & 1304.6	Quiz & End Term
42.	Tutorial			1304.5	Quiz & End Term
43.	String class and it's methods	Illustrate the use of string and experiment with different string methods	Flipped classroom	1304.4	Quiz & End Term
44.	Character extraction, comparision, searching and modifying			1304.4	Quiz & End Term
45.	String Buffer Class			1304.4	Quiz & End Term
46.	Collection framework, Arraylist	Recall different user define data structure and experiment with pre define java class to implement data structure	Lecture, Practice questions	1304.4	Quiz & End Term
47.	LinkList, HashMap,Vector			1304.4	Quiz & End Term
48.	Making own generics class			1304.4	Quiz & End Term
49.	Tutorial			1304.4	Quiz & End Term

B. 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
CS 2104.1	Students will be able to explain and describe how to compile and execute a simple as well as complex Java Application using Command Based Interface as well as using Eclipse Tool.	**2**	**1**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**-**	**-**
CS 2104.2	Students will be able to design and apply the concepts of encapsulation and abstraction using class, objects and interfaces.	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**2**	**-**	**-**
CS 2104.3	Students will be able to describe and Demonstrate various inheritance and polymorphism forms using Java Classes and Interfaces.	**3**	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**3**	**-**	**-**
CS 2104.4	Students will be able to recall and operate various collection data structure such as linked lists, queues, stacks using Java's collection framework	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**2**	**-**	**-**
CS 2104.5	Student will be able to define, apply and illustrate the use of advanced programming constructs/features such as exception handling, multithreading and event handling in real-life programming domains.	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**3**	**-**	**-**
CS2104.6	Student will be able to reconstruct a real world problem in the form of various collaborating classes and objects.	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**2**	**1**	**1**	**2**	**3**	**-**	**-**

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

MANIPAL UNIVERSITY JAIPUR

SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
COURSE HAND-OUT

CS2131 OBJECT ORIENTED PROGRAMMING LAB ||| 1 Credits|| [0 0 2 1]
Session: August-December-2020 | Faculty NAME: Mr. MANU SHRIVASTAVA|| CORE

A. Introduction:

This course will 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

[CS1304.1]:	Identify basic programming construct of java language
[CS1304.2]:	Identify and develop different classes based on real world scenario.
[CS1304.3]:	To identify and experiment with different class to demonstrate polymorphism and inheritance and exception handling model
[CS1304.4]:	Understand Multi-threading Model and built classes to demonstrate multi-threading programming
[CS1304.5]:	Analyse real world problem and model Graphical user interface to solve problem

C PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM 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 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]. 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 CSE program, the student:

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	To Be Decided	
End Term Exam (Summative)		
	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

Control statements and arrays, Stacks and Lists, Strings, Classes and methods, Inheritance, Packages, Interfaces, Exception Handling, Threads, Input/Output, Event Handling, Applets, involving AWT, Programs involving AWT.

F TEXT BOOK

Java: The Complete Reference (9th Edition), By Herbert Schildt, McGraw Hill Education, ISBN-10:0071808558, ISBN-13: 978-0071808552

G REFERENCE

Java Concepts (4th Edition), Bt Cay horstmann, Wiley India, ISBN-10:0471697044, ISBN-13:978-0471697046, (Year:2005)

H . Lecture Plan

Lec No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**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	CS1304.1	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	CS1304.1 CS1304.2	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	CS1304.2 CS1304.3	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	CS1304.2 CS1304.3	Continuous Evaluation, project, End Term
9-10	Multithreading in Java	Illustrate multithreading programming and solve real world problem using multithreading model	Lecture Demonstration	CS1304.2 CS1304.3 CS1304.4	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	CS1304.2 CS1304.3 CS1304.5	Continuous Evaluation, project, 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
[CS1304.1]:	Understand basic programming construct of java language	1				1								1		
[CS1304.2]:	Identify and develop different classes based on real world scenario.	1	1	1		1								1		
[CS1304.3]:	To identify and experiment with different class to demonstrate polymorphism and inheritance and exception handling model	1	2	2	1	1								2		
[CS1304.4]:	Understand Multi-threading Model and built classes to demonstrate multi-threading programming	1	2	2	1	1								2		
[CS1304.5]:	Analyse real world scenario and model Graphical user interface to solve problem	1	2	2	1	1								2		

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science & Engineering
Course Hand-out

Design & Analysis of Algorithm | CS1501| 4 Credits | 3 1 0 4

Session: Aug 20 – Nov 20 |Dr. Sandeep Chaurasia| Mr. Tarun Jain |Mr. Manu Shrivastava | Mr. Satpal Singh | Class: V CSE
Session: Aug 20 – Nov 20 |Dr. Pratistha Mathur| Class: V IT
Session: Aug 20 – Nov 20 |Dr. Manoj Sharma | Dr. Geeta | Class: V CCE

Course Coordinator: Dr. Sandeep Chaurasia

A. Introduction: This course aims to discuss various techniques for designing efficient algorithms and analyse their complexity and performance. The course is intended to provide the students an experience in algorithm design and to emphasize both the practical as well as the mathematical formulation 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

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

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

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

D. 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; ~~**Trees: B-Tree Red Black Tree;**~~ **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]

E. Text Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, *"Computer Algorithms"*, 2nd Edition, University Press, 2008.
2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, *"Introduction to Algorithms*", 3rd Edition, MIT press, 2010.

F. Reference Book:

A. V. Aho, J. E. Hopcroft and J. D. Ullman, "*The Design and Analysis of Computer Algorithms*", 1st Edition, Pearson Education, 2002.

G. Web Reference :

To be Shared with lecture material.

H. Lecture Plan:

Lec #	TOPICS	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Introduction to Algorithms, Specification of Algorithm, Complexity	Slides / Black Board	1501.1	Quiz 1 and Sessional-I and End-Sem
2.	Asymptotic Notation- Analysis of Algorithms	Slides / Black Board	1501.1	Quiz 1 and Sessional-I and End-Sem
3.	Time & Space Complexity – Hands-on	Slides / Black Board	1501.1	Quiz 1 and Sessional I and End-Sem
4.	Insertion Sort and Analysis, QA-Discussions	Slides / Black Board	1501.1	Quiz 1 and Sessional-I and End-Sem
5.	Selection Sort and Bubble Sort Analysis, QA-Discussions	Slides / Black Board	1501.1	Quiz 1 and Sessional-I and End-Sem
6.	Divide and Conquer: Merge Sort and Analysis, QA-Discussions	Slides / Black Board	1501.2	Quiz 1 and Sessional-I and End-Sem
7.	Quick Sort and Analysis,	Slides / Black Board	1501.2	Quiz 1 and Sessional-I and End-Sem
8.	Master Theorem and its cases	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
9.	Randomized Quick sort Analysis	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
10.	Heap Sort - Insertion, Deletion – Analysis	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
11.	Heap Sort- Priority Queue	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
12.	Heap - Insertion, Deletion – Analysis	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
13.	Strassen's Matrix Multiplication	Slides / Black Board	1501.2	Quiz 2 and Sessional-I and End-Sem
14.	Greedy Paradigm - Introduction, Coin Change Problem	Slides / Black Board	1501.3	Quiz 3 and Sessional-I and End-Sem
15.	Job Sequencing with deadline, Interval Scheduling Problem (Given as Assignment)	Slides / Black Board	1501.3	Quiz 3 and Sessional-I and End-Sem
16.	Knapsack-problem,	Slides / Black Board	1501.3	Quiz 3 and Sessional-I and End-Sem
17.	Optimal Merge tape, Huffman Encoding	Slides / Black Board	1501.3	Quiz 3 and Sessional-I and End-Sem

18.	Spanning Trees - MST	Slides / Black Board	1501.3	Quiz 3 and Sessional-1 and End-Sem
19.	Prim's, Algorithm	Slides / Black Board	1501.3	Quiz 3 and Sessional-2 and End-Sem
20.	Kruskal's Algorithm	Slides / Black Board	1501.3	Quiz 3 and Sessional-2 and End-Sem
21.	Dijkstra's Algorithm-SSSP	Slides / Black Board	1501.3	Quiz 3 and Sessional-2 and End-Sem
22.	Graph Search Algorithm - BFS/ DFS	Slides / Black Board	1501.3 & 1501.5	Quiz 4 and Sessional-2 and End-Sem
23.	Topological Sort,	Slides / Black Board	1501.3 & 1501.5	Quiz 4 and Sessional-2 and End-Sem
24.	Bellman Ford Algorithm	Slides / Black Board	1501.3 & 1501.5	Quiz 4 and Sessional-2 and End-Sem
25.	Connected Components, Bi-connected Components	Slides / Black Board	1501.3 & 1501.5	Quiz 4 and Sessional-2 and End-Sem
26.	Introduction to Dynamic Programming-	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
27.	Top Down Fibonacci, Binomial Coefficient	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
28.	Bottom up Binomial Coefficient, Dynamic Knapsack,	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
29.	Longest Integer Sequence, Longest Common Subsequence	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
30.	Multi-Stage Graph	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
31.	Floyd Warshal Algorithm – All pair of shortest path	Slides / Black Board	1501.3	Quiz 5 and Sessional-2 and End-Sem
32.	Matrix Chain Multiplication	Slides / Black Board	1501.3	Quiz 6 and Sessional-2 and End-Sem
33.	TSP- DP method	Slides / Black Board	1501.3	Quiz 6 and Sessional-2 and End-Sem
34.	OBST-Optimal Binary Search Tree **(Assignment)**	Slides / Black Board	1501.3	Quiz 6 and Sessional-2 and End-Sem
35.	Backtracking Intro – Problems	Slides / Black Board	1501.4	Quiz 6 and Sessional-2 and End-Sem
36.	Graph Coloring, M-Graph Coloring	Slides / Black Board	1501.4	Quiz 6 and Sessional-2 and End-Sem
37.	Sum of Subset Problem	Slides / Black Board	1501.4	Quiz 6 and End-Sem
38.	N-Queen Problem	Slides / Black Board	1501.4	Quiz 6 and End-Sem

39.	**Sudoku Game - Design & Implementation (Given as an assignment)**	Slides / Black Board	1501.4	Quiz 6 and End-Sem
40.	Branch & Bound – Knapsack (Skip)	Slides / Black Board	1501.4	Quiz 6 and End-Sem
41.	Branch & Bound - Job Assignment	Slides / Black Board	1501.4	End-Sem
42.	15 Puzzle Problem **(Given as an assignment)**	Slides / Black Board	1501.4	End-Sem
43.	Branch & Bound – TSP	Slides / Black Board	1501.4	End-Sem
44.	String Matching – Meaning and Application	Slides / Black Board	1501.5	End-Sem
45.	Naïve String Matching, Rabin Karp Algorithm **(Assignment)**	Slides / Black Board	1501.5	End-Sem
46.	Knuth-Morris-Pratt (KMP) Algorithm	Slides / Black Board	1501.5	End-Sem
47.	Randomization & Approximation Algorithm (Prime Number)	Slides / Black Board	1501.5	End-Sem
48.	Introduction to complexity classes – P, NP, NP Hard & NP Complete.	Slides / Black Board	1501.5	End-Sem

I. Course Evaluation (Tentative): As per DOA guidelines

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 (Accumulated and Averaged)	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.

J. Make-up Policy: As per University Norms

K. Chamber Consultation: online as per Instructor

L. Notice: Via email/ Teams/WhatsApp (Use University Microsoft Account)

M. Consultancy Hours: *To be Announced later*

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

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

Lab Manual
Design and Analysis of Algorithms
Course Code: CS1530
Semester-V

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology
Department of Computer Science & Engineering
Lab Hand-out
Design & Analysis of Algorithm | CS1530| 1 Credits | 0 0 2 1

Session: Aug 20 – Nov 20 |Dr. Sandeep Chaurasia| Mr. Tarun Jain |Mr. Manu Shrivastava | Mr. Satpal Singh | Class: V CSE
Session: Aug 20 – Nov 20 |Dr. Pratistha Mathur| Class: V IT
Session: Aug 20 – Nov 20 |Dr. Manoj Sharma | Dr. Geeta | Class: V CCE

Course Coordinator: Dr. Sandeep Chaurasia

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] Illustrate basic concepts of various algorithm and their complexities.
   [CS1530.2] Select and/or apply appropriate algorithm to solve real life problems and assess the trade-offs involved in the design choices also calculate the running time complexity.
   [CS1530.3] Demonstrate and analyze various paradigms such as greedy, divide and conquers approach to enhance their skills, also used in sorting algorithms like merge sort, heap sort and quick sort etc and analyses of different cases.
   [CS1530.4] Demonstrating dynamic programming, backtracking and graph-based techniques to enhance entrepreneurship skills.
   [CS1530.5] Developing employability skills to solve various application based on different designing approach

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 CSE program, the student:

[PSO.1] Will be able to identify the existing open problems in the field of computing Science and propose the best possible solutions.
[PSO.2] Will be able to apply knowledge of AI, Machine Learning and Data Mining in analyzing big data for extracting useful information from it and for performing predictive analysis.
[PSO.3] Will be able to design, manage and secure wired/ wireless computer networks for transfer and sharing of information.

5. **ASSESSMENT PLAN:**

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous Assessments	70
External Exam(Summative)	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.	

6. **SYLLABUS**

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

7. **Text Books:**

1. E. Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms", 2nd Edition, University Press, 2008.
2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, "Introduction to Algorithms", 3rd Edition, MIT press, 2010.

8. **Reference Book:**

A. V. Aho, J. E. Hopcroft and J. D. Ullman, "The Design and Analysis of Computer Algorithms", 1st Edition, Pearson Education, 2002.

9. **Web Reference:**

Share with lab sessions.

10. **LAB PLAN**

Lab No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1.	**Searching**	Programs based on Iterative Binary Search & Recursive Binary Search.	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
2.	**Sorting**	Programs to implement Insertion Sort & Selection Sort.	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
3.	**DAC Sorting**	Programs to implement Merge Sort & Quick Sort.	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
4.	**Heap & Priority Queue**	Programs to implement sorting a given list of elements in ascending order using the following sorting methods. HeapSort – MAX Heap and MIN Heap & programs based on Priority Queue.	Lab	CS1530.1 CS1530.3	Internal Evaluation Home Assignments External Evaluation
5.	**Greedy method**	Programs to implement knapsack problem using greedy method.	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation

6.	**Greedy method-Graph**	Programs to implement the single source shortest path problem using greedy method. (Dijkstra's).	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation
7.	**Greedy method-Spanning Trees**	Programs to implement Prim's & Kruskal's algorithms.	Lab	CS1530.4 CS1530.2	Internal Evaluation Home Assignments External Evaluation
8.	**Graph Traversal**	Programs to implement Breadth first search & Depth first search traversal algorithms.	Lab	CS1530.4 CS1530.2	Internal Evaluation Home Assignments External Evaluation
9.	**Dynamic Programming**	Write a program to implement Fibonacci series dynamic programming using top-down & bottom up approach algorithms.	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation
10.	**Dynamic Programming**	Write a program to implement longest integer sequence LIS & longest common subsequence.	Lab	CS1530.4	Internal Evaluation Home Assignments External Evaluation
11.	**Dynamic Programming**	Write a program to implement Binomial Coefficient & travelling sales person problem using Dynamic Programming.	Lab	CS1530.4 CS1530.5	Internal Evaluation Home Assignments External Evaluation
12. 1	**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 CS1530.5	Internal Evaluation Home Assignments External Evaluation

13.	**Randomization**	Write a program to implement Randomized Quick sort & Graph Coloring Problem.	Lab	CS1530.5 CS1530.4	Internal Evaluation Home Assignments External Evaluation

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

12. **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
[CS1530.1]	Illustrate basic concepts of various algorithm and their complexities.	2	1										2	1		
[CS1530.2]	Select and/or apply appropriate algorithm to solve real life problems and assess the trade-offs involved in the design choices also calculate the running time complexity.		1	2									2	3		
[CS1530.3]	Demonstrate and analyze various paradigms such as greedy, divide and conquers approach to enhance their skills, also used in sorting algorithms like merge sort, heap sort and quick sort etc and analyses of different cases.		1	2									2	2		
[CS1530.4]	Demonstrating dynamic programming, backtracking and graph-based techniques to enhance entrepreneurship skills.		1	2									2	3		
[CS1530.5]	Developing employability skills to solve various application based on different designing approach		1	2									2	3		

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science & Engineering
Course Hand-out

Software Engineering| CS 1502 | 4 Credits | 3 1 0 4

Session: July 20- Nov 21 | Faculty: Dr. Neha Chaudhary | V Sem

A. Introduction: The aim of this course is to enable a clear understanding and knowledge of the foundations, techniques, tools and processes in the area of software engineering and its practices followed in software industry. The course will prepare students to apply engineering methods and processes on software projects.

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

[CS 1502.1] Describe basic concept related to software engineering Methods, tool, Process Model and use them in software project.

[CS 1502.2] Apply different Estimation Techniques based on project Metrics, Measures and indicators

[CS 1502.3] Design software and architecture at different detail levels based on requirements for software projects

[CS 1502.4] Select appropriate Testing methods and their procedures for any project

[CS 1502.5] Improve entrepreneurship skills by understanding quality of software projects based on software quality assurance techniques.

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

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	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.	
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: The Evolving Role of Software, The changing nature of software, Legacy software, Software Myths, Software Engineering: A Layered Technology, A Process Framework, umbrella activities, measures, metrics, indicators, The Capability Maturity Model Integration (CMMI), Specialized Process Models, The Unified Process; Agile development: Agile Process Models Software Engineering Practice, Communication Practice, Planning Practices, Modeling Practices, Construction Practice, Deployment Computer–Based Systems, The System Engineering Hierarchy, Business Process Engineering: An Overview; Product Engineering: An Overview, Data Modeling Concepts, Object Oriented Analysis, Flow-Oriented Modeling, Taxonomy of Quality Attributes, Perspectives of Quality, Quality System, Software Quality Assurance, Capability Maturity Model Observation on Estimation, The Project Planning Process, Software Scope and Feasibility, Human Resources, Empirical Estimation Model

F. TEXT BOOKS

T1. Pressman R, Software Engg. Practioner Approach (MGH), 2006

T2. Jalote Pankaj, An integrated approach to Software Engineering (Narosa)

T3. Rajib Mall, Introduction to Software Engineering, TMH

G. REFERENCE BOOKS

R1. Sommerville, Software Engineering 10e, Pearson

Lecture Plan:

S.NO	Topics as per the university and syllabus	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
		Introduction to software engineering	To explain teachers expectations and understand student expectations	**Lecture**	NA	NA
1.	Introduction	Software, Emergence of software engineering, evolving role of software, The changing nature of software.	Define role and nature of software	**Lecture**	[1502.1]	Class Quiz Mid Term - I End Term
2.		Legacy software, Software Myths, Software crisis.	Analyze types of software and myths associated with them.	**Lecture**	[1502.1]	Class Quiz Mid Term - I End Term
3.		Introduction to software engineering: Layered Approach, Generic approach, Process Framework.	Recall software engineering layered approach and process framework	**Lecture**	[1502.1]	Class Quiz Mid Term - I End Term
4.		The process, software products, Software Characteristics, Applications.	Recall software products, Software Characteristics, Applications.	**Lecture**	[1502.1]	Class Quiz Mid Term - I End Term
5.	Models	Software development life cycle, Assessment Model-CMMI	**Appraise s**oftware development life cycle, Assessment Model-CMMI	**Lecture**	[1502.1]	Class Quiz-1 Mid Term - I End Term
6.		Process Models- Conventional Process Model (Traditional Waterfall Model, prototype, RAD)	**Choose between** process Models	**Lecture**	[1502.1]	Class Quiz Mid Term - I End Term
7.		Evolutionary Process Model (Incremental Model, Spiral models, Component based process model, unified process model), Comparison of various models	**Compare** Evolutionary Process Model	**Lecture**	[1502.1]	Class Quiz Mid Term - I End Term

8.	Agile development	An Agile view of process, Human Factors	Define agile view of process	**Lecture**	[1502.1]	Class Quiz Mid Term - I End Term
9.		Agile Process Models (Extreme programming, Adaptive Software Development, Dynamic System Development method)	Apprise Agile process models and its adaptive software development using Extreme programming	**Lecture**	[1502.1]	Class Quiz Mid Term - I End Term
10.		Agile process Models (Scrum, Crystal, Feature Driven Development, Agile Modeling)	Assess agile process Models (Scrum, Crystal, Feature Driven Development, Agile Modeling)	**Lecture**	[1502.1]	Class Quiz Mid Term - I End Term
11.		Case study Based on Agile Model	Build systems based on Agile Model	**Lecture/Lab**	[1502.1]	Class Quiz Mid Term - I End Term
12		Test Driven Development	TDD,TDD and traditional testing, documentation, Test-driven database development, Scaling TDD via Agile Model-Driven Development (AMDD)	**Lecture/Lab**	[1502.1]	Class Quiz Mid Term - I End Term
13.		Examples on TDD				
14.	Requirements Analysis and specification	Requirement Engineering, Type of requirements, Software requirements specifications	Illustrate methods of Requirement Engineering, Type of requirements, Software requirements specifications	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - I End Term
15.		Software Engineering Practice (elicitation, analysis, documentation, validation, Management)	Explain Software Engineering Practice (elicitation, analysis, documentation, validation, Management)	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - I End Term

16.	Estimation Techniques	Size estimation- LOC Estimation	Evaluate the size of project and estimation- size of project using LOC Estimation	**Lecture/Lab**	[1502.2]	Class Quiz Mid Term - II End Term
17.		Function Count Method	Apply Function Count method	**Lecture/Lab**	[1502.2]	Class Quiz Mid Term - II End Term
18.		Cost Estimation	Apply Cost Estimation techniques in software projects	**Lecture/Lab**	[1502.2]	Class Quiz Mid Term - II End Term
19.		Halstead Size Estimation	Evaluate software project using Halstead Size Estimation	**Lecture/Lab**	[1502.2]	Class Quiz Mid Term - II End Term
20.		Effort Estimation-COCOMO Model	Effort Estimation- using COCOMO Model	**Lecture/Lab**	[1502.1]	Class Quiz Mid Term - II End Term
21.	Software designing	Analysis Modeling: Data Modeling, Functional modeling and information flow, Data flow diagrams	Apply Analysis Modeling: Data Modeling, Functional modeling and information flow, Data flow diagrams	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
22.		Behavioral Modeling; The mechanics of structured analysis: Creating entity/ relationship diagram	Apply Behavioral Modeling; The mechanics of structured analysis: Creating entity/ relationship diagram	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
23.		Data flow model, control flow model, the control and process specification; The data dictionary	Design Data flow model, control flow model, the control and process specification; The data dictionary	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
24.		Unified modeling language – an introduction, Discussion on Class diagrams, Object diagrams, Sequence diagrams, use case diagram.	Apply Unified modeling language and develop UML Diagrams	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
25.		Case Study Based on Software Design	Develop Case Study Based on Software Design	**Flipped Classroom**	[1502.3]	Class Quiz Mid Term - II End Term

26.	System Design	Design concepts and principles, the design process	Design concepts and principles and show design process	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
27.		Design and software quality, design principles	Relate design and software quality, design principles	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
		Design concepts: Abstraction, refinement, modularity	Recall concept of Abstraction, refinement and modularity	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
28.		software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding	Develop software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
29.		Effective modular design: Functional independence, Cohesion, Coupling	Appraise effective modular design: Functional independence, Cohesion, Coupling	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
30.	Architecture Design	Software architecture: Data Design: Data modeling, data structures, databases and the data warehouse.	Develop Software architecture: Data Design: Data modeling, data structures, databases and the data warehouse.	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
31.		Analyzing alternative Architectural Designs ,architectural complexity;	Analyzing alternative Architectural Designs ,architectural complexity;	**Lecture/Lab**	[1502.3]	Class Quiz Mid Term - II End Term
32.	Software testing	Software Testing Techniques, software testing fundamentals (Software re-engineering, reverse engineering, restructuring, forward engineering).	Analyze Software Testing Techniques, software testing fundamentals	**Lecture/Lab**	[1502.4]	Class Quiz Mid Term - II End Term
33.		Functional Testing(black Box): Boundary value analysis	Experiment with functional Testing(black Box): Boundary value analysis	**Lecture/Lab**	[1502.4]	Class Quiz Mid Term - II End Term

34.		Equivalence class Testing,	Apply Equivalence class Testing,	**Lecture/Lab**	[1502.4]	Class Quiz Mid Term - II End Term
35.		Decision table based testing	Make use of Decision table based testing	**Lecture/Lab**	[1502.4]	Class Quiz Mid Term - II End Term
36.		Structural Testing (White box) : Path testing	Experiment with Structural Testing (White box) : Path testing	**Lecture/Lab**	[1502.4]	Class Quiz Mid Term - II End Term
37.		Cyclomatic Complexity	Evaluate Cyclomatic Complexity	**Lecture/Lab**	[1502.4]	Class Quiz Mid Term - II End Term
38.		Graph Matrices	Examine Graph Matrices for testing	**Lecture/Lab**	[1502.4]	Class Quiz Mid Term - II End Term
39.		Data Flow Testing	Make use of Data Flow Testing	**Lecture/Lab**	[1502.4]	Class Quiz Mid Term - II End Term
40.		Unit testing, Integration Testing, System Testing, Validation Testing, Testing Tools (Static Testing tools, Dynamic Testing tools, characteristics of Modern tools).	Develop test cases using different methods	**Lecture/Lab**	[1502.4]	Class Quiz Mid Term - II End Term
41.		Debugging: Debugging techniques, Debugging Approaches, Debugging Tools.	Choose Debugging tools and techniques	**Lecture/Lab**	[1502.4]	Class Quiz End Term
42.		Software re-engineering, reverse engineering, restructuring, forward engineering.	Apply concepts of Software re-engineering, reverse engineering, restructuring, forward engineering.	**Lecture/Lab**	[1502.4]	Class Quiz End Term
43.		Case Study based on Software Testing	Take part in Case Study based on Software Testing	**Flipped Classroom**	[1502.4]	Class Quiz End Term
44.	Software Quality Assurance, Software Maintenance	Quality concepts, Software quality assurance ,	Apply Quality concepts, Software quality assurance , SQA activities, Software reviews	**Lecture**	[1502.5]	Class Quiz End Term

45.		SQA activities, Software reviews	Recall Formal technical reviews and Formal approaches to SQA.	**Lecture**	[1502.5]	Class Quiz End Term
46.		Statistical software quality assurance; software reliability: Measures of reliability and availability, The ISO 9000 Quality standards	Explain Statistical software quality assurance and ISO 9000 Quality standards	**Lecture**	[1502.5]	Class Quiz End Term
47.		Characteristics of software maintenance, Software maintenance processes model	Identify characteristics of software maintenance, Software maintenance processes model	**Lecture**	[1502.5]	Class Quiz End Term
48		Case Study based on Software Quality Assurance and Software Maintenance	Take part in Case Study based on Software Quality Assurance and Software Maintenance	**Flipped Classroom**	[1502.5]	Class Quiz End Term
	Total	48 lectures				

H. Course Articulation Matrix: (Mapping of COs with POs and 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
1502.1	[1502.1]. Describe basic concept related to software engineering Methods, tools , Process Model and use them in software project.		2	1	1	1				2	3	1	3	3		
1502.2	[1502.2]. Apply different Estimation Techniques based on project Metrics, Measures and indicators	1	3	2	2	3					3	3		3		
1502.3	[1502.3]. Design software and architecture at different detail levels based on requirements for software projects		3	2	3	3				3	3	3	3	3		
1502.4	[1502.4]. Demonstrate the Testing methods and their procedures to implement in any project		2	1	3	3					3	1		3		
1502.5	[1502.5]. Assess quality of software projects based on software quality assurance techniques.		1	2	2	2					3	2		3		

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

I. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1502.1	Describe basic concept related to software engineering Methods, tool, Process Model and use them in software project.															
1502.2	Apply different Estimation Techniques based on project Metrics, Measures and indicators															
1502.3	Design software and architecture at different detail levels based on															

	requirements for software projects															
1502.4	Demonstrate the Testing methods and their procedures to implement in any project															
1502.5	Improve entrepreneurship skills by Assess quality of software projects based on software quality assurance techniques.															

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

MANIPAL UNIVERSITY JAIPUR

SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
COURSE HAND-OUT
SOFTWARE ENGINEERING LAB|| CS-1532|| 1 Credits|| [0 0 2 1]
Session: JULY-NOV-2020 | Faculty NAME: Dr. Neha Chaudhary

A. Introduction:

The aim of Software Engineering Lab is to impart state-of-the-art knowledge on Software Engineering and UML. The subject will introduce the concept of Software development life cycle. Student will learn Rational Rose Software, Load Runner and Selenium tool

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

[CS1532.1]: Improve Entrepreneurship skills by understanding software projects and applying concepts of UML

[CS1532.2]: Assess project parameters by applying estimation techniques.

[CS1532.3]: Apply methods of requirement analysis, develop SRS and detail design.

[CS1532.4]: Develop Project based on requirements.

[CS1532.5]: Design of test cases based on software requirement and software design.

C PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PROGRAM 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 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]. 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 CSE program, the student:

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Weekly evaluation (record+execution+viva)	50
	Mini project	20
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

Introduction to Unified Modeling Language (UML 2.0), Use case diagrams, Class diagram, Object diagram, Activity diagram, sequence diagram, component diagram, deployment diagram, state chart diagram, ER Diagrams and DFD Designing Test Cases, Mini-Projects
& Case Studies.

F TEXT BOOK

1. R. S. Pressman, “Software Engineering: A Practitioners Approach”, 7 th Edition, TMH, 2016.

G REFERENCE

1. W. Boggs and M. Boggs, “Mastering UML with Rational Rose with CDROM” SYBEX Inc., Alameda, CA, USA, 1999.

H . Lecture Plan

Lec No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	**Mode of Assessing the Outcome**
1-2	Identifying the Requirements from Problem Statements	Identify functional and non-functional requirements from a given problem statement	Lecture/ Demonstration	**[CS1532.1]**	Continuous Evaluation, Project
3	Estimation of Project Metrics	Estimate cost, effort and duration for a software project	Lecture Demonstration	**[CS1532.5]**	Continuous Evaluation, Project
5-6	Modeling UML Use Case Diagrams and Capturing Use Case Scenarios, Modeling UML Class Diagrams and Sequence diagrams	Develop Use Case Diagrams & Sequence diagrams	Demonstration	**[CS1532. 2]**	Continuous Evaluation, Project
7	E-R Modeling and Statechart and Activity Modeling from the Problem Statements	Construct E-R Modeling, Statechart and Activity Modeling	Lecture Demonstration	**[CS1532.2]**	Continuous Evaluation, project, End Term
8-9	Coding & Development	Develop project based on requirements and detail design	Lecture Demonstration	**[CS1532.3]**	Continuous Evaluation, project, End Term
10	Estimation of Test Coverage Metrics and Structural Complexity	Estimation of Test Coverage Metrics and Structural Complexity	Lecture Demonstration	**[CS1532. 4] [CS1532. 5]**	Continuous Evaluation, project, End Term
11-12	Designing Test Suites	hands-on experience on Load Runner and Selenium testing tool.	Lecture Demonstration	**[CS1532. 4]**	Continuous Evaluation, project, 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
[CS1532.1]:	Apply concepts of UML to design Use Case Diagrams	1	2	3	1	2								3		
[CS1532.2]:	Do requirement analysis, develop SRS and detail design.	1	2	3	1	1								3		
[CS1532.3]:	Develop Project based on requirements.	1	3	3	1	1								3		
[CS1532.4]:	Design of test cases based on requirement and design with the help of testing tools	1	2	2		3								3		
[CS1532.5]:	Do estimation of project parameters.	1	2	2	1	1								3		

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science & Engineering
Course Hand-out

Automata & Compiler Design | CS 1505 | 4 Credits | 3 1 0 4

Session: July '20 – December '20 | Faculty: Dr. Rishi Gupta, Dr. Satyabrata Roy, Dr. Ankit Shrivastava, Mr. Virender Dehru, Mr. Rohit Kumar Gupta | Class: Department Core Course

A. **Introduction:** The objective of this course is to make the students familiar with the fundamental area of computer science which will enable the students to focus on abstract models of computation. The course exposes students to the computability theory, as well as to the complexity theory. The goal is to allow them to answer fundamental questions about problems, such as whether they can or cannot be computed. The objective is also to make the students familiar with the language processors 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 answer in detail about how a compiler works and how it reports to its users various types of errors.

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

[1505.1]. Classify alphabet, strings, language and build regular expression and use these concepts to construct finite automata.

[1505.2]. Compare the characteristics of different types of formal languages and grammars as mentioned in Chomsky Hierarchy and to build push down automata.

[1505.3]. Determine the type of computational problems and examine the decidability of them by constructing Turing machines and propose an optimal abstract model that can be applied to a suitable real life problem.

[1505.4]. Check the performance of each phase of a compiler and compare the working principles of different types of parsers.

[1505.5]. Construct optimized compiler using various type checking rules and concepts of storage organizations, thus developing optimized compiler construction skill.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Quiz	15
	Assignments	15
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction: Automata Theory: Mathematical Preliminaries and Notation :Review of set theory, function, relation; Finite Automata: Deterministic and Non Deterministic Finite Automata (FA), Regular languages, Mealy and Moore machine; Regular Sets and Regular Grammars: Chomsky Hierarchy, Regular Expressions, Regular Grammar and FA, Pumping Lemma for Regular Languages; Context Free Languages (CFL) and Grammars: Ambiguity, Methods for Transforming Grammars; Push Down Automata: Nondeterministic Pushdown Automata (NPDA), Design of NPDA, PDA and CFLs; Introduction to Turing machine; Introduction to Compiler Design: Structure of a Compiler; Lexical Analysis, Recognition of Tokens; Introduction to LR Parsing: Simple LR, More Powerful LR Parsers Generators; Syntax Directed Translations; Type Checking: Rules for Type Checking, Storage Organization.

F. Text Books

T1. An Intorduction to Formal Languages and Automata – Peter Linz, Jones and Bartlett Student Edition, Fifth Edition, 2010.

T2. Compilers : Principles, Techniques and Tools – A. Aho, J. Ullman, M. S. Lam, R. Sethi, Pearson Education, 2nd Edition, 2007.

G. Reference Books

R1. Introduction to the Theory of Computation – Michael Sipser, Cengage Learning, Third Edition, 2012.

R2. Introduction to Languages and the Theory of Computation – John Martin, Tata McGraw Hill, Fourth Edition, 2010.

R3. Introduction to Automata Theory, Languages and Computations – J. E. Hopcroft, R. Motwani, J. Ullman, Pearson Education, 3rd Edition, 2006.

H. Online Lecture Plan:

Lec No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1	Mathematical Preliminaries and Notation, Review of set theory	Understand basics of set theory, groups, relations, functions.	Online Lecture	NA	NA
2	Function, relation, Three Basic Concepts i.e. string, sentence and languages	Understand basics of set theory, groups, relations, functions.	Online Lecture	NA	In Class Quiz (Not Accounted)
3-8	Design of Deterministic Finite Automata (DFA), Minimization of DFA	Introduction to automata theory and finite state machines	Online Lecture, Practice questions	1505.1	Home Assignment Mid Term I End Term
9-10	Design of FA with output: Mealy and Moore machine and their equivalence	Understand the design principles of Mealy and Moore machines	Online Lecture, Practice questions	1505.1	In Class Quiz Home Assignment Mid Term I End Term
11-12	Equivalence of DFA and NDFA, Removal of null moves from FA	Understanding the basic difference between DFA and NDFA and realising the importance of NDFA	Online Lecture, Practice questions	1505.1	In Class Quiz Home Assignment Mid Term I End Term
13	Chomsky Hierarchy of Grammar and Formal Languages	Understand the notations and properties of formal languages and grammar, compare different types of languages and their grammars according to Chomsky Hierarchy	Online Lecture, Practice questions	1505.2	In Class Quiz Home Assignment Mid Term I End Term
14-21	Regular Languages: Construction of Regular Expressions, equivalence of Regular Expressions and Finite Automata, equivalence of regular grammar and finite automata, Identifying non-regular languages and Pumping Lemma for regular languages	Understand the properties of regular languages and equivalence between FA and RE, FA and regular grammar. Apply pumping lemma to identify non-regular languages.	Online Lecture, Practice questions	1505.2	In Class Quiz Home Assignment Mid Term I End Term
22-25	Ambiguity in CFGs, Derivation trees, Simplification of CFGs, CNF and GNF, Pumping Lemma for CFGs	Understand the properties of CFLs, normal forms of CFGs. Apply pumping lemma to identify non-CFLs.	Online Lecture, Practice questions	1505.2	In Class Quiz Home Assignment Mid Term I End Term
26-31	Design of PDA, Types of PDA, Equivalence of PDA: NPDA and DPDA, Conversion of PDA and CFGs.	Design pushdown automata and understanding the properties of it variants. Equivalence between PDA and CFGs.	Online Lecture, Practice questions	1505.1 1505.2	In Class Quiz Home Assignment Mid Term II End Term

32-35	Introduction to Turing machines, design of Turing machines, properties of recursive and recursively enumerable languages, decidability.	Design of Turing machines, application of Turing machines and understanding the properties of recursive and recursively enumerable languages. Understanding whether a given problem is decidable	Online Lecture, Practice questions	1505.2 1505.3	In Class Quiz Home Assignment Mid Term II End Term
36-38	Introduction to compilers, structure and phases of a compiler, lexical analysis phase of a compiler	Summarize the structure and roles of each phase of a compiler. Illustrate the role of a lexical analyser.	Flipped Classroom	1505.4	In Class Quiz Home Assignment Mid Term II End Term
39-46	Introduction to syntax analysis and parsing, computing FIRST and FOLLOW, LR(0), SLR(1), CLR(1) and LALR(1) parsing	Develop and compare the working principles of different types of parsers.	Online Lecture, Practice questions	1505.4	In Class Quiz Home Assignment Mid Term II End Term
47-50	Introduction to Syntax directed translations, S-attributes, I-attributes and L-attributes, Building annotated trees	Understand and develop syntax directed translation scheme and annotated trees	Online Lecture, Practice questions	1505.4 1505.5	In Class Quiz Home Assignment End Term
51-52	Type Checking: Rules for Type Checking, Storage Organization.	Understanding concepts of type checking and its various rules. Summarize the storage organization.	Flipped Classroom	1505.4 1505.5	In Class Quiz Home Assignment 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
[CS1505.1]	Illustrate alphabet, strings, language and build regular expression and applying these concepts to construct finite automata.	**3**	**2**	**1**									**2**	**3**		
[CS1505.2]	Compare the characteristics of different types of formal languages and grammars as mentioned in Chomsky Hierarchy and to build push down automata.	**1**	**2**	**3**	**1**								**1**	**1**		
[CS1505.3]	Determine the type of computational problems and examine the decidability of them by constructing Turing machines and propose an optimal abstract model that can be applied to a suitable real life problem.	**1**	**3**	**3**	**1**								**1**	**2**		
[CS1505.4]	Inspect the performance of each phase of a compiler and compare the working principles of different types of parsers.	**1**	**2**	**2**									**1**	**1**		
[CS1505.5]	Develop optimized compiler construction skills using various type checking rules and concepts of storage organizations.	**1**	**2**	**3**									**1**	**2**		

MANIPAL UNIVERSITY
JAIPUR

SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
COURSE HAND-OUT

AUTOMATA AND COMPILER DESIGN LAB || CS1535|| 1 Credits|| [0 0 2 1]
Session: JULY-NOV-2020 | Faculty Name: Dr. Satyabrata Roy, Dr. Ankit Srivastava, Dr. Rishi Gupta|| CORE

A. Introduction:

This course is meant to provide an understanding of design of abstract models of computation, the language translation peculiarities by designing complete translator for mini language. Students would learn to use two language processing tools LEX and YACC.

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

[CS1535.1]:	Design finite automata, Mealy machine and Moore machines.
[CS1535.2]:	Understand language processing system.
[CS1535.3]:	Implement different phases of a compiler.
[CS1535.4]:	Develop parser designing skill for any given language.
[CS1535.5]:	Make use of the LEX and YACC tools.

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 CSE program, the student:

[PSO.1] Will be able to design, develop and implement efficient software for a given real life problem.
[PSO.2] Will be able to apply knowledge of AI, Machine Learning and Data Mining in analyzing big data for extracting useful information from it and for performing predictive analysis.
[PSO.3] Will be able to design, manage and secure wired/ wireless computer networks for transfer and sharing of information.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous evaluation (Record + Execution + Viva)	50
	Mid – Term Lab Evaluation	20
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 finite automata systems in gcc compiler/eclipse platform; Implementation of lexical analyser in gcc compiler/eclipse platform; Computation of FIRST and FOLLOW for different types of parsing techniques; Demonstration and use of LEX and YACC tools for compiler design; Mini-Projects & Case Studies.

F. Text Books

T1. An Intorduction to Formal Languages and Automata – Peter Linz, Jones and Bartlett Student Edition, Fifth Edition, 2010.

T2. Compilers : Principles, Techniques and Tools – A. Aho, J. Ullman, M. S. Lam, R. Sethi, Pearson Education, 2nd Edition, 2007.

G. Reference Books

R1. J. R Levine, T. Mason and D. Brown, "lex & yacc", 2 nd Edition, O' Reilly Publishing, 1992.

H . Lecture Plan

Lec No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1-2	Introduction and simulation of the behaviours of some sample DFA, Mealy machines and Moore machines	• To acquaint and clear teachers expectations and understand student expectations • Implementing the behaviour of DFA	Lecture Demonstration at system	CS1535.1	Continuous Evaluation End Term Examination
3-4	• Context Free Grammars and Push Down Automata • Introduction to lexical analyser	• Understand normalization of CFGs • Design PDA • Construct lexical analyser.	Lecture Demonstration at system	CS1535.1 CS1535.2	Continuous Evaluation End Term Examination
5-6	• Computing FIRST and FOLLOW for CFGs. • Symbol table implementation	• Understand parsers. • Design symbol table.	Lecture Demonstration at system	CS1535.1 CS1535.2 CS1535.3	Continuous Evaluation End Term Examination
7-14	Demonstrate the use of LEX and YACC	Demonstrate lexical analysis and syntax analysis using tools.	Lecture Demonstration at system	CS1535.1 CS1535.2 CS1535.3	Continuous Evaluation Project End Term Examination

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES			
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
[CS1535.1]	Design finite automata, Mealy machine and Moore machines.	3		3	1									2			
[CS1535.2]	Understand language processing system.	3	3	3	1	2								3			
[CS1535.3]	Implement different phases of a compiler.	1	1		1	2								3			
[CS1535.4]	Develop parser designing skill for any given language.	3	3	3	2	2								2			
[CS1535.5]	Make use of the LEX and YACC tools.	3		1										3			

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science Engineering

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

Session: August, 2020 – Nov, 2020 | Faculty: Mr. Saket Acharya, Mr. Amit Kumar Bairwa| Dr. Anshuman Kalla Class: V Semester

A. Introduction:

This course is to provide students with the fundamental concepts and techniques used for communicating data in efficient and reliable manner. The student will be able to understand and describe various encoding techniques, flow & error control mechanisms and 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

[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.

[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.

[1504.3]: Develop skills pertaining to error detection and correction techniques in order to find and overcome error encountered during transmission and discuss flow control and error control techniques.

[1504.4]: Discuss and distinguish between different types of multiplexing techniques and spread spectrum techniques.

[1504.5]: Identify and compare various generations of wireless cellular networks.

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

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

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

PO6. **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.

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 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.

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 multidisciplinary 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)

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	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	Students who misses a class will have to report to the teacher about the	

(Formative)	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

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.

F. Text Books

1. W. Stallings, "Data and Computer Communications", 9th Edition, Pearson Education, 2010

G. Reference Books

1. B. Forouzan, "Data communication & networking" Fifth Edition. TMH, 2012.
2. L. Peterson and T. Davie "*Computer Networks: A Systems Approach*" Fifth Edition, Morgan Kaufmann Publishers, 2012.
3. R. Stevens, *"TCP/IP Illustrated*", Addison-Wesley Publication, 2011.

H. Lecture Plan

Lecture No.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Data, Data Communication, Data Network, Internet	Define the significance of relevant terminologies, Layered Architecture and	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.	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 and Signals	Explain the transmission of digital & analog signals over different types of transmission media and characteristics of Analog and Digital Transmission	Lecture	[1504.1]	Class Quiz Mid Term - I End Term
7.	Analog and Digital Transmission		Lecture	[1504.1]	Class Quiz Mid Term - I End Term
8.	Attenuation, Delay Distortion, Noise	Identify and comprehend various transmission impairments and its effects	Lecture & Problem Solving Practice	[1504.1]	Class Quiz Mid Term - I End Term

9.	Data Rate and Nyquist Bandwidth	Define and understand significance of Channel Capacity	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.	Twisted Pair & CAT Types	Identify and distinguish various Transmission Media: Guided Transmission Media	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.	Antennas , Terrestrial Microwave	Explain the principles of Wireless Transmission	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.	Ground Wave Propagation, Sky Wave Propagation	Identify and explain wireless propagation modes	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.	Free Space Loss	Explain the principles of Line-of-sight Propagation	Lecture & Problem Solving Practice	[1504.2]	Class Quiz Mid Term - I End Term
18.	Atmospheric Absorption, Multipath, Refraction		Lecture	[1504.2]	Class Quiz Mid Term - I End Term
19.	Analog and Digital Signals, Line Coding Schemes: Unipolar, Polar	Identify and distinguish various Signal Encoding Techniques: Digital-To-Digital Conversion	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.	ASK & FSK	Explain the principles of Digital Data – Analog Signal and draw the respective waveforms	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.	Pulse Code Modulation	Explain the principles of Analog Data – Digital Signal and draw the respective waveforms	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.	Asynchronous and Synchronous Transmission	Apply the knowledge of various error detection and correction techniques in order to find and overcome error encountered during 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.	Framing	Data Link Control Protocols: Discuss flow control and error control techniques.	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
39.	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.	Introduction to Multiplexing	Discuss and distinguish between different types of multiplexing techniques	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.	The Concept of Spread Spectrum	Principles of spread spectrum techniques and in particular CDMA technique	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.	Introduction, Generations: 1G, 2G, 3G,	Identify and compare various generations of wireless cellular networks.	Lecture	[1504.5]	End Term
52.	4G, and 5G		Lecture	[1504.5]	End Term

I. Course Articulation Matrix (Mapping of COs with POs and PSOs) for Data Communications:

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
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	1	2	

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	2	
1504.3	Develop skills pertaining to 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
1504.4	Distinguish between different types of multiplexing techniques and spread spectrum techniques.	2								1	2			2	2	
1504.5	Identify and compare various generations of wireless cellular networks.	2						1					1	1	2	

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT

Department of Computer Science and Engineering
Course Hand-out

Linux System and Shell Programming | CS 1551 | 3 Credits | 3 0 0 3

Session: July - Nov 2020 | Faculty: Dr. Sunita Singhal | Class: V Semester DE-1

A. **Introduction:** This course explains the structure of the Unix/Linux operating system and how to write system and network programs. The course covers the details of the file system, terminal and device input/output, multi-tasking, interprocess communication, and network programming. Theory is presented in the context of how Unix/Linux implements the ideas.

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

[1551.1]. Figure out how most Linux commands work and write system programs for implementing general file system utilities, process trees, internal data structures of operating systems, input/output redirection & for handling signals.

[1551.2]. Design, write and test programs to improve skills on inter-process communication that uses pipe, socket API and Remote procedure calls.

[1551.3]. Apply employability based concepts related to concurrency to achieve the same for cooperating processes.

[1551.4]. Include their own driver in kernel code, recompile it and boot from their kernel.

[1551.5]. Write advanced shell scripts.

[1551.6]. Develop projects like Shell, Network File System, File Transfer Protocol and other network applications for entrepreneurship and 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 Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	15
	Sessional Exam II (Closed Book)	15
	Quizzes and Assignments (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.	
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

Fundamentals: Processes in Linux, Process system calls, Background processes and daemons, Linux I/O, Device terminology, I/O system calls, select and poll Functions, Filters and redirection, Linux File system navigation, Directory access, File system implementation, Hard links and symbolic links;

Asynchronous events: Basic signal concepts, generating signals, manipulating signal masks and signal sets, Catching, and ignoring signals, Waiting for signals, Handling signals, Programming with asynchronous I/O, POSIX times, Sleep functions.

Inter-process communication: Named and unnamed pipes, Sockets, Remote procedure calls, Network file system; **Concurrency:** POSIX thread attributes, Synchronization functions, Mutex locks, Condition variables, Signal handling and threads;

Character device driver development: Driver concepts, Writing character drivers, Interrupt handling, Interfacing with hardware;

Shell scripting: Shell scripts with the help of variables, Loops, Conditional statements, Command line arguments, test command, expr command, Interactive scripts with read, Functions & file manipulations, Regular expression & filters;

Advanced scripting techniques: Providing command line options to scripts, exporting variables, Arrays, Remote shell execution, connecting to MySQL using shell, Essential System Administration jobs, Debugging using GDB, make utility, Customizing the environment.

F. TEXT BOOKS

T1. W. R. Stevens and S. A. Rago, "*Advanced Programming in the UNIX Environment*", 3rd Edition, Addison-Wesley, 2013.

T2. S. Das, "*Unix Concepts and Applications*", 4th Edition, McGraw Hill, 2006.

G. REFERENCE BOOKS

R1. W. R. Stevens and B. Fenner, *"UNIX Network Programming, Volume 1: The Sockets Networking API*", 3rd Edition, Pearson Education, 2003.

R2. W. R. Stevens, *"UNIX Network Programming, Volume 2: Interprocess Communications*", 2nd Edition, Pearson Education, 1998.

R3. K. A. Robbins and S. Robbins, "*Unix Systems Programming: Communication, Concurrency, and Threads*", 2nd Edition, Prentice Hall, 2004.

R4. M. Bach, "*Design of Unix Operating System*", PHI.

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	Processes in Linux, Process system calls, Background processes and daemons	Describe kernel data structures for process, syntax of process system calls, write system programs for creating different process trees	Lecture	1551.1	Quiz MTE-1 End Term Programming Assignment
4,5	Linux I/O, Device terminology, I/O system calls, select and poll Functions	Describe I/O system calls routines, device independence, Identify in-memory data structures after execution of system calls	Lecture	1551.1	Quiz MTE-1 End Term Programming Assignment
6,7,8	Filters and redirection, Linux File system navigation, Directory	Figure out how linux commands work and able to write system	Lecture	1551.1	Quiz MTE-1 End Term

	access, File system implementation, Hard links and symbolic links	programs for the same			
9,10	Basic signal concepts, Generating signals, Manipulating signal masks and signal sets, Catching and ignoring signals, Waiting for signals, Handling signals, Programming with asynchronous I/O, POSIX times, Sleep functions	Identify the effect of signals related to process group and write system programs for catching signals	Lecture	1551.1	Quiz MTE-1 End Term Programming Assignment
11,12,13	Inter-process communication: Named and unnamed pipes	Identify the kernel data structures on execution of pipe and mkfifo system calls and write IPC programs using them	Lecture	1551.2 1551.6	Quiz Mid Term 1 End Term Programming Assignment Project
14,15,16,17,18	UDP Sockets, Iterative TCP Sockets, Concurrent TCP Sockets, Remote procedure calls, SUN RPC	Design, write and test programs that use the POSIX socket API and Remote procedure calls.	Lecture	1551.2 1551.6	In Class Quiz MTE-1 End Term Project
19, 20, 21	Network file system	Configure NFS, describe its implementation, develop their own NFS code	Lecture	1551.6	In Class Quiz MTE-2 End Term Project
22,23,24,25,26	POSIX thread attributes, Synchronization functions, Mutex locks, Condition variables Signal handling and threads	Apply concepts related to concurrency to achieve the same for cooperating processes	Lecture	1551.3	Class Quiz Mid Term 2 End Term Programming Assignment
27,28,29,30	Character device driver development: Driver concepts, Writing character drivers, Interrupt handling, Interfacing with hardware	Include their own driver in kernel code, recompile it and boot from their kernel	Lecture Self-Study	1551.4 1551.6	Class Quiz End Term Project
31,32,33,34	Shell scripts with the help of variables, Loops, Conditional statements, Commandline arguments, test command, expr command, Interactive scripts with read, Functions & file manipulations, Regular expression & filters	Recall Shell Scripts	Lecture Self-Study	1551.5	Class Quiz End Term Programming Assignment
35,36,37	Advanced scripting techniques: Providing command line options to scripts, Exporting variables, Arrays, Remote shell execution	Write advanced shell scripts	Lecture	1551.5	End Term Project
38,39,40	Connecting to MySQL using shell, Essential System Administration jobs, Debugging using GDB, make utility,	Write scripts for system administration and customizing the environment, know how to use debugger and make utility	Lecture	1551.5	End Term Project

	Customizing the environment.				

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
CS 1551.1	Figure out how most Linux commands work and write system programs for implementing general file system utilities, process trees, internal data structures of operating systems, input/output redirection & for handling signals.	2		1									1	1	1	1
CS 1551.2	Design, write and test programs for inter-process communication that uses pipe, socket API and Remote procedure calls.	3		2	1								2	1		1
CS 1551.3	Describe concepts related to concurrency and achieve the same for cooperating processes.	2	1	1									1	1	1	1
CS 1551.4	Include their own driver in kernel code, recompile it and boot from their kernel.	3				2					1	1	1	1		1
CS 1551.5	Write advanced shell scripts.	2											2	1	1	1
CS 1551.6	Develop minor projects like Shell, Network File System, File Transfer Protocol and other network applications.	3		3	1					1	1		2	2		2

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science Engineering
Course Hand-Out

Digital Image Processing| CS 1553 | 3 Credits | 3 0 0 3

Session: Aug 20 – Dec 20 | Faculty: Mr. Harish Sharma and Dr. Vivek Verma | Class: Departmental Elective

A. INTRODUCTION: This course is offered by Dept. of Computer Science Engineering as a program elective course, targeting students who wish to pursue research & development in industries or higher studies in field of Computer Science, Information Technology and Computer Communication Engineering. The objective of the course is demonstrate the various steps involved in processing of images. The students will learn various Image processing algorithms and apply them for practical automation applications like object recognition, identification, Research and analytics.

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

[1553.1] distinguish various Image Processing techniques to make successful applications related to recognition and hence increase their employability.

[1553.2] Apply Image enhancement and restoration algorithms to enhance their technical skills.

[1553.3] Analyze the use of spatial and transformation domain techniques for filtering, compression, segmentation and recognition.

[1553.4] Use image processing algorithms for practical real world applications**.**

C. PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES:

- **PO1: Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
- **PO2: Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- **PO3: 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
- **PO4: 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
- **PO5: Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
- **PO6: The engineer and society**: 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**: 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**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
- **PO9: Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- **PO10: 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
- **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 multidisciplinary 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

- **PSO1:** Will be able to design, develop and implement efficient software for a given real life problem.
- **PSO2:** Will be able to apply knowledge of AI, Machine Learning and Data Mining in analysing big data for extracting useful information from it and for performing predictive analysis.
- **PSO3:** Will be able to design, manage and secure wired/ wireless computer networks for transfer and sharing of information.

D. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Exam)	15
	Sessional Exam II (Open Book) (Handwritten Notes)	15
	Class Assignments (10), Quiz (10), Subject Project (10)	30
End Term Exam (Summative)	End Term Exam (Open Book) (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.	
Make up Assignments (Formative)	Students who miss more than 3 classes will have to report to the teacher about the absence. A makeup assignment on the topic taught on those days of absence will be given which has to be submitted within a week from date assignment given. No extensions will be given on this. The attendance for those 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 and complete the assignment, especially before a flipped classroom. 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

Prerequisites: Basic knowledge of Coordinate Geometry, Linear algebra and matrix operations.

Fundamentals of Image Processing: Steps in image processing, Image file formats, Basic relationships between pixels. Image Histogram. Colour fundamentals & models – RGB, HSI YIQ;

Image Enhancement and Restoration: Spatial domain enhancement: Point Operations-Log transformation, Power-law transformation.

Frequency domain enhancement: introduction to image transform, Fourier transform, 2D DFT. Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering;

Image Coding and Compression Lossless compression, Lossy compression, JPEG, MPEG;

Image Segmentation and Representation and descriptions: Grey level features edges and lines: Similarity and correlation, Template matching, Edge detection using templates; Representation scheme, Boundary Descriptors, Regional Descriptors;

Overview of Applications: Biometric Authentication**.**

Text Books:

1. **R. C. Gonzalez and R. E. Woods,** "Digital Image Processing", 4th Edition, Pearson Education, 2018.
2. **A.K Jain,** "Fundamentals of Digital Image Processing", Prentice Hall of India, 1994.

Reference Books:

1. **K. R. Castleman,** "Digital Image Processing", 1st Ed. Pearson Education, 2011.
2. **S. Jayaraman, S Esakkirajan, T Veerakumar,** "Digital Image Processing", Pearson Education, 2016.
3. **A. McAndrew,** "Introduction to Image processing using MATLAB", Cengage Learning Publisher, 2009.

F. Lecture Plan:

Lecture	Unit	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	**Fundamentals of Image Processing**	Introduction To Digital Image Processing And Its Applications	Student should able to identify Image Processing Applications	Lecture	1553.1	In Class Quiz Mid / End Term
2.		Steps In Image Processing	Student should able to basic Image processing steps	Lecture	1553.1	In Class Quiz Mid / End Term
3.		Image File Formats	Student should able to identify appropriate Image File format	Lecture	1553.1	In Class Quiz Mid / End Term
4.		Basic Relationships Between Pixels. Image Histogram.	Student should able to understand Image histogram and its properties	Lecture	1553.1	In Class Quiz Mid / End Term
5.		Colour Fundamentals & Models – RGB, HIS, YIQ;	Student should be able to understand different color model and conversion between them	Lecture	1553.1	In Class Quiz Mid / End Term
6.		Exercise In MATLAB / Tutorial	Student should be able to open and manipulate the image in MATLAB	Lecture /Activity	1553.1	In Class Quiz Mid / End Term
7.	**Image Enhancement and Restoration**	Spatial Domain Enhancement	Student should be able to understand the basic of spatial filtering	Lecture	1553.2	In Class Quiz Mid / End Term
8.		Laplace Filter, Average Filter, Median Filter	Student should be able to design different smoothing and sharpening filter	Lecture	1553.2	In Class Quiz Mid / End Term
9.		Point Operations-Log Transformation	Student should be able to understand significance of linear transformation	Lecture	1553.2	In Class Quiz Mid / End Term
10.		Power-Law Transformation.	Student should be able to understand significance of linear transformations	Lecture	1553.2	In Class Quiz Mid / End Term
11.		Exercise In MATLAB / Tutorial	Student should be able to implement Power law transformation in MATLAB	Activity	1553.2	In Class Quiz Mid / End Term
12.		**Research Project Discussion**	Student should be able to identify a research problem for project in the subject and start literature survey for the same.	Self-Study, Activity	1553.2	Project Activity
13.	**Frequency domain enhancement**	Introduction To Image Transforms	Student should be able to understand difference between point processing, neighbourhood processing and transformation domain processing.	Lecture	1553.3	In Class Quiz Mid / End Term
14.		Fourier Transform, 2D DFT	Student should be able to understand transformation domain filtering	Lecture	1553.3	In Class Quiz Mid / End Term
15.		Restoration: Noise Models, Type Of Noise	Student should be able to identify nature of noise distribution.	Lecture	1553.3	In Class Quiz Mid / End Term
16.		Noise Removal Methods	Student should be able to understand noise removal method	Lecture	1553.3	In Class Quiz Mid / End Term
17.		Restoration Using Inverse Filtering,	Student should be able to understand inverse filtering.	Lecture	1553.3	In Class Quiz Mid / End Term

18.		Wiener Filtering	Student should be able to formulate wiener filtering.	Lecture	1553.3	In Class Quiz Mid / End Term
19.		Exercise In MATLAB / Tutorial	Student should be able to implement and simulate frequency domain filtering.	Tutorial	1553.3	In Class Quiz End Term
20.	**Image Coding and Compression**	Introduction To Image Coding & Compression	Student should be able to understand various image encoding techniques and there relation to compression application	Lecture	1553.3	In Class Quiz End Term
21.		Lossless Compression	Student should be able to understand basics lossless compression	Lecture	1553.3	In Class Quiz End Term
22.		Lossy Compression	Student should be able to understand basics lossy compression	Lecture	1553.3	In Class Quiz End Term
23.		JPEG, MPEG	Student should be able to understand difference and significance of JPEG and MPEG	Lecture	1553.3	In Class Quiz End Term
24.		Exercise In MATLAB / Tutorial	Student should be able to implement and simulate compression impact in MATLAB	Activity	1553.3	In Class Quiz End Term
25.		**Research Project Progress Discussion**	Student should present their progress work of literature survey and start implementation of the research based project.	Presentation	1553.4	Project Activity
26.	**Image Segmentation and Representation and descriptions**	Introduction Of Image Segmentation and its Applications	Student should be able to understand the significance of image segmentation.	Lecture	1553.4	In Class Quiz End Term
27.		Grey Level Features	Student should be able to significance of grey level features.	Lecture	1553.4	In Class Quiz End Term
28.		Edges and Lines Detection	Student should be able to differentiate between line and edges.	Lecture	1553.2	In Class Quiz End Term
29.		Similarity Measures and Correlation,	Student should be able to various similarity and distance metrics	Lecture	1553.4	In Class Quiz End Term
30.		Template Matching	Student should be able to implement template matching algorithm	Lecture	1553.4	In Class Quiz End Term
31.		Edge Detection Using Templates	Student should be able to detect edge using template matching	Lecture	1553.2	In Class Quiz End Term
32.		Representation Scheme, Boundary Descriptors,	Student should be able to understand various descriptor for boundary	Lecture	1553.2	In Class Quiz End Term
33.		Regional Descriptors;	Student should be able to understand and implement region descriptor	Lecture	1553.2	In Class Quiz End Term
34.		Exercise In MATLAB / Tutorial	Student should be able to implement Image segmentation technique	Lab Activity	1553.4	In Class Quiz
35.	**Image Processing Applications**	Biometric Authentication,	Student should be able to various application of image processing in deep like biometric authentication.	Lecture	1553.4	In Class Quiz End Term
36.		**Research Project Submission / Evaluation**	Student should submit the research paper in format and present same.	Evaluation, Activity	1553.4	Project Activity

G. Course Articulation Matrix: (Mapping of COs with POs and 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
CS 1553.1	Distinguish various Image Processing techniques to make successful applications related to recognition and hence increase their employability.	2	1	2		1	1						2	1	2	
CS 1553.2	Apply Image enhancement and restoration algorithms to enhance their technical skills.	2	1	1	1	1								3	3	
CS 1553.3	Analyze the use of spatial and transformation domain techniques for filtering, compression, segmentation and recognition.	2	1	1		1								2	2	1
CS 1553.4	Use image processing algorithms for practical real world applications**.**	1	2	2	3	2		1		1	3	1	3	3	3	1

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT

Department of Computer Science and Engineering
Course Hand-out

Big Data Analytics | CS 1701 | 4 Credits | 3 1 0 4

Session: Aug 20 – Nov 20 | Faculty: Dr. Santosh Kumar Vishwakarma, Prof. Bali Devi, Prof. Priyank Singh Hada

A. Introduction: This course provides practical foundation level in big data Analytics. The course provides grounding in basic and advanced methods to big data technology and tools, including Hadoop and its ecosystem.

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

[1701.1] Understand fundamentals of Data Analytics & the need of the Big Data Analytics

[1701.2] Implement the structured lifecycle approach to data science and big data analytics projects skills.

[1701.3] Solve the industry challenges in analyzing big data applications and create statistical models that impact increase employability skills.

[1701.4] Implement various theoretical models of data analytics using the R tool/R studio

[1701.5] Use analytical platforms such as Hadoop, NoSQL DBMS software for performing advanced data analytics

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. Assessment Plan:

Criteria	Description	Date	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)		15
	Sessional Exam II (Closed Book)		15
	Quizzes and Assignments (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 in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.		

E. SYLLABUS

Introduction to big data: definition, need and evolution of BDA, applications of Big Data, **Big Data Analytics:** Analysing big data, sources of big data, characteristics of big data (4 V's), Drivers of BDA, types of data, structured vs. unstructured data, data marts, Case study based tutorial, Differences between traditional DWDM and BDA, Limitations of traditional RDBMSs to store and analyse Big Data

Data science, definition and concepts, **data scientists:** key competencies and characteristics of data scientists, More discussions on data science: data wrangling, data munging, data jujitsu, Tutorial based on data science applications, Big Data Analytics Ecosystem, **State of the Practice in Analytics:** Data Analytics Lifecycle and discussions, Roles for a Successful Analytics Project; Case Study to apply the data analytics lifecycle, Analytical databases and DW appliances; Hadoop distributions – Comparing various BDA tools

Analyzing and Exploring the Data: Challenges when managing and analyzing big data, The role of Data Virtualization in a Big Data environment; Why to visualize data. **Statistics for Model Building and Evaluation:** Statistics in the Analytic Lifecycle, Hypothesis Testing, Difference of means

Advanced Analytics – Theory and Methods Overview: K-means clustering, Association Rules, Linear Regression, Logistic Regression, Naïve Bayesian Classifiers, Tutorial based on advanced analytics, Decision Trees, Time Series Analysis, Text Analytics; Tutorial based on analytics

Big Data Platforms and Storage Options: The new multi-platform Analytical Ecosystem; Beyond the Data Warehouse - Analytical databases, Hadoop and NoSQL DBMSs

F. TEXT BOOKS

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services.

G. REFERENCE BOOKS

1. Michael Minelli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends", John wiley,2013

Lecture Plan:

Lecture No.	Sub-Topics	Session outcome	Mode of Delivery	Corresponding CO	Modes of Accessing the CO
1.	Definition, Need and evolution of BDA	Will get to know the need of the BDA	Lecture	1701.1	Mid Term I, Quiz & End Term
2.	Applications of Big Data	Analyse on various real time applications of BDA	Discussion	1701.1	Mid Term I, Quiz & End Term
3.	Analysing big data	Identify the Need of Big Data	Lecture/PPT	1701.1	Mid Term I, Quiz & End Term
4.	sources of big data, Drivers of BDA	Conclude on various Data sources	Lecture/PPT	1701.1	Mid Term I, Quiz & End Term
5.	characteristics of big data (4 V's)	List out the key characteristics of the BDA	Lecture/PPT	1701.1	Mid Term I, Quiz & End Term
6.	Types of data, structured vs. unstructured data, data marts,	Deal with variety of the data	Flipped Class	1701.1	Mid Term I, Quiz & End Term
7.	Case study based tutorial	Real time application – Discussion	Activity	1701.1	Mid Term I, Quiz & End Term
8.	Differences between traditional DWDM and BDA, Limitations of traditional RDBMSs to store and analyze Big Data,	Identify the differences between Data Mining and Data Analytics	Lecture/PPT	1701.1	Mid Term I, Quiz & End Term

9.	Data science, definition and concepts,	Would define the definition of Data Science	Flipped Classes	1701.1	Mid Term I, Quiz & End Term
10.	key competencies and characteristics of data scientists	List out the key competencies and characteristics of data scientists	Lecture	1701.2	Mid Term I, Quiz & End Term
11.	More discussions on data science: data wrangling, data munging	Define Data Wrangling and munging	Flipped Classes	1701.2	Mid Term I, Quiz & End Term
12.	data jujitsu, Tutorial based on data science applications	Work on data jujitsu	Lecture	1701.2	Mid Term I, Quiz & End Term
13.	Big Data Analytics Ecosystem,	Analyse on BDA Ecosystem	Lecture	1701.2	Mid Term I, Quiz & End Term
14.	Data Analytics Lifecycle and discussions	Explain on BDA lifecycle	Discussion	1701.2	Mid Term II, Quiz & End Term
15.	Roles for a Successful Analytics Project	Identify the key indicators to make analytics project	Lecture	1701.2	Mid Term II, Quiz & End Term
16.	Case Study to apply the data analytics lifecycle	Implement some real time issues	Activity	1701.2	Mid Term II, Quiz & End Term
17.	Analytical databases and DW appliances	Compare the DW and Analytical DB's	Flipped Class	1701.2	Mid Term II, Quiz & End Term
18.	Hadoop distributions – Comparing various BDA tools	Access the Hadoop platforms	Lecture	1701.2	Mid Term II, Quiz & End Term
19.	Challenges when managing and analyzing big data	List the challenges in BDA process.	Discussion	1701.3	Mid Term II, Quiz & End Term
20.	The role of Data Virtualization in a Big Data environment	Create Data Virtualization	Lecture/PPT	1701.3	Mid Term II, Quiz & End Term
21.	Why to visualize data	Mention the advantage of visualization	Lecture/PPT	1701.3	Mid Term II, Quiz & End Term
22.	Statistics in the Analytic Lifecycle	Will do Statistics in the Analytic Lifecycle	Lecture/PPT	1701.3	Mid Term II, Quiz & End Term
23.	Hypothesis Testing	Will perform Hypothesis Testing	Activity	1701.3	Mid Term II, Quiz & End Term

24.	Difference of means	Perform Difference of means	Activity	1701.3	Mid Term II, Quiz & End Term
25.	K-means clustering	Perform K-means clustering	Activity	1701.4	Mid Term II, Quiz & End Term
26	Association Rules	Perform Association Rules	Activity	1701.4	Mid Term II, Quiz & End Term
27	Linear Regression, Logistic Regression	Perform Linear Regression, Logistic Regression	Activity	1701.4	Mid Term II, Quiz & End Term
28	Naïve Bayesian Classifiers	Perform Naïve Bayesian Classifiers	Activity	1701.4	Mid Term II, Quiz & End Term
29	Tutorial based on advanced analytics	Will implement real time issues	Activity	1701.4	Mid Term II, Quiz & End Term
30	Decision Trees	Perform Decision Trees	Activity	1701.4	Mid Term II, Quiz & End Term
31	Time Series Analysis	Perform Time Series Analysis	Activity	1701.4	Mid Term II, Quiz & End Term
32	Text Analytics	Perform Text Analytics	Activity	1701.4	Mid Term II, Quiz & End Term
33	Tutorial based on analytics	Will implement real time issues	Activity	1701.4	Mid Term II, Quiz & End Term
34	The new multi-platform Analytical Ecosystem	Understand Analytical ecosystem	Lecture	1701.5	Quiz & End Term
35	Beyond the Data Warehouse - Analytical databases	Understand Analytical DB's	Lecture/PPT	1701.5	Quiz & End Term
36	Introduction to Hadoop and Hadoop ecosystem	Will learn basics of Hadoop	Lecture/PPT	1701.5	Quiz & End Term
37,38	Advantages of Hadoop & HDFS	Will learn basics of Hadoop file systems	Lecture/PPT	1701.5	Quiz & End Term
39,40	MAPREDUCE, Hadoop Clustering	Will learn basics of Hadoop clustering	Lecture/PPT	1701.5	Quiz & End Term

41,42,43	Ecosystem component: Oozie, Spark, Scala, ML lib, Pig, Hive, kafka, flume	Will run applications on different modern tools	Flipped Class	1701.5	Quiz & End Term
44	Hadoop Usage for Applications	Implement projects on Hadoop platform	Activity	1701.5	Quiz & End Term
45	Introduction to NoSQL Data base, Advantages of NoSQL	Will learn basics of NoSQL	Lecture	1701.5	Quiz & End Term
46, 47	Mongodb	Incur knowledge on advantages of No SQL	Lecture/PPT	1701.5	Quiz & End Term
47,48	Cassandra	Incur knowledge on No SQL	Lecture/PPT	1701.5	Quiz & End Term
50	NoSQL DBMSs projects & case studies	Incur knowledge on advantages of No SQL	Activity	1701.5	Quiz & End Term

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS 1701.1	Understand fundamentals of Data Analytics & the need of the Big Data Analytics	2	3										1	3		
CS 1701.2	Implement the structured lifecycle approach to data science and big data analytics projects skills.		3											2		
CS 1701.3	Solve the industry challenges in analyzing big data applications and create statistical models that impact increase employability.		2	2											2	
CS 1701.4	Implement various theoretical models of data analytics using the R tool/R studio				3	1									3	
CS 1701.5	Use analytical platforms such as Hadoop, NoSQL DBMS software for performing advanced data analytics					2						2		2		

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

MANIPAL UNIVERSITY JAIPUR

SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE ENGG.
COURSE HAND-OUT

BIG DATA ANALYTICS LAB || CS1730|| 1 Credits|| [0 0 2 1]
Session: JULY-NOV-2020

A. Introduction:

This course is meant to offer to computer science engineering undergraduate students in their seventh semester to have an overview in the field of Data Science and Big Data Analytics. Students will learn the basic concepts in data analytics like retrieving, visualization of the data, Hypothesis testing on the data sets using R Tool. Students will also learn the fundamentals how to design and perform basic Hadoop platform operations.

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

[CS1730.1]:	Identify and practice basic functions and commands in R Programming
[CS1730.2]:	Identify and perform different techniques in visualization of the analytical results and develop analytical skills.
[CS1730.3]:	Use of software tools for performing Hypothesis tests for data analytical problems to increase employability skills.
[CS1730.4]:	Configure the Hadoop clusters and perform map reduce concepts.
[CS1730.5]:	To identify the depth of the problem and to propose the solution.

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 Objectives

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Weekly evaluation (record+execution+viva)	50
	Mini project	20
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

Introduction to data environment accessing lab environment, database environment-retail data, census data; Introduction to R; Basic Statistics, visualization and hypothesis tests; K-means clustering; Association rules; Linear regression; logistic regression; naïve Bayesian classifier building naïve Bayesian classifier, census data; Decision trees; time series analysis with arima; HADOOP, HDFS, MAPREDUCE and PIG; In-database analytics click stream data, computation of ordered aggregates, logistic regression with MADLIB; Case study

F TEXT BOOK

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services.

2. Michael Minelli, Michele Chambers, Ambiga Dhiraj, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends”, john wiley,2013

G REFERENCE

1. Dr Mark Gardener, “Beginning R, *The Statistical Programming Language*”, 2nd Edition, John Wiley India pvt. Ltd, 2017.

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	Working with R Basic commands and visualization.	To study and implement basic functions and commands in R Programming as following: • Basic Statistics • Visualization methods using R Tool	Lecture/ Demonstration	CS1730.1 CS 1730.2	Internal Evaluation
4-10	Performing Various hypothesis tests	To perform data analytics hypothesis tests such as : Logistic, Regression, Time Series Analysis etc. in R Tool	Demonstration	CS 1730.1 CS 1730.2 CS 1730.3	Internal Evaluation Project End Sem Exam
10-14	Configure Hadoop systems and perform Map Reduce concepts	Implement the following file management tasks in Hadoop System (HDFS): Adding files and directories, retrieving files, Deleting files, Map Reduction	Lecture/ Demonstration	CS 1730.4 CS 1730.5	Internal Evaluation Project End Sem Exam

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

CO	STATEMENT	CORRELATION WITH PROGRAM 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
[CS1730.1]:	Identify and practice basic functions and commands in R Programming	2	1			2								1	2	
[CS1730.2]:	Identify and perform different techniques in visualization of the analytical results and develop analytical skills.	1	2	1	1	2									2	
[CS1730.3]:	Use of software tools for performing Hypothesis tests for data analytical problems to increase employability skills.	1	2		1	2								1		
[CS1730.4]:	Configure the Hadoop clusters and perform map reduce concepts.	1	2		2	2								1	2	
[CS1730.5]:	To identify the depth of the problem and to propose the solution.	1	1	1	1	1								1	1	

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

MANIPAL UNIVERSITY JAIPUR
SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Course Hand-out

Information System Security | CS1704 | 4 credits | [3 1 0 4]

Session: JUL 20 – DEC.20| Faculty: Dr. C.S. Lamba/ Dr. Roheet Bhatnagar / Mr. Prashant Manuja | Class: (VII Sem)

A. Introduction: This course is offered by Dept. of Computer Science, the aim of the course to provide the students basic background on information systems. This is targeting students who wish to pursue career in the field of information security. The course includes understanding the principles for multi-layer security and management systems for the network. The focus is on techniques and protocol used for different types of security policies.

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

[1704.1] Apply the concept of information system and classical cryptography.
[1704.2] To analyse the concepts of cipher algorithms with mathematical standards.

[1704.3] Conduct public key encryption with key exchange fundamentals.

[1704.4] Prepare authentication management and its relevant issues.

[1704.5] Design the applications of cryptography for information systems.

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 CSE program, the student:

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	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.	
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 – Basic objectives of cryptography, secret-key and public-key cryptography, one-way and trapdoor one-way functions, cryptanalysis, attack models, classical cryptography; **Block ciphers:** Modes of operation, DES and its variants, AES, linear and differential cryptanalysis; **Message digest:** Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions; **Public-key parameters:** Modular arithmetic, gcd, primality testing, Chinese remainder theorem, modular square roots, finite fields; **Intractable problems:** Integer factorization problem, RSA problem, modular square root problem, discrete logarithm problem, Diffie-Hellman problem, known algorithms for solving the intractable problems; **Public-key encryption:** RSA, Rabin and EIGamal schemes, side channel attacks; **Key exchange:** Diffie-Hellman and MQV; **Digital signatures:** RSA, DSA and NR signature schemes, blind and undeniable signatures; **Entity authentication:** Passwords, challenge-response algorithms, zero-knowledge protocols; **Standards:** IEEE, RSA and ISO standards.**Network security:** Certification, public-key infra-structure (PKI), secure socket layer (SSL), Kerberos; **Advanced topics:** Elliptic and hyper-elliptic curve cryptography, number field sieve, lattices and their applications in cryptography, hidden monomial cryptosystems, cryptographically secure random number generators.

F. Text Books

1. B. A. Forouzan, D. Mukhopadhyay, "*Cryptography and Network Security"*, Mc-Graw Hill, 2nd Edition, 2008.
2. W. Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, 5th edition, 2010.

3. References:

1. J. Pieprzyk, T. Hardjono, J. Seberry, Fundamentals of Computer Security, Springer International Edition, 2003.

Sr.No.	Topics to be covered	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Basic objectives of cryptography	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
2	secret-key and public-key cryptography	Understanding of different key concepts	Lecture	1704.1	Class Quiz Sessional 1 End Term
3	one-way and trapdoor one-way functions	Understanding of different functions involved in network	Flipped Class	1704.2	Class Quiz Sessional 1 End Term
4	cryptanalysis	Understanding of basic component and standards for cryptography	Lecture	1704.2	Class Quiz Sessional 1 End Term
5	attack models- Passive & active attacks	Knowledge about different attack models	Lecture and Flipped Class	1704.2	Class Quiz Sessional 1 End Term
6	classical cryptography	Understanding the working of classical cryptography	Lecture	1704.2	Class Quiz Sessional 1 End Term
7	Cipher techniques- block cipher & stream cipher	Understanding the working of substitution techniques of cipher			
8	Cipher techniques- ceaser cipher, affine cipher, vigenere cipher, playfair cipher, hill cipher, transposition technique	Understanding the working of transposition techniques of cipher			
8	Modes of operation DES and its variants	Knowledge of DES	Lecture	1704.2	Class Quiz Sessional 1 End Term
9	DES and its variants	Knowledge of DES & its variant	Lecture	1704.2	Class Quiz Sessional 1 End Term

10	AES Structure, AES Round Functions	Knowledge of AES		1704.2	Class Quiz Sessional 1 End Term
11	AES Key Expansion	Knowledge of AES & their functions	Lecture	1704.2	Class Quiz Sessional 1 End Term
12	linear and differential cryptanalysis	Knowing about cryptanalysis	Lecture / Flipped Class	1704.2	Class Quiz Sessional 1 End Term
13	Properties of hash functions	Understand the concepts of hash functions	Lecture	1704.2	Class Quiz Sessional 1 End Term
14	MD2	Recall different hash algorithms	Flipped Lecture	1704.3	Class Quiz Sessional 2 End Term
15-16	MD5	Recall different hash algorithms	Flipped Class	1704.3	Class Quiz Sessional 2 End Term
17	SHA-1	Identify SHA-1 & hash algorithms	Lecture	1704.3	Class Quiz Sessional 2 End Term
18	keyed hash functions	Explain keyed hash algorithms	Lecture	1704.3	Class Quiz Sessional 2 End Term
19	attacks on hash functions	Recall attacks on hash functions	Lecture	1704.4	Class Quiz Sessional 2 End Term
20	Modular arithmetic	Understanding of modular functions	Lecture	1704.4	Class Quiz Sessional 2 End Term
21-22	gcd, primality testing	Know about GCD & primality testing	Lecture	1704.4	Class Quiz Sessional 2 End Term
23	Chinese remainder theorem	Understanding of Chinese remainder theorem	Lecture	1704.4	Class Quiz Sessional 2 End Term
24	modular square roots, finite fields	Understanding the square roots concept	Lecture	1704.4	Class Quiz Sessional 2 End Term

25	Integer factorization problem, RSA problem	Understanding factorization Concepts	Lecture	1704.4	Class Quiz Sessional 2 End Term
26	modular square root problem	Knowing concept of modular square	Lecture	1704.4	Class Quiz Sessional 2 End Term
27	discrete logarithm problem	Knowing Concept of DLP	Lecture	1704.4	Class Quiz Sessional 2 End Term
28	Diffie-Hellman problem, known algorithms for solving the intractable problems	Understanding concept of DH problem	Lecture	1704.5	Class Quiz Sessional 2 End Term
29-30	RSA, Rabin and EIGamal schemes	Know the concept of RSA	Lecture	1704.5	Class Quiz Sessional 2 End Term
31	side channel attacks, Diffie-Hellman and MQV	Understanding the concept of side channel attacks	Lecture	1704.5	Class Quiz Sessional 2 End Term
32	RSA Signature	Understanding the RSA signature	Lecture	1704.5	Class Quiz Sessional 2 End Term
33	DSA and NR signature schemes	Understanding the concept of DH	Lecture	1704.5	Class Quiz Sessional 2 End Term
34	blind and undeniable signatures	Understanding the signature	Lecture	1704.5	Class Quiz Sessional 2 End Term
35	Passwords, challenge-response algorithms	Know the concept of CR algorithms	Lecture	1704.5	Class Quiz Sessional 2 End Term
36	zero-knowledge protocols	Know the concept of zero knowledge protocols	Lecture	1704.5	Class Quiz End Term
37	IEEE, RSA standards	Know the concept of IEEE, RSA standards	Lecture	1704.5	Class Quiz End Term

38	ISO standards	Know the concept of ISO standards	Lecture	1704.5	Class Quiz End Term
39	Certification, public-key infra-structure (PKI)	Understanding the concept of PKI	Lecture	1704.5	Class Quiz End Term
40	secure socket layer (SSL)	Understanding the concept of SSL	Lecture	1704.5	Class Quiz End Term
41	Kerberos	Understanding the concept of Kerberos	Lecture	1704.5	Class Quiz End Term
42	Elliptic and hyper-elliptic curve cryptography	Understanding the concept of ECC	Lecture	1704.5	Class Quiz End Term
43	number field sieve	Know the number field sieve	Lecture	1704.5	Class Quiz End Term
44	lattices and their applications in cryptography	Applications of cryptography	Lecture	1704.5	Class Quiz End Term
45	hidden monomial cryptosystems	Understanding of cryptosystems	Lecture	1704.5	Class Quiz End Term
46	Cryptographically secure random number generators.	Know the concept of secure random number generators	Lecture	1704.5	Class Quiz End Term

2. 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
CS 1704.1	Apply the concept of information system and classical cryptography.	3	2							1	1			2		
CS 1704.2	To analyse the concepts of cipher algorithms with mathematical standards.		3	3	2					1				2		
CS 1704.3	Conduct public key encryption with key exchange fundamentals.	3			3	2				1				3	2	
CS 1704.4	Prepare authentication management with its relevant issues.			3	2							3			2	3
CS 1704.5	Design the applications of cryptography for information systems.		3		2									3		2

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

MANIPAL UNIVERSITY JAIPUR

School of Computing & Information Technology

Department of Computer Science & Engineering
Course Hand-out

Machine Learning | CS 1750 | 3 Credits | 3 0 0 3

Session: August 20– Dec 20 | Faculty: Dr. Sandeep Chaurasia, Mr. Priyank S Hada, Ms. Anubha Parashar | Class: Department Elective VII Sem

A. Introduction: This course is offered by Dept. of Computer Science & Engineering as an 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. Offers in depth knowledge of use Machine Learning for personal purpose, handle specific topics like Reinforcement Learning, NLP and Deep Learning, handle advanced techniques like Dimensionality Reduction, know which Machine Learning model to choose for each type of problem, build an army of powerful Machine Learning models and know how to combine them to solve any problem.

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

[CS1750.1] Explain the range of machine learning algorithms along with their strengths and weaknesses.
[CS1750.2] Explain the basic theory, dataset extraction, pre-processing, processing underlying machine learning.
[CS1750.3] Perform evaluation of learning algorithms and model selection and hence enhance entrepreneurship skills.
[CS1750.4] Identify machine learning problems corresponding to different applications.
[CS1750.5] Explain the concept of transfer learning and deep learning architecture and hence improve employability skills.

C. Program Outcomes and Program Specific Outcomes

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
[PO.9]. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

The graduation from B.Tech. in Computer Science & Engineering will empower the student:

PSO 1: Will be able to design, develop and implement efficient data extraction technique.
PSO 2: Will be able to apply knowledge to select, extract features from dataset, extracting useful information from it and for performing predictive analysis.
PSO 3: Will be able to classify data on various machine learning algorithms for a given real life problem sharing of information.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Open Notes)	15
	Sessional Exam II (Open Notes)	15
	In class Quizzes and Assignments, Activity feedbacks (Accumulated and Averaged)	30
End Term Exam (Summative)	End Term Exam (Open 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.	
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: concept learning and decision trees: Learning Problems**, Designing Learning systems**, Perspectives and Issues, Decision Tree learning, Heuristic Space Search; **Neural networks and genetic algorithms:** Neural Network Representation, Problems, Perceptron's, Multilayer Networks and Back Propagation Algorithms, Advanced Topics, Genetic Algorithms, Hypothesis, Space Search, **Bayesian and computational learning:** Bayes Theorem, Maximum Likelihood, Minimum Description, Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Network – EM Algorithm – Probably Learning; **Evaluation Hypothesis:** Sampling Theory-Mean, Bias, Variance; **Instant based learning and learning set of rules:** K- Nearest Neighbour Learning, Locally Weighted Regression, Case-Based Reasoning, Sequential Covering Algorithms, Learning Rule Sets: Learning First Order Rules, Learning Sets of First Order Rules; **Analytical learning and reinforced learning**: Perfect Domain Theories, Explanation Based Learning, Inductive-Analytical Approaches, Reinforcement Learning, Task, Q-Learning, Temporal Difference Learning

F. Textbooks

T1. M. Mohri, A. Rostamizadeh, A. Talwalker, "Foundations of Machine Learning", MIT Press, Cambridge, MA, 2019.

T2. T.M. Mitchell, "Machine learning", 4 th Indian Edition, McGraw-Hill India, 2018.

G. Reference Books

R1. T. Hastie, R. Tibshirani, J. Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer, 2009.

R2. C.M. Bishop, “Pattern Recognition and Machine Learning”, 5th Edition, Springer Verlag, 2018.

R3. S.N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, 4th Edition, Wiley, 2018.

R4. EthemAlpaydin, “Introduction to Machine Learning”, 4th Ed., PHI Learning Pvt. Ltd., 2017.

H. Lecture Plan:

Lec No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1	Machine Learning – Introduction	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
2	Use of ML, Types of ML	Supervised, Unsupervised, Reinforcement, Batch & Online Learning	Lecture	1750.1	In Class Quiz
3,4	Challenges of ML	Quality of training data, Non representative training data, Poor quality data.	Lecture	1750.1	In Class Quiz End Term
5,6	Challenges of ML	Poor-Quality Data, Irrelevant Features, Overfitting the Training Data, under fitting the Training Data Stepping Back, Testing and Validating	Lecture	1750.1	Home Assignment End Term
7,8	Machine learning on Real Data	Frame the Problem, Select a Performance Measure, Check the assumptions, Get the data, create a test.	Lecture	1750.2	In Class Quiz End Term
9	Visualization of Data	Visualizing geographical data, correlations, experiment with attribute	Lecture	1750.2	Class Quiz Mid Term I End Term
10	Pre-processing of Data for ML	Data cleaning, Handling text, feture scaling & transformation.	Lecture	1750.2	Class Quiz Mid Term I End term
11	Training & Testing of Model	Training and evaluating on a training set, cross validation.	Lecture	1750.2	Home Assignment Class Quiz Mid Term I End Term
12	Classification	Case Study of MNIST dataset Performance Measures Multi Class Classification	Lecture	1750.2	Class Quiz Mid Term I End Term
13	Linear Regression	Formulation	Lecture	1750.3/4/5	Class Quiz Mid Term I End Term
14	Gradient Decent	Batch Gradient, Stochastic Gradient & Mini Batch	Lecture	1750.3/4/5	Class Quiz End Term
15,16	Polynomial Regression	Multi variate regression	Lecture	1750.3/4/5	Class Quiz Mid Term II End Term

17, 18	Regularization & Logistic Regression	Regression, Estimating Probability, Decision Boundaries, Softmax regression	Lecture	1750.3/4/5	Class Quiz Mid Term II End Term
19, 20	Artificial Neural Network -	Introduction, Neuron, Model, Perceptron	Lecture	1750.3/4/5	Class Quiz Mid Term II End Term
21- 23	Multilayer Perceptron & Backpropagation.	Activation Function, Hidden Layers, Weights, Bias	Lecture	1750.3/4/5	Class Quiz Mid Term II End Term
24 - 26	Decision Tree	Training & visualizing, making prediction, CART training algorithm, Computational Complexity, Entropy, Regularization hyper parameter.	Lecture	1750.3/4/5	Class Quiz End Term
27 – 29	Naïve Bayes	Learning Classifiers based on Bayes Rule, Discrete Inputs, Continuous Input, Conditional independence Multinomial Naive Bayes	Lecture	1750.3/4/5	Class Quiz End Term
30 – 31	Belief Network	Gaussian Bayes classifiers, Document classification Bayesian belief Network	Lecture	1750.3/4/5	Class Quiz End Term
32 -35	Support Vector Machine	Linear SVM Soft Margin Classifier Non Linear SVM SVM Regression	Lecture	1750.3/4/5	Class Quiz End Term
36-37	Ensemble Learning & Random Forest	Voting Classifiers Bagging Random Forest Boosting	Lecture	1750.3/4/5	Class Quiz End Term
38-39	Instance Based Learning	k-Nearest Neighbours KNN algorithm How do we choose the factor K	Lecture	1750.3/4/5	Class Quiz End term
40	Unsupervised Learning	Concept of clustering with some example, K-means algorithm	Lecture	1750.3/4/5	Class Quiz
41	Reinforcement Learning	Learning Task Markov Decision Process Learning to optimize rewards	Lecture	1750.3/4	Class Quiz Mid Term II End Term
42	Convolution Neural Network	Architecture Convolution Layer Pooling Layer CNN Architecture	Lecture	1750.6	Class Quiz Mid Term II End Term

43	Recurrent Neural Network	Recurrent Neurons Basic RNN Deep RNN LSTM GRU	Lecture	1750.6	Class Quiz Mid Term II End Term
44	Natural Language Processing	Introduction and application of NLP. Processing Raw text Learning to classify text Developing Chatbot	Lecture	1750.3/4/5	Class Quiz End Term
45	Conclusion and Course Summarization	NA	Lecture		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
[CS1750.1]	Explain the range of machine learning algorithms along with their strengths and weaknesses.	3							1					1	2	
[CS1750.2]	Explain the basic theory underlying machine learning.		2	2			3					2		2	1	3
[CS1750.3]	Identify how to apply a variety of learning algorithms to data.				2	2								2	1	
[CS1750.4]	Perform evaluation of learning algorithms and model selection and hence enhance entrepreneurship skills.						2		2	3				2	1	3
[CS1750.5]	Identify machine learning problems corresponding to different applications.			1						1	1			1	1	
[CS1750.6]	Explain the concept of transfer learning and deep learning architecture and hence improve employability skills.	3	2	2	2					2			1		1	3

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

MANIPAL UNIVERSITY JAIPUR

SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING

Course Hand-out

Advanced Computer Networks | CS1756 | 3 credits| [3 0 0 3]

Session: Aug – Dec 2020 | Faculty: Mr. Manoj R | Class: Dep. Elective (VII Sem)

A. Introduction: This course is offered by Dept. of Computer Science as a department elective, the aim of the course to provide the students advanced background on relevant computer networking topics to have a comprehensive and deep knowledge. This is targeting students who wish to pursue research& development in industries or higher studies in field of Computer Networks. The course includes understanding the principles for multi-layer network and management systems for the network. The focus is on techniques and protocol for medium access control, remote procedure calls and quality assurance.

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

[CS 1756.1] Compare the OSI reference model and the TCP-IP reference model

[CS 1756.2] Extend the MAC layer concepts for wireless medium

[CS 1756.3] Make use of concepts of protocols, network interfaces, and performance issues in local and wide area networks

[CS 1756.4] Analysis network management and its protocols

[CS 1756.5] Apply QoS parameters on models

[CS 1756.6] Develop an entrepreneurship skills in the field of IT Infrastructure

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Program Outcomes:

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

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

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

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

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

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

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

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

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

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

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

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

Program Specific Outcomes (PSO'S)

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

[PSO. 1] Will be able to identify the existing open problems in the field of computing Science and propose the best possible solutions.

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	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 – network architecture - protocol implementation issues – Quantitative performance metrics - network design. **Reference models**- The OSI Reference Model- The TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models **Low level network technologies**-Ethernet to token ring to wireless-Issues with data link protocols Encoding framing and error detection and correction-sliding window protocol **Medium access control sub layer**-Basic models of switched networks-Datagrams versus virtual circuits switching technologies-Switched Ethernet and ATM- The design of hardware based switches **Network layer** – network layer design issues-Routing algorithms-Congestion control algorithms-Internetworking- The network layer in the internet-Internet Protocol (IP).-Unicast, multicast, and inter domain routing **Transport layer**-Elements of transport protocol Congestion control – Performance issues The Internet's Trans-mission Control Protocol (TCP)- Remote Procedure Call (RPC)- –Implementation semantics of RPC -client-server applications- The Real-

time Transport Protocol(RTP) - Multimedia applications- Congestion control and resource allocation.- congestion control in TCP–UDP –Quality of service in IP. **Application layer**-Domain name server-World wide web-Hypertext transfer protocol Presentation formatting and data compression- **Network security**- crypto graphic tools- the problems of key distribution – General authentication techniques - Pretty Good Privacy (PGP)- Secure Shell (SSH),- IP Security architecture(IPSEC).-Firewalls .**Network applications and the protocols**- File transfer protocol - email and the Web, multimedia applications such as IP telephony and video streaming- Overlay networks like peer-to-peer file sharing and content distribution networks- Web Services architectures for developing new application protocols**.**

TEXTBOOKS

T1. A S Tanenbaum, Computer Networks, 5th Ed., Pearson, 2010.

T2. Behrouz A. Forouzan, TCP/IP Protocol Suite,4th Ed., McGraw Hill Education, 2010.

T3. James F. Kurose & Keith W. Ross, Computer Networking- A Top Down Approach, Pearson Education, 2017.

REFERENCE BOOKS

R1. L. L. Peterson and Bruce S. Davie, Computer Network a systems approach, 5th Ed., MK ,2011.

R2. Douglas Comer and David L Stevens, Internetworking with TCP/IP-Vol II, 3rd Ed, Pearson Education (India), 2015.

F. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1	Introduction and course Hand-out briefing	To acquaint and clear teacher's expectations and understand student expectations	Lecture	NA	NA
2	Reference Model: The OSI Reference Model-TCP/IP Model and Comparison	Recall OSI and TCP/IP Reference Models	Lecture	1756.1	Class Quiz Sessional 1 End Term
3	Introduction to Local Area Network, Network Devices	Recall Networks, Local Area Networks	Flipped Class	1756.2	Class Quiz Sessional 1 End Term
4	Introduction to Data Link Protocol, Error Correction and Error Detection	Recall DLL basic and Error Correction and Error Detection	Flipped Lecture	1756.3	Class Quiz Sessional 2 End Term
5-6	Medium Access Control: Protocol, Datagram versus Virtual Circuits	Know about MAC protocols, Datagram and Virtual Circuit	Flipped Class	1756.3	Class Quiz Sessional 2 End Term
7	Random Access, Control Access	Identify MAC protocols, Medium Access Techniques	Lecture	1756.3	Class Quiz Sessional 2 End Term
8	Channelization, Data Link layer Switching	Explain Channelization and Switching	Lecture	1756.3	Class Quiz Sessional 2 End Term
9	Ethernet Protocol, Standard Ethernet,	Understanding of basic component and standards for Ethernet	Lecture	1756.2	Class Quiz Sessional 1 End Term
10	Fast Ethernet, Gigabit Ethernet	Knowledge about Fast Ethernet and Gigabit and Application of Ethernet	Lecture and Flipped Class	1756.2	Class Quiz Sessional 1 End Term

11	Telephone Network, Cable Network, ATM	Understanding of working of telephone network	Lecture	1756.2	Class Quiz Sessional 1 End Term
12	SONET	Knowledge of Architecture, Protocol for SONET	Lecture	1756.2	Class Quiz Sessional 1 End Term
13	ATM	Enable to explanation Protocol, Specifications, devices required for ATM	Lecture	1756.2	Class Quiz Sessional 1 End Term
14	Wireless LANs: IEEE 802.11	Understand protocol and Architecture of Wireless LANs	Lecture	1756.2	Class Quiz Sessional 1 End Term
15	Bluetooth	Explain Blue tooth and Blue tooth Scenarios	Lecture	1756.2	Class Quiz Sessional 1 End Term
FIRST SESSIONAL EXAM					
16	WiMAX, Cellular Telephony,	Knowing about WiMAX, Cellular Telephony	Lecture / Flipped Class	1756.2	Class Quiz Sessional 1 End Term
17	Satellite Network Virtual LANs: Connecting Devices, Virtual LANs	Understand Virtual network and Connecting Devices	Lecture	1756.2	Class Quiz Sessional 1 End Term
18	Network Layer: Introduction to Routing Algorithm and Congestion Control Algorithm	Recall Routing Algorithm and Congestion Control	Lecture	1756.4	Class Quiz Sessional 2 End Term
19	Transport Layer: A simple Transport Layer Protocol,	Understanding of Transport Layer	Lecture	1756.4	Class Quiz Sessional 2 End Term
20-21	Remote Procedure Call	Know about Remote procedure call components	Lecture	1756.4	Class Quiz Sessional 2 End Term
22	Real Time Transport Protocol	Understanding of Real Time Transport protocol	Lecture	1756.4	Class Quiz Sessional 2 End Term
23	Standard Client Server Protocols : TALNET	Understanding TALNET	Lecture	1756.4	Class Quiz Sessional 2 End Term
24	Network Management	Understanding Network Management Concepts	Lecture	1756.4	Class Quiz Sessional 2 End Term
25	SNMP	Knowing concept of SNMP	Lecture	1756.4	Class Quiz Sessional 2 End Term
26	ANS.1	Knowing Concept of ANS.1	Lecture	1756.4	Class Quiz, Sessional 2, End Term
27	Quality of Service: Data Flow Characteristics	Understanding concept of Quality of Services	Lecture	1756.5	Class Quiz, End Term
SECOND SESSIONAL EXAM					
28-29	Flow Control to Improve QoS	Know the method to improve QoS	Lecture	1756.5	Class Quiz End Term

30-31	Integrated Services	Identifying Integrated Service and Application	Lecture	1756.5	Class Quiz End Term
32-33	Differentiated Services.	Identifying Differentiated Services and Application	Lecture	1756.5	Class Quiz, End Term
34	Conclusion and Course Summarization	Summarization	Lecture	All	End Term
35-36	Revision			All	End Term
END TERM EXAM					

G. 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	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
[LN1756.1]	Compare the OSI reference model and the TCP-IP reference model	**1**		**1**					**2**			**1**	
[LN1756.2]	Extend the MAC layer concepts for wireless medium	**2**		**1**		**1**		**1**		**1**		**1**	
[LN1756.3]	Make use of concepts of protocols, network interfaces, and performance issues in local and wide area networks	**1**	**1**						**1**		**2**	**2**	
[LN1756.4]	Analysis network management and its protocols	**2**		**1**	**1**						**3**		
[LN1756.5]	Apply QOC parameters on models		**2**				**1**		**1**			**2**	
[LN1756.6]	Develop an entrepreneurship skills in the field of IT Infrastructure	**1**		**1**	**1**						**2**		

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science & Engineering
Course Hand-out

Advanced Data Structures | CS1757 | 3 Credits | 3 0 0 3

Session: July 20 – Nov 20 | Faculty: Mr. Tarun Jain, Mr. Jaya Krishna, Ms. Somya Goyal | Class: VII CSE and VII CCE (DE)

Course Coordinator: Mr. Tarun Jain

A. Introduction: This course is offered by Computer Science and 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 advanced concept of data structures hence this course is introduced at this level to make the students understand various advanced concept of organizing data and storing it into memory and use the type depending upon the application.

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

CS1757.1 Understand the concept of indexing using dictionaries & hashing techniques.
CS1757.2 Illustrate skip lists, operation and their probabilistic analysis to solve real life problems to enhance entrepreneurship capabilities.
CS1757.3 Analyse various advanced algorithms concept such as splay trees, operations on splay trees to enhance employability.
CS1757.4 Demonstrate the concept of various string matching algorithms such as Boyer-Moore Algorithm, the Knuth-Morris-Pratt algorithm and Standard Tries.
CS1757.5 Analyse searching techniques related to computational geometry.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. Syllabus:

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. **Hashing:** Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing. **Skip Lists:** Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists. **Splay Trees:** Splaying, Search and Update Operations on Splay Trees, Amortized Analysis of Splaying. **Text Processing:** String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem. **Computational Geometry:** One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad trees, k-D Trees.

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

E. Text Books:

1. Mark Allen Weiss, Data *Structures and Algorithm Analysis in C++*, 2nd Edition, Pearson, 2004.
2. T. H. Cormen, C. E. Leiserson, R.L.Rivest, and C. Stein, *"Introduction to Algorithms*", 3rd Edition, MIT press, 2010.

F. Reference Book:

1. M T Goodrich, *Roberto Tamassia, Algorithm Design*, John Wiley, 2002.

2. Lecture Plan:

Lecture No.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Dictionaries Definition, Abstract Data Type, Implementation using array and lists	Understanding of Definition of Dictionary and issues in implementation	Lecture	CS1757.1	Class Quiz Sessional 1 End Term
2-3	Implementation of Dictionaries **using BST, issues, using Direct Addressing, Issues. Intro to Hash Tables**	Capable to implement Dictionaries	Lecture	CS1757.1	Class Quiz Sessional 1 End Term
3-4	Hash Table, Hash Function, uniform load, collision.	Capable to implement Dictionaries	Lecture	CS1757.1	Class Quiz Sessional 1 End Term
5	**Chaining, Example, Analysis**	Understanding of separate chaining	Lecture	CS1757.1	Class Quiz Home Assignments Sessional 1

					End Term
6-7	Open Addressing, Linear probe, Quadratic Probe, Example	Understanding of Open addressing	Lecture	CS1757.1	Class Quiz Home Assignments Sessional 1 End Term
7-8	Double Hashing, Rehashing, Examples		Lecture	CS1757.1	Class Quiz Home Assignments Sessional 1 End Term
9	Extendible Hashing	Understanding of extendible hashing	Lecture	CS1757.1	Class Quiz Home Assignments Sessional 1 End Term
10	Need for Randomizing Data Structures and Algorithms	Understanding the concept of randomization	Lecture	CS1757.2	Class Quiz Sessional 1 End Term
11-12	Search and Update Operations on Skip Lists	Knowledge of skip lists and understanding the operations on it	Lecture	CS1757.2	Class Quiz Sessional 1 End Term

13-14	Probabilistic Analysis of Skip Lists	Capable to analyse skip lists	Lecture	CS1757.2	Class Quiz Sessional 2 End Term
15	Deterministic Skip Lists	Understanding deterministic skip lists	Lecture	CS1757.2	Class Quiz Sessional 2 End Term
16	Splaying	Understanding splaying phenomenon	Lecture	CS1757.3	Class Quiz Sessional 2 End Term
17-18	Search and Update Operations on Splay Trees	Perform search and update operations on splay trees	Lecture	CS1757.3	Class Quiz Home Assignments Sessional 2 End Term
19-20	Amortized Analysis of Splaying	Capable to analyse operations on splay tree	Lecture	CS1757.3	Class Quiz Sessional 2 End Term
21	String Operations	Understanding text processing operations	Lecture	CS1757.4	Class Quiz Sessional 2 End Term

22	Brute-Force Pattern Matching	Understanding Brute-Force Pattern Matching	Lecture	CS1757.4	Class Quiz Sessional 2 End Term
22-23	The Boyer-Moore Algorithm	Understanding the Boyer-Moore Algorithm	Lecture	CS1757.4	Class Quiz Sessional 2 End Term
23-24	The Knuth-Morris-Pratt Algorithm	Understanding the Knuth-Morris-Pratt Algorithm	Lecture	CS1757.4	Class Quiz Sessional 2 End Term
25	Standard Tries	Knowledge of standard tries	Lecture	CS1757.4	Class Quiz Sessional 2 End Term
26	Compressed Tries	Knowledge of compressed tries	Lecture	CS1757.4	Class Quiz Sessional 2 End Term
27	Suffix Tries	Knowledge of suffix tries	Lecture	CS1757.4	Class Quiz Sessional 2 End Term
28	The Huffman Coding Algorithm	Understanding Huffman coding algorithm	Lecture	CS1757.4	Class Quiz Sessional 2 End Term

29	The Longest Common Subsequence Problem (LCS)	Understanding LCS problem	Lecture	CS1757.4	Class Quiz End Term
30	Applying Dynamic Programming to the LCS Problem	Capable to apply dynamic programming to LCS problem	Lecture	CS1757.4	Class Quiz End Term
31	One Dimensional Range Searching	Understanding one dimensional range searching	Lecture	CS1757.5	Class Quiz End Term
32	Two-Dimensional Range Searching	Understanding two-dimensional range searching	Lecture	CS1757.5	Class Quiz End Term
33	Constructing a Priority Search Tree	Capable to construct priority search tree	Lecture	CS1757.5	Class Quiz End Term
34	Searching a Priority Search Tree	Capable to search in a priority search tree	Lecture	CS1757.5	Class Quiz End Term
35	Priority Range Trees	Understanding priority range trees	Lecture	CS1757.5	Class Quiz End Term
36	Quad trees	Understanding quad trees concept	Lecture	CS1757.5	Class Quiz End Term
37	k-D Trees	Understanding k-D trees	Lecture	CS1757.5	Class Quiz End Term

3. Course Evaluation (Tentative): As per DOA guidelines

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 (Accumulated and Averaged)	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.		

4. **Make-up Policy:** As per University Norms
5. **Chamber Consultation:** online as per Instructor
6. **Notice:** Via email/ Teams/WhatsApp (Use University Microsoft Account)
7. **Consultancy Hours:** *To be Announced later*

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	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CS 1757.1	Understand the concept of indexing using dictionaries & hashing techniques.	3	2													1
CS 1757.2	Illustrate skip lists, operations and their probabilistic analysis to solve real life problems to enhance entrepreneurship capabilities.	3	3	2			1		1	1		2	2	2	2	
CS 1757.3	Analyse various advanced algorithms concept such as splay trees, operations on splay trees to enhance employability.	2		2	3	2				1		1	2	2	2	
CS 1757.4	Demonstrate the concept of various string matching algorithms such as Boyer-Moore Algorithm, the Knuth-Morris-Pratt algorithm and Standard Tries.			3	2							3			2	
CS 1757.5	Analyse searching techniques related to computational geometry.	2			2	3									2	1

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science Engineering
Course Hand-out

Real Time System CS 1758 | 3 Credits | 3 0 0 3

Session Jul 20 - Nov 20 | B.Tech VII Semester | DE

A. Introduction The course will enable the students to get familiar with the implementation and application of real time system in various disciplines. This course is focused on abstract models of real time systems. The course exposes students to the timings constraint, deadlines, workloads, time scheduling algorithms and real time communication systems.

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

[CS1758.1]: Analyse the need and use of Real Time System in different disciplines.
[CS1758.2]: Implement scheduling algorithms in real time applications.
[CS1758.3]: Implement real time scheduling uniprocessor algorithms.
[CS1758.4]: Evaluate the effect of Resource Contention and Resource sharing and Access Control (RAC) and hence develop employability skills.
[CS1758.5]: Detailed understanding of real time database management systems.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **PO1: Engineering knowledge**: : Apply the knowledge of basic science and fundamental computing in solving complex engineering problems

2. **PO2: Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **PO3: 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

4. **PO4: 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

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

6. **PO6: 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

7. **PO7: 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

8. **PO8: Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse IT teams, and in multidisciplinary settings.

10. PO10: 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

11. 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 multidisciplinary environments

12. 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

D. PROGRAM SPECIFIC OUTCOMES

The graduation from B.Tech. in Computer Science & Engineering will empowers the student:

PSO 1: Will be able to design, develop and implement efficient software for a given real life problem.
PSO 2: Will be able to apply knowledge of AI, Machine Learning and Data Mining in analysing big data for extracting useful information from it and for performing predictive analysis.
PSO 3: Will be able to design, manage and secure wired/ wireless computer networks for transfer and sharing of information.

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 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.	

F. SYLLABUS

Introduction to real-time systems, Modeling of a Real-Time System, Task assignment and scheduling, Resource management, Real-time operating systems, RTOS services, Programming language with real-time support, System design techniques, Inter task communication, Fault tolerant techniques, Reliability evaluation methods; Performance analysis, Case studies of real-time systems.

G. TEXT BOOKS

1. Liu, Jane W.S., Real Time Systems, Pearson Education, 2000.
2. Laplante, Phillip A., Real-Time Systems Design and Analysis, WSE, 3rd Ed., 2004.

H. REFERENCE BOOKS

1. Li Quing, Real-Time Concepts for Embedded Systems, CMP books, paperback 2003.
2. Burns Allen and Wellings Andy, Concurrent and Real-Time Programming in ADA, Cambridge University Press, paperback 2007.

I. Lecture Plan:

S. No.	Lecture no.	Topic to be covered	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	L-1	Introduction	To learn basics about real time systems	Lecture	1758.1	In Class Quiz End Term
2.	L-2	Real - Time System Characteristics	To learn basic characteristics of real time systems	Lecture	1758.1	Class Quiz Mid Term I End Term
3.	L-3	Few Basic Issues	To analyse basic issues of real time systems	Lecture	1758.1	Class Quiz Mid Term 1 End term
4.	L-4	Modelling Timing Constraints	To learn timing constraints in real time systems	Lecture	1758.1	Home Assignment Class Quiz Mid Term 1 End Term
5.	L-5	Modelling Timing Constraints (Contd.)	To learn timing constraints in real time systems	Lecture	1758.1	Class Quiz Mid Term 1 End Term
6.	L-6	Basics of Real - Time Task Scheduling	To understand scheduling	Lecture	1758.1	Class Quiz Mid Term I End Term
7.	L-7	Cyclic Scheduler	To understand scheduling algorithms	Lecture	1758.1, 1758.2	Class Quiz End Term
8.	L-8	Event - Driven Scheduling	To understand scheduling algorithms	Lecture	1758.1, 1758.2	Class Quiz Mid Term 1 End Term
9.	L-9	Rate Monotonic Scheduler	To understand scheduling algorithms	Lecture	1758.1, 1758.2	Class Quiz Mid Term 1 End Term
10.	L-10	RMA Scheduling : Further Issues	To understand scheduling algorithms	Lecture	1758.1, 1758.2	Class Quiz Mid Term 1 End Term

11.	L-11	Deadline Monotonic Scheduling and Other Issues	To understand scheduling algorithms	Lecture	1758.1, 1758.2, 1758.3	Class Quiz Mid Term 1 End Term
12.	L-12	Few Issues in Use of RMA	To understand issues in scheduling algorithms	Lecture	1758.3	Class Quiz End Term Mid Term II
13.	L-13	Resource Sharing Among Real-Time Tasks	To understand resource sharing	Lecture	1758.3	Class Quiz End Term Mid Term II
14.	L-14	Highest Locker and Priority Ceiling Protocols	To understand priority protocols	Lecture	1758.3	Class Quiz End Term Mid Term II
15.	L-15	An Analysis of Priority Ceiling Protocol	To understand priority protocols	Lecture	1758.3	Class Quiz End Term Mid Term II
16.	L-16	Handling Task Dependencies	To understand task dependencies	Lecture	1758.3	Class Quiz End Term Mid Term II
17.	L-17	Real-Time Task Scheduling on Multiprocessors and Distributed Systems	To understand scheduling algorithms	Lecture	1758.3, 1758.4	Class Quiz End term Mid Term II
18.	L-18	Real-Time Task Scheduling on Multiprocessors and Distributed Systems (Contd.)	To understand scheduling algorithms in distributed systems	Lecture	1758.3, 1758.4	Class Quiz Mid Term II
19.	L-19	Clock Synchronization in Distributed Real-Time Systems	To understand clock synchronization in real time systems	Lecture	1758.3, 1758.4	Class Quiz Mid Term II End Term
20.	L-20	Internal Clock Synchronization in Presence of Byzantine Clocks	To understand clock synchronization in real time systems	Lecture	1758.4	Class Quiz Mid Term II End Term

21.	L-21	A Few Basic Issues in Real-Time Operating Systems	To understand basic issues in real time systems	Lecture	1758.4	Class Quiz Mid Term II End Term
22.	L-22	MCQ Based Quiz	-	Lecture	1758.4	Class Quiz End Term Mid Term II
23.	L-23	A Few Basic Issues in Real-Time Operating Systems (Contd.)	To understand basic issues in real time systems	Lecture	1758.4	Class Quiz End Term Mid Term II
24.	L-24	Unix and Windows as RTOS	To learn operating systems as real time system	Lecture	1758.4	Class Quiz End Term Mid Term II
25.	L-25	Real - Time POSIX	To learn POSIX as real time system	Lecture	1758.4	Class Quiz End Term
26.	L-26	Real - Time POSIX (Contd.)	To learn POSIX as real time system	Lecture	1758.4	Class Quiz End Term
27.	L-27	Open Source and Commercial RTOS	To learn commercial real time system	Lecture	1758.4	Class Quiz End Term
28.	L-28	Open Source and Commercial RTOS (Contd.)	To learn commercial real time system	Lecture	1758.4	Class Quiz End Term
29.	L-29	Benchmarking Real - Time Computer & Operating Systems	To learn commercial real time system	Lecture	1758.4	In Class Quiz (Not Accounted)
30.	L-30	Benchmarking Real - Time Computer & Operating Systems (Contd.)	To learn commercial real time system	Lecture	1758.4, 1758.5	In Class Quiz End Term
31.	L-31	Real - Time Communications	To understand real time communication	Lecture	1758.4, 1758.5	Home Assignment End Term

32.	L-32	Few Basic Issues in Real - Time Communications	To understand basic issues in real time systems	Lecture	1758.4, 1758.5	In Class Quiz End Term
33.	L-33	Review of Computer Networking	To understand computer networking	Lecture	1758.4, 1758.5	Class Quiz End Term
34.	L-34	Real - Time Communication in a LAN	To understand computer networking	Lecture	1758.4, 1758.5	Class Quiz End term
35.	L-35	Real - Time Communication in a LAN (Contd.)	To understand computer networking	Lecture	1758.4, 1758.5	Home Assignment Class Quiz End Term
36.	L-36	Performance of Two Real -Time Communication Protocols	To understand real time communication in networks	Lecture	1758.4, 1758.5	Class Quiz End Term
37.	L-37	Real - Time Communication over Packet Switched Networks	To understand real time communication in networks	Lecture	1758.4, 1758.5	Class Quiz End Term
38.	L-38	Real - Time Communication over Packet Switched Networks (Contd.)	To understand real time communication in networks	Lecture	1758.4, 1758.5	Class Quiz End Term
39.	L-39	Real - Time Communication over Packet Switched Networks (Contd.)	To understand real time communication in networks	Lecture	1758.4, 1758.5	Class Quiz End Term
40.	L-40	Real - Time Databases	To learn real time databases	Lecture	1758.4, 1758.5	Class Quiz End Term

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

	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
CO STATEMENTS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
[CS1758.1]: Analyse the need and use of Real Time System in different disciplines.	**3**	**1**			**3**	**3**						**3**	3		
[CS1758.2]: Understand the parameters affecting the Real Time System including timing constraints, deadlines, Temporal Parameters of Real Time Workload, etc	**3**	**2**									**1**		3		
[CS1758.3]: Implement real time scheduling algorithms	**3**	**2**	**3**										3		
[CS1758.4]: Evaluate the effect of Resource Contention and Resource Access Control (RAC) and hence develop employability skills	**3**	**2**						**2**	**1**	**2**		**3**	3		
[CS1758.5]: Detailed understanding of real time communication systems	**3**	**2**								**2**	**2**		3	3	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

Information Retrieval | CS1759 | 3 Credits | 3 0 0 3

Session: Aug 20 – Dec 20

| Faculty: Dr. Santosh K., Mr. Satpal Kushwaha, Ms. Ginika and Dr. Vaishali Yadav/Mr. Vivek Sharma |

Class: CSE 7th Semester (Program Elective)

A. Introduction: This course is offered by Dept. of Computer Science & Engineering as program elective, targeting students who wish to pursue research & development in industries or higher studies in field of Engineering, including search engines optimization and document retrieval. Offers introductory knowledge of various ranking based retrievals. Introducing the concept of clustering & classification and understating the concepts of indexing & crawling.

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

[CO 1759.1] Apply information retrieval principles to retrieve the relevant records in large collections of data and hence enhance the employability skills.

[CO 1759.2] Describe the techniques of indexing in retrieval i.e. Boolean retrieval and rank based retrieval.

[CO 1759.3] Observe the behaviours of wild card queries, free text queries & representation of queries in vector space model and hence inculcate entrepreneurship skills.

[CO1759.4] Apply the concept of text similarity measures in retrieval for optimizing the relevant records retrieved and hence improve the employability skills.

[CO 1759.5] Describe web characteristics, how indexing & crawling managed in web server.

[CO 1759.6] Analyse classification & clustering on text data and hence enhance the entrepreneurship skills.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

[PSO.1]. Will be able to clearly understand the basic principles, concepts and applications in the field of computer based Communication/networking, information sharing, signal processing, web based systems, smart devices and communication technology.

[PSO.2]. Will be able to nail down the issues prevalent in the field of Computer and Communication Engineering.

[PSO.3]. Will be able to identify and devise solutions for the existing open problems in the field of computing and propose the best possible solutions.

[PSO.4]. Will be able to apply the contextual knowledge in the field of computing and communication to assess social, health, safety and cultural issues and endure the consequent responsibilities relevant to the professional engineering practice.

D. Assessment Plan:

Criteria	Description	Date	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	As per academic calendar	15
	Sessional Exam II (Closed Book)	As per academic calendar	15
	Quizzes (4) and Assignments (3) (Accumulated and Averaged)	Regularly	30
End Term Exam (Summative)	End Term Exam (Closed Book)	As per academic calendar	40
	Total		**100**
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.		
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.		

E. SYLLABUS

Boolean retrieval - The term vocabulary and postings lists. Dictionaries and tolerant retrieval. Index construction. Index compression. **Rank retrieval** - Scoring, term weighting and the vector space model. Computing scores in a complete search system. Evaluation in information retrieval. Relevance feedback and query expansion. **XML retrieval**- Probabilistic information retrieval. Language models for information retrieval. Text classification. Vector space classification. **Support vector machines**- and machine learning on documents, flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing. **Web search basic -** Searching the Web, Challenges, Characterizing the Web, Search Engines, Browsing, Mata searchers, Web crawlers, robot exclusion, Web data mining, Metacrawler, Collaborative filtering, Web agents (web shopping, bargain finder), Economic, ethical, legal and political issues.

F. REFERENCE BOOKS

1) Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008

2) B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, The MIT Press, 2010.

3) K. Sparck Jones & P. Willett, Readings in Information Retrieval. Morgan Kaufmann, 1997.

4) Witten, A. Moffat, & T. Bell, Managing Gigabytes: Compressing and Indexing Documents and Images. Morgan Kaufmann, Second Edition, 1999.

5) S. Buttcher, C. Clarke, G. Cormack, Information Retrieval: Implementing and Evaluating search Engines, Addison Wesley, 2010

6) R. Baeza-Yates & B. Ribeiro-Neto, Modern Information Retrieval. Addison Wesley, 1999, 2nd Edition, 2011

G. Lecture Plan:

Sr.No.	Topics to be covered	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	**Boolean Model:** Introduction to information retrieval: An example information retrieval problem	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
2.	A first take at building an inverted index	Understanding of different functions involved in Boolean IR	Lecture/PPT	1759.1	Class Quiz Sessional 1 End Term
3.	Boolean retrieval, Processing Boolean queries, The extended Boolean model versus ranked retrieval	Understanding of basic component and standards for Boolean IR	Lecture/PPT	1759.1	Class Quiz Sessional 1 End Term
4.	Pre-processing: Document processing, stemming, String matching,	Knowledge about different pre-processing techniques	Flipped Class	1759.1	Class Quiz Sessional 1 End Term
5.	Basic NLP tasks – POS tagging shallow parsing	Understanding the working of POS tagging	Lecture/PPT	1759.1	Class Quiz Sessional 1 End Term
6.	Overview of text retrieval systems: System architecture, Boolean models	Knowledge of Boolean Models	Lecture and Flipped Class	1759.1	Class Quiz Sessional 1 End Term
7.	Inverted Indexes, Document ranking, IR Evaluation	Knowledge of Inverted Index	Lecture/PPT	1759.2	Class Quiz Sessional 1 End Term
8.	The term vocabulary and postings lists: Document delineation and character sequence decoding	Knowledge of Document ranking	Lecture/PPT	1759.2	Class Quiz Sessional 1 End Term
9.	Obtaining the character sequence in a document, Choosing a document unit	Knowledge of IR Evaluation	Lecture/PPT	1759.2	Class Quiz Sessional 1 End Term

10.	Determining the vocabulary of terms: Tokenization, Dropping common terms: stop words	Knowing about Tokenization	Lecture/PPT	1759.2	Class Quiz Sessional 1 End Term
11.	Normalization(equivalence classing of terms), Stemming and lemmatization	Understand the concepts of Normalization	Lecture/PPT	1759.2	Class Quiz Sessional 1 End Term
12.	Dictionaries and tolerant retrieval: Faster postings list intersection via skip pointers, Positional postings and phrase queries	Understand the concepts of tolerant retrieval	Lecture / Flipped Class	1759.2	Class Quiz Sessional 1 End Term
13.	Bi-word indexes, Positional indexes, Combination schemes, Search structures for dictionaries, Wildcard queries, General wildcard queries	Understand the concepts of Indexes	Lecture/PPT	1759.2	Class Quiz Sessional 1 End Term
14.	Permuterm indexes, k-gram indexes for wildcard queries, Spelling correction, Implementing spelling correction, Forms of spelling correction	Understand the concepts of Permuterm Indexes	Flipped Lecture	1759.3	Class Quiz Sessional 2 End Term
15.	Index construction: Hardware basics, blocked sort-based indexing, Single-pass in-memory indexing	Explain Index construction	Flipped Class	1759.3	Class Quiz Sessional 2 End Term
16.	Distributed indexing, Dynamic indexing, Index compression	Explain about Distributing Indexing	Lecture/PPT	1759.3	Class Quiz Sessional 2 End Term
17.	**Rank Retrieval:** Scoring, term weighting and the vector space model: Parametric and zone indexes, Weighted zone scoring, Learning weights	Understanding Rank retrieval	Lecture/PPT	1759.3	Class Quiz Sessional 2 End Term
18.	The optimal weight G, Term frequency and weighting, Inverse document frequency, Tf-idf weighting	Know about Term frequency, IDF	Lecture/PPT	1759.3	Class Quiz Sessional 2 End Term
19.	The vector space model for scoring: Dot products,	Understanding of Vector Space Model	Lecture	1759.3	Class Quiz Sessional 2 End Term
20.	Queries as vectors, Computing vector scores.	Understanding the Queries and VSM	Lecture	1759.3	Class Quiz Sessional 2 End Term

21.	Variant TF-IDF functions : Sublinear TF scaling, Maximum TF normalization	Understanding TF-IDF	Lecture/PPT	1759.4	Class Quiz Sessional 2 End Term
22.	Document and query weighting schemes, Pivoted normalized document length	Knowing concept of Document and query weighting schemes	Lecture/PPT	1759.4	Class Quiz Sessional 2 End Term
23.	Evaluation in information retrieval: Information retrieval system evaluation	Knowing Concept of IR evaluation	Lecture/PPT	1759.4	Class Quiz Sessional 2 End Term
24.	Standard test collections, Evaluation of unranked retrieval sets	Understanding concept of Test Collection	Lecture/PPT	1759.4	Class Quiz Sessional 2 End Term
25.	Evaluation of ranked retrieval results, Relevance feedback and query expansion	Know the concept of relevance feedback	Lecture/PPT	1759.4	Class Quiz Sessional 2 End Term
26.	**XML Retrieval :** XML retrieval: Basic XML concepts, Challenges in XML retrieval, A vector space model for XML retrieval	Understanding the concept XML retrieval	Lecture/PPT	1759.4	Class Quiz Sessional 2 End Term
27.	Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval, Language models for information retrieval.	Understanding the evaluation of XML	Lecture/PPT	1759.4	Class Quiz Sessional 2 End Term
28.	Text classification and Naive Bayes: Naive Bayes text classification	Understanding the concept of Text classification	Lecture/PPT	1759.4	Class Quiz Sessional 2 End Term
29.	The Bernoulli model, Properties of Naive Bayes	Understanding Bernoulli model	Lecture/PPT	1759.5	Class Quiz Sessional 2 End Term
30.	Vector space classification; Document representations and measures of relatedness in vector spaces	Know the concept of VSM	Lecture/PPT	1759.5	Class Quiz Sessional 2 End Term

31.	Rocchio classification, k nearest neighbor, Classification with more than two classes, The bias-variance trade-off	Know the concept of Rocchio classification	Lecture/PPT	1759.5	Class Quiz Sessional 2 End Term
32.	**Support Vector Machines:** SVM and machine learning on documents	Know the concept of SVM	Lecture/PPT	1759.5	Class Quiz Sessional 2 End Term
33.	Flat clustering: Evaluation of clustering, K-means	Know the concept of clustering	Lecture/PPT	1759.5	Class Quiz End Term
34.	Cluster cardinality in K-means, Cluster pruning	Understanding the concept of PKI	Lecture/PPT	1759.5	Class Quiz End Term
35.	Hierarchical clustering,	Understanding the concept of Clustering	Lecture/PPT	1759.5	Class Quiz End Term
36.	Matrix decompositions and latent semantic indexing	Understanding the concept of Matrix decompositions	Lecture/PPT	1759.5	Class Quiz End Term
37.	**Web search basic:** Web search: Background and history, searching the web, Characterizing the Web	Understanding the concept of Web search basic	Lecture/PPT	1759.5	Class Quiz End Term
38.	Search engines, Browsing, Meta searchers, Web crawlers	Understanding the concept of search engines	Lecture/PPT	1759.6	Class Quiz End Term
39.	Web crawler features, Crawler architecture, Distributing the crawler	Know the features of crawler	Lecture/PPT	1759.6	Class Quiz End Term
40.	Robot exclusion, Web data mining, Meta Crawler	Applications of web mining	Lecture/PPT	1759.6	Class Quiz End Term
41.	Collaborative filtering, Web agents (Web shopping, bargain finder)	Understanding collaborative filtering	Lecture/PPT	1759.6	Class Quiz End Term
42.	Economic issues, Ethical issues, Legal issues and political issues	Know all the issues of IR	Lecture/PPT	1759.6	Class Quiz End Term

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1759.1	Apply information retrieval principles to retrieve the relevant records in large collections of data and hence enhance the employability skills.	3	3	2	2	2								1	2	
CO1759.2	Describe the techniques of indexing in retrieval i.e. Boolean retrieval and rank based retrieval.	3	2		2	3								2	1	
CO1759.3	Observe the behaviours of wild card queries, free text queries & representation of queries in vector space model and hence inculcate entrepreneurship skills.	3	2		2	3								2	3	
CO1759.4	Apply the concept of text similarity measures in retrieval for optimizing the relevant records retrieved and hence improve the employability skills.	3	2	1	2	2	2							2	2	
CO1759.5	Describe web characteristics, how indexing & crawling managed in web server.	1	2		2	3	1	2							1	2
CO1759.6	Analyse of classification & clustering on text data and hence entrepreneurship skills.	3	2	3	2	3		2				2	2	2	3	

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

I. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO1759.1	Apply information retrieval principles to retrieve the relevant records in large collections of data and hence enhance the employability skills.															
CO1759.2	Describe the techniques of indexing in retrieval i.e. Boolean retrieval and rank based retrieval.															
CO1759.3	Observe the behaviours of wild card queries, free text queries & representation of queries in vector space model and hence inculcate entrepreneurship skills.															
CO1759.4	Apply the concept of text similarity measures in retrieval for optimizing the relevant records retrieved and hence improve the employability skills.															
CO1759.5	Describe web characteristics, how indexing & crawling managed in web server.															
CO1759.6	Analyse of classification & clustering on text data and hence entrepreneurship skills.															

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer and Science Engineering
Course Hand-out

Principles of Distributed Systems CS1760 | 3 Credits | 3 0 0 3

Session: Aug 20 – Dec 20 (2020-21 Odd Sem) | Faculty: Dr. Vijander Singh |Mr. Ankit Mundra Course: Department Elective-5 Class: B.Tech. 4th Year VII Semester

A. Introduction This course provides fundamentals and structure of distributed systems using multiple levels of software. Specific topics include distributed algorithms, distributed file systems, distributed databases, security and protection, distributed services such as the world-wide web, and examples of research and commercial distributed systems.

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

[1760.1] Identify the core principles, problems and challenges in distributed systems and compare with Uniprocessor system.

[1760.2] Define and label various communication mechanisms to provide the communication among processes in distributed environment.

[1760.3] Understand and Apply suitable algorithms to coordinate and synchronize multiple tasks in a distributed system.

[1760.4] Describe fault handling techniques during inter-process coordination in distributed environment.

[1760.5] Compile design aspects of cutting-edge distributed computing models like Grid computing, peer to peer networks and IoT.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES

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

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

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

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 get eligible 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 should 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.	

D. SYLLABUS

CS1760 Principles of Distributed Systems

Introduction concepts related to distributed computing and distributed operating systems. Communication via Message Passing and Various Message Passing Models, Logical Time, Physical Time and Local and Global State, Ordering of Messages (Causal Ordering) and Group Communication via Broadcasting of Messages, Termination Detection, Global Predicate Detection, Distributed Mutual Exclusion Algorithms, Distributed Deadlock Detection Algorithms, Distributed Shared Memory Systems, Check pointing and Rollback Recovery, Consensus and Agreement Algorithms, Failure Detection and Self Stabilization, etc. The design aspects of various advanced distributed computing models like Cluster of cooperative computers, Grid computing, Peer-to-Peer networks, and Internet of Things.

TEXT BOOKS

T1. G. Coulouris, J. Dollimore, T. Kindberg, "Distributed Systems, Concepts and Design", Pearson, 5th Edition 2012..

T2. A. S. Tanenbaum, M. Van Steen, "Distributed Systems, Principles and Paradigms", Pearson, 2nd Edition 2007.

T 3. A. D. Kshemkalyani, M. Singhal, "Distributed Computing: Principles, Algorithms, and Systems", Paperback edition, Cambridge University Press, March 2011.

REFERENCE BOOKS

R1. Mei- Ling Liu, *"Distributed Computing: Principles and Application*", Pearson Education, 2004.

E. Tentative Lecture Plan:

Lecture No.	Topic(s) to be covered	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction concepts related to distributed computing and distributed operating systems	To understand basics about distributed computing	Lecture	1760.1	Home Assignment In Class Quiz Mid Term I
2	Goals & Design Issues wrt Distributed System	Compare the uniprocessor and Distributed system and analyze the need of DS	Lecture	1760.1	Home Assignment Class Quiz Mid Term I End Term
3	Message Passing versus Shared Memory	Relate the shared and message passing concepts of communication	Lecture	1760.1, 1760.2	Home Assignment Class Quiz Mid Term I End Term
4	Communication via Message Passing	To learn Message passing communication	Lecture	1760.1, 1760.2	Home Assignment Class Quiz Mid Term I End Term
5	Clients/Server Architectures and Models	To learn basic client server model	Lecture	1760.1, 1760.2	Home Assignment Class Quiz Mid Term I End Term
6	Remote Procedure Call Model of Communication	To learn basic RPC model	Lecture	1760.1, 1760.2	Home Assignment Class Quiz Mid Term I End term
7	Group Communication Model of Communication	To learn basic Group Communication model	Lecture	1760.1, 1760.2	Home Assignment Class Quiz Mid Term I End Term
8	Logical Time, Physical Time	To learn Logical and Physical time	Lecture	1760.1, 1760.2	Home Assignment Class Quiz End Term
9	Local and Global State	To learn Local and Global State state	Lecture	1760.1, 1760.2	Home Assignment Class Quiz Mid Term I End Term

10	Ordering of Messages (Causal Ordering)	To learn Causal Ordering	Lecture	1760.1	Home Assignment Class Quiz Mid Term I End Term
11	Group Communication via Broadcasting of Messages	To learn Group Communication via Broadcasting of Messages	Lecture	1760.1, 1760.2	Home Assignment Class Quiz Mid Term I End Term
12	Various Message Passing Models	To learn various message passing models in DS	Lecture	1760.1, 1760.2	Home Assignment Class Quiz Mid Term I End Term
13	Alternative communication methods- RPC	To learn process in RPC	Lecture	1760.1, 1760.2	Home Assignment Class Quiz End Term Mid Term II
14	Termination Detection	To learn Termination Detection	Lecture	1760.1	Home Assignment Class Quiz End Term Mid Term II
15	Global Predicate Detection	To learn what is global predicate detection problem	Lecture	1760.1	Home Assignment Class Quiz End Term Mid Term II
16	Mutual Exclusion: Concept	To learn the concept of mutual exclusion	Lecture and illustration	1760.1, 1760.2	Home Assignment Class Quiz End Term Mid Term II
17	Uniprocessor & Distributed Mutual Exclusion	To learn mutual exclusion in distributed system wrt uniprocessor system	Lecture	1760.1, 1760.2	Home Assignment Class Quiz End Term Mid Term II
18	Different Mutual Exclusion Algorithms	To learn mutual exclusion algorithms in distributed systems	Lecture	1760.1, 1760.2, 1760.3	Home Assignment Class Quiz End Term Mid Term II
19	Deadlock: Concept	To learn concept of deadlock	Lecture	1760.1, 1760.2	Home Assignment Class Quiz End term Mid Term II

20	Distributed deadlock detection	Handle deadlock in distributed system	Lecture	1760.1, 1760.2, 1760.3	Home Assignment Class Quiz End Term Mid Term II
21	Distributed Shared Memory Systems	To learn challenges and issues in distributed shared memory systems	Lecture	1760.1, 1760.3, 1760.4	Home Assignment Class Quiz End Term Mid Term II
22	Checkpointing	To learn how checkpoint will be helpful in distributed system	Lecture	1760.3, 1760.4	Home Assignment Class Quiz End Term Mid Term II
23	Rollback Recovery	To learn rollback of the processes	Lecture	1760.2, 1760.3, 1760.4	Home Assignment Class Quiz End Term Mid Term II
24	Consensus and Agreement Concept	To learn concept of consensus and agreement	Lecture	1760.2, 1760.4	Home Assignment Class Quiz End Term Mid Term II
25	Consensus and Agreement Algorithm	To learn Consensus and Agreement Algorithm	Lecture	1760.2, 1760.3, 1760.4	Home Assignment Class Quiz End Term Mid Term II
26	Failure Detection and Self stabilization	Failure Detection and Self stabilization	Lecture	1760.1, 1760.2, 1760.3, 1760.4	Home Assignment Class Quiz End Term Mid Term II
27	Fault tolerance: Introduction to fault tolerance, Process Resilience,	To understand fault tolerance in distributed systems	Lecture	1760.1, 1760.2, 1760.3, 1760.4	Home Assignment Class Quiz End Term Mid Term II
28	Failure Detection and Self stabilization	Learn failure handling	Lecture	1760.1, 1760.2, 1760.3, 1760.4	Home Assignment Class Quiz End Term
29	Advanced Distributed computing Models-1	Introduction to advanced distributed computing models-I	Lecture	1760.5	Home Assignment Class Quiz End Term

30	Advanced Distributed computing Models-2	Introduction to advanced distributed computing models-2	Lecture	1760.5	Home Assignment Class Quiz End Term
31	Cluster of Cooperative Computers	To understand clusters in cooperative networks	Lecture	1760.2, 1760.4, 1760.5	Class Quiz End Term
32	Cluster of Cooperative Computers	To understand clusters in cooperative networks	Lecture	1760.2, 1760.4, 1760.5	Class Quiz End Term
33	Grid Computing	To understand basic concepts of grid computing and IOT	Lecture	1760.2, 1760.4, 1760.5	Class Quiz End Term
34	Peer to Peer Networks	To learn Peer to Peer Networks	Lecture	1760.2, 1760.4, 1760.5	In Class Quiz End Term
35	Internet of Things	To learn IoT wrt Distributed system	Lecture	1760.2, 1760.4, 1760.5	Class Quiz End term
36	Problems and Questionnaire	-	Lecture	1760.1, 1760.2,1760.3 1760.4, 1760.5	Class Quiz End Term

F. 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
CS 1760.1	Identify the core principles, problems and challenges in distributed systems and compare with Uniprocessor system.	2	3													
CS 1760.2	Define and label various communication mechanisms to provide the communication among processes in distributed environment.	2	2	2									1			
CS 1760.3	Understand and Apply suitable algorithms to coordinate and synchronize multiple tasks in a distributed system.	3	2	3									1	1		2
CS 1760.4	Describe fault handling techniques during inter-process coordination in distributed environment.	3	2	2									1	1		2
CS 1760.5	Compile design aspects of cutting-edge distributed computing models like Grid computing, peer to peer networks and IoT.	3		1	2								2	1	2	

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

MANIPAL UNIVERSITY JAIPUR
SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
Course Hand-out

Principles of Programming Languages (OE) | CS 1593 | 3 credits | [3 0 0 3]

Session: Aug 20– Dec 20 | Faculty: Ms. Bali Devi | Class: V & VII Sem

A. Introduction: This course is offered by Dept. of Computer Science & Engineering, the aim of the course to provide the students basic background on programming languages. This is targeting students who wish to pursue career in the field of any programming languages. The course includes understanding the principles for different types of programming languages and syntax used to manage that languages. The focus is on techniques and terms used for different types of programming languages.

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

[1593.1] Apply the concept of different programming languages to understand common features of programming language and implementation.
[1593.2] Discuss the notations to describe syntax and semantics of programming languages.
[1593.3] Illustrate the fundamentals and operations used in sub programs and parameter passing mechanisms.

[1593.4] Recognize the concepts of concurrency control, and exception handling.

[1593.5] Explain the implementations and description of logic programming with examples.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

[PO.2] Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
[PO.3] Design/development of solutions: Design solutions for complex engineering problems and design system components or processes_that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
[PO.4] Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
[PO.5] Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools_including prediction and modeling to complex engineering activities with an understanding of the limitations
[PO.6] The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues,_and the consequent responsibilities relevant to the professional engineering practice

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

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

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

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

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

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

Program Specific Outcomes (PSOs)

[PSO1] Should be able to understand the principles, concepts, and applications in the field of computer-based Communication/networking, information sharing, signal processing, applications, and communication technology.

[PSO2] Should be able to understand medium access mechanisms and routing mechanisms and relevant issues. Should be able to understand QOC.

[PSO3] Identify the existing open problems in the field of computing and propose the best possible solutions. 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	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 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 – **Preliminary Concepts:** Concepts of programming languages; **Syntax and Semantics:** general Problem of describing Syntax and Semantics; **Data types:** Primitive, character, user defined, array, associative record, union, pointer and reference types; **Expressions and Statements:** Assignment Statements, Control Structures; **Subprograms and Blocks:** Fundamentals of sub-programs, Scope of life time of variables, static and dynamic scope, design issues of sub-programs and operations; **Abstract Data types:** Abstractions and encapsulation, introductions to data abstraction, design issues, language examples; **Concurrency:** Subprogram level concurrency, semaphores, monitors, massage passing, Java threads, C# threads, **Exception handling:** Exceptions, exception Propagation, Exception handler in Ada, C++ and Java, **Logic Programming Language:** Introduction and overview of logic programming.

Textbooks:

1. R. W. Sebesta, "*Concepts of Programming Languages*", 8th Edition, Pearson Education, 2008.
2. D. A. Watt," *Programming Language Design Concepts*", Wiley, 2007.

References:

1. A. B. Tucker, R. E. Noonan, "*Programming Languages*", 2nd Edition, TMH, 2007.
2. K. C. Louden, "*Programming Languages*", 2nd Edition, Thomson, 2003.
3. T. W. Pratt, *"Programming Languages",* 4th Edition, PHI, 2006.

F. LECTURE PLAN:

Sr.No.	Topics to be covered	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction to the subject	Understanding of subject credits and outcomes of subject	Lecture	NA	NA
2	Introduction to programming languages	Understanding the concepts of PL.	Lecture	1593.1	Mid Term I, Quiz & End Term
3	Different types of programming languages	Understanding of different PL	Flipped Class	1593.2	Mid Term I, Quiz & End Term
4	Syntax and semantics of PL	Understanding of basic component PL	Lecture	1593.2	Mid Term I, Quiz & End Term
5	General problem of syntax & Semantics	Knowledge about syntax of PL.	Lecture and Flipped Class	1593.2	Mid Term I, Quiz & End Term
6	Introduction to data types	Understanding the data types.	Lecture	1593.2	Mid Term I, Quiz & End Term

7	Different types of data types	Knowledge of different data types.	Lecture	1593.2	Mid Term I, Quiz & End Term
8	Introduction to array	Knowledge of array	Lecture	1593.2	Mid Term I, Quiz & End Term
9	Introduction to record, associative record	Knowledge of records	Lecture	1593.2	Mid Term I, Quiz & End Term
10	Introduction to union	Knowledge of union	Lecture	1593.2	Mid Term I, Quiz & End Term
11	Introduction to pointer	Knowing about pointer	Lecture / Flipped Class	1593.2	Mid Term I, Quiz & End Term
12	Introduction to pointer to reference type	Understand the pointer concept	Lecture	1593.2	Mid Term I, Quiz & End Term
13	Introduction to expressions	Understanding the different expressions	Flipped Lecture	1593.3	Mid Term I, Quiz & End Term
14-15	Expressions, Control structures	Recall different control structures	Flipped Class	1593.3	Mid Term I, Quiz & End Term
16	Introduction to sub- programs	Identify sub programs	Lecture	1593.3	Mid Term II, Quiz & End Term
17	Scope, lifetime of sub programs	Explain scope and lifetime of sub programs	Lecture	1593.3	Mid Term II, Quiz & End Term
18	Static and dynamic scope of variables	Recall static and dynamic	Lecture	1593.4	Mid Term II, Quiz & End Term
19	Design issues of sub-programs	Understanding of design issues	Lecture	1593.4	Mid Term II, Quiz & End Term
20-21	Sub program operations	Know about sub program operations	Lecture	1593.4	Mid Term II, Quiz & End Term
22	Introduction to Abstract Data types:	Understanding of abstract data type	Lecture	1593.4	Mid Term II, Quiz & End Term
23	Introduction to encapsulation	Understanding the encapsulation	Lecture	1593.4	Mid Term II, Quiz & End Term

24	Different language examples for designing purpose	Understanding language examples	Lecture	1593.4	Mid Term II, Quiz & End Term
25	Introduction to Concurrency:	Knowing concept of concurrency	Lecture	1593.4	Mid Term II, Quiz & End Term
26	Subprogram level concurrency	Knowing Concept of subprogram level concurrency	Lecture	1593.4	Mid Term II, Quiz & End Term
27	Introduction to semaphores	Understanding concept of semaphores	Lecture	1593.5	Quiz & End Term
28-29	Introduction to monitors	Know the concept of monitors	Lecture	1593.5	Quiz & End Term
30	Concept of massage passing	Understanding the concept of message passing	Lecture	1593.5	Quiz & End Term
32	Concepts of Java threads and C# threads	Understanding the threads	Lecture	1593.5	Quiz & End Term
34	Introduction to Exceptions	Understanding the concept of exceptions	Lecture	1593.5	Quiz & End Term
35	Exception handler in Ada, C++, and Java	Understanding the exception handler	Lecture	1593.5	Quiz & End Term
36	Introduction to Logic Programming Language	Know the concept of logic programming	Lecture	1593.5	Quiz & End Term
37	Revision	Understanding of problems	Lecture	1593.5	Quiz & End Term
38	Revision	Understanding of problems	Lecture	1593.5	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
CS 1593.1	To understand the concept of different programming languages.	3	2					1			1			2		
CS 1593.2	To master the concepts of programming languages with their standards.		3	3	2					1				2		
CS 1593.3	To understand the fundamentals and operations used in sub programs.	3			3	2				1				3	2	
CS 1593.4	Understand concurrency used in languages.			3	1							3			2	3
CS 1593.5	To master the implementations and description of logic programming.		3		2									3		2

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science & Engineering
Course Hand-out

Data Mining| CS 1790 | 4 Credits | 3 1 0 4

Session: July 20- Nov 20 | Faculty: Dr. Neha Chaudhary | V &VII Sem

A. Introduction: The objective of this course is to enable a clear understanding and knowledge of the concepts and techniques of data mining

The course explores the concepts and techniques of data mining, a promising and flourishing frontier in database systems. Data Mining is automated extraction of patterns representing knowledge implicitly stored in large databases, data warehouses, and other massive information repositories

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

[CS 1790.1] Elaborate various concepts related to Data Mining, Data Analysis and Preprocessing

[CS 1790.2] Apply Various Kinds of Association Rules, frequent pattern mining and correlation

[CS 1790.3] Compare different data mining techniques in classification & prediction.

[CS 1790.4] classify data set based on different clustering Algorithms

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

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	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.	
Homework/ Home Assignment/ Activity Assignment (Formative)	These works are graded with marks. 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

Data mining: Introduction to Data mining, Types of Data, Data Mining Functionalities, Interestingness of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Data Warehouse, Issues, Data, Pre-processing; association rule mining and classification: Mining Frequent Patterns, Mining Various Kinds of Association Rules, Correlation Analysis, Constraint Based Association Mining, Classification and Prediction : Basic Concepts , Decision Tree, Induction , Bayesian Classification , Rule Based Classification , Support Vector Machines, Apriori algorithm, FP-Growth algorithm, Associative Classification , Lazy Learners, Other Classification Methods, Prediction; clustering and applications and trends in data mining: Cluster Analysis, Types of Data, Categorization of Major Clustering Methods: K-means, Partitioning Methods , Hierarchical Methods, Density Based Methods, Model-Based Clustering- Web Mining, Text Mining, Spatial Mining, Case study on Data mining with data sets.

F. TEXT BOOKS

T1: Concepts and Techniques Book by Jiawei Han

G. REFERENCE BOOKS

R1: Reference Books Data Mining: Practical Machine Learning Tools and Techniques Book by Eibe Frank and Ian H. Witten

Lecture Plan:

S.NO	Topics as per the university and syllabus	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Data mining: Introduction to Data mining	Data mining: Introduction to Data mining	To explain teachers expectations and understand student expectations	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
2	Data mining: Introduction to Data mining	Types of Data	Define Types of Data	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
3	Data mining: Introduction to Data mining	Major Issues in Data Mining	Identify Major Issues in Data Mining	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
4	Data mining: Introduction to Data mining	Data Mining Functionalities	Define Data Mining Functionalities	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
5	Data mining: Introduction to Data mining	Interestingness of Patterns	Find Patterns among the data	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
6	Data mining: Introduction to Data mining	Classification of Data Mining Systems	Classification of Data Mining Systems	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
7	Data mining: Introduction to Data mining	Data Mining Task Primitives	Define Data Mining Task Primitives	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
8	Data Pre-processing;	Data Pre-processing: An overview	Illustrate the concept of Data Pre-processing	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
9	Data Pre-processing;	Data Quality	Analyse the Data Quality	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
10	Data Pre-processing;	Major Tasks in Data Preprocessing	Identify the Tasks in Data Preprocessing	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
11	Data Pre-processing;	Data Cleaning	Apply Data Cleaning	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term

12	Data Pre-processing;	Data Integration	Apply Data Integration	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
13	Data Pre-processing;	Data Reduction	Apply Data Reduction	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
14	Data Pre-processing;	Data Transformation and Data Discretization	Plan Data Transformation and Data Discretization	Online Lecture	**[CS 1790.1]**	Class Quiz Mid Term End Term
15	association rule mining	Mining Frequent Patterns	Select Frequent Patterns from the data by using Mining	Online Lecture	**[CS 1790.2]**	Class Quiz Mid Term End Term
16	association rule mining	Mining Various Kinds of Association Rules	Make use of Mining Various Kinds of Association Rules	Online Lecture	**[CS 1790.2]**	Class Quiz Mid Term End Term
17	association rule mining	Correlation Analysis	Show Correlation Analysis	Online Lecture	**[CS 1790.2]**	Class Quiz Mid Term End Term
18	association rule mining	Constraint Based Association Mining	Summarize Constraint Based Association Mining	Online Lecture	**[CS 1790.2]**	Class Quiz Mid Term End Term
19	Classification and Prediction :	Classification and Prediction : Basic Concepts	Explain the concept of Classification and Prediction	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
20	Classification and Prediction :	Decision Tree	Apply Decision Tree	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
21	Classification and Prediction :	Induction	Explain Induction	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
22	Classification and Prediction :	Bayesian Classification	Apply the concept of Bayesian Classification	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
23	Classification and Prediction :	Rule Based Classification	Illustrate Rule Based Classification	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
24	Classification and Prediction :	Support Vector Machines	Illustrate Support Vector Machines	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term

25	Classification and Prediction :	Apriori algorithm	Make use of Apriori algorithm	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
26	Classification and Prediction :	FP-Growth algorithm	Make use of FP-Growth algorithm	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
27	Classification and Prediction :	Associative Classification	Show the concept of Associative Classification	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
28	Classification and Prediction :	Lazy Learners	Apply Lazy Learners in classification	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
29	Classification and Prediction :	Other Classification Methods	Compare Classification Methods	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
30	Classification and Prediction :	Introduction to Neural Network	Illustrate the Neural Network Model	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
31	Classification and Prediction :	Back Prapogation Algorithm	Apply Back Prapogation Algorithm	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
32	Classification and Prediction :	Back Prapogation Algorithm Example	Apply Back Prapogation Algorithm Example	Online Lecture	**[CS 1790.3]**	Class Quiz Mid Term End Term
33	clustering and applications and trends in data mining: Cluster Analysis	Major Clustering Methods: K-means	Categorization of Major Clustering Methods: K-means	Online Lecture	**[CS 1790.4]**	Class Quiz Mid Term End Term
34	clustering and applications and trends in data mining: Cluster Analysis	Partitioning Methods	Analyse Partitioning Methods	Online Lecture	**[CS 1790.4]**	Class Quiz Mid Term End Term
35	clustering and applications and trends in data mining: Cluster Analysis	Hierarchical Methods	Examine Hierarchical Methods	Online Lecture	**[CS 1790.4]**	Class Quiz Mid Term End Term
36	clustering and applications and trends in data mining: Cluster Analysis	Density Based Methods	Analyse Density Based Methods	Online Lecture	**[CS 1790.4]**	Class Quiz Mid Term End Term
37	clustering and applications and trends in data mining: Cluster Analysis	Model-Based Clustering- Web Mining	Analyse Model-Based Clustering- Web Mining	Online Lecture	**[CS 1790.4]**	Class Quiz Mid Term End Term

38	clustering and applications and trends in data mining: Cluster Analysis	Text Mining	Discover Text Mining	Online Lecture	**[CS 1790.4]**	Class Quiz Mid Term End Term
39	clustering and applications and trends in data mining: Cluster Analysis	Spatial Mining	Discover Spatial Mining	Online Lecture	**[CS 1790.4]**	Class Quiz Mid Term End Term
40	clustering and applications and trends in data mining: Cluster Analysis	Case study on Data mining with data sets.		Online Lecture	**[CS 1790.4]**	Class Quiz Mid Term End Term

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

		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
[CS 1790.1]	Elaborate various concepts related to Data Mining, Data Analysis and Pre-processing	1	2	1	1	1				2	3	1	3	3		
[CS 1790.2]	Apply Various Kinds of Association Rules, frequent pattern mining and correlation		3	2	2	3					3	3		3		
[CS 1790.3]	Compare different data mining techniques in classification & prediction.		3	3	3	3				3	3	3	3	3		
[CS 1790.4]	classify data set based on different clustering Algorithms		2	1	3	3					3	1		3		
			1	2	2	2					3	2		3		

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

I. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CS 1790.1]	Elaborate various concepts related to Data Mining, Data Analysis and Pre-processing															
[CS 1790.2]	Apply Various Kinds of Association Rules, frequent pattern mining and correlation															
[CS 1790.3]	Compare different data mining techniques in classification & prediction.															
[CS 1790.4]	classify data set based on different clustering Algorithms															

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Course Hand-out

Problem Solving Using Computers | CS 1001 | 3 Credits | 3 0 0 3

Session: Mar 2021 – June 2021 | Faculty: Dr Sandeep Chaurasia| Dr Prakash Ramani |Mr. Satpal Singh| | Mr. Manoj R | Ms Anjana Syamala| Dr Ashish Jain | Dr Nirmal Kumar Gupta | Ms Smarnika Mohapatra | Mr Anurag Bhatnagar | Mr Deevesh Choudhary |Dr Hemlata Goyal | Dr Vijay Kumar Sharma | Mr Prashant Hemrajani | Mr. Vivek Sharma

Class: B. Tech 1st Year

A. **Introduction:** Problem solving using computers course focuses on basic computer fundamentals, number system and programming in C fundamentals. By means of C language students learn to write set of instructions to create a program so that desire output can be generated by computer.

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

[CS1001.1]. Understand number systems, elements of programming languages and designing flow charts.

[CS1001.2]. Applying the basic programming concepts such as tokens, data types, operators and control statements for implementing programs.

[CS1001.3]. Describe and analyze the concepts of array data type (1D and 2D), functions, structure and union.

[CS1001.4]. Illustrate the concept of pointers and file handling

[CS1001.5]. Creating algorithms or pseudo code to solve real life problems using programing constructs.

C. 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 teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

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

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

PROGRAM SPECIFIC OUTCOMES:

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	20
	Sessional Exam II (Close Book)	20
	Quizzes (03) and Assignment (03)	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.	
Quizzes	3 Quizzes (Close Book)	

E. SYLLABUS

Digital computer fundamentals: Algorithms and flowcharts, the von Neumann architecture, programs, assembly language, high level programming languages; Number System: binary, decimal, octal, hexadecimal; Imperative programming (Using C): data types, variables, operators, expressions, statements, control structures, functions, arrays and pointers, recursion, records (structures), files, input/output, some standard library functions and some elementary data structures.

F. Text Books

T1. E. Balagurusamy, "Programming in ANSI C", 7th Edition, McGraw Hill Publication, 2017.

T2. Y. P. Kanetkar, "Let us C", 16th Edition, BPB Publication, 2017.

G. Reference Books

R1. B. W. Kernighan, D. M. Ritchie, "The C Programing Language", 2nd Edition, Prentice Hall of India, 2014.

R1. B. Gottfired, "Schaum's Outline Series: Programming with C", 3rd Edition, McGraw Hill Publication, 2012.

H. Lecture Plan:

lecture	Topics	Session Outcome	Mode of Delivery ONLINE	Corresponding CO	Mode of Assessing CO
1	Number systems: decimal, binary, octal, hexadecimal, base-r conversions	To acquaint knowledge about basics of number system	Lecture	1001.1	Mid Term I, Quiz & End Term
2	Number systems: decimal, binary, octal, hexadecimal, base-r conversions	To acquaint knowledge about basics of number system	Activity	1001.1	Mid Term I, Quiz & End Term
3	Basic architecture of computers and its building block	Describing basic architecture of computer	Lecture	1001.1	Mid Term I, Quiz & End Term
4	Computer languages: machine language, assembly language, high level language; translators: assembler, compiler, interpreter	Differentiate between machine language and high-level language	Lecture	1001.1	Mid Term I, Quiz & End Term
5	Short history, character set, tokens	Different characters and tokens	Guided Self-Study	1001.2	Mid Term I, Quiz & End Term
6	Constants (integer, real, character, string); variables, keywords	Describe and implementation of various constant type	Lecture	1001.2	Mid Term I, Quiz & End Term
7	Data types (table including range, memory and format specifier)	Implementation of various data type	Lecture	1001.2	Mid Term I, Quiz & End Term
8	Operators: arithmetic, relational, logical, assignment	Implementation of various arithmetic operations	Lecture	1001.2	Mid Term I, Quiz & End Term
9	Bitwise, conditional, type-cast, sizeof, comma	Implementation of various operators	Lecture	1001.2	Mid Term I, Quiz & End Term
10	Operator precedence and associativity, type conversion	Implementation of precedence in programming	Activity (Think Pair Share)	1001.2	Mid Term I, Quiz & End Term
11	Operator precedence and associativity, type conversion	Implementation of precedence in programming	Lecture	1001.2	Mid Term I, Quiz & End Term
12	Input and output statements (formatted and unformatted) : printf, scanf	Implementation of input and	Lecture	1001.2	Mid Term I, Quiz & End Term

		output statements			
13	Gets, puts, getchar, putchar	Implementation of input and output statements using system functions	Activity	1001.2	Mid Term I, Quiz & End Term
14	Decision statements: if, if-else, nested if-else, if-else ladder	Implementation of decision statements	Lecture	1001.3	Mid Term I, Quiz & End Term
15	Decision statements: if, if-else, nested if-else, if-else ladder	Implementation of decision statements	Lecture	1001.3	Mid Term I, Quiz & End Term
16	Switch, break statement	Learning the implementation of switch and break	Lecture	1001.3	Mid Term I, Quiz & End Term
17	Switch, break statement	Learning the implementation of switch and break	Lecture	1001.3	Mid Term I, Quiz & End Term
18	Repetitive structures: for, while, do-while	Learning the implementation of looping	Lecture	1001.3	Mid Term II, Quiz & End Term
19	Repetitive structures: for, while, do-while	Learning the implementation of looping	Lecture	1001.3	Mid Term II, Quiz & End Term
20	Nested loops	Learning the implementation of looping	Activity (Think Pair Share)	1001.3	Mid Term II, Quiz & End Term
21	Nested loops	Learning the implementation of looping	Lecture	1001.3	Mid Term II, Quiz & End Term
22	Continue and break statements	Describe the usage of continue and break	Lecture	1001.3	Mid Term II, Quiz & End Term
23	Continue and break statements	Describe the usage of continue and break	Lecture	1001.3	Mid Term II, Quiz & End Term
24	1-D array: definition, declaration, initialization, input array, output array	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
25	1-D array: definition, declaration, initialization, input array, output array	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
26	1-D character array: character array, string, string standard function	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
27	1-D character array: character array, string, string standard function	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term

28	Use of 1D array: Linear Search and Bubble Sort	Describe use of linear array	Activity	1001.4	Mid Term II, Quiz & End Term
29	2-D array: definition, declaration, initialization, input array, output array, one simple program	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
30	2-D array: definition, declaration, initialization, input array, output array, one simple program	Describe and define array of various data type	Lecture	1001.4	Mid Term II, Quiz & End Term
31	2-D array: definition, declaration, initialization, input array, output array, one simple program	Describe and define array of various data type	Lecture, Activity	1001.4	Mid Term II, Quiz & End Term
32	Pointers: introduction	Describe functionality of pointers in programming	Lecture	1001.4	Mid Term II, Quiz & End Term
33	1-D Array and pointer	Implementation of ID array with pointer	Lecture	1001.4	Mid Term II, Quiz & End Term
34	Functions: introduction to functions	Describe importance of function and modular programming	Lecture, Activity	1001.4	Mid Term II, Quiz & End Term
35	Function prototype, call, definition	Describe importance of function and modular programming	Lecture	1001.4	Mid Term II, Quiz & End Term
36	Storage classes	Describe usage of storage classes	Lecture	1001.4	Mid Term II, Quiz & End Term
37	Structures: definition, declaration, initialization, array of structures	Describe usage of structures	Lecture	1001.4	Quiz & End Term
38	Structures: definition, declaration, initialization, array of structures	Describe usage of structures	Lecture	1001.4	Quiz & End Term
39	Union, difference between union and structures	Describe usage of union	Lecture	1001.4	Quiz & End Term
40	File handling: introduction, operations on files, opening modes	Describe usage of file handling with various operations and modes	Lecture	1001.5	Quiz & End Term
41	File handing function	Describe usage of file handling with various operations and modes	Lecture	1001.5	Quiz & End Term
42	File handing function	Describe usage of file handling with various operations and modes	Lecture	1001.5	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
CS 1001.1:	Understand number systems, elements of programming languages and designing flow charts.	2	1										1	2	1	1
CS 1001.2:	Applying the basic programming concepts such as tokens, data types, operators and control statements for implementing programs.	2		1									2	1		
CS 1001.3:	Describe and analyze the concepts of array data type (1D and 2D), functions, structure and union.	3	1										2	1		
CS 1001.4:	Illustrate the concept of pointers and file handling	2		2									1			
CS 1001.5:	Creating algorithms or pseudo code to solve real life problems using programing constructs	3	2	1									3	3	1	1

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Course Hand-out

Problem Solving Using Computers Lab
| CS 1030 | 1 Credit | 0 0 2 1

Session: Mar 2021 – June 2021 | Faculty: Dr Sandeep Chaurasia| Dr Prakash Ramani |Mr. Satpal Singh| | Mr. Manoj R | Ms Anjana Syamala| Dr Ashish Jain | Dr Nirmal Kumar Gupta | Ms Smarnika Mohapatra | Mr Anurag Bhatnagar | Mr Deevesh Choudhary |Dr Hemlata Goyal | Dr Vijay Kumar Sharma | Mr Prashant Hemrajani | Mr. Vivek Sharma

Class: B.Tech 1st Year

A. Introduction: Problem Solving Using Computers focuses on basic computer fundamentals, number system and programming fundamentals. By means of C language students learn to write set of instruction to create a program so that desire output can be generated by computer.

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

[CS1030.1]. Design and develop flow chart, algorithms and pseudo code to solve real life problems.
[CS1030.2]. Illustrate the basic programming concepts such as tokens, data types, operators and control statements.
[CS1030.3]. Demonstrate the concepts array data type (1D and 2D), functions, structure and union.
[CS1030.4]. Describe the concept of pointers and file handling.

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. Assessment Plan:

Criteria	Description	Maximum Marks
Lab	Practical Lab Exam	40
	Day to Day Assessment	60
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home. 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 will be assessed and marks will be awarded.	

E. SYLLABUS

Digital computer fundamentals: Algorithms and flowcharts, the von Neumann architecture, programs, assembly language, high level programming languages; Number System: binary, decimal, octal, hexadecimal; Imperative programming (Using C): data types, variables, operators, expressions, statements, control structures, functions, arrays and pointers, recursion, records (structures), files, input/output, some standard library functions and some elementary data structures.

F. Text Books

T1. E. Balagurusamy, "Programming in ANSI C", 7th Edition, McGraw Hill Publication, 2017.

T2. Y. P. Kanetkar, "Let us C", 16th Edition, BPB Publication, 2017.

G. Reference Books

R1. B. W. Kernighan, D. M. Ritchie, "The C Programing Language", 2nd Edition, Prentice Hall of India, 2014.

R1. B. Gottfired, "Schaum's Outline Series: Programming with C", 3rd Edition, McGraw Hill Publication, 2012.

H. Lab Experiment Plan:

S No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1	Algorithms and Flow Charts	Describe the flowcharts and design of algorithm	Demonstration	1030.1	Mid Term I, Viva voce & End Term
2	Working with Linux Commands	Use Unix commands to manage files and develop programs, including multi-module programs	Demonstration	1030.1	Mid Term I, Viva voce & End Term
3	Formula based C Programs	Understand the fundamentals of C programming.	Demonstration	1030.2	Mid Term I, Viva voce & End Term
4	Control Structures: If statement	Choose the loops and decision making statements to solve the problem.	Demonstration	1030.2	Mid Term I, Viva voce & End Term
5	Control Structures: Switch	Choose the loops and decision making statements to solve the problem.	Demonstration	1030.3	Mid Term I, Viva voce & End Term
6	Control Structures: Loops	Choose the loops and decision making statements to solve the problem	Demonstration	1030.3	Mid Term I, Viva voce & End Term
7	Control Structures: Nested Loops	Choose the loops and decision making statements to solve the problem	Demonstration	1030.3	Mid Term I, Viva voce & End Term
8	1-D Array	Implement different Operations on arrays	Demonstration	1030.3	Mid Term I, Viva voce & End Term
9	2-D Arrays	Implement different Operations on arrays	Demonstration	1030.4	Mid Term I, Viva voce & End Term
10	Strings	Implementation of precedence in programing	Demonstration	1030.4	Mid Term I, Viva voce & End Term
11	Functions	Use functions to solve the given problem	Demonstration	1030.4	Mid Term I, Viva voce & End Term
12	Pointers	Understand pointers, structures and unions	Demonstration	1030.4	Mid Term I, Viva voce & End Term
13	Structures	Understand pointers, structures and unions	Activity (Jigsaw)	1030.4	Mid Term I, Viva voce & End Term
14	End Term Exam				

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS 1030.1:	Design and develop flow chart, algorithms and pseudo code to solve real life problems.	3											1	3		
CS 1030.2:	Illustrate the basic programming concepts such as tokens, data types, operators and control statements.	2													2	
CS 1030.3:	Demonstrate the concepts array data type (1D and 2D), functions, structure and union.	2		1									2	2		
CS 1030.4:	Describe the concept of pointers and file handling.	1											2	1		

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Hand-out

Operating Systems | CS 2201 | 4 Credits | 3 0 1 3

Session: Jan 21-May 21 | Faculty: Dr. Umashankar Rawat | Class: B. Tech. IV SEM

A. Introduction: This course is offered by Dept. of Computer Science and engineering as a department core subject. The course provides a comprehensive understanding of Operating System principles, techniques and approaches used for designing the software. The focus of the course is to make the students understand how various components of operating system interact and provides services for execution of application software. Student will be apprised of process management, deadlock, concurrency control, memory management, file management and I/O management in detail, which will be beneficial for software development.

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

[2201.1]. Describe the objectives, structure, functionality, and types of operating systems.
[2201.2]. Apply skills to develop system programs using file and process system calls and PThread API.
[2201.3]. Judge various process scheduling algorithms as per scheduling criteria.
[2201.4]. Examine concepts related to process synchronization and various deadlock handling strategies to solve resource allocation problems.
[2201.5]. Distinguish different memory management techniques and page replacement algorithms.
[2201.6]. Compare various disk scheduling and storage strategies.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. ASSESSMENT PLAN:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	Quizzes and Assignments (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
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: Definition of operating systems, Single and multi-processor systems, Operating system Services, System commands and system calls, Interrupt, System boot. **OS Structure**: Simple, Layered, Microkernel, Hybrid, Modules, Types of OS, Multi-user, Multitasking, Embedded, Real-time, Network, Distributed. **Virtualization:** Introduction, Hypervisor, Data center, Virtual data center, VMware virtualization products. **Process and Thread:** Process concept, Operations on processes, Inter-process communication, UNIX pipes, Multithreading, Multithreaded models, PThread API. **Process Scheduling:** Basic concepts, Scheduling criteria, Scheduling algorithms. **Synchronization:** Critical section problem, Peterson solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Deadlock, Methods for handling deadlock. **Memory Management:** Swapping, Contiguous memory allocation, Paging, Structure of Page Table, Segmentation, Demand Paging, Page Replacement Policies, Allocation of Frames, Thrashing. **File System Interface and Implementation:** File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File System Structure, File System Implementation, Allocation Methods, Free Space Management. **Disk Management:** Disk Scheduling Algorithms, Disk Management, Swap Space Management.

References:

1. A. Silberschatz, P. B. Galvin, G. Gagne, *Operating System Concepts*, (9e), Wiley, 2014.
2. A.S. Tanenbaum, H. Bos, *Modern Operating Systems*, (4e), Pearson, 2015.
3. W. Stallings, *Operating Systems: Internals and Design Principles*, (9e), Pearson, 2018.

F. Lecture Plan:

Lecture No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction and Course Hand-out briefing	To acquaint and clear teachers' expectations and understand student expectations	Lecture	NA	NA

2,3	**Introduction:** Definition of operating systems, Single and multi-processor systems, Operating system Services, System commands and system calls, Interrupt, System boot.	Discuss the objectives of OS, dual mode CPU operation, execution of system calls, interrupts, and booting process.	Lecture	2201.1	Quiz MTE-1 End Term
4,5,6	**OS Structure:** Simple, Layered, Microkernel, Hybrid, Modules, Types of OS, Multi-user, Multitasking, Embedded, Real-time, Network, Distributed.	Distinguish various operating system structures and types of operating systems.	Lecture	2201.1	Quiz MTE-1 End Term
7,8	**Virtualization:** Introduction, Hypervisor, Data center, Virtual data center, VMware virtualization products.	Describe Hypervisor, Virtual Data Center and other VMware virtualization products.	Lecture	2201.1	Quiz MTE-1 End Term
9,10,11,12, 13	**Process:** Process Concept, Process scheduling Operations on processes Inter-process Communication, Unix Pipes	Describe process state transitions, process control block, and context switching and write system programs for process creation, execution, inter-process communication.	Lecture	2201.2	Quiz MTE-1 End Term Programming Assignment
14,15,16	**Multithreaded Programming:** Overview, multithreaded models Thread libraries Programs using Pthreads	Describe significance of threads, multithreaded models and write system programs using PThreads	Lecture	2201.2	Quiz MTE-1 End Term Programming Assignment
17, 18, 19, 20	**Process scheduling:** Basic concepts, scheduling criteria, Scheduling Algorithms.	Judge various algorithms used for process scheduling based on various scheduling criteria	Lecture Tutorial	2201.3	Quiz Mid Term I End Term
FIRST SESSIONAL EXAM					
21, 22, 23, 24, 25	**Process Synchronization:** Background, Critical section problem Peterson's solution Synchronization Hardware, Semaphores Classical problems of synchronization.	Apply concepts related to concurrency to achieve the same for cooperating processes.	Lecture Tutorial	2201.4	Quiz MTE-2 End Term
26, 27	Synchronization Programs using PThreads	Write programs for synchronization problems.	Lecture	2201.4	Quiz MTE-2 End Term Project
28, 29, 30, 31	**Deadlocks:** System model, Deadlock Characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.	Apply various deadlock handling strategies to solve resource allocation problems.	Lecture Tutorial	2201.4	Quiz MTE-2 End Term
32, 33, 34, 35, 36	**Memory Management:** Background, Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation,	Distinguish between different memory management techniques.	Lecture Tutorial	2201.5	Quiz MTE-2 End Term
37, 38, 39, 40, 41	Demand Paging, Page Replacement Policies, Allocation of Frames, Thrashing.	Describe the concept of virtual memory, and compare various page replacement algorithms	Lecture Tutorial	2201.5	Quiz End Term
SECOND SESSIONAL EXAM					

42, 43, 44, 46, 47, 48	**File System Interface and Implementation:** File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File System Structure, File System Implementation, Space Allocation Methods for Files, Free Space Management.	Compare various file allocation methods and free space management techniques.	Lecture Tutorial	2201.6	Quiz End Term
49, 50, 51	**Disk Management:** Disk Scheduling Algorithms, Disk Management, Swap Space Management.	Compare various disk scheduling algorithms.	Lecture Tutorial	2201.6	Quiz End Term
END TERM EXAM					

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS 2201.1	Describe the objectives, structure, functionality and types of operating systems.	**3**									**1**		**2**			
CS 2201.2	Apply skills to develop system programs using file and process system calls and PThread API.	**2**		**3**		**1**				**1**			**2**	**1**		**2**
CS 2201.3	Judge various process scheduling algorithms as per scheduling criteria.	**3**											**2**	**1**		**1**
CS 2201.4	Examine concepts related to process synchronization and various deadlock handling strategies to solve resource allocation problems	**3**	**2**	**2**									**2**	**1**		**1**
CS 2201.5	Distinguish different memory management techniques and page replacement algorithms.	**3**											**2**	**1**		**1**
CS 2201.6	Compare various disk scheduling and storage strategies	**3**											**2**	**1**		**1**

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

MANIPAL UNIVERSITY JAIPUR
School of Computing and Information Technology

Department of Computer Science & Engineering

Course Hand-out

Relational Database Management Systems| CS 2202 | 4 Credits | 3 1 0 4

Session: Feb '21 – May '21 |

Faculty: Dr. Sandeep Joshi, Dr. Satyabrata Roy, Dr. Santosh K Vishwakarma (Course Coordinator), Dr. Rishi Gupta

Class: B.Tech. 2nd Year IV Semester (Core Course)

A. **Introduction:** This course introduces the role and nature of relational database management systems (RDBMS) in today's IT environment. The course covers understanding and application of the integral aspects of RDBMS such as ER Diagrams, Relational Algebra, Keys concepts, Normalization, Transaction Management, Concurrency Control, Indexing & Structured Query Language components.

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

CS2202.1: **Identify** the basic concepts of Relational Database Management System and **compare** various data models used in database design.
(Knowledge Level / Understand Level)

CS2202.2: **Identify** the Entity relationship modelling concepts & mapping to relational models & **apply** the design concepts for real world problems.
(Knowledge Level / Apply Level)

CS2202.3: **Analyze** various Relational Formal Query Languages.
(Analyze Level)

CS2202.4: **Recognize** the use of normalization in database design and **apply** normal forms to carry out schema refinement.
(Knowledge Level / Apply Level)

CS2202.5: **Apply** and **Relate** the concept of transaction, concurrency control and recovery in database.
(Apply Level)

CS2202.6: **Explain** the database file storage structures and access techniques, concepts of indexing using B tree & B+ Tree.
(Knowledge Level)

C. Vision, Mission, Program Educational Objectives, Program Outcomes, Program Specific Outcomes

Vision:

To achieve Excellence in Computer Science & Engineering Education for Global Competency with Human Values

Mission:

1. Provide innovative Academic & Research Environment to develop competitive Engineers in the field of Computer Science Engineering
2. Develop Problem-solving & Project Management Skills by Student Centric Activities & Industry Collaboration
3. Nurture the Students with Social & Ethical Values

Program Educational Objectives (PEOs)

1. Graduates will Demonstrate Professional Skills on Global Platform in Computer Science Engineering and Integrated Domains
2. Graduates will Enhance Knowledge and Skills through Higher Studies and Lifelong Learning of New Computing Technologies
3. Graduates will Provide Innovative Solutions to Drive Societal Advancement through Technology Entrepreneurship and Start-up

Program Specific Outcomes (PSOs)

1. Graduates will be able to design, develop and implement efficient software. for a given real life problem.
2. Graduates will be able to apply knowledge of AI, Machine Learning and Data Mining in analyzing big data for extracting useful information from it and for performing predictive analysis.
3. Graduates will be able to design, manage and secure wired/ wireless computer networks for transfer and sharing of information.

Program Outcomes (POs):

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

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

[PO.3]. Design 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]. 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]. 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]. 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]. 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]. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.

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

[PO.10]. 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]. 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]. Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	20
	Sessional Exam II	20
	Quizzes (MS Teams): 03 MOOC: 01 Assignments: 02 1 before MTE1 2 before MTE2	10 5 5
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)	As per the guidelines from Academic Section	
Homework/ Home Assignment/ Activity Assignment (Formative)	As per the guidelines from Academic Section	

E. SYLLABUS

Introduction: Data, data processing requirement, traditional file-based system, Def of database, database management system, 3-schema architecture, Benefits of DBMS. Database system applications, Purpose of database systems, Different database users. DBMSs, data driven development, OLAP, OLTP.

Data Modelling and ER/EER diagrams: Conceptual data model, Conceptual data modelling using E-R data model, entities, attributes, relationships, Generalization, specialization, specifying constraints.

Relational Algebra and Calculus: Selection and projection set operations, renaming - Joins – Union, intersection, Division, Examples of Algebra overviews, Relational calculus, Tuple relational Calculus, Domain relational calculus, Expressive Power of Algebra, and calculus.

Relational Model, ER mapping to relational models & Relational Algebra: the relational data model, relational constraints and the relational algebra, relational model concepts, relational constraints and relational database schemas, update operations and dealing with constraints violations, basic relational algebra operations, additional relational operations, examples of queries in relational database design using ER-to-Relational Mapping**.**

SQL: Data definition, Constraints, and schema changes in SQL2, Basic queries in SQL, more complex SQL queries, Insert, Delete and Update statements in SQL, Views (Virtual tables) in SQL, Specifying General Constraints as assertion, Additional features of SQL.

Database Design & Normalization : Def of relation, relational model operators, Keys, relational model integrity rules, Functional dependencies and normalization for relational databases :Informal design guidelines for schemas, functional dependencies, Normal forms based on Primary keys, General definitions of second and third normal forms, Boyce-Codd normal form, Relational database algorithms and further dependencies: Algorithms for relational database schema design, multivalued dependencies and fourth normal form.

Transaction Processing & Management: Transaction concept &State, Concurrency Control: Lock Based Protocols, Multiple granularities, Deadlocks.

Recovery: Recovery & Atomicity, Log based Recovery.

Concurrency control mechanisms: concurrency control techniques: Locking techniques for concurrency control techniques, concurrency control based on Timestamp ordering, multi-version concurrency control techniques, validation (optimistic) concurrency for concurrency control in indexes, some other concurrency control issues.

File Storage, Indexing & Hashing: File structures, RAID Level, Order indices, B+-Tree Indices File, B+- Tree extensions, Multiple Key Access, Static Hashing and Dynamic Hashing.

F. TEXT BOOKS

1. Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", TMH, New Delhi, 7th Edition, 2019

2. R. Elmasri, S. B. Navathe, "Fundamentals of Database Systems", Addison & Wesley, 7th Edition, 2016

G. REFERENCE BOOKS

1. C. J. Date, "Database Systems", Prentice Hall of India, New Delhi, 2012
2. Raghu Ramakrishnan, "Database Management Systems (2nd Ed)", McGraw Hill, 2000.
3. Ivan Bayross, "Introduction to SQL", Tata McGraw, 2010.

H. Lecture Plan: 48 Lectures

S.No.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Introduction to Data, Information, Traditional file-based system vs database management systems.	Classify, Compare & recall different file-based system, Data Model.	PPT, Lecture, Class Notes	CS2202.1	Mid Term I, Quiz & End Term
2.	Data Models & Its types, Schema, and Instance	Compare file systems and DBMS	PPT, Lecture, Class Notes	CS2202.1	Mid Term I, Quiz & End Term
3.	Three Schema Architecture, Data Independence Concept	Classify and Compare different Data Model.	PPT, Lecture, Class Notes	CS2202.1	Mid Term I, Quiz & End Term
4.	Conceptual data model, E-R data model. Components of ER Model	Understand and design Entity Relationship Model	PPT, Lecture, Class Notes	CS2202.1 & CS2202.2	Mid Term I, Quiz & End Term
5.	Relationship & Its types, Relationship Sets, Mapping Cardinality & Participation Constraints.	Understand and design ER Model and illustrate the concept of mapping cardinality & participation	PPT, Lecture, Class Notes	CS2202.1 & CS2202.2	Mid Term I, Quiz & End Term
6.	Enhanced Entity- Relationship (EER) Model: Specialization and Generalization	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	CS2202.1 & CS2202.2	Mid Term I, Quiz & End Term
7.	Relational Model Concepts: Domain, Attributes, Tuples and Relations, Constraints	Understand the concepts of relational model	PPT, Lecture, Class Notes	CS2202.1 & CS2202.2	Mid Term I, Quiz & End Term
8.	Entity Integrity, Referential Integrity and Foreign Keys.	Understand various concepts of key constraints.	PPT, Lecture, Class Notes	CS2202.1 & CS2202.2	Mid Term I, Quiz & End Term
9.	Relational database design using ER-to-Relational Mapping.	Understand mapping of ER models into relations	PPT, Lecture, Class Notes	CS2202.1 & CS2202.2	Mid Term I, Quiz & End Term
10.	Mapping EER Model constructs to Relations.	Understand mapping of EER models into relations	PPT, Lecture, Class Notes	CS2202.1 & CS2202.2	Mid Term I, Quiz & End Term
11.	Relational Algebra: Unary Relational Operations SELECT and PROJECT, RENAME	Understand unary relational operations like	PPT, Lecture, Class	CS2202.3	Mid Term I, Quiz & End Term

		SELECT and PROJECT	Notes		
12.	Relational Algebra Operation from Set Theory: UNION, INTERSECTION, CARTESIAN PRODUCT	Interpret different Relational Algebra operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CS2202.3	Mid Term I, Quiz & End Term
13.	Binary Relational Operations: JOIN and DIVISION Operation	Interpret JOIN and DIVISON operations and apply the techniques and rules in different problems.	PPT, Lecture, Class Notes	CS2202.3	Mid Term I, Quiz & End Term
14.	Variations of JOIN: THETA JOIN, EQUI JOIN, NATURAL JOIN, INNER JOIN and OUTER JOIN	Interpret different types of JOIN operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CS2202.3	Mid Term I, Quiz & End Term
15.	Additional Relational Operations: Generalized Projection, Aggregate Functions and Grouping.	Interpret additional Relational Algebra operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
16.	Tuple Relational Calculus: Tuple Variable and Range Relations, Expressions and Formulas in tuple relational calculus.	Interpret different Relational Calculus operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
17.	The Existential and Universal Quantifiers, Safe Expressions.	Understand existential and universal and existential quantifiers.	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
18.	Domain Relational Calculus.	Understand concepts of domain relational calculus.	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
19.	SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema change statements in SQL.	Understand fundamentals of SQL	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
20.	Relational Model Constraints Domain Constraints, Key Constraints and Constraints on NULL Values.	Understand and design Entity Relationship Model and illustrate the concept of NULL values.	PPT, Lecture, Class Notes	CS2202.3	Mid Term I, Quiz & End Term
21.	Basic queries in SQL	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
22.	Correlated Nested Queries, EXISTS and UNIQUE functions in SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
23.	Joined tables in SQL and Outer Joins, Aggregate functions in SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
24.	GROUP BY, HAVING Clauses, INSERT, DELETE, AND UPDATE Statements in SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
25.	Views (Virtual tables) in SQL, Specifying General Constraints as assertion and Triggers, Additional. features of SQL.	Interpret SQL and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	CS2202.3	Mid Term II, Quiz & End Term
26.	Database Design: Anomalies in databases	Understand the concepts of different anomalies and how they can be removed	PPT, Lecture, Class Notes	CS2202.4	Mid Term II, Quiz & End Term
27.	Functional Dependencies: Definition of functional dependencies, Inference rules for functional dependencies.	Understand concepts of functional dependencies	PPT, Lecture, Class Notes	CS2202.4	Mid Term II, Quiz & End Term

28.	Equivalence of sets of functional dependencies, Minimal sets of functional dependencies.	Understand the process of finding out equivalence among given sets of FDs and finding out minimal sets of functional dependencies	PPT, Lecture, Class Notes	CS2202.4	Mid Term II, Quiz & End Term
29.	Normal forms based on Primary keys, Normalization of relations, Definition of Super Key and Candidate Key. Definition of Prime and Non-Prime Attribute.	Understand different normalization techniques for optimizing database and analyze database design	PPT, Lecture, Class Notes	CS2202.4	Mid Term II, Quiz & End Term
30.	Normal Forms: First normal form, Second normal form.	Understand 1NF and 2NF	PPT, Lecture, Class Notes	CS2202.4	Mid Term II, Quiz & End Term
31.	Third normal form and Boyce-Codd normal form.	Understand 3NF and BCNF	PPT, Lecture, Class Notes	CS2202.4	Mid Term II, Quiz & End Term
32.	Multivalued dependencies and fourth normal form.	Understand concepts of multivalued dependencies	PPT, Lecture, Class Notes	CS2202.4	Mid Term II, Quiz & End Term
33.	Properties of Relational Decompositions: Dependency preservation and Lossless join property of a decomposition.	Understand concepts of relational decompositions	PPT, Lecture, Class Notes	CS2202.4	Mid Term II, Quiz & End Term
34.	Introduction to transaction processing, Desirable properties of transactions.	Understand and summarize transaction processing	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
35.	Characterizing schedules based on recoverability.	Understand and summarize concepts of recoverability of schedules	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
36.	Characterizing schedules based on Serializability: Serial, Nonserial and conflict serializable schedules.	Understand and summarize concepts of schedules	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
37.	View equivalence and View Serializability.	Understand and summarize concepts of serializability	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
38.	Concurrency control techniques: Two Phase locking Protocol	Understand and summarize concurrency control techniques.	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
39.	Types of 2PL: Basic 2PL, Strict 2PL, Rigorous 2PL.	Understand the concepts of locking for concurrency control	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
40.	Deadlock prevention protocol (Wait-Die, Wound-Wait), Deadlock detection and starvation.	Understand different strategies of deadlock prevention and detection strategies	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
41.	Concurrency control based on Timestamp Ordering (Basic TO, Strict TO and Thomas's Write Rule.	Understand concurrency control based on timestamp ordering.	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
42.	Granularity of Data items and Multiple Granularity Locking.	Understand concepts of multiple granularities locking	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
43.	Database Recovery Techniques: Recovery Concepts, Recovery Technique based on Deferred Update.	Understand and summarize recovery techniques.	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term
44.	Recovery Technique based on Immediate Update, Recovery Systems Check pointing and Shadow paging.	Understand and summarize recovery techniques.	PPT, Lecture, Class Notes	CS2202.5	Quiz & End Term

45.	File Storage: File structures (Fixed Length Record, Variable Length Record), Record Blocking and Spanned versus Un-spanned Records.	Explain different database storage structure and access technique	Lectures, Flipped Classroom	CS2202.6	Quiz & End Term
46.	RAID organization and Levels, Hashing Techniques (Internal and External Hashing).	Explain RAID organization and Hashing techniques	Lectures, Flipped Classroom	CS2202.6	Quiz & End Term
47.	Indexing Structure: Single Level ordered indexes (Primary, Clustering, and Secondary).	Explain different indexing techniques	PPT, Lecture, Class Notes	CS2202.6	Quiz & End Term
48.	Multilevel Indexes, Dynamic multilevel indexes using B-Tree & B+ Tree	Explain different indexing techniques	PPT, Lecture, Class Notes	CS2202.6	Quiz & End Term

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	**Identify** the basic concepts of Relational Database Management System and **compare** various data model used in database design.	1												1		
2	**Identify** the Entity relationship modelling concepts & mapping to relational model & **apply** the design concepts for real world problems.	2	3	3	2	3				2	2	2		2	2	
3	**Analyze** various Relational Formal Query Languages	2		1	2	2				1				2	2	
4	**Recognize** the use of normalization in database design and **apply** normal forms to carry out schema refinement.	2	2	3	2	2	2					2		2	2	
5	**Apply and Relate** the concept of transaction, concurrency control and recovery in database.	2	2	1		2	1							2	2	
6	**Explain** the database file storage structures and access techniques, concepts of indexing using B tree & B+ Tree.	1		1	1	1								2		

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT

Department of Computer Science and Engineering
Course Hand-out

Computer Organization | CS 2203 | 4 Credits | 3 0 1 4

Session: Feb 21 – May 21 | Faculty: Dr. Rajveer S Shekhawat | Dr. Aditya Sinha | Anubha Parashar | Class: IV Semester

A. Introduction: This course is offered by Dept. of Computer Science and Engineering for fourth 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.

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

[2203.1]. Describe and explain CPU, its building blocks and their working
[2203.2]. Describe fundamental concepts od pipeline and hazards.
[**2203.3].** Distinguish the memory hierarchy and organization.
[2203.4]. Illustrate and compare different I/O mechanisms.
[2203.5]. Explain the various methodologies for parallel processing.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. Assessment Plan:

Criteria	Description	Date (Tentative)	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)		15
	Sessional Exam II (Closed Book)		15
	Quizzes and Assignments (Accumulated and Averaged)	Regularly	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 miss a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.		
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.		

E. SYLLABUS

Processor Datapath and Control: Logic Design Conventions, Building a Datapath, Implementation Schemes, ~~Exceptions,~~ Microprogramming. **Pipelining:** Overview, Pipelined Datapath, Pipelined Control, ~~Data Hazards~~ and Forwarding, ~~Data Hazards~~ and Stalls, Branch Hazards. **Memory Hierarchy:** Basics of Caches, Measuring and Improving Cache Performance, Virtual Memory, Address Translation. **Storage and Other Peripherals:** Disk Storage and Dependability, Networks, Connecting I/O Devices to Processor and Memory, Interfacing I/O Devices to the Memory, Processor, and Operating System, I/O Performance Measures, Redundant Array of Inexpensive Disks. **Multicores, Multiprocessors and Clusters:** Shared Memory Multiprocessors, Clusters and other Message-Passing Multiprocessors, Hardware Multithreading, SISD, MIMD, SIMD, SPMD and Vector Processors

F. TEXTBOOKS

T1. D. A. Patterson, J. L. Hennessy, Computer Organization and Design: The Hardware and Software Interface, (5e), Elsevier, 2014.

T2. M. Morris Mano, *"Computer System Architecture"*, Pearson, 3rd Edition Revised, 2014.

G. REFERENCE BOOKS

R1. J. L. Hennessy, D. A. Patterson, Computer Architecture: A Quantitative Approach, (6e), Morgan Kaufmann Publishers, 2019

R2. W. Stallings, Computer Organization and Architecture –Designing for Performance, (9e), Pearson, 2013.

R3. John P. Hayes, *"Computer Architecture and Organization",* TMH, 3rd Edition, 1998.

H. Lecture Plan:

Lectures	Major Topics	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing CO
1.	Processor Datapath and Control (Lecture 01-05)	Introduction	Lecture	21203.1	Mid Term I, Quiz & End Term
2.		Logic Design Conventions	Lecture	21203.1	Mid Term I, Quiz & End Term
3.		Implementation Schemes	Lecture	21203.1	Mid Term I, Quiz & End Term
4.		Exceptions	Lecture	21203.1	Mid Term I, Quiz & End Term
5.		Tutorial	Activity	21203.1	Mid Term I, Quiz & End Term
6.		Building a Datapath	Lecture	21203.1	Mid Term I, Quiz & End Term
7.		Microprogramming	Lecture	21203.1	Mid Term I, Quiz & End Term
8.		Tutorial	Activity	21203.1	Mid Term I, Quiz & End Term
9.	Pipeline (Lecture 06-18)	Pipeline, Designing of Pipeline	Lecture	21203.2	Mid Term I, Quiz & End Term
10.		Types of Pipeline	Lecture	21203.2	Mid Term I, Quiz & End Term
11.		RISC Pipeline	Lecture	21203.2	Mid Term I, Quiz & End Term
12.		Data Dependency	Lecture	21203.2	Mid Term I, Quiz & End Term
13.		Tutorial	Activity	21203.2	Mid Term I, Quiz & End Term
14.		Control Dependency	Lecture	21203.2	Mid Term I, Quiz & End Term
15.		Branch Prediction Buffer	Lecture	21203.2	Mid Term I, Quiz & End Term
16.		Instruction Scheduling	Lecture	21203.2	Mid Term I, Quiz & End Term
17.		Hazards, Types of Hazards	Lecture	21203.2	Mid Term I, Quiz & End Term
18.		Tutorial	Flipped Class	21203.2	Mid Term I, Quiz & End Term
19.		Forwarding, Data Hazards and Stalls	Lecture	21203.2	Mid Term I, Quiz & End Term
20.		Forwarding, Data Hazards and Stalls	Lecture	21203.2	Mid Term I, Quiz & End Term
21.		Branch Hazards	Lecture	21203.2	Mid Term I, Quiz & End Term
22.		Tutorial	Flipped Class	21203.2	Mid Term I, Quiz & End Term

23.	Memory Hierarchy (Lecture 19-34)	Introduction to basic structure of memory hierarchy	Lecture	21203.3	Mid Term II, Quiz & End Term
24.		Program Execution	Lecture	21203.3	Mid Term II, Quiz & End Term
25.		Memory Organization, Types of memory organization	Lecture	21203.3	Mid Term II, Quiz & End Term
26.		Memory Interfacing	Lecture	21203.3	Mid Term II, Quiz & End Term
27.		Tutorial	Flipped Class	21203.3	Mid Term II, Quiz & End Term
28.		Instruction Cycle	Lecture	21203.3	Mid Term II, Quiz & End Term
29.		8085 CPU Memory Organisation	Lecture	21203.3	Mid Term II, Quiz & End Term
30.		Tutorial	Flipped Class	21203.3	Mid Term II, Quiz & End Term
31.		Cache Memory Organization		21203.3	Mid Term II, Quiz & End Term
32.		Cache Mapping Technique		21203.3	Mid Term II, Quiz & End Term
33.		Replacement Algorithms		21203.3	Mid Term II, Quiz & End Term
34.		Updating Techniques		21203.3	Mid Term II, Quiz & End Term
35.		Tutorial	Flipped Class	21203.3	Mid Term II, Quiz & End Term
36.		Multiple Caches		21203.3	Mid Term II, Quiz & End Term
37.	Storage and Other Peripherals (Lecture 25-39)	Disk Storage and Dependability	Lecture	21203.4	Mid Term II ,Quiz & End Term
38.		IO Organisation	Lecture	21203.4	Mid Term II ,Quiz & End Term
39.		IO Modes – Programmed IO	Lecture	21203.4	Mid Term II ,Quiz & End Term
40.		IO Modes – Interrupt Driven Mode	Lecture	21203.4	Mid Term II ,Quiz & End Term
41.		DMA Operating Modes	Lecture	21203.4	Mid Term II ,Quiz & End Term
42.		Tutorial	Flipped Class	21203.4	Mid Term II ,Quiz & End Term
43.	Multicores, Multiprocessors and Clusters (Lecture 40-47)	Shared Memory Multiprocessors	Lecture	21203.5	Quiz & End Term
44.		Clusters and other Message-Passing Multiprocessors	Lecture	21203.5	Quiz & End Term
45.		Multiplication of Positive Numbers	Lecture	21203.5	Quiz & End Term

46.		SISD	Lecture	21203.5	Quiz & End Term
47.		Tutorial	Flipped Class	21203.5	Mid Term II, Quiz & End Term
48.		MIMD	Lecture	21203.5	Quiz & End Term
49.		SIMD	Lecture	21203.5	Quiz & End Term
50.		SPMD	Lecture	21203.5	Quiz & End Term
51.		Conclusion	Lecture	21203.5	-
52.		Tutorial	Flipped Class	21203.5	Mid Term II, Quiz & End Term

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Cpu buiind block, memory opr(intro) bus(intro) instruction pahtay, opecode usage and its functionality. Microprogramming., execution usit

X86 instructions, address, instruction databaths, opcode, addressing moedes, instructions and their execution .

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[2203.1]	Apply Boolean algebra and K map to obtain simpler Boolean expression that will require fewer logic gates.	3	2	1	1								1	1		
[2203.2]	Design and analyse combinational and sequential logic circuits.	2	2	3	1								1		1	
[2203.3]	Describe interconnection between various functional units of a computer system and able to assess the performance of a computer.	3	1	1									1	1		1
[2203.4]	Apply arithmetic operations on signed and unsigned numbers and analyse the design of fast arithmetic circuits.	1	3	2									1			1
[2203.5]	Develop skills to write assembly language programs for a given high level language construct using various addressing modes.		1	3		1							1	2	1	1

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and IT

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Hand-out

Operating Systems Lab | CS 2230 | 1 Credit | 0 0 2 1

Session: Jan 21-May 21 | Faculty: Dr. Umashankar Rawat | Class: B. Tech. IV SEM

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

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

[CS2230.1]: Describe basic Unix commands and use them to write shell scripts.
[CS2230.2]: Apply skills to develop system programs using file and process system calls and PThread API.
[CS2230.3]: Compare various algorithms used for process scheduling.
[CS2230.4]: Examine concepts related to process synchronization and various deadlock handling strategies to solve resource allocation problems.
[CS2230.5]: Examine the performance of different memory management techniques and page replacement algorithms.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. ASSESSMENT PLAN:

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

E. SYLLABUS

Basic Linux commands: Illustration of shell functions, wild cards, redirection, pipes, sequencing, grouping, background processing, command substitution, sub shells, Shell programming. **System Calls:** File and process, I/O Redirection, IPC using Pipe and Signals. **PThread API:** Multithreaded programs, Synchronization programs using PThreads and Semaphores, CPU Scheduling, Deadlock, Memory Management. **Creating a Virtual Machine:** Virtual Machine Files and Snapshots, Virtual Machine Cloning and Exporting.

TEXT BOOKS

T1. W. R. Stevens , S. A. Rago, Advanced Programming in the UNIX Environment, (3e), Addison-Wesley, 2013.
T2. S. Das, Unix Concepts and Applications, (4e), McGraw Hill, 2006.
T3. K. A. Robbins, S. Robbins, Unix Systems Programming: Communication, Concurrency, and Threads, (2e), Prentice Hall, 2004.

REFERENCE BOOKS

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

F. Lecture Plan

Lab No.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1-3	**Introduction- Linux Operating System, Unix Commands and Shell Scripts**	Define basic terminology related to OS. List and demonstrate various basic Unix and shell script commands. Illustrate use of Unix and Shell scripts commands in writing shell scripts.	Lecture Demonstration at system	CS2230.1	Continuous Evaluation / End Term Examination
4	**System Calls**	Use file system calls to write system programs.	Lecture Demonstration at system	CS2230.2	Continuous Evaluation / End Term Examination
5-6	**Process Control**	Illustrate process creation and its termination. (Using fork and kill) Illustrate Inter-Process communication using pipes. Illustrate Zombie and Orphan Process.	Lecture Demonstration at system	CS2230.2	Continuous Evaluation / End Term Examination
7	**Thread**	Use PThread API to write multithreaded programs.	Lecture Demonstration at system	CS2230.2	Continuous Evaluation / End Term Examination
8	**Creating a Virtual Machine**	Examine Virtual Machine Files and Snapshots, Virtual Machine Cloning and Exporting.	Lecture Demonstration at system	CS2230.1	Continuous Evaluation / End Term Examination
9	**Process Scheduling**	Write CPU Scheduling Algorithm programs that is FCFS, SJF, Priority and Round Robin.	Lecture Demonstration at system	CS2230.3	Continuous Evaluation / End Term Examination
10	**Process Synchronization**	Use Pthread API to write Producer-Consumer, Reader-Writer Synchronization Problems using Semaphores	Lecture Demonstration at system	CS2230.4	Continuous Evaluation / End Term Examination
11	**Deadlock**	Apply Bankers Algorithm for Deadlock Avoidance.	Lecture Demonstration at system	CS2230.4	Continuous Evaluation / End Term Examination

12-13	**Memory Management Policies**	Illustrate Page Replacement Algorithms: FIFO, Optimal and LRU Illustrate memory allocation strategies: First Fit, Best Fit, Next Fit and Worst Fit	Lecture Demonstration at system	CS2230.5	Continuous Evaluation / End Term Examination

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

CO	**STATEMENT**	Correlation with program outcomes												Correlation with program specific outcomes		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CS2230.1]:	Describe basic Unix commands and use them to write shell scripts.	**3**				**2**				**1**			**2**	**2**	**2**	**2**
[CS2230.2]:	Apply skills to develop system programs using file and process system calls and PThread API.	**2**		**2**		**3**				**1**			**2**	**2**		**2**
[CS2230.3]:	Compare various algorithms used for process scheduling.	**2**		**2**						**1**			**2**	**1**		
[CS2230.4]:	Examine concepts related to process synchronization and various deadlock handling strategies to solve resource allocation problems.	**2**		**2**						**1**			**2**	**1**		
[CS2230.5]:	Examine the performance of different memory management techniques and page replacement algorithms.	**2**		**2**						**1**			**2**	**1**		

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

MANIPAL UNIVERSITY
JAIPUR

SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE &
ENGINEERING

Course Hand-out

Relational Database Management Systems Lab| CS 2231 |

4 Credits | 3 1 0 4 Session: Feb '21 – May '21

Faculty: Dr. Santosh K Vishwakarma (Course Coordinator), Dr. Satyabrata Roy, Dr. Rishi Gupta
Ms. Swati Shrivastava

Class: B.Tech. 2nd Year IV Semester

A. Introduction:

This practical course introduces the fundamental requirement of working with relational database management systems software. The lab provides a strong formal foundation in database concepts, technology, and practice to the participants to groom them into well-informed database application developers. Students will learn SQL and procedural interfaces to SQL comprehensively.

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

[CS2231.1]:	Demonstrate the concepts of ER, EER diagrams and introduction to SQL
[CS2231.2]:	Demonstrate the concepts and queries of DDL
[CS2231.3]:	Demonstrate the concepts and queries of DML
[CS2231.4]:	Demonstrate the concepts and queries of DCL
[CS2231.5]:	Demonstrate the concepts of triggers in database
[CS2231.6]:	Demonstrate the concepts of stored procedures and transaction to acquire efficient database management skill.

C. Vision, Mission, Program Educational Objectives, Program Outcomes, Program Specific Outcomes

Vision:

To achieve Excellence in Computer Science & Engineering Education for Global Competency with Human Values

Mission:

1. Provide innovative Academic & Research Environment to develop competitive Engineers in the field of Computer Science Engineering
2. Develop Problem-solving & Project Management Skills by Student Centric Activities & Industry Collaboration
3. Nurture the Students with Social & Ethical Values

Program Educational Objectives (PEOs)

1. Graduates will Demonstrate Professional Skills on Global Platform in Computer Science Engineering and Integrated Domains

2. Graduates will Enhance Knowledge and Skills through Higher Studies and Lifelong Learning of New Computing Technologies

3. Graduates will Provide Innovative Solutions to Drive Societal Advancement through Technology Entrepreneurship and Start-up

Program Specific Outcomes (PSOs)

1. Graduates will be able to design, develop and implement efficient software. for a given real life problem.

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

3. Graduates will be able to design, manage and secure wired/ wireless computer networks for transfer and sharing of information.

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and 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 are not just a slogan, it is to be practised in each action. Thus, a B Tech CCE should understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous evaluation (Record + Execution + Viva)	60
	Lab project	10
End Term Exam (Summative)	End Term Exam (CLOSED BOOK)	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

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

F. Text Books

T1. "Teach yourself SQL & PL/SQL using Oracle 8i & 9i with SQLJ", Ivan Bayross, BPB Publications, 2010

G. Reference Books

R1. Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", TMH, New Delhi, 2006

H . Lecture Plan

Lab No.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction to basic DDL, DML and DCL commands and domain types in SQL. DDL statements to create, drop, alter, view and rename the Database.	• Understand basic concepts of DDL, DML and DCL • Demonstrate working of various DDL statements	Lecture Demonstration at system	CS2231.1 CS2231.2	Continuous Evaluation End Term Examination
2	Write DML statements to insert the values into the tables. Use variants to insert values such as insert multiple records and insert records resulting from a select query. Write statements to add and delete a column in a table which is pre-existent. Write DML statements to update a table for single and multiple field updation. Write DML statements to delete single or multiple record(s) from a table.	• Demonstrate working of various DML statements	Lecture Demonstration at system	CS2231.2	Continuous Evaluation End Term Examination
3-4	Add primary key constraint to a pre- existent table. Add NOT NULL / UNIQUE constraint to a pre-existent column. Define the foreign key constraint. Show the errors returned by Database when: a) FK constraint is violated b) A referenced item is deleted	• Understand use of different types of constraints	Lecture Demonstration at system	CS2231.1 CS2231.2	Continuous Evaluation End Term Examination

	Define and demonstrate cascading effect in foreign key referenced tables. Define, add and drop the check/default constraint. Define auto increment arguments/attributes of a table.				
5-6	Practice SELECT query with following options: Distinct, order by, between, top/max/min and other aggregation keywords, group by, having, wild	Demonstrate nested subqueries and different DML statements	Lecture Demonstration at system	CS2231.3	Continuous Evaluation Project End Term Examination
7-8	Write a query to create INNER JOIN/ LEFT JOIN / RIGHT JOIN / FULL JOIN in two tables.	Demonstrate different JOIN operations	Lecture Demonstration at system	CS2231.3	Continuous Evaluation Project End Term Examination
9	Write a query to create/delete VIEW from two tables including some selection criteria. Write a query to create and delete clustered/non-clustered index for a table.	Demonstrate the use of VIEW and indexing	Lecture Demonstration at system	CS2231.3	Continuous Evaluation Project End Term Examination
10-11	To implement the concept of trigger in database: ▪ How to apply database triggers ▪ Types of database triggers ▪ Create/delete database triggers	Demonstrate use of TRIGGERS	Lecture Demonstration at system	CS2231.5	Continuous Evaluation Project End Term Examination

	▪ Create trigger to demonstrate magic tables (INSERTED and DELETED). ▪ Create a hypothetical situation to undo the changes in a table via Trigger (Max credit limit reached/ Balance insufficient etc.).				
12-13	Write some stored procedures to cover the following problems: Demonstrate Control structures Swap two numbers Find the sum of digits. Calculate grades etc. Define Transaction, demonstrate the Commit and Rollback operations using hypothetical situations.	Demonstrate stored procedures and transaction	Lecture Demonstration at system	CS2231.4 CS2231.6	Continuous Evaluation Project End Term Examination

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

CO	STATEMENT	CORRELATION WITH PROGRAM 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
[CS2231.1]:	Demonstrate the concepts of ER, EER diagrams and introduction to SQL	1	1	2	2	1	1		1	1		1		1	1	
[CS2231.2]:	Demonstrate the concepts and queries of DDL	1	1	1										1		
[CS2231.3]:	Demonstrate the concepts and queries of DML	1	1	1										1		
[CS2231.4]:	Demonstrate the concepts and queries of DCL	1		1					1	1	1	1		1		
[CS2231.5]:	Demonstrate the concepts of triggers in database	1	1	2	1	1				1		1		1		1
[CS2231.6]:	Demonstrate the concepts of stored procedures and transaction to acquire efficient database management skill.	1	1	2	1	1						1		1		

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology
Department of Computer Science and Engineering
Course Hand-out
Computer Networks | CS 1602 | 4 Credits | 3104
Session: Jan 2021 – June 21
Faculty: Dr. Sunita Singhal, Dr. Vijander Singh, Amit Bairwa, Saket Acharya, Arvind Dakha, Somya Goyal, Ankit Mudra, Kavita Jhajharia and Neha V. Sharma
Class: VI Semester

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

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

CS1602.1: Understand the basic concept of TCP/IP model, IPV4, class full addressing, sub netting and classless addressing.

CS1602.2: Implement the Routing and its types.

CS1602.3: Demonstrate the Internet control protocols, IPV6 transitions.

CS1602.4: Analyse the Transport Layer and Its protocols, congestion control.

CS1602.5: Describe the Application Layer, its protocols, and Network Security.

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Program Outcomes:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

B. 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.	
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.	

C. SYLLABUS

Network Layer: Network layer design issues, routing algorithms, congestion control algorithms, Quality of service, MPLS. Classful addressing, Sub-netting, Classless addressing, variable length blocks, address allocation; Protocols: ARP & DHCP: Introduction, Packet Format, message types, IPV4 header format, fragmentation, options, checksum. ICMP: Message format, message types. Dynamic routing protocols: RIP, OSPF & BGP, Multicasting Protocol;

Transport Layer: Transport services, state diagram, Elements of Transport Protocols: addressing, Connection establishment, connection release, Error control and Flow Control, Multiplexing, Congestion Control: Bandwidth allocation, regulating the sending rate, UDP: UDP header, TCP: TCP

service model, TCP segment header, TCP connection establishment, TCP connection release, TCP window management, Timer management.
Application Layer: DNS: Name space, domain resource records, Electronic Mail: SMTP, POP, IMAP, MIME, HTTP, HTTPS, SNMP.
Network Security: Security Goals, Attacks, Attack prevention techniques, Firewall, IDS, DMZ, IPsec.

TEXTBOOKS:

1. A S Tanenbaum, Computer Networks, 5th Ed., Pearson, 2010.
2. B.A. Forouzan, TCP/IP Protocol Suite, 4th Ed., TMH, 2010.

REFERENCE BOOK:

1. W.R. Stevens, TCP/IP illustrated, Volume 1: The Protocols, 2nd Ed., Addison-Wesley, 2015.
2. D E. Comer, Internetworking with TCP/IP Principles, Protocols and Architecture, 6th Ed., Pearson, 2013.

D. Lecture Plan:

lecture	Major Topics	Topics	Session Outcome	Corres ponding CO	Mode of delivery	Mode Of Assessing CO
1	Introduction	Introduction of course	Understanding of course, objectives, evaluation		lecture	
2	Network Layer	Store-and-Forward Packet Switching, Services Provided to the Transport Layer	Understanding of packet switching and services provided to transport layer	1602.1	lecture	Mid Term I, Quiz & End Term
3		Implementation of Connectionless Service, Implementation of Connection-Oriented Service	learn implementation of connectionless and connection-oriented service	1602.1	lecture	Mid Term I, Quiz & End Term
4		Characteristics and Types, The Optimality Principle	Understanding of types and characteristics of routing protocols and optimality principle	1602.2	lecture	Mid Term I, Quiz & End Term
5		Shortest Path Routing, Flooding	Understanding of shortest path routing algorithm	1602.2	lecture	Mid Term I, Quiz & End Term
6		Distance Vector Routing,	Understanding of distance vector routing algorithm	1602.2	lecture	Mid Term I, Quiz & End Term

7		Link State Routing, Hierarchical Routing,	Understanding of link state routing protocol and Hierarchical routing	1602.2	lecture	Mid Term I, Quiz & End Term
8		IP Addresses, Classfull addressing, Classless addressing	Knowledge of IP Address	1602.2	lecture	Mid Term I, Quiz & End Term
9		Subnetting	Understanding of need of subnetting	1602.2	lecture	Mid Term I, Quiz & End Term
10		Subnetting	Understanding implementation of subnetting	1602.2	lecture	Mid Term I, Quiz & End Term
11		CIDR—Classless Interdomain Routing	Understanding of CIDR	1602.3	lecture	Mid Term I, Quiz & End Term
12		NAT—Network Address Translation	Learn Network address translation	1602.3	lecture	Mid Term I, Quiz & End Term
13		DHCP, ARP, RARP	Understanding of network protocols	1602.3	lecture	Mid Term I, Quiz & End Term
14		ICMP, IPV4 header format	Understanding of network protocols	1602.3	lecture	Mid Term I, Quiz & End Term
15		Fragmentation	Learn concept of fragmentation	1602.2	lecture	Mid Term I, Quiz & End Term
16		RIP, OSPF, BGP	Understanding of dynamic routing protocols	1602.2	lecture	Mid Term I, Quiz & End Term
17		RIP, OSPF, BGP	Understanding of dynamic routing protocols	1602.2	lecture	Mid Term I, Quiz & End Term
18		General Principles of Congestion Control, Congestion Prevention Policies	Understanding of congestion principles and prevention	1602.1	lecture	Mid Term I, Quiz & End Term
19		Congestion Control in Virtual-Circuit Subnets	Understanding of congestion control in virtual circuit subnets	1602.1	lecture	Mid Term I, Quiz & End Term

20		Congestion Control in Datagram Subnets	Understanding of congestion control in Datagram subnets	1602.1	lecture	Mid Term I, Quiz & End Term
21		Requirements	Understanding of Quality-of-Service requirements	1602.1	lecture	Mid Term I, Quiz & End Term
22		Techniques for Achieving Good Quality of Service	Understanding of Techniques for achieving good QoS	1602.1	lecture	Mid Term I, Quiz & End Term
23		Techniques for Achieving Good Quality of Service	Understanding of Techniques for achieving good QoS	1602.2	lecture	Mid Term I, Quiz & End Term
		First Sessional Examination				
24	Transport Layer	Introduction to Transport Layer, Transport Service Primitives	Understanding of transport layer and service primitives	1602.4	lecture	Mid Term II, Quiz & End Term
25		Elements of Transport Protocols, Addressing,	Understanding of elements of transport protocols	1602.4	lecture	Mid Term II, Quiz & End Term
26		Connection Establishment, Connection Release	Understanding of connection establishment and release process	1602.4	lecture	Mid Term II, Quiz & End Term
27		Flow Control and Buffering	Understanding of flow control and buffering in transport layer	1602.4	lecture	Mid Term II, Quiz & End Term
28		Multiplexing	Understanding of Multiplexing in transport layer	1602.4	lecture	Mid Term II, Quiz & End Term
29		UDP, UDP Header	Understanding of UDP	1602.4	lecture	Mid Term II, Quiz & End Term
30		TCP Service Model, TCP Protocol	Understanding of TCP	1602.4	lecture	Mid Term II, Quiz & End Term
31		TCP Segment Header,	Understanding of TCP segment header	1602.4	lecture	Mid Term II, Quiz & End Term
32		TCP Connection Establishment,	Understanding of TCP connection	1602.4	lecture	Mid Term II, Quiz & End Term

		TCP Connection Release	establishment and release process			
33		TCP Transmission Policy, Window Management	Understanding of TCP transmission policy and window management	1602.4	lecture	Mid Term II, Quiz & End Term
34		Connection Control	Understanding of Connection control	1602.4	lecture	Mid Term II, Quiz & End Term
35		Timer Management	Understanding of timer management	1602.4	lecture	Mid Term II, Quiz & End Term
36	Application Layer	Introduction to Application Layer	Understanding of application layer	1602.5	lecture	Mid Term II, Quiz & End Term
37		DNS—The Domain Name System	Understanding of DNS	1602.5	lecture	Mid Term II, Quiz & End Term
38		SMTP, POP	Understanding of email	1602.5	lecture	Mid Term II, Quiz & End Term
39		IMAP, MIME	understanding of email	1602.5	lecture	Mid Term II, Quiz & End Term
40		HTTP	Understanding of web and protocol	1602.5	lecture	Mid Term II, Quiz & End Term
41		HTTPS	Understanding of secure web protocol	1602.5	lecture	Mid Term II, Quiz & End Term
42		SNMP	Understanding of network management protocol	1602.5	lecture	Mid Term II, Quiz & End Term
		Second Sessional				
43	Network Security	Security Goals and Attacks	Understanding of security goals and attacks	1602.5	lecture	Quiz & End Term
44		Firewall	Understanding of firewalls	1602.5	lecture	Quiz & End Term
45		Firewall	Understanding of firewalls	1602.5	lecture	Quiz & End Term
46		IDS, DMZ	Understanding of intrusion detection system	1602.5	lecture	Quiz & End Term
47		IPsec	Understanding of IP security	1602.5	lecture	Quiz & End Term
48		IPsec	Understanding of IP security	1602.5	lecture	Quiz & End Term

E. 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
CS1602.1	Understand the basic concept of TCP/IP model, IPV4, class full addressing, sub netting and classless addressing.	2		3		3										1
CS1602.2	Implement the Routing and its types			2												1
CS1602.3	Demonstrate the Internet control protocols, IPV6 transitions.					1										1
CS1602.4	Analyse the Transport Layer and Its protocols, congestion control.					1										1
CS1602.5	Describe the Application Layer, its protocols, and Network Security.							2		2						1

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science and Engineering
Course Hand-out

Computer Graphics and Multimedia | CS 1604 | 4 Credits | 3 0 1 4

Session: Jan 21 – May 21 | Faculty: Ms. Shikha Mundra/Dr. Neha Chaudhary / Mr. Nitesh Pradhan / Ms. Bali Devi | Class: CSE 6th Sem | Class: Compulsory

A. **Introduction:** This course is offered by Dept. of Computer Science and engineering as a compulsory subject, targeting students who wish to pure research & development in industries or higher studies in field of Computer graphics and multimedia. This course aims to make the students aware of components of automated visual technology and related concepts that include display devices, and visual display units, geometric, mathematical and algorithmic concepts necessary for programming computer graphics, windows, clipping and view-ports object representation in relation to images displayed on screen, the models of lighting and shading. After learning through this course, students will be able to understand how a visual device displays components over display unit such as monitor, TV etc. Also, the students will have an overview of multimedia technology wherein they would come across various media formats, their characteristics, and animation basics. Prerequisite for the course is knowledge of fundamental mathematics including Coordinate Geometry and Programming Concepts.

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

[CS1604.1]. Describe graphical display systems along with their skills and applications

[CS1604.2]. Analyse the underlying algorithms for the scan conversion of graphic primitives as per the needs of raster and random scan displays.

[CS1604.3]. Design and implement the model for spatial manipulation of graphic primitives using 2D and 3D transformations

[CS1604.4]. Comprehend the models for illumination and shading.

[CS1604.5]. Overview the core multimedia concepts, compression techniques and basics of animation.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO2: Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3: 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

PO4: 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

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: 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: 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: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO10: 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

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 multidisciplinary 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

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

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

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

Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	15
	Sessional Exam II	15
	In class Quizzes and Assignments, Activity feedbacks (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.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

D. SYLLABUS

Basics Of Computer Graphics: Pixel, Frame buffer, Application of computer graphics, Raster Graphics fundamentals; Graphic Displays: Cathode Ray Tube, Random and Raster Scan displays; Scan Conversion: Line Generation- Digital Differential Analyzer (DDA), Bresenham's Algorithm, Algorithms for Circle Generation - Mid Point and Bresenham's Algorithm, Polygon generation and filling algorithms, Anti-aliasing; **Two Dimensional Transformations:** Introduction, Homogeneous representation of points, Basic transformation -Translation, Rotation, Scaling, Reflection, Shear; Clipping and Windowing: Point and Line Clipping, Cohen – Sutherland Algorithm, Sutherland - Hodgman Algorithm; **Three Dimensional transformation:** Translation, Rotation and Scaling; Parallel & Perspective Projection: Types of Parallel & Perspective Projection; Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painter's Algorithm, Z-Buffer Algorithm; Basic Illumination Model: Diffuse reflection, Specular reflection, Phong and Gouraud shading; **Introduction to Multimedia:** Concepts and uses, hypertext and hypermedia; Image, video and audio standards; Audio: digital audio, MIDI,

processing sound, sampling, compression; Video: MPEG compression standards, inter-frame and intra-frame compression; **Animation:** types, techniques, key frame animation, utility, morphing.

E. TEXT BOOKS

T1. "Computer Graphics C version/OpenGL version", Donald Hearn and M. Pauline Baker, 4th edition, Pearson Education.

T2. "Multimedia: Computing, Communications, and Applications", R. Steinmetz, Prentice Hall, 1995.

F. REFERENCE BOOKS

R1. "Computer graphics Principles and Practice", J. F. Hughes and J. D. Foley, Pearson Education. Addison-Wesley, 2014.

R2. "Procedural elements for computer graphics", David F. Rogers, Tata McGraw Hill 2nd Edition.

R3. "Multimedia Fundamentals, Volume 1: Media Coding and Content Processing", R. Steinmetz and K. Nahrstedt, Tata McGraw Hill Edition, Pearson Education, 2002.

G. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1	Introduction to Computer graphics	Gain the knowledge of real time requirement of graphical technology	Lecture	CO 1	1st Sessional ET Exam Class Quiz
2	Display technologies	Advancement in graphical technology	Lecture and Discussion	CO 1	1st Sessional ET Exam Class Quiz
3	CRT and its component	Learning of Foundation Of graphical technology	Lecture	CO 1	1st Sessional ET Exam Class Quiz
4	Raster scan system, Random Scan	Background knowledge to develop any algorithm	Lecture	CO 1	1st Sessional ET Exam Class Quiz
5	Frame buffers and Color CRT	How the data of every pixel get stored	Discussion & Question Answer Session	CO 1	1st Sessional ET Exam Class Quiz Home Assignment
6	Scan converting lines- DDA algorithm & problems	Learn to draw a line using pixels	Lecture	CO 2	1st Sessional ET Exam Class Quiz
7,8	Scan converting lines – Bresenham's algorithm & problems along with example	Learn to draw a line using pixels	Discussion & Question Answer Session	CO 2	1st Sessional ET Exam Class Quiz
9	Scan converting Circle – polar coordinate	Learn to draw a circle using pixels	Lecture	CO 2	1st Sessional ET Exam

	method, Midpoint algorithm				Class Quiz
10,11	Scan converting Circle – Bresenham's algorithm along with example	Learn to draw a circle using pixels	Lecture	CO 2	1st Sessional ET Exam Class Quiz
12,13	Scan converting Ellipse – Midpoint algorithm along with example	Learn to draw a ellipse using pixels	Lecture	CO 2	1st Sessional ET Exam Class Quiz,
14	Polygon Filling – Scan fill algorithm	Explore the methods to fill any polygon	Lecture	CO 2	1st Sessional ET Exam Class Quiz
15	Polygon Filling – Boundary fill Algo	Explore the methods to fill any polygon	Lecture	CO 2	1st Sessional ET Exam Class Quiz
16	Polygon Filling – Flood fill Algo	Explore the methods to fill any polygon	Lecture	CO 2	1st Sessional ET Exam Class Quiz
17	Windowing concepts, Clipping algorithms	Learn to extract only region of interest from complete scenario	Lecture	CO 2	1st Sessional ET Exam Class Quiz
18,19	Line Clipping- 1	Learn to extract only region of interest from complete scenario	Lecture & Question Answer Session	CO 2	1st Sessional ET Exam Class Quiz
20, 21	Line Clipping-2	Learn to extract only region of interest from complete scenario	Lecture & Question Answer Session	CO 2	1st Sessional ET Exam Class Quiz
22	Polygon clipping	Learn to extract only region of interest from complete scenario	Lecture	CO 2	1st Sessional ET Exam Class Quiz, Home assignment
FIRST SESSIONAL EXAM					
23	Matrix representation and Homogeneous coordinates	Learn to manipulate a geometry	Lecture	CO 3	2nd Sessional ET Exam Class Quiz
24	Inverse Transformation	Learn to manipulate a geometry using matrix	Lecture	CO 3	2nd Sessional ET Exam Class Quiz

25,26,27	2D transformations – Translation, Scaling, Rotation	Learn to manipulate a geometry using matrix	Lecture	CO 3	2nd Sessional ET Exam Class Quiz
28,29	2D composition transformations	Learn to manipulate a geometry using matrix	Discussion & Question Answer Session	CO 3	2nd Sessional ET Exam Class Quiz
30	3D transformations – Translation, Scaling	Learn to manipulate a 3D geometry using matrix	Lecture with visualization	CO 3	2nd Sessional ET Exam Class Quiz
31	3D transformations – Rotation	Learn to manipulate a 3D geometry using matrix	Lecture with visualization	CO 3	2nd Sessional ET Exam Class Quiz
32,33	3D composition transformations	Learn to manipulate a 3D geometry using matrix	Lecture	CO 3	2nd Sessional ET Exam Class Quiz Home assignment
34,35	Hidden surface elimination	To show multiple overlapping object onto a 2D screen	Lecture	CO 4	2nd Sessional ET Exam Class Quiz
36	Basic illumination model, Light Source	Contribution of light to create a natural scene onto 2D screen	Lecture	CO 4	2nd Sessional ET Exam Class Quiz
37	Ambient light, Diffuse Reflection	Contribution of light to create a natural scene onto 2D screen	Lecture with visualization	CO 4	2nd Sessional ET Exam Class Quiz
38,39	Specular reflection, Phong model	Contribution of light to create a natural scene onto 2D screen	Lecture with visualization	CO 4	2nd Sessional ET Exam Class Quiz
40,41,42	Constant shading, Gouraud shading, Phong shading	Contribution of light to create a natural scene onto 2D screen to visualize metallic property of any object	Lecture with visualization	CO 4	2nd Sessional ET Exam Class Quiz Home assignment
43	Multimedia techniques	About multimedia and its real time application	Discussion	CO 5	2nd Sessional ET Exam Class Quiz
SECOND SESSIONAL EXAM					

44	Raster method for computer animation	Usage of already learnt method for animation	Lecture	CO 5	ET Exam Class Quiz
45	hypertext and hypermedia	Learn essential component of a multimedia system	Lecture	CO 5	ET Exam Class Quiz
46	Image, video and audio standards	Reference of multiple standards	Lecture	CO 5	ET Exam Class Quiz
47	Sampling and compression algorithm	How to reduce the size of data for easy transmission	Lecture	CO 5	ET Exam Class Quiz
48	Animation : types, techniques,	Various types of animation	Lecture	CO 5	ET Exam Class Quiz
49,50	key frame animation, Morphing	How to corelate frames to create a real animation	Lecture	CO 5	ET Exam Class Quiz
51,52	Revision/Doubt Class		Discussion & Question Answer Session		
END TERM EXAM					

H. Course Articulation Matrix: (Mapping of COs with POs and 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
CS 1604.1	Describe graphical display systems along with their skills and applications	3	2									1				
CS 1604.2	Analyse the underlying algorithms for the scan conversion of graphic primitives as per the needs of raster and random scan displays.		3									1	2	2		
CS 1604.3	Design and implement the model for spatial manipulation of graphic primitives using 2D and 3D transformations		2			3							3	2		
CS 1604.4	Comprehend the models for illumination and shading	1				2							2	3		
CS 1604.5	Overview the core multimedia concepts and basics of animation	2				2							1	3		

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

I. Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS 1604.1	Describe graphical display systems along with their skills and applications															
CS 1604.2	Analyse the underlying algorithms for the scan conversion of graphic primitives as per the needs of raster and random scan displays.															
CS 1604.3	Design and implement the model for spatial manipulation of graphic primitives using 2D and 3D transformations															
CS 1604.4	Comprehend the models for illumination and shading															
CS 1604.5	Overview the core multimedia concepts and basics of animation															

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

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SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
COURSE HAND-OUT

Computer Networks Lab| CS 1631| 1 Credit | 0 0 2 1

Session: Jan '21 – May '21

Faculty: **Dr. Sunita Singhal, Dr. Vijander Singh, Amit Bairwa, Saket Acharya, Arvind Dakha, Somya Goyal, Ankit Mudra, Kavita Jhajharia and Neha V. Sharma**

|Class: B.Tech. IIIrd Year VI Semester

A. Introduction:

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

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

[CS1631.1]: Demonstrate the concepts of cisco packet tracer and network connecting devices.
[CS1631.2]: Demonstrate the concept of topology and configuration.
[CS1631.3]: Demonstrate the implementation of different protocols.
[CS1631.4]: Demonstrate the concepts NAT protocol configuration.
[CS1631.5]: Demonstrate the concept of socket programming.
[CS1631.6]: Demonstrate the usage different network utilities.

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 IT 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 IT graduate should be able to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

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

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

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

Program Specific Outcomes (PSOs)

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

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

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

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

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D. Assessment Plan:

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

E. SYLLABUS

Cisco Packet Tracer: Introduction to packet tracer and networking device components, Router mode, Switch/Router basic commands; designing of star topology using HUB and Switch, IP configuration of end devices, Configuring DHCP server, Static routing, RIP, OSPF, VLAN and NAT. Network programming: Transmission control protocol and User datagram protocol. Network Utilities: PING, NETSTAT, IPCONFIG, IFCONFIG, ARP, TRACE-ROUTE

F. REFERENCES

1. A S Tanenbaum,"Computer Networks", 5th Edition, Pearson, 2010.
2. B.A. Forouzan, "TCP/IP Protocol Suite", 4th Edition, TMH, 2010.
3. L. Laura Chappell, J. Aragon and G.Combs, "Troubleshooting with Wireshark: Locate the Source of performance Problems", Laura Chappell University, 2014.

G . Lab Plan

Lab No.	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1	Introduction to Packet tracer and networking device components	Understand packet tracer, types of interface and networking devices.	Lecture Demonstration at system	CS1631.1	Continuous Evaluation End Term Examination
2	Router Mode, Switch/Router basic commands	Understand router and switch basic modes	Lecture Demonstration at system	CS1631.1 CS1631.2	Continuous Evaluation End Term Examination
3	Star Topology using HUB and Switch, IP configuration of end devices, show command, copy command, password setting, hostname setting	Understand topology creation and configuration	Lecture Demonstration at system	CS1631.2	Continuous Evaluation End Term Examination
4	DHCP configuration	Understand DHCP and configuration	Lecture Demonstration at system	CS1631.3	Continuous Evaluation End Term Examination
5-7	Configuration of Static Routing Protocol Configuration of RIPv1 and RIPv2. Configuration of OSPF and troubleshooting	Understand implementation of static and dynamic routing	Lecture Demonstration at system	CS1631.3	Continuous Evaluation End Term Examination
8	Configuration of VLAN and troubleshooting	Understand VLAN configuration and troubleshooting	Lecture Demonstration at system	CS1631.3	Continuous Evaluation End Term Examination
9	NAT Protocol Configuration and troubleshooting	Understand NAT and its configuration	Lecture Demonstration at system	CS1631.4	Continuous Evaluation End Term Examination
10-11	Socket Programming using UDP Socket Socket Programming using TCP Socket	Demonstrate the use of socket programming using UDP and TCP sockets	Lecture Demonstration at system	CS1631.5	Continuous Evaluation End Term Examination

12	Network Utilities- Ping, Netstat, Ipconfig, Ifconfig, Arp, Trace-route	Demonstrate the use of network utilities	Lecture Demonstration at system	CS1631.6	Continuous Evaluation End Term Examination

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CS1631.1]:	Demonstrate the concepts of packet tracer and network connecting devices.	1	1	2	2	1	1		1	1		1				1
[CS1631.2]:	Demonstrate the concept of topology and configuration.	1	1	1												1
[CS1631.3]:	Demonstrate the implementation of different protocols.	1	1	1												1
[CS1631.4]:	Demonstrate the concepts NAT protocol configuration.	1		1					1	1	1	1				1
[CS1631.5]:	Demonstrate the concept of socket programming.	1	1	2	1	1				1		1				1
[CS1631.6]:	Demonstrate the usage different network utilities.	1	1	2	1	1						1				1

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

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SCHOOL OF COMPUTING & INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
COURSE HAND-OUT

Computer Graphics And Multimedia Lab | CS 1633 | 4 Credits | 3 1 0 4

Session: Jan – May 2021 | Faculty: Ms. Shikha Mundra |Dr. Neha Choudhary| Ms. Bali Devi | Mr. Nitesh Pradhan / Class: CSE 6th Sem.

A. Introduction: The aim of this course is to enable a clear understanding and knowledge of computer graphics with its applications using multimedia.

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

[1633.1]. Describe the concept of computer graphics along with its applications and develop skill to draw basic output primitives.

[1633.2]. Demonstrate various algorithms for scan conversion, area filling and viewing algorithm.

[1633.3]. Analyse scene description through viewing coordinate transformation, projection and visible surface detection.

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 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 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.

[PO.13].

Program Specific Outcomes (PSOs)

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Continuous evaluation (Record + Execution + Viva)	70
End Term Exam (Summative)	End Term Exam (CLOSED BOOK)	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

Drawing of primitives like line, Circle, Ellipse, parallel lines, text using header file graphics.h. Exploring Graphics.h header file with its built in function, setting path of graphics drivers. Experiments on Digital Differential Analyser, Bresenhems algorithm and Midpoint algorithm with reduction of aliasing effect. Implementation of algorithm to clip a line using Cohen Sutherland and efficient Liang barsky clipping algorithm. Development of transformation like Translation, Scaling Rotation, Reflection in 2D and 3D Environment with 2D and 3D object. Implementation of transformation using built in function of opengl library. Experiments of illumination models using opengl library.

F. Text Books

T1. 1. D. Hearn and M. P. Baker, "Computer Graphics with OPENGL version", 4th Edition, Pearson Education, 2011

H . Lecture Plan

Lab No.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction to Graphics Commands and exploration of graphics.h	Understand basic commands and in built function of Graphics.h Demonstrate working of graphics sample program	Lecture Demonstration at system	CS1633.1	Continuous Evaluation
2	Drawing of Lines with multiple slope using DDA algorithm	Understand the algorithm and how the line are drawn through DDA	Lecture Demonstration at system	CS1633.1	Continuous Evaluation
3	Drawing of Lines using Bresenham's line drawing algorithm .	Understand use of Bresehnam's line drawing over DDA	Lecture Demonstration at system	CS1633.2	Continuous Evaluation
4	Drawing of Circles using Mid-Point Algorithm and Bresenhem's algorithm	Demonstrate Mid-Point circle works	Lecture Demonstration at system	CS1633.2	Continuous Evaluation Project
5	Drawing of Ellipses for Region 1 using midpoint algorithm .	Demonstrate ellipses for Region 1	Lecture Demonstration at system	CS1633.2	Continuous Evaluation Project
6	Drawing of Ellipses for Region 2 using midpoint algorithm.	Demonstrate ellipses for Region 2	Lecture Demonstration at system	CS1633.2	Continuous Evaluation Project
7	Clip a line using Cohen Sutherland algorithm	Demonstrate Line Clipping Liang Barsky algorithm	Lecture Demonstration at system	CS1633.1	Continuous Evaluation Project
8	Clip a line using Liang Barsky clipping algorithm	Demonstrate Line Clipping Cohen Sutherland algorithm	Lecture Demonstration at system	CS1633.2	Continuous Evaluation Project
9	Transformations as Scaling, Translation and Rotation for 2D object	Demonstrate 2-D Transformations	Lecture Demonstration at system	CS1633.3	Continuous Evaluation Project
10	Transformations as Scaling and Translation for 3D object	Demonstrate 3-D Transformations	Lecture Demonstration at system	CS1633.3	Continuous Evaluation Project

11	To implement Text compression algorithm like arithmetic compression, Run length encoding, Huffman encoding multimedia techniques	Demonstrate multimedia techniques based on compression algorithm.	Lecture Demonstration at system	CS1633.3	Continuous Evaluation Project end term followed by End Term Examination
12	To display a project based on combination of all graphical methods	Demonstrate project-based implementation.			

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

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES												CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
[CS1633.1]:	Describe the concept of computer graphics along with its applications and develop skill to draw basic output primitives.	1	1	2	2	3						1		1		
[CS1633.2]:	Demonstrate various algorithms for scan conversion, area filling and viewing algorithm.	1	1	1										1		1
[CS1633.3]:	Analyse scene description through viewing coordinate transformation, projection and visible surface detection	3	1	1							1			1		1

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

MANIPAL UNIVERSITY JAIPUR

School of Computing & Information Technology

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Course Hand-out

Distributed Database | CS 1650| 3 Credits | 3 0 0 3

Session: Jan 21-May 21 | Faculty: Assistant Prof. Swati Srivastava | Class: CSE/IT/CC VI SEM

A. Introduction: This course is offered by the Department of Computer Science & Engineering as a program elective. Course is a combination of Database as well as computer network. It gives a new dimension to database subject. Students will learn that database is spread on different locations, will be accessed.

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

[CS 1650.1] Get familiar with the currently available models, technologies for and approaches to building distributed database systems and services

[CS 1650.2] **I**ntroduce architecture and design of distributed database systems

[CS 1650.3] Expose about query processing, concurrency control and reliability

[CS 1650.4] Apply parallel database and database interoperability

[CS 1650.5] Be able to apply learned skills to solving practical database related tasks

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

[PO.3]. Design 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]. 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]. 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]. 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]. 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]. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

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

[PO.10]. 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]. 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]. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs)

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

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

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

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	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: Distributed Data Processing, Complicating Factors, and Problem Areas; **Distributed DBMS Architecture:** DBMS Standardization, Distributed DBMS Architecture; **Distributed Database Design:** Alternative Design Strategies, Distribution Design Issues, Fragmentation, Distribution Transparency, Allocation; **Semantic Data Control:** Authentication and Access rights, View Management, Semantic Integrity control & its enforcement; **Overview of Query Processing:** Query Processing Problem, Objective of Query Processing, Complexity of Relational Algebra Operations, Characterization of Query Processors, Layers of Query Processing; **Distributed Concurrency Control:** Serializability Theory, Deadlock Management, Relaxed Concurrency Control; **Distributed DBMS Reliability:** Reliability Concepts & Measures, Failures & Fault Tolerance in Distributed systems, Dealing with site failures, Network Partitioning; **Parallel Database Systems:** Database Servers, Parallel Architectures, Parallel DBMS Techniques, Parallel Execution problems; **Database Interoperability:** Database Integration, Query Processing, Transaction Management, Object Orientation & Interoperability; **Current Issues:** World Wide Web, Push-based Technologies, Mobile Databases.

TEXTBOOKS

T1. M. T. Ozsu and P. Valduriez; Principles of Distributed Database Systems, 3rd Edition, Springer Publishing, 2011

REFERENCE BOOKS

R1. S. K. Rahimi and Frank S Haug: Distributed Database Management Systems-A Practical Approach, Wiley Publication, 2010.

R2. C. M. Ricardo: *Database Systems:* Principles, Design, and Implementation, 8th Edition, McMillan, 1990

F. Lecture Plan:

Class Number	Topics	Session Outcome	Mode of Delivery	Corresponding Course Outcome	Mode of Assessing the Outcome
1	**Introduction:** Course Hand-out briefing	To acquaint and clear teachers' expectations and understand student expectations	Lecture & Interaction	-	-
2	**Introduction:** Introduction to Distributed Database	To understand fundamentals of Distributed Database	PPT, Lecture, Class Notes	**CS 1650.1**	Mid Term I, Quiz & End Term
3	**Introduction:** Complicating Factors, and Problem Areas	To understand problems area and its factors	PPT, Lecture, Class Notes	**CS 1650.1**	Mid Term I, Quiz & End Term
4	**Distributed DBMS Architecture:** DBMS Standardization	To understand DBMS standardization	PPT, Lecture, Class Notes	**CS 1650.1& CS 1650.2**	Mid Term I, Quiz & End Term
5	**Distributed DBMS Architecture:** Distributed DBMS Architecture	Distributed Database architecture and its comparison with DBMS	PPT, Lecture, Class Notes	**CS 1650.1& CS 1650.2**	Mid Term I, Quiz & End Term
6	**Distributed Database Design:** Alternative Design Strategies	Understand different design strategies of Distributed Database	PPT, Lecture, Class Notes	**CS 1650.1& CS 1650.2**	Mid Term I, Quiz & End Term
7	**Distributed Database Design:** Distribution Design Issues	Challenges in Distributed Database	PPT, Lecture, Class Notes	**CS 1650.1& CS 1650.2**	Mid Term I, Quiz & End Term
8	**Distributed Database Design:** Fragmentation	To present the various fragmentation strategies and algorithms	PPT, Lecture, Class Notes	**CS 1650.1& CS 1650.2**	Mid Term I, Quiz & End Term
9	**Distributed Database Design:** Distribution Transparency	Transparency and its advantages	PPT, Lecture, Class Notes	**CS 1650.1& CS 1650.2**	Mid Term I, Quiz & End Term
10	**Distributed Database Design:** Allocation	To address allocation problem and its solutions	PPT, Lecture, Class Notes	**CS 1650.1& CS 1650.2**	Mid Term I, Quiz & End Term
11	**Semantic Data Control:** Authentication	Data protection: prevent unauthorized users from understanding the physical content of data	PPT, Lecture, Class Notes	**1650.2 & CS 1650.3**	Mid Term I, Quiz & End Term
12	**Semantic Data Control:** Access rights	Access control to authorized user	PPT, Lecture, Class Notes	**1650.2 & CS 1650.3**	Mid Term I, Quiz & End Term

13	**Semantic Data Control** View Management	Logical view of Distributed Database	PPT, Lecture, Class Notes	**1650.2 & CS 1650.3**	Mid Term I, Quiz & End Term
14	**Semantic Data Control** Semantic Integrity control & its enforcement	Semantic Integrity control & its enforcement	PPT, Lecture, Class Notes	**1650.2 & CS 1650.3**	Mid Term I, Quiz & End Term
15	**Overview of Query Processing:** Query Processing Problem	Different strategies and its challenges in query processing	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
16	**Overview of Query Processing** Objective of Query Processing	Objective of Query Processing	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
17	**Overview of Query Processing** Complexity of Relational Algebra Operations	Complexity of Relational Algebra Operations	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
18	**Overview of Query Processing** Characterization of Query Processors	To evaluate and compare query processors in the context of both centralized systems and distributed systems	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
19	**Overview of Query Processing** Layers of Query Processing	Layers of Query Processing	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
20	**Distributed Concurrency Control:** Serializability Theory	Correctness criterion for concurrency control algorithms	PPT, Lecture, Class Notes	**CS 1653.3**	Mid Term II, Quiz & End Term
21	**Distributed Concurrency Control:** Deadlock Management	To understand deadlock occurrence and its solution	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
22	**Distributed Concurrency Control:** Relaxed Concurrency Control	Correctness of concurrent execution	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
23	**Distributed DBMS Reliability:** Reliability Concepts & Measures	Reliability Concepts & Measures	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
	Distributed DBMS Reliability: Failures & Fault Tolerance in Distributed systems	To understand Failures & Fault Tolerance in Distributed systems	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
24	**Distributed DBMS Reliability:** Dealing with site failures	To develop non-blocking termination and independent recovery protocols	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
25	**Distributed DBMS Reliability:** Network Partitioning	The network partitions and its relevant e atomic commit protocols	PPT, Lecture, Class Notes	**CS 1650.3**	Mid Term II, Quiz & End Term
26	**Parallel Database Systems:** Database Servers	Introduction to Database servers	PPT, Lecture, Class Notes	**CS 1650.4**	Mid Term II, Quiz & End Term
27	**Parallel Database Systems:** Parallel Architectures	Design choices in order to provide the aforementioned advantages with a good cost/performance	PPT, Lecture, Class Notes	**CS 1650.4**	Mid Term II, Quiz & End Term
28	**Parallel Database Systems:** Parallel DBMS Techniques	Parallel DBMS Techniques	PPT, Lecture, Class Notes	**CS 1650.4**	Mid Term II, Quiz & End Term
29	**Parallel Database Systems:** Parallel Execution problems	Initialization, interference and skew	PPT, Lecture, Class Notes	**CS 1650.4**	Mid Term II, Quiz & End Term
30	**Database Interoperability:** Database Integration	Database Integration	PPT, Lecture, Class Notes	**CS 1650.4**	Quiz & End Term
31	**Database Interoperability:** Query Processing	Query Processing	PPT, Lecture, Class Notes	**CS 1650.4**	Quiz & End Term
32	**Database Interoperability:** Transaction Management	Implementation of Transaction Management	PPT, Lecture, Class Notes	**CS 1650.4**	Quiz & End Term

33	**Database Interoperability:** Object Orientation	Object Orientation	PPT, Lecture, Class Notes	**CS 1650.4**	Quiz & End Term
34	**Database Interoperability:** Interoperability	Interoperability concepts	PPT, Lecture, Class Notes	**CS 1650.4**	Quiz & End Term
35	**Current Issues:** World Wide Web	Current issues in world wide web	PPT, Lecture, Class Notes	**CS 1650.4 & CS 1650.5**	Quiz & End Term
36	**Current Issues:** Push-based Technologies	Push-based Technologies	PPT, Lecture, Class Notes	**CS 1650.4 & CS 1650.5**	Quiz & End Term
37	**Current Issues:** Mobile Databases	Mobile Databases	PPT, Lecture, Class Notes	**CS 1650.4 & CS 1650.5**	Quiz & End Term

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

CO	STATEMENT	Correlation with Program Outcomes **(POs)**												Correlation with Program Specific Outcomes (PSOs)		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
[CS 1653.1]	Get familiar with the currently available models, technologies for and approaches to building distributed database systems and services	1						2						1		1
CS 1653.2]	Introduce architecture and design of distributed database systems	1	1				2	2			2				2	1
CS 1653.3]	Expose about query processing, concurrency control and reliability	1		1			2	2						1	1	
CS 1653.4]	Apply parallel database and database interoperability				2		2	1	2						1	2
CS 1653.5]	Be able to apply learned skills to solving practical database related tasks			1		2				2		2	2		1	

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science and Engineering

Course Hand-out

Cloud Computing & Cloud Infrastructure Services | CS 1653 | 3 Credits | 3 0 0 3 | Class: B. Tech. (CSE)/IT/CCE VI SEM

A. Introduction: This course is designed in a way so that students will be able to know current cloud computing technologies such as Infrastructure as a Service, Platform as a Service, Software as a Service, and Systems as a Service. For different layers of the cloud technologies, practical solutions such as Google, Amazon, Microsoft, SalesForce.com, etc. as well as theoretical solutions (covered by a set of papers) are introduced The main objective of this course is to introduce cloud computing concepts and technology , to understand the different service model and deployment model, to understand the different technologies that enable cloud computing, to understand difference between the Grid Computing and Cloud Computing, to understand different cloud computing architectures/frameworks, to understand the cloud infrastructure components and service management processes, to understand the cloud security concerns and solutions.

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B Course Outcomes

Upon completion of this course, the student will be able to

CS-1653.1: Implement the phases of transition from classic data center to virtual data center and then to the cloud

CS-1653.2: Implement virtualization technology at compute, storage, network, desktop, and application layers of its infrastructure

CS-1653.3: Implement the cloud infrastructure components and service management processes

CS-1653.4: Implement the security concern over the cloud

c. Program Outcomes and Program Specific Outcomes

[PO.1]. **Engineering knowledge**:_Apply the knowledge of basic science and fundamental computing in solving complex engineering problems

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

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

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

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

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

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

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

[PO.9]. **Individual and 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

d. <u>Program Specific Outcomes</u>

[PSO.1]. To apply creativity in support of the design, simulation, implementation and inference of existing and advanced technologies.

[PSO.2]. To participate & succeed in IT oriented jobs/competitive examinations that offer inspiring & gratifying careers.

[PSO.3]. To recognize the importance of professional developments by pursuing postgraduate studies and positions.

e. **Assessment Plan:**

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Close Book)	15
	Sessional Exam II (Close Book)	15
	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.
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.

f. Syllabus

Pre-requisite(s): Fundamentals of Computers, Operating System, Application Software and System Architecture.

Syllabus: **Introduction:** Clouds and Cloud Computing: Basic Concepts, Cloud Classifications, and Types of Services, deployment models; Classic Data Centre (CDC): DBMS concepts, CDC drawbacks and need of Cloud Resources, CDC Management and case studies; Virtualized Data Centre (VDC): Compute and Storage, Compute virtualization overview, Compute virtualization techniques, Virtual Machines, VM Resource management techniques, Physical to virtual conversion, Hypervisor Management Software, Virtual Infrastructure Requirements; Storage: Storage virtualization overview, Virtual Machine Storage, Block level and File level virtualization, Virtual provisioning and automated storage tiering, VMware; Networking: VDC networking overview, VDC networking components , VLAN and VSAN technologies, Network traffic management, Exercise – VDC networking; Desktop and Application: Desktop virtualization, Application virtualization, Business Continuity in VDC, Fault tolerance mechanism in VDC, Backup in VDC, Replication and migration in VDC, Cloud infrastructure and service creation, Cloud service management; Cloud Security: Security basics, Cloud security concerns and threats, Cloud security mechanisms, Access control and identity management in Cloud, Governance, risk, and compliance, Security best practices for Cloud, Cloud Migration; Issues in Cloud Considerations: Migration Considerations, Security issues at different phases to adopt the Cloud.

References:

1. Josyula, Venkata, Malcolm Orr, and Greg Page. *Cloud computing: Automating the virtualized data centre*, (1e), Cisco Press, 2011.

2. Ray Rafaels. *Cloud computing*, (2e), CreateSpace Independent Publishing Platform, 2018.
3. Buyya, Rajkumar, James Broberg, and Andrzej M. Goscinski, *Cloud computing: Principles and Paradigms*", (1e), John Wiley & Sons, 2010.

Lec No.	Topics	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction Considerations	Lecture	CS-1653.1	Mid Term1. Quiz/ Assignment, End term
2	Security issues at different phases to adopt the Cloud.	Lecture	CS-1653.1	Mid Term1. Quiz/ Assignment, End term
3	Security issues at different phases to adopt the Cloud.	Lecture	CS-1653.1	Mid Term1. Quiz/ Assignment, End term
4	Classic Data Center	Lecture	CS-1653.1	Mid Term1. Quiz/ Assignment, End term
5	Classic Data Center DBMS concepts	Lecture	CS-1653.2	Mid Term1. Quiz/ Assignment, End term
6	CDC drawbacks and need of Cloud Resources,	Lecture	CS-1653,2	Mid Term1. Quiz/ Assignment, End term
7	CDC Management and case studies,	Lecture	CS-1653.2	Mid Term1. Quiz/ Assignment, End term
8	**VDC** Compute and Storage	Lecture	CS-1653.2.	Mid Term1. Quiz/ Assignment, End term
9	**Virtualized Data Center** virtualization, virtualization techniques	Lecture	CS-1653.2.	Mid Term1. Quiz/ Assignment, End term
10	Virtualized Data Center, Virtual Machines	Lecture	CS-1653.3	Mid Term2. Quiz/ Assignment, End term
11	VM Resource management techniques	Lecture	CS-1653.3	Mid Term2. Quiz/ Assignment, End term
12	Physical to virtual conversion	Lecture	CS-1653.3.	Mid Term2. Quiz/ Assignment, End term
13	Hypervisor Management, Virtual Infrastructure Requirements	Lecture	CS-1653.3	Mid Term2. Quiz/ Assignment, End term
14	Storage virtualization overview, Virtual Machine Storage	Lecture	CS-1653.3	Mid Term2. Quiz/ Assignment, End term
15	Block level and File level virtualization,	Lecture	CS-1653.3	Mid Term2. Quiz/ Assignment, End term
16	Provisioning ,VM ware details	Lecture	CS-1653.3	Mid Term2. Quiz/ Assignment, End term
17	VDC networking overview,	Lecture	CS-1653.3	Mid Term2. Quiz/ Assignment, End term
18	VDC networking components,	Lecture	CS-1653.3	Mid Term2. Quiz/ Assignment, End term

19	VLAN and VSAN technologies,	Lecture	CS-1653.3	Mid Term2. Quiz/ Assignment, End term
20	Network traffic management,	Lecture	CS-1653.3	Quiz End term
21	Exercise – VDC networking	Lecture	CS-1653.3	Quiz, Assignment End term
22	Desktop virtualization \ Application virtualization	Lecture	CS-1653.3	Quiz, Assignment End term
23	Business Continuity in VDC,.	Lecture	CS-1653.3	Quiz, Assignment End term
24	Fault tolerance mechanism in VDC, Backup in VDC	Lecture	CS-1653.3	Quiz, Assignment End term
25	Replication and migration in VDC, Cloud infrastructure and service creation,	Lecture	CS-1653.3	Quiz, Assignment End term
26	Cloud service management	Lecture	CS-1653.4	Quiz, Assignment End term
27	Security	Lecture	CS-1653.4	Quiz, Assignment End term
28	Cloud security concerns and threats,	Lecture	CS-1653.4	Quiz, Assignment End term
29	Cloud security mechanisms,	Lecture	CS-1653.4	Quiz, Assignment End term
30	Access control and identity management in Cloud,	Lecture	CS-1653.4	Quiz, Assignment End term
31	Governance, risk, and compliance	Lecture	CS-1653.4	Quiz, Assignment End Term Examination
32	Security best practices for Cloud,	Lecture	CS-1653.4	Quiz, Assignment End Term Examination
33	Cloud Migration	Lecture	CS-1653.4	Quiz, Assignment End Term Examination
34	Migration Considerations	Lecture	CS-1653.4	Quiz, Assignment End Term Examination
35	Security issues at different phases to adopt the Cloud	Lecture	CS-1653.4	Quiz, Assignment End Term Examination
36	Application development in Google App Engine, BlueMix and RackSpace IoT and Cloud Computing for future Internet	Lecture		
Total No. of Lectures		**36**		

Course Outcome Attainment Level Matrix:

CO	STATEMENT	ATTAINMENT OF PROGRAM OUTCOMES **THRESHOLD VALUE: 40%**												ATTAINMENT OF PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS-1653.4.1	Implement the phases of transition from classic data center to virtual data center and then to the cloud	2	2	2						2		2		3	2	2
CS-1653.4.2	Implement virtualization technology at compute, storage, network, desktop, and application layers of infrastructure	1	2	2	2	3					1			3	1	2
CS-1653.4.3	Describe the cloud infrastructure components and service management processes	1		2								2		2	2	2
CS-1653.4	Implement the security concern over the cloud		3											1		2

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

MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science & Engineering
Course Hand-out

FUNDAMENTAL OF DATABASES | CS 2080 | 3 Credits | 3 0 0 3

Session: Jan '21 – May '21 | Faculty: Mr. Tarun Jain | (Open Elective Course)

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

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

CS2080.1: Classify, Compare & recall different file-based system, Data Model.

CS2080.2: Understand and summarize transaction processing, Indexing, Hashing and Storage management techniques.

CS2080.3: Interpret different query language SQL, Relation Algebra, calculus and acquire the skill apply the techniques and rules in different real-life problems.

CS2080.4: Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.

CS2080.5: Understand different normalization technique for optimizing database and analyse database design.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

[PO.3]. Design 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]. 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]. 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]. 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]. 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]. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

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

[PO.10]. 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]. 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]. 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)

PSO1. Will be able to design, develop and implement efficient software for a given real life problem.

PSO2. Will be able to apply knowledge of AI, Machine Learning and Data Mining in analyzing big data for extracting useful information from it and for performing predictive analysis.

PSO3. Will be able to design, manage and secure wired/ wireless computer networks for transfer and sharing of information.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	15
	Sessional Exam II (Closed Book)	15
	5 Quizzes (Open Book Mode), 2 Assignments (Accumulated and Averaged)	20+10
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

Introduction: Database-System Applications, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture. File Management System: Indexing and Hashing. Relational Algebra: Algebra, Tuple Calculus, Domain Calculus. SQL: Data Definition Language, Data manipulation language , SQL Data Types and Schemas, Integrity Constraints, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null Values, Nested Sub-queries, Correlated queries. Join: Inner, Outer, Left, Right and Natural. The Entity-Relationship Model: Constraints, Entity-Relationship Diagrams, Entity-Relationship Design Issues, Weak Entity Sets, Extended E-R Features. Normalization: Normal Forms, BCNF.

F. TEXT BOOKS

1. Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", TMH, New Delhi, 2006

2. R. Elmasri, S. B. Navathe, "Fundamentals of Database Systems", Addison & Weisely, New Delhi, 2008

G. REFERENCE BOOKS

1. C. J. Date, "Database Systems", Prentice Hall of India, New Delhi, 2012
2. Raghu Ramakrishnan, "Database Management Systems (2nd Ed)", McGraw Hill, 2000.
3. Ivan Bayross, "Introduction to SQL", Tata McGraw, 2010.

H. Lecture Plan: 36 Lectures

Lectures	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode Of Assessing CO
1.	Introduction to Data, data processing requirement, desirable characteristics of an ideal data processing system.	Classify, Compare & recall different file based system, Data Model.	PPT, Lecture, Class Notes	2080.1	N. A.
2.	Traditional file based system, its drawback, File processing systems versus database management systems.	Compare file systems and DBMS	PPT, Lecture, Class Notes	2080.1	Mid Term I, Quiz & End Term
3.	Data Models, Schemas and Instances. Categories of Data Models.	Classify and Compare different Data Model.	PPT, Lecture, Class Notes	2080.1	Mid Term I, Quiz & End Term
4.	Three Schema Architecture, Data Independence (Logical & Physical).	Classify and Compare various architectures and data independence.	PPT, Lecture, Class Notes	2080.1	Mid Term I, Quiz & End Term
5.	Benefits of DBMS. Database system applications, Purpose of database systems, Different database users.	Classify, Compare & recall different file based system, Data Model.	PPT, Lecture, Class Notes	2080.1	Mid Term I, Quiz & End Term
6.	Introduction to transaction processing, Desirable properties of transactions.	Understand and summarize transaction processing	PPT, Lecture, Class Notes	2080.2	Quiz & End Term
7.	File Storage: File structures (Fixed Length Record, Variable Length Record),	Explain different database storage structure and access technique	Lectures, Flipped Classroom	1402.2	Quiz & End Term
8.	Record Blocking and Spanned versus Un-spanned Records.	Explain different database storage structure and access technique	Lectures, Flipped Classroom	1402.2	Quiz & End Term
9.	RAID organization and Levels, Hashing Techniques (Internal and External Hashing).	Explain RAID organization and Hashing techniques	Lectures, Flipped Classroom	1402.2	Quiz & End Term
10.	Indexing Structure	Explain different indexing techniques	PPT, Lecture, Class Notes	1402.2	Quiz & End Term

11.	Single Level ordered indexes (Primary, Clustering, and Secondary).	Explain different indexing techniques	PPT, Lecture, Class Notes	1402.2	Quiz & End Term
12.	Relational Model Concepts: Domain, Attributes, Tuples and Relations.	Understand the concepts of relational model	PPT, Lecture, Class Notes	2080.3	Mid Term I, Quiz & End Term
13.	Relational Model Constraints and Relational Database Schema: Domain Constraints, Key Constraints and Constraints on NULL Values.	Understand and design Entity Relationship Model and illustrate the concept of NULL values.	PPT, Lecture, Class Notes	2080.3	Mid Term I, Quiz & End Term
14.	Relational Algebra: Unary Relational Operations SELECT and PROJECT.	Understand unary relational operations like SELECT and PROJECT	PPT, Lecture, Class Notes	2080.3	Mid Term I, Quiz & End Term
15.	Sequences of Operations and the RENAME Operation.	Understand the sequences of operations and the RENAME Operation.	PPT, Lecture, Class Notes	2080.3	Mid Term I, Quiz & End Term
16.	Relational Algebra Operation from Set Theory: UNION, INTERSECTION, CARTESIAN PRODUCT (CROSS PRODUCT) Operations.	Interpret different Relational Algebra operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	2080.3	Mid Term I, Quiz & End Term
17.	Binary Relational Operations: JOIN and DIVISION Operation	Interpret JOIN and DIVISON operations and apply the techniques and rules in different problems.	PPT, Lecture, Class Notes	2080.3	Mid Term I, Quiz & End Term
18.	Variations of JOIN: THETA JOIN, EQUI JOIN, NATURAL JOIN, INNER JOIN and OUTER JOIN	Interpret different types of JOIN operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	2080.3	Mid Term I, Quiz & End Term
19.	Additional Relational Operations: Generalized Projection, Aggregate Functions and Grouping.	Interpret additional Relational Algebra operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	2080.3	Mid Term II, Quiz & End Term
20.	Tuple Relational Calculus: Tuple Variable and Range Relations, Expressions and Formulas in tuple relational calculus.	Interpret different Relational Calculus operations and apply the techniques and rules in different problems	PPT, Lecture, Class Notes	2080.3	Mid Term II, Quiz & End Term
21.	The Existential and Universal Quantifiers, Safe Expressions.	Understand existential and universal and existential quantifiers.	PPT, Lecture, Class Notes	2080.3	Mid Term II, Quiz & End Term
22.	Domain Relational Calculus.	Understand concepts of domain relational calculus.	PPT, Lecture, Class Notes	2080.3	Mid Term II, Quiz & End Term
23.	SQL Data Definition and Data Types, Specifying Constraints in SQL,	Understand fundamentals of SQL	PPT, Lecture, Class Notes	2080.3	Mid Term II, Quiz & End Term

	Schema change statements in SQL.				
24.	Conceptual data model, Conceptual data modelling using E-R data model.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	2080.4	Mid Term I, Quiz & End Term
25.	Entity Types, Entity Sets, Attributes, Keys and Weak Entity type.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	2080.4	Mid Term I, Quiz & End Term
26.	Relationship Types, Relationship Sets, Roles, and Structural Constraints.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	2080.4	Mid Term I, Quiz & End Term
27.	Enhanced Entity-Relationship (EER) Model: Subclass, Super classes and Inheritance.	Understand and design Entity Relationship Model and illustrate the concept of cardinality, mapping and various constraints.	PPT, Lecture, Class Notes	2080.4	Mid Term I, Quiz & End Term
28.	Specialization and Generalization, Constraints and characteristics of Specialization and Generalization Hierarchies.	Understand the concepts of generalization and specialization and various constraints associated.	PPT, Lecture, Class Notes	2080.4	Mid Term I, Quiz & End Term
29.	Database Design: Redundant information in tuples and update anomalies, insertion anomalies, deletion anomalies and modification anomalies.	Understand the concepts of different anomalies and how they can be removed	PPT, Lecture, Class Notes	2080.5	Mid Term II, Quiz & End Term
30.	Properties of Relational Decompositions: Dependency preservation and Lossless join property of a decomposition.	Understand concepts of relational decompositions	PPT, Lecture, Class Notes	2080.5	Mid Term II, Quiz & End Term
31.	Functional Dependencies: Definition of functional dependencies, Inference rules for functional dependencies.	Understand concepts of functional dependencies	PPT, Lecture, Class Notes	2080.5	Mid Term II, Quiz & End Term
32.	Equivalence of sets of functional dependencies, Minimal sets of functional dependencies.	Understand the process of finding out equivalence among given sets of FDs and finding out minimal sets of functional dependencies	PPT, Lecture, Class Notes	2080.5	Mid Term II, Quiz & End Term
33.	Normal forms based on Primary keys, Normalization of relations, Definition of Super Key and Candidate Key.	Understand different normalization techniques for optimizing database and analyse database design	PPT, Lecture, Class Notes	2080.5	Mid Term II, Quiz & End Term

	Definition of Prime and Non-Prime Attribute.				
34.	Normal Forms: First normal form, Second normal form.	Understand 1NF and 2NF	PPT, Lecture, Class Notes	2080.5	Mid Term II, Quiz & End Term
35.	Third normal form and Boyce-Codd normal form.	Understand 3NF and BCNF	PPT, Lecture, Class Notes	2080.5	Mid Term II, Quiz & End Term
36.	Multivalued dependencies and fourth normal form.	Understand concepts of multivalued dependencies	PPT, Lecture, Class Notes	2080.5	Mid Term II, Quiz & End Term