NEW HORIZON
COLLEGE OF ENGINEERING

Department of Computer Engineering

Scheme and Syllabus
5th & 6th Semesters

BATCH: 2021-25 | CREDITS: 160 | (2021 Scheme)

Academic Year 2023-24

NEW HORIZON COLLEGE OF ENGINEERING

VISION

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

MISSION

- To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.
- To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.
- To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

QUALITY POLICY

To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level.

VALUES

- Academic Freedom
- Integrity
- Inclusiveness
- Innovation
- Professionalism
- Social Responsibility

DEPARTMENT OF COMPUTER ENGINEERING

VISION

To produce engineers, researchers and technologists with managerial skills of highest competence who would be able to solve the challenges of society.

MISSION

- To impart high quality professional training, practical experience and value education in the ComputerEngineering.
- To pursue creative research in Computer Engineering in order to serve the engineering community and society.
- To prepare and encourage a student for Lifelong learning to meet career and ethical challenges through active participation in co-curricular and extracurricular activities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1:	To prepare globally competent graduates having strong fundamentals of Computer Engineering domain knowledge, updated with modern technology to provide effective solutions for engineering problems.
PEO2:	To acuminate graduates with ability to adapt and develop projects towards the latest technological era of the Computing and IT sector with a high degree of innovative ideas.
PEO3:	To produce committed and motivated graduates with research attitude, investigative approach, and multidisciplinary thinking for implementation ofstrategic tasks.
PEO 4:	To shape the graduates with strong managerial and communication skills towork and learn continuously and effectively as individuals as well as in teams.

PEO TO MISSION STATEMENT MAPPING

Mission Statements	**PEO1**	**PEO2**	**PEO3**	**PEO4**
To impart high quality professional training, practical experienceand value education in the Computer Engineering.	3	2	2	2
To pursue creative research in Computer Engineering in order toserve the engineering community and society.	3	2	2	2
To prepare and encourage a student for Lifelong learning to meet career and ethical challenges through active participation in co- curricular and extracurricular activities.	2	2	3	3

Correlation: 3- High, 2-Medium, 1-Low

PROGRAM OUTCOMES (POS) WITH GRADUATE ATTRIBUTES

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, Engineering fundamentals,and an Engineering specialization to the solution of complex Engineering problems in Computer Engineering.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex Engineering problems in Computer Engineering 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 of Computer Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmentalconsiderations.
PO4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments in Computer Engineering, 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 in Computer Engineering 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 in Computer Engineering.
PO7	**Environment and Sustainability:** Understand the impact of the professional Engineering solutionsof Computer Engineering 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 ofthe Engineering practice.
PO9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader indiverse teams, and in multidisciplinary settings.
PO10	**Communication Skills:** 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, tomanage projects and in multidisciplinary Environments.
PO12	**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 (PSOs)

PSO1: The ability to apply the knowledge of core science, engineering mathematics and engineering fundamentals to design and develop the computing systems.

PSO2: The ability to provide effective and efficient real time solutions to problems in computer engineering using acquired knowledge in various domains.

Mapping of POs with PEOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	2	3	-	-	-	3	-	3	-
PEO2	3	3	3	2	3	-	-	-	3	-	3	-
PEO3	3	3	3	2	3	-	-	-	3	-	3	-
PEO4	3	3	3	2	3	-	-	-	3	-	3	-

Correlation: 3- High, 2-Medium, 1-Low

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Computer Engineering

Scheme of Teaching and Examinations for 2021- 2025 BATCH (2021 Scheme)

V Semester

S.No	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	TOTAL
1	PCC	21CEE51	Computer Organizationand Operating Systems	CEE	3	0	0	0	3	3	50	50	**100**
2	PCCL	21CEL51	Operating Systems Lab	CEE	0	0	1	0	1	2	50	50	**100**
3	PCC	21CEE52	Computer Networks	CEE	3	0	0	0	3	3	50	50	**100**
4	PCCL	21CEL52	Computer Networks Lab	CEE	0	0	1	0	1	2	50	50	**100**
5	PCC	21CEE53	Cyber Security	CEE	3	0	0	0	3	3	50	50	**100**
6	PEC	21CEE54X	Professional Elective Course -I	CEE	3	0	0	0	3	3	50	50	**100**
7	AEC	21CEL55X	Ability EnhancementCourse-I	CEE	0	0	1	0	1	2	50	50	**100**
8	MP	21CEE56	Mini Project	CEE	0	0	1	0	1	2	50	50	**100**
9	AEC	21CEK57	Research Methodologyand IPR	CEE	1	0	0	0	1	2	50	50	**100**
10	UHV	21CEK58	Innovation and Design Thinking	CEE	1	0	0	0	1	1	50	50	**100**
	Total								**18**	**21**	**500**	**500**	**1000**

NCMC	**21NSS84**	National Service Scheme (NSS)	NSS coordinator	All students have to register for any one of the courses namely National Service Scheme, Physical Education (PE) (Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of V semester. The activities shall be carried out from (for 4 semesters) between V semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall to be reflected in the calendar prepared for the NSS, PE and Yoga activities.
	21PES84	Physical Education (PE) (Sportsand Athletics)	Physical Education Director	
	21YOG84	Yoga	Yoga Teacher	

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC**: Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **PROJ**: Mini Project work L: Lecture, T: Tutorial, P: Practical S: **SDA**: Self Study for Skill Development, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation

Professional Elective Courses-I			
21CEE541	Artificial Intelligence	21CEE544	Data Mining & Ware Housing
21CEE542	Object Oriented Analysis and Design	21CEE545	Computer Graphics
21CEE543	User Interface Design		

Ability Enhancement Course-V			
21CEL551	Web Technology	21CEL554	Software Testing
21CEL552	App Development Using Kotlin	21CEL555	Golang Programming
21CEL553	Ruby Programming		

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini project as

(i) A group of 2 if mini project work is single discipline (applicable to all IT allied branches)

(ii) A group of 2- 4 if mini project work is single discipline (applicable to all Core Branches)

(iii) A group of 2 - 4 students if the Mini Project work is a multidisciplinary (Applicable to all Branches)

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Computer Engineering

Scheme of Teaching and Examinations for 2021- 2025 BATCH (2021 Scheme)

VI Semester

Sl.No	CourseCode		Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	HSMC	21CEE61	Software Engineering and Project Management	CEE	3	0	0	0	3	3	50	50	**100**
2	PCC	21CEE62	Multi Core Architecture	CEE	3	0	0	0	3	3	50	50	**100**
3	PCCL	21CEL62	Multi Core ArchitectureLab	CEE	0	0	1	0	1	2	50	50	**100**
4	PCC	21CEE63	Machine Learning	CEE	3	0	0	0	3	3	50	50	**100**
5	PCCL	21CEL63	Machine Learning Lab	CEE	0	0	1	0	1	2	50	50	**100**
6	PEC	21CEE64X	Professional Elective Course-II	CEE	3	0	0	0	3	3	50	50	**100**
7	UHV	21CEK65	Social Connect and Responsibility	CEE	0	0	1	0	1	2	50	50	**100**
8	INT	21CEE66	Innovation/Entrepreneur ship/ Societal Internship	CEE	0	0	3	0	3	0	50	50	**100**
9	MP	21CEE67	Mini project	CEE	0	0	1	0	1	2	50	50	**100**
10	OEC	21NHOP6XX	Industrial Open Elective Course-I	Offering Dept.	3	0	0	0	3	3	50	50	**100**
	Total								**22**	**21**	**500**	**450**	**1000**

NCMC	**21NSS84**	National Service Scheme (NSS)	NSS coordinator	All students have to register for any one of the courses namely National Service Scheme, Physical Education (PE) (Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of V semester. The activities shall be carried out from (for 4 semesters) between V semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall to be reflected in the calendar prepared for the NSS, PE and Yoga activities.
	21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director	
	21YOG84	Yoga	Yoga Teacher	

HSMC: Humanity and Social Science & Management Course, **PCC**: Professional Core Course, **PCCL**: Professional Core Course laboratory, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project work**, L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, C**IE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation.

Industrial Open Elective Course (OEC): Credit for OEC is 03 (L: T: P: S) can be considered as (3: 0: 0 : 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering.

21XXX61(HSMC)- This course must be pertaining to economics and management of the concerned degree program. The course syllabus should have both economics and management topics and the course title should bear the word Management.

For IT allied Branches: Software Product Management

For Core Branches: Engineering Economics and Management / Industrial Management / Construction Management

Professional Elective Courses-II			
21CEE641	Cryptography and Network Security	21CEE644	Big Data Analytics
21CEE642	Cloud Computing	21CEE645	Bio Inspired Design and Innovation
21CEE643	Natural Language Processing		

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

SEMSTER V
(SYLLABUS)

COMPUTER ORGANIZATION AND OPERATING SYSTEM

Course Code	**21CEE51**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE51.1	Describe the different computer architectures, instruction sets, addressing modes and memory.
21CEE51.2	Apply the concepts of basic functional units to demonstrate the working of computational system.
21CEE51.3	Demonstrate the structure and functions of Operating system.
21CEE51.4	Apply the concept of concurrency to implement a given problem using Scheduling.
21CEE51.5	Analyze processes, threads and scheduling algorithms
21CEE51.6	Evaluate appropriate concepts of deadlock and submit report in a team.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE51.1	3	-	2	-	-	-	-	-	-	-	-	2	2	2
21CEE51.2	3	2	2	-	-	-	-	-	-	-	-	2	2	2
21CEE51.3	3	2	2	2	-	-	-	-	-	-	-	2	2	2
21CEE51.4	3	2	2	2	-	-	-	-	-	-	-	2	2	2
21CEE51.5	3	2	2	2	-	-	-	-	-	-	-	2	2	2
21CEE51.6	3	2	2	2	-	-	-	-	-	-	-	2	2	2

MODULE-1	**Basic Structure of Computers**	**21CEE51.1**	**8 Hours**

Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Basic Number representation and arithmetic operations and characters, Bus Structure, Bus operation.

Text Book	Text Book Chapter1 – 1.3, 1.4, 1.6

MODULE-2	**Computer Arithmetic & Memory System**	**21CEE51.2**	**8 Hours**

Addition subtraction of signed numbers, Multiplication of unsigned and signed numbers, Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations.

Text Book	Text Book 1 2.1, Chapter5 – 5.1 to 5.4, 5.5

MODULE-3	**Introduction to operating systems & Process**	**21CEE51.3**	**8 Hours**

What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Process concept; Process scheduling; Operations on processes; Inter process communication Text.

Self-study / Case Study / Applications	Investigate of Microkernel Based Operating Systems.
Text Book	Text Book 2: Chapter 1, 3.1, 3.2, 3.3, 3.4

MODULE-4	**Multi-threaded Programming**	**21CEE51.3, 21CEE51.4**	**8 Hours**

Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores – Problems related to synchronization

Self-study / Case Study / Applications	Inter-hours rolling scheduling of behind-the-meter storage operating systems using electricity price forecasting based on deep convolutional neural network.
Text Book	Text Book 2: 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3, 5.4, 5.5, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7

MODULE-5	Deadlocks	21CEE51.5, 21CEE51.6	8 Hours

Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention;Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

Self-study / Case Study / Applications	Investigate Preempt able and Non Preempt able Resources.
Text Book	Text Book 2: Chapter 7, 8.1 to 8.6

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	5
L3	Apply	10	7.5	5
L4	Analyze	5	7.5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002, ISBN: 1259005275, 978-1259005275
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley- India, 2006. ISBN: 10. 812650962

Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture a quantitative approach, Elsevier, FifthEdition, 2012, ISBN: 9780123838728
2. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition, 2011, ISBN:978-1-4390-7920-1
3. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013, ISBN:978-1259005589
4. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014, ISBN:978-8120348363.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106105163
- https://nptel.ac.in/courses/106105214

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Demonstrations using real objects.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

OPERATING SYSTEMS LAB

Course Code	**21CEL51**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21CEL51.1	Write Basic Unix commands and shell programming.
21CEL51.2	Apply the knowledge of various CPU Scheduling Algorithms on Operating System Concepts.
21CEL51.3	Analyze the Process Creation and Inter Process Communication, Page Replacement Algorithms, File Organization and File Allocation Strategies.
21CEL51.4	Develop Deadlock Avoidance and Deadlock Detection on various algorithms.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEL51.1	3	-	3	2	3	-	-	-	-	-	-	1	3	2
21CEL51.2	3	-	3	2	3	-	-	-	-	-	-	1	3	3
21CEL51.3	3	-	3	2	3	-	-	-	-	-	-	1	2	2
21CEL51.4	3	-	3	2	3	-	-	-	-	-	-	1	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments		
	• Basic of Assembly level programming. • Basic of memory in Computer Organization.	2	**NA**
	PART - A		
1	Write basics of UNIX commands and various UNIX editors such as vi, gedit.	2	21CEL51.1
2	Write a C programs to simulate UNIX commands like cp, ls, grep	2	21CEL51.1
3	Write a Program for System Calls of Unix Operating System (fork, getpid, exit)	2	21CEL51.2
4	Write a simple program to print your name and details	2	21CEL51.2
5	Write a Shell program to swap the two integers	2	21CEL51.2
6	Write simple shell programs by using conditional, branching and looping statements	2	21CEL51.2
	PART - B		
7	To write a C program for implementation of Priority scheduling algorithms.	2	21CEL51.3
8	To write a C program for implementation of Round Robin scheduling algorithms.	2	21CEL51.3
9	Write C programs to implement the FCFS CPU Scheduling Algorithms	2	21CEL51.3 21CEL51.4
10	Write C programs to implement the SJF CPU Scheduling Algorithms	2	21CEL51.3
11	To write a c program to implement Threading and Synchronization Applications.	2	21CEL51.3
12	Write a C Program for Deadlock free condition in Operating System	2	21CEL51.3

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- File organization Technique – Single level directory
  http://ebootathon.com/labs/beta/csit/OS/exp2/
  https://coa-iitkgp.vlabs.ac.in/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	Remember	**5**	**5**
L2	Understand	5	5
L3	Apply	10	10
L4	Analyze	-	10
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (25 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	**10**
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=ybvbDlsDdk4**
- **http://www.damiantgordon.com/Courses/OperatingSystems1/**
- **https://www.youtube.com/watch?v=ETV_rzainOc**

Reference Books:

1) Neil Matthew, Richard Stones- Beginning Linux® Programming, Third Edition 2004, Wiley Publishing, Inc ISBN: 0-7645-4497-7

COMPUTER NETWORKS

Course Code	**21CEE52**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEE52.1	Describe the components of data communications
21CEE52.2	Apply the concepts of Physical and Data Link Layer Functionalities
21CEE52.3	Analyze the concepts of Network routing algorithms
21CEE52.4	Investigate the role of TCP-IP architecture in real time environment
21CEE52.5	Evaluate the importance of network security requirements in real time
21CEE52.6	Develop the working of real time application protocols

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE52.1	3	3	3	2	-	-	-	-	-	-	-	2	3	3
21CEE52.2	3	3	3	2	-	-	-	-	-	-	-	2	3	3
21CEE52.3	3	3	3	2	-	-	-	-	-	-	-	2	3	3
21CEE52.4	3	3	3	3	-	-	-	-	-	-	-	2	3	3
21CEE52.5	3	3	3	3	-	-	-	-	-	-	-	2	3	3
21CEE52.6	3	3	3	3	-	-	-	-	-	-	-	2	3	3

MODULE-1	**Introduction**	**21CEE52.1**	**8 Hours**

Introduction: Introduction: Data Communication-Components, Data Representation, Data Flow; Networks-Network Criteria, Physical structures, Network Types-LAN, WAN, Networking devices

Network Models- Protocol Layering-principles of protocol layering-logical, connection; TCP/IP Protocol Suite-LayeredArchitecture, Layers in the TCP/IP CO3. Protocol suite, Description of each layer, OSI Model, TCP/IP vs OSI model.

Self-study / Case Study / Applications	1. Crimp the cross-wired cable and straight through cable using clamping tool and connect the computers using LAN. 2. Self-study about the following network devices Repeater • Hub • Switch • Bridge • Router • Gate Way
Text Book	Text Book 1: Chapter 1, 2

MODULE-2	**Physical And Data Link Layer**	**21CEE52.2**	**8 Hours**

Physical Layer- Digital Transmission-Characteristics, DDC -Line coding schemes- Unipolar, Polar, Bipolar. Data Link Layer: Data Link Control- Framing-Character Oriented, Bit Oriented, HDLC

Text Book	Text Book 1: Chapter 2, 3.6 5.4, 5.6

MODULE-3	**Ip Addressing And Routing**	**21CEE52.3, 21CEE52.4**	**8 Hours**

Datagrams and Virtual Circuits-Connectionless Packet Switching-virtual packet switching, Routing in Packet Networks-Routing algorithm classification. TCP/IP architecture, The Internet Protocol-IP packet, IP ddressing, Subnet Addressing, CIDR, ARP, RARP, Fragmentation and reassembly, Ipv6-Header Format, Migrating Issues fromIpv4 to IPv6, UDP.

Text Book	Text Book 2: Chapter 7,8

MODULE-4	**Network Security**	**21CEE52.5**	**8 Hours**

Overview of Network Security, Col, 4 Overview of Security Methods, Secret-Key Encryption Protocols, Public-Key Encryption Protocols, Authentication-SHA.

Text Book	Text Book 3: Chapter 10

MODULE-5	**Applications, Network Management**	**21CEE52.6**	**8 Hours**

Application layer overview, Domain col,5 Name System (DNS), Remote Login Protocols, E-mail, File Transfer and FTP,World Wide Web and HTTP

Applications	Simulate DNS, FTP, WWW, HTTP protocols using packet tracer tool.
Text Book	Text Book 3: Chapter 9

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Behrouz A. Forouzan: Data Communication and Networking, 5th Edition Tata McGraw-Hill, 2013, ISBN: 978-1259064753
2. Alberto Leon Garcia & Indra Widjaja, Communication Networks — Fundamental Concepts & key architectures, , 2nd Edition, Tata McGraw-Hill, 2004, India, ISBN: N 0-07-119848-2
3. Nadir F Mir, Computer & Communication Networks, Pearson Education, edition, 2014, India, ISBN: 978-0-13-381474-3

Reference Books:

1. W. Stallings, Data& Computer Communication Prentice-Hall, 9th edition, 2014, ISBN: 978-9332518865
2. A.S. Tanenbaum, Computer networks, Prentice-Hall, 5th edition, 2014, ISBN: 978-0-13-212695-3

Web links and Video Lectures (e-Resources):

- **https://nptel.ac.in/courses/106105183**
- **https://www.youtube.com/watch?v=-6Uoku-M6oY**
- **https://www.youtube.com/watch?v=PYFqhGDejM4**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of various commands used in networks.
- Video demonstration of latest trends in networks
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to work with packet tracer
  - Organizing Group wise discussions on issues in network connectivity

COMPUTER NETWORKS LAB

Course Code	**21CEL52**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEL52.1	Apply the Primitive operations of Data Link Layer
21CEL52.2	Apply Socket programming interface for client server programming
21CEL52.3	Analyze the different protocols across various OSI model
21CEL52.4	Design and develop efficient security, congestion control algorithms

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEL52.1	3	3	3	3	2	-	-	-	-	-	-	2	3	3
21CEL52.2	3	3	3	3	2	-	-	-	-	-	-	2	3	3
21CEL52.3	3	3	3	3	2	-	-	-	-	-	-	2	3	3
21CEL52.4	3	3	3	3	2	-	-	-	-	-	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments		
	• Familiarise with Ubuntu UI and the execution procedure • Acquiring the knowlege of TCL scripting language for the running simulations	2	NA
	PART-A		
1	Develop a program for error detecting code using CRC-CCITT (16-bits)	2	21CEL52.1
2	Develop a program to implement frame sorting technique using buffers	2	21CEL52.1
3	Using TCP/IP sockets, develop a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.	2	21CEL52.2
4	Write a program for distance vector algorithm to find suitable path for transmission.	2	21CEL52.4
5	Write a program for simple RSA algorithm to encrypt and decrypt the data.	2	21CEL52.4
6	Write a program for congestion control using Leaky bucket algorithm	2	21CEL52.3
	PART-B		
7	Simulate a four-node point –to- point network with links connected as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agents between n0-n3 and UDP agents between n1-n3. Apply relevant applications and determines the number of packets sent by TCP/UDP.	2	21CEL52.3
8	Simulate an Ethernet LAN using N nodes and set multiple traffic nodes and determine collision across different nodes	2	21CEL52.3
9	Simulate an Ethernet Lan using n nodes (6-10), change the error rate and data rate and compare the throughput.	2	21CEL52.3
10	Simulate the different types of internet traffic such as FTP and HTTP over a network and analyze the throughput.	2	21CEL52.3
11	Simulate an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source/destination.	2	21CEL52.3
12	Simulate simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.	2	21CEL52.3

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- GSM Implementation on NS2. https://youtu.be/C89SJNVm6vE?si=9PKZVISlnGdbeTmp
- CDMA Implementation on NS2. https://youtu.be/UChBjpXQwDI?si=y2BwXK-qbfUHd67y

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	5
L5	Evaluate	5	10
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	10
L4	Analyze	20
L5	Evaluate	15
L6	Create	-

Suggested Learning Resources:

Web links:

- **https://www.youtube.com/watch?v=47uz-aHhRMk**
- **https://skillsforall.com/course/getting-started-cisco-packet-tracer?utm_source=netacad.com&utm_medium=referral&utm_campaign=packet-tracer&courseLang=en-US&userlogin=0**
- **https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3850/software/release/3se/consolidated_guide/b_consolidated_3850_3se_cg_chapter_01.html**

Reference Books:

1)Walker Schmidt, CCNA: A Comprehensive Beginners Guide To Learn About The CCNA (Cisco Certified Network Associate) Routing And Switching Certification From A-Z - 2019. ISBN 978-1096027492

CYBER SECURITY			
Course Code	**21CEE53**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to

21CEE53.1	Describe the basics of cyber security, cyber-crime and cyber law
21CEE53.2	Classify various types of attacks and learn the tools to launch the attacks.
21CEE53.3	Analyze the various tools to perform information gathering.
21CEE53.4	Apply intrusion techniques to detect intrusion
21CEE53.5	Apply intrusion prevention techniques to prevent intrusion
21CEE53.6	Develop self-learning and research skills to apply the concepts for the cyber world.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE53.1	1	1	1	-	-	1	-	1	-	-	-	-	2	2
21CEE53.2	-	3	1	-	-	1	-	-	-	-	-	-	2	1
21CEE53.3	-	2	1	-	-	-	-	-	-	-	-	-	2	2
21CEE53.4	3	-	-	-	-	-	-	-	-	-	-	-	2	3
21CEE53.5	3	-	-	1	-	-	-	-	-	-	-	-	2	2
21CEE53.6	2	2	1	-		1	-	-	-	-	-	-	3	2

MODULE-1	**Introduction**	**21CEE53.1**	**8 Hours**

Cyber Security – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; CyberLaws – The Indian IT Act – Cybercrime and Punishment.

Case Study	Case Study about a cyber-crime and identify the type of attack cybercriminal used
Text Book	Text Book 1 - chapter 1

MODULE-2	**Attacks And Countermeasures**	**21CEE53.1, 21CEE53.2**	**8 Hours**

Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

Self-Study	Do self-study about Open Worldwide Application Security Project (OWASP) and explore the world of Cyber Security
Text Book	Text Book 2: Chapter 3

MODULE-3	**Reconnaissance**	**21CEE53.3, 21CEE53.4**	**8 Hours**

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS– NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

Text Book	Text Book 3: Chapter 2. Text Book 4 : Chapter 2 & Chapter 3

MODULE-4	**Intrusion Detection**	**21CEE53.4, 21CEE53.5**	**8 Hours**

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

Text Book	Text Book 5: Chapter 8

MODULE-5	**Intrusion Prevention**	**21CEE53.4, 21CEE53.5, 21CEE53.6**	**8 Hours**

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems –Example Unified Threat Management Products.

Text Book	Text Book 5: Chapter 9

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	7.5	5
L3	Apply	10	7.5	5
L4	Analyze	5	-	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011
2. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones &Bartlett Learning Publishers, 2013, ISBN: 13: 978-1284116458
3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and PenetrationTesting Made easy", Elsevier, 2011, ISBN: 9780124116443.
4. Kimberly Graves, "CEH Official Certified Ethical Hacker Review Guide", Wiley Publishers,2007, ISBN: 13: 978-0782144376
5. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015, ISBN: 10. 9780134794105

Reference Books:

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021,ISBN: 978812652179
2. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014, ISBN: 978159327564.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=EKdZutMkmTE
- https://www.youtube.com/watch?v=D4fYyu305jg
- https://owasp.org/www-project-top-ten/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in distributed systems
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

ARTIFICIAL INTELLIGENCE

Course Code	**21CEE541**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE541.1	Describe the characteristics of AI that make it useful to real-world problems
21CEE541.2	Apply strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, planning and constraint management
21CEE541.3	Analyze the modern view of AI as the study of agents that receive percepts from the environment and perform actions.
21CEE541.4	Illustrate AI facing major challenges and the complexity of typical problems within thefield.
21CEE541.5	Investigate the techniques presented and apply them to real world problems.
21CEE541.6	Develop strategies for acquiring Knowledge on logical Analysis.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE541.1	2	2	-	-	-	-	-	-	-	-	-	-	3	3
21CEE541.2	2	2	-	-	1	-	-	-	-	-	-	-	3	2
21CEE541.3	2	2	-	-	1	-	-	-	-	-	-	-	3	3
21CEE541.4	2	2	-	-	-	-	-	-	-	-	-	-	3	3
21CEE541.5	-	2	-	-	-	-	-	-	-	-	-	-	3	3
21CEE541.6	2	2	-	-	-	-	-	-	-	-	-	-	3	3

MODULE-1	**Introduction**	**21CEE541.1 21CEE541.2 21CEE541.3**	**8 Hours**

Introduction and Intelligent systems, What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, Applications of A.I. Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agent, How the components of agent programs work.

Self Study	Introduction to cognitive computing
Text Book	Text Book 1 - chapter 1 & 2, Text Book 2 - chapter 1

MODULE-2	**Search Algorithms**	**21CEE541.1 21CEE541.2 21CEE541.3**	**8 Hours**

Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search, Informed search strategies: generate and test search, Best first search, Beam search algorithm, Hill climbing, A* algorithm, A* admissible, AO* algorithm.

Text Book	Text Book 1 - chapter 3 & 4

MODULE-3	**Classical And Adversarial Search**	**21CEE541.1 21CEE541.3 21CEE541.4**	**8 Hours**

Beyond Classical Search, Local Search Algorithms and Optimization Problems: Hill-climbing search Simulated annealing, Local beam search, Genetic algorithms, Adversarial Search: Study of minimax algorithm. Alpha-- Beta Pruning, Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Satisfaction Algorithm

Text Book	Text Book 1 - chapter 4 & 5

MODULE-4	**Quantifying Uncertainty**	**21CEE541.1 21CEE541.3 21CEE541.4**	**8 Hours**

Representing vagueness: Fuzzy sets and fuzzy logic, Study of fuzzy logic and Decision trees, Implementation aspects of Decision trees. Learning from Examples: Forms of Learning, Supervised Learning, Un Supervise Learning, Reinforcement Learning.

Self study	Experiential based learning and resolution
Text Book	Text Book 1 – chapter 13 & 14

MODULE-5	Logical Agents	21CEE541.1, 21CEE541.5, 21CEE541.6	8 Hours

Logical Agents: Knowledge representation structures: Frames, semantic net, Scripts, Logic: Prepositional Logic, Neural Networks, First Order Logic Natural language processing and Expert system.

Text Book	Text Book 1 - chapter 8 & 10

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Peter and Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall Series, 2010, Third edition, ISBN-0-13- 103805

Reference Books:

1. Elaine Rich, Kevin Knight and Nair, Artificial Intelligence Mc grew hill, 2010, Third edition, ISBN-978-0-07- 008770-5, TMH
2. Saroj Kausik, Artificial Intelligence, 2011, First Edition, ISBN 978-81-315-1099-5, Cengage Learning

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=uMzUB89uSxU
- https://www.youtube.com/watch?v=LK5j3pp0Too
- https://developer.ibm.com/videos/what-is-artificial-intelligence/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Case study
- Organizing Group wise discussions on issues
- Seminars

OBJECT ORIENTED ANALYSIS & DESIGN

Course Code	**21CEE542**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE542.1	Describe the concepts and explain projects using OO concepts
21CEE542.2	Apply the knowledge of UML in design diagrams.
21CEE542.3	Analyze and make use various concepts and types of the design pattern.
21CEE542.4	Examine use case modeling and domain modeling to various domains.
21CEE542.5	Demonstrate appropriate design patterns.
21CEE542.6	Evaluate code from design and compare various testing techniques.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE542.1	3	2	2	-	-	-	-	-	-	-	-	2	2	2
21CEE542.2	3	2	2	-	-	-	-	-	-	-	-	2	2	2
21CEE542.3	3	2	2	-	-	-	-	-	-	-	-	2	2	2
21CEE542.4	3	2	2	2	-	-	-	-	-	-	-	2	2	2
21CEE542.5	3	2	2	2	-	-	-	-	-	-	-	2	2	2
21CEE542.6	3	2	2	-	-	-	-	-	-	-	-	2	2	2

MODULE-1	**Advanced Object and Class Concepts**	**21CEE542.1**	**8 Hours**

Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling: Events, States, Transitions and Conditions, State Diagrams, State diagram behavior.

Text Book	Text Book-1: 4, 5

MODULE-2	**Use Case Modelling**	**21CEE542.2, 21CEE542.4**	**8 Hours**

Overview; Detailed object-oriented Requirements definitions; System Processes- A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated
Object-oriented Models.

Self-study / Case Study / Applications	Specifying persistence, class views and excluding classes for UML
Text Book	Text Book-2: Chapter- 6:Page 210 to 250

MODULE-3	**Process Overview**	**21CEE542.3**	**8 Hours**

Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.

Self-study / Case Study / Applications	Design and Implementation of Automated Teller Machine Emulator.
Text Book	Text Book-1: Chapter- 10,11,and 12

MODULE-4	**Use case Realization**	**21CEE542.3, 21CEE542.4**	**8 Hours**

The Design Discipline within up iterations: Object Oriented Design-The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with Communication Diagrams; Updating the Design Class Diagram; Package Diagrams-Structuring the Major Components; Implementation Issues for Three-Layer Design.

Self-study / Case Study / Applications	Create a UML use case diagram for the Movie/Game DVD Rental system including use cases, actors, interactions between actors and use cases, relationships between use cases.
Text Book	Text Book-2: Chapter 8: page 292 to 346

MODULE-5	Design Patterns	21CEE542.5,21CEE542.6	8 Hours

Introduction; what is a design pattern? Describing design patterns, the catalogue of design patterns, Organizing the catalogue, how design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only)

Self-study / Case Study / Applications	Apply principles and patterns to create better ***object*** designs.
Text Book	Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, Ch-3,Ch-4.

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005, ISBN-10 0130159204, ISBN-13 978-0130159205.
2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005 ISBN-10 8131502694, ISBN-13 978-8131502693.

Reference Books:

1. Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides: Design Patterns -Elements of Reusable Object-Oriented Software, Pearson Education, 2007, ISBN-13 978-0201633610.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc19_cs48/preview

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Case study
- Organizing Group wise discussions on issues
- Seminars

USER INTERFACE DESIGN

Course Code	**21CEE543**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE543.1	Explain the importance of user interface and benefits of good design.
21CEE543.2	Apply the user interface design process for business function.
21CEE543.3	Analyze the types of system menus and navigation schemes
21CEE543.4	Design the various types of system graphical menus.
21CEE543.5	Examine the guidelines of windows and device-based controls.
21CEE543.6	Develop the screen-based controls using tests.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE543.1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
21CEE543.2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
21CEE543.3	3	3	-	-	-	-	-	-	-	-	-	-	2	-
21CEE543.4	-	3	3	-	-	-	-	-	-	-	-	-	2	-
21CEE543.5	-	3	-	-	-	-	-	-	-	-	-	-	2	-
21CEE543.6	3	-	-	-	-	-	-	-	-	-	-	-	2	-

MODULE-1	**Introduction**	**21CEE543.1**	**8 Hours**

Overview, The importance of user interface – Defining the user interface, The importance of Good design, Characteristicsof graphical and web user interfaces, Principles of user interface design,

Self-study / Case Study / Applications	Predict how AI can impact UID and research the use of AI in the design of the User Interface Design of different application.
Text Book	Text Book 1: Part 1

MODULE-2	**The User Interface Design Process**	**21CEE543.1 21CEE543.2**	**8 Hours**

Obstacles, Usability, Fourteen design steps of UID, Human characteristics in Design, Human Interaction speeds,Business Functions-Business definition and requirement analysis, Basic business functions, Design standards.

Self-study / Case Study / Applications	Investigate user interface design of specific application with respect to 14 design steps of UID.
Text Book	Text Book 1: Part 2, Step 1, Step 2

MODULE-3	**System Menus And Navigation Schemes**	**21CEE543.3 21CEE543.4**	**8 Hours**

Structures of menus, Functions of menus, Contents of menus, Formatting of menus, Phrasing the menu, selectingmenu choices, Navigating menus, Kinds of graphical menus.

Self-study / Case Study / Applications	Review AI tools for UI:UX Design
Text Book	Text Book 1: Step 4

MODULE-4	**Windows**	**21CEE543.5**	**8 Hours**

Characteristics, Components of window, Window presentation styles, Types of windows, organizing windowfunctions, Window operations, Web systems, Characteristics of device-based controls.

Self-study / Case Study / Applications	Identify the application and list out the improvement that can be adopted in the UID.
Text Book	Text Book 1: Step 5 , Step 6

MODULE-5	Screen Based Control	21CEE543.6	8 Hours
Operable control, Text control, Selection control, Custom control, Presentation control, Usability, prototypes, kinds of tests.			
Self-study / Case Study / Applications	Survey on user interface design Innovations, design, applications, and case studies of the same.		
Text Book	Text Book 1: Step 7, Step 14		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Wilbert O. Galitz, "The Essential Guide to User Interface Design", John Wiley & Sons, Second Edition, 2002. ISBN-13: 978-0-470-05342-3

Reference Books:

1. Ben Sheiderman, "Design the User Interface", Pearson Education, 4th edition, 1998. ISBN-13 978-0201694970.
2. Alan Cooper," The Essential of User Interface Design", Wiley- Dream Tech Ltd., 1st edition, 2002. ISBN-13: 978-8126502134.

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/106/103/106103115/
- https://www.coursera.org/specializations/user-interface-design
- https://www.figma.com/ui-design-tool/
- https://www.interaction-design.org/literature/topics/ui-design

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts s

DATA MINING & WAREHOUSING

Course Code	**21CEE544**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE544.1	Describe the scope and necessity of Data Mining & Warehousing for the society
21CEE544.2	Apply the design techniques for Data Warehousing so that it can be able to solve the root problems.
21CEE544.3	Analyze various tools of Data Mining and their techniques to solve the real time problems
21CEE544.4	Design various algorithms based on data mining tools
21CEE544.5	Design further interest in research and design of new Data Mining techniques.
21CEE544.6	Develop Descriptive Mining of Complex Data Objects

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE544.1	3	3	3	3	-	-	-	-	-	-	-	3	3	2
21CEE544.2	3	3	3	3	-	-	-	-	-	-	-	3	3	2
21CEE544.3	3	3	3	3	-	-	-	-	-	-	-	3	3	2
21CEE544.4	3	3	3	3	-	-	-	-	-	-	-	3	3	3
21CEE544.5	3	3	3	3	-	-	-	-	-	-	-	3	3	3
21CEE544.6	3	3	3	3	-	-	-	-	-	-	-	3	3	3

MODULE-1	**Data Warehousing and Business Analysis**	**21CEE544.1 21CEE544.2**	**8 Hours**

Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

Case Study	Case Study: ETL (Extract, Transform, and Load) is a three-step process to a targetdatabase destination for business intelligence and reporting.
Text Book	Text Book 1 – 4.1, 4.2, 4.3, Reference Book 3- Chapter 8

MODULE-2	**Data Mining & Association Rule Mining**	**21CEE544.1 21CEE544.2**	**8 Hours**

Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture of A Typical Data Mining Systems-Classification of Data Mining Systems.
Association Rule Mining: - Efficient and Scalable Frequent Item Set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

Case Study	Case Study: A – priori algorithm with any sample data set.
Text Book	Text Book 1 – 1.2, 1.3, 3.1, 3.2, 3.3, 3.4, 3.5, Reference Book 3 - Chapter 1, 2, 3

MODULE-3	**Classification and Prediction**	**21CEE544.3 21CEE544.4**	**8 Hours**

Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification –Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

Self-study	Study of Bayesian Classification with sample data set
Text Book	Text Book 1 - 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, Reference Book 3 - Chapter 4

MODULE-4	**Cluster Analysis**	**21CEE544.4, 21CEE544.5**	**8 Hours**

Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – ClusteringHigh-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

Text Book	Text Book 1 – 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 11.1, 11.2, 11.4, 12.1

MODULE-5	Mining Object, Spatial, Multimedia, Text and Web Data	21CEE544.5, 21CEE544.6	8 Hours

Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

Text Book	Text Book 1 – 13.1, 13.2, 13.3, 13.4, 13.5

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011, ISBN-10: 9780123814791

Reference Books:

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw - Hill Education, Tenth Reprint 2017, ISBN-10: 0070587418
2. KP. Soman, Shyam Diwakar and V. Ajay "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006, ISBN-978-81-203-2897-6
3. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2014, ISBN-10: 8120350022
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2016, ISBN-10: 9332571406

Web links and Video Lectures (e-Resources):

- https://www.digimat.in/nptel/courses/video/106105174/L01.html
- https://www.youtube.com/watch?v=m-aKj5ovDfg
- https://onlinecourses.nptel.ac.in/noc21_cs06/preview
- https://onlinecourses.swayam2.ac.in/cec19_cs01/preview

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- KDD Data Sets could be downloaded and used for analyzing the same for various algorithms.
- NSL-KDD Data Sets could be downloaded and used for analyzing the same for various algorithms.
- Comparison study shall be made for the above 2 mentioned data sets with various algorithms used.

COMPUTER GRAPHICS

Course Code	**21CEE545**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE545.1	Interpret the fundamental principles of computer graphics
21CEE545.2	Illustrate primitives and attributes for designing graphics
21CEE545.3	Analyze the two-dimensional graphics and their transformations
21CEE545.4	Analyze the three-dimensional graphics and their transformations
21CEE545.5	Implement illumination and color models using OpenGL
21CEE545.6	Design a Computer Animation with 2D and 3D effects

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE545.1	3	-	-	-	-	-	-	-	-	-	-	3	3	-
21CEE545.2	3	3	3	2	-	-	-	-	-	-	-	3	3	-
21CEE545.3	3	3	3	2	-	-	-	-	-	-	-	3	3	-
21CEE545.4	3	3	3	-	-	-	-	-	-	-	-	3	3	-
21CEE545.5	3	3	3	-	2	-	-	-	-	-	-	3	3	-
21CEE545.6	3	3	3	-	2	-	-	-	-	-	-	3	3	-

MODULE-1	**Introduction**	**21CEE545.1**	**8 Hours**

Introduction to Computer Graphics and OpenGL: Input Devices, Hard-Copy Devices, Graphics Networks,Graphics on the Internet, Coordinate Representations, Graphics Functions, Software Standards
OpenGL: Related Libraries, Header Files, Display-Window Management Using GLUT, A Complete OpenGL Program

Text Book	Text Book 1: Chapter 1

MODULE-2	**Attributes of Graphics Primitives**	**21CEE545.2**	**8 Hours**

OpenGL State Variables, Color and Grayscale, OpenGL Color Functions, PointAttributes, OpenGL Point-Attribute Functions, Line Attributes, OpenGL Line-Attribute Functions, Curve Attributes

Text Book	Text Book 1: - Chapter 2, 3

MODULE-3	**Two-Dimensional Geometric Transformations**	**21CEE545.3, 21CEE545.4**	**8 Hours**

Basic Geometric Transformations, Matrix Representations and Homogeneous Coordinates, Composite Transformations, Raster Methods for Geometric Transformations, OpenGL Raster Transformations,OpenGL Functions for Geometric Transformations

Text Book	Text Book 2: Chapter 3

MODULE-4	**Three-Dimensional Geometric Transformations**	**21CEE545.5**	**8 Hours**

Translation, Rotation, Scaling, Composite Transformations, Affine Transformations,OpenGL Geometric-Transformation Functions, OpenGL Geometric- Transformation Programming Examples.

Text Book	Text Book 2: Chapter 4

MODULE-5	**Computer Animation**	**21CEE545.6**	**8 Hours**

Design of Animation Sequences, Traditional Animation Techniques, General Computer- Animation Functions, Computer-Animation Languages, Key-Frame Systems, Motion Specifications, Character Animation, Periodic Motions, OpenGL Animation Procedures

Case Study	Survey on Computer generated Films - A case Study
Text Book	Reference Book 3: Chapter 3

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Hearn Baker Carithers, "Computer Graphics with OpenGL", Pearson New International Edition,2014, ISBN 9780130153906
2. J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, "Computer Graphics - Principles and Practice", Second Edition in C, Pearson Education, 2003, ISBN 9780130153906
3. F. S. Hill Jr., "Computer Graphics using OpenGL", Pearson Education, 2003, ISBN 9780023548567.

Reference Books:

1. Xiang, Plastock,"Computer Graphics" , sham's outline series, 2nd edition, TMG, Jan 2015, ISBN 13: 978-0070601659.
2. Kelvin Sung, Peter Shirley, stevenBaer , "Interactive Computer Graphics, concepts and Applications", 1st Edition ,Cengage Learning, 2010, ISBN 9788131512708.
3. M M Raikar &Shreedhara K S, "Computer Graphics using OpenGL", 1st Edition, Cengage publication, 2019, ISBN 9789351070528.

Web links and Video Lectures (e-Resources):

- Welcome to OpenGL:https://learnopengl.com/
- Basic OpenGL:http://www.opengl-tutorial.org/beginners-tutorials/
- An Introduction on OpenGL with 2D Graphics :

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in Graphics
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to work with latest tools available in CG Organizing Group wise discussions on issues in network connectivity

WEB TECHNOLOGY

Course Code	**21CEL551**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEL551.1	Understand the importance of HTML and CSS.
21CEL551.2	Develop basic skills in analyzing the usability of a web site using HTML.
21CEL551.3	Conduct hands on experience using open source technologies such as HTML, CSS, and JavaScript
21CEL551.4	Generate an application based upon the concepts of HTML, CSS and JavaScript

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEL551.1	2	2	-	-	-	-	-	-	-	-	2	2	3	2
21CEL551.2	2	-	-	-	-	-	-	-	-	-	2	2	3	2
21CEL551.3	2	-	-	-	-	-	-	-	-	-	2	2	3	2
21CEL551.4	2	-	-	-	-	-	-	-	-	-	2	2	3	2

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments		
	• Text editor-VS code installation. • HTML basics, HTML tags, HTML elements, HTML headings, HTML styles, HTML attributes.	2	NA
	PART-A		
1	Design a Time table Webpage using the HTML '<table>' tag ensure it spans the full width of the page.	2	21CEL551.1
2	Create a biodata form using HTML and CSS by using and different input types .	2	21CEL551.1
3	Insert an image ,video(YouTube video),running message and create a link such that clicking on it takes the user to other page.	2	21CEL551.2
4	Design a responsive event form using the HTML and CSS.	2	21CEL551.2
5	Implement 3 different ways of adding CSS to HTML document. • Inline - by using the style attribute inside HTML elements • Internal - by using a <style> element in the <head> section External - by using a <link> element to link to an external CSS file	2	21CEL551.2
6	Create a HTML document containing a nested list showing a content page of any book	2	21CEL551.3
	PART-B		
7	Design a count down timer using Javasript	2	21CEL551.4
8	Create a dynamic search and highlight project using HTML,CSS and Javascript	2	21CEL551.4
9	A program to fetch and display API data in table format	2	21CEL551.4
10	A JavaScript program to differentiate foreach(),map(),filter(),reduce()	2	21CEL551.4
11	Develop a program to count the characters and words using javascript	2	21CEL551.4
12	Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient	2	21CEL551.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. Library Management system https://youtu.be/VU6kdE7Eo_c?si=Ty4f1AG0qpOaB0Ea
2. Registration Form Validation. https://youtu.be/PAUxi3f9HB0?si=weDbk4pbE2V0q_GO

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	Remember	**-**	**-**
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	**-**
L2	Understand	5
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	**-**

Suggested Learning Resources:

Reference Books:

1. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", 4th Edition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
2. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)
3. Nicholas C Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)
4. David Sawyer Mcfarland, "JavaScript & jQuery: The Missing Manual", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (ISBN:978- 9351108078)

APP DEVELOPMENT USING KOTLIN

Course Code	**21CEL552**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEL552.1	Write a basic program using Android studio.
21CEL552.2	Develop basic skills in analyzing the usability of a App Development using Kotlin.
21CEL552.3	Conduct hands on experience using Android Studio for sending Messages.
21CEL552.4	Generate an application based upon the concepts of Kotlin.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEL552.1	3	2	-	-	3	-	-	-	-	-	-	2	3	2
21CEL552.2	3	2	2	-	3	-	-	-	-	-	-	2	3	2
21CEL552.3	3	2	2	-	3	-	-	-	-	-	-	2	3	2
21CEL552.4	3	2	2	-	3	-	-	-	-	-	-	2	3	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Basic of creating buttons using HTML and CSS.	2	NA
	PART-A		
1	Installation of Android studio.	2	21CEL552.1
2	Development of Hello World Application using kotlin.	2	
3	Design an android application to create page using Intent and one Button and pass the Values from one Activity to second Activity.	2	21CEL552.2
4	Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button	2	21CEL552.2
5	Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout)	2	
6	Design an android application Send SMS using Intent using kotlin.	2	21CEL552.3
	PART-B		
7	Create a basic android application using Kotlin.	2	21CEL552.3
8	Design Android Radio Button Using Kotlin	2	
9	Design an android application for menu using Kotlin.	2	21CEL552.3
10	Create a user registration application that stores the user details in a database table Using Kotlin.	2	21CEL552.4
11	Write a sample code for sending SMS in Android using SMS Intent to a number Using Kotlin.	2	
12	Create a code showing how to Send an Email via Intent using Kotlin.	2	21CEL552.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- **Build Your Next Mobile App Project with Kotlin App Development.**
  https://developer.android.com/codelabs/build-your-first-android-app-kotlin#0

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	**30**
L1	Remember	**-**	**-**
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	5
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Kotlin in Action, Authors: Dmitry Jemerov & Svetlana Isakova, 2021 ISBN-10 1617293296 ISBN-13 978-1617293290.
2. Head First Kotlin: A Brain-Friendly Guide, Authors: Dawn Griffiths & David Griffiths, 2019, ISBN-10 9352138074, ISBN-13 978-9352138074.
3. https://onlinecourses.swayam2.ac.in/aic20_sp02/preview

RUBY PROGRAMMING

Course Code	**21CEL553**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEL553.1	Explain the ruby scripting language in detail
21CEL553.2	Conduct experiments regarding mathematical functions using ruby.
21CEL553.3	Analyze the features of ruby scripting language over others.
21CEL553.4	Make an effective report based on experiments

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEL553.1	3	3	3	3	2	-	-	-	-	-	-	2	3	3
21CEL553.2	3	3	3	3	2	-	-	-	-	-	-	2	3	3
21CEL553.3	3	3	3	3	2	-	-	-	-	-	-	2	3	3
21CEL553.4	3	3	3	3	2	-	-	-	-	-	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments		
	• Create a web page using Anchor tag with its attributes and an image at its centre. Add CSS to customize the properties of the font. • Write a Javascript program to display the current day and time.	2	NA
	PART-A		
1	Write a ruby script to create a new string which is n copies of a given string where n is a non-negative integer	2	21CEL553.1 21CEL553.2
2	Write a ruby script which accepts the radius of a circle from the user and compute the parameter and area	2	21CEL553.1 21CEL553.2
3	Write a ruby script which accepts the user's first and last name and print them in reverse order with space between them	2	21CEL553.1 21CEL553.2
4	Write a ruby script to accept a filename from the user print the extension of that.	2	21CEL553.1 21CEL553.2
5	Write a ruby script to find the greatest of three numbers.	2	21CEL553.1 21CEL553.2
6	Write a ruby script to find the greatest of 3 numbers.	2	21CEL553.1 21CEL553.2 21CEL553.3
	PART-B		
7	Write a ruby script to check two integers and return true if one of them is 20 otherwise return their sum.	2	21CEL553.1 21CEL553.2 21CEL553.3
8	Write a ruby script to check 2 temperatures and return true if one is less than 0	2	21CEL553.2
9	Write a ruby script to find the factorial of a number	2	21CEL553.3
10	Write a ruby script to retrieve the total marks where subject name and marks of a student stored in a hash.	2	21CEL553.3
11	Write a ruby script to copy the content of 1 string to the other.	2	21CEL553.4
12	Write a ruby script to handle file operations.	2	21CEL553.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

- Demonstrate Ruby/TK widget Classes. https://www.tutorialspoint.com/ruby/ruby_tk_entry.htm
- Demonstrate Standard Configuration Options.

https://www.academia.edu/37529638/MODULE_3_CONFIGURING_COMPUTER_SYSTEMS_AND_NETWORKS_Content_Standard_Performance_Standard

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	5
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Text book:

1. 1Yukihiro Matsumoto, David Flanagan, "The Ruby Programming Language: Everything You Need to Know", Greyscale Indian Edition, Shroff First Edition, 2008, ISBN-10: 9788184044928
2. Tim Warren, "Ruby Programming For Beginners: The Simple Guide to Learning Ruby Programming Language Fast!", Ingram Publishing, 2019, ISBN-10: 176103040X
3. Hal Fulton, André Arko, "Ruby Way, The: Solutions and Techniques in Ruby Programming (Addison-Wesley Professional Ruby Series) Paperback - Illustrated, 12 March 2015, Addison-Wesley; 3rd edition, 2015, ISBN-10: 0321714636

Suggested Learning Resources:

Web links and e- learning resources:

1) https://www.youtube.com/watch?v=t_ispmWmdjY
2) https://www.youtube.com/watch?v=8wZ2ZD--VTk
3) https://www.tutorialspoint.com/ruby/index.htm

SOFTWARE TESTING

Course Code	**21CEL554**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEL554.1	Analyze the requirements for the given problem statement.
21CEL554.2	Design and implement various solutions for the given problem.
21CEL554.3	Employ various design strategies for problem solving.
21CEL554.4	Construct control flow graphs for the solution that is implemented.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEL554.1	2	2	2	-	-	-	-	-	-	-	-	2	3	2
21CEL554.2	2	-	2	-	3	-	-	-	-	-	-	2	3	2
21CEL554.3	2	-	2	-	3	-	-	-	-	-	-	2	3	2
21CEL554.4	2	-	2	-	-	-	-	-	-	-	-	2	3	2

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments		
	• Should have basic knowledge of basic computer functionality, basic mathematics, computer language, and logical operators, understanding of the software development life cycle (SDLC).	2	NA
	PART-A		
1	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Derive test cases for your program based on decision-table approach, execute the test cases and discuss the results.	2	21CEL554.1
2	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, execute the test cases and discuss 3the results.	2	21CEL554.2
3	Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on equivalence class partitioning, execute the test cases and discuss the results.	2	21CEL554.2
4	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.	2	21CEL554.3
5	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.	2	21CEL554.3
6	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.	2	21CEL554.4

PART-B			
7	Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results	2	21CEL554.4
8	Design, develop, code and run the program in any suitable language to implement the binary search algorithm. Determine the basis path sand using them derive different test cases, execute these test cases and discuss the test results	2	21CEL554.4
9	Design, develop, code and run the program in any suitable language to implement the quicksort algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.	2	21CEL554.4
10	Verify the calculator is a normal calculator and not a scientific calculator.	2	21CEL554.4
11	Verify the addition of two integer numbers	2	21CEL554.4
12	Design, develop, code and run the program in any suitable language to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.	2	21CEL554.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

1. Consider an automated banking application. The user can dial the bank from a personal computer, provide asix-digit password, and follow with a series of keyword commands that activate the banking function.
   http://vlabs.iitkgp.ernet.in/se/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	5
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:
Reference Books:

1. The Art of Software Testing(Book): 3rd edition, ISBN-10 1118031962, ISBN-13 978-1118031964.
2. Software Testing, 2nd Edition, 2005, ISBN 0-8493-0809-7.
3. Agile Testing: A Practical Guide for Testers and Agile Teams, ISBN-10 9780321534460 ISBN-13 978-0321534460.
4. Software Test Automation - Effective Use of Test Execution Tools ISBN 0201331403, 9780201331400.

GOLANG PROGRAMMING

Course Code	**21CEL555**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEL555.1	Understand the basics of Go programming language
21CEL555.2	Analyze the control structure of Go programming language
21CEL555.3	Analyze the array, slice array and Map data structures
21CEL555.4	Implement functions, struct and interface in Go programming language

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEL555.1	3	3	3	-	2	-	-	-	1	1	-	2	3	3
21CEL555.2	3	3	3	-	2	-	-	-	1	1	-	2	3	3
21CEL555.3	3	3	3	-	2	-	-	-	1	1	-	2	3	3
21CEL555.4	3	3	3	-	2	-	-	-	1	1	-	2	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments		
	• Text editor-Vs code installation • Basics of c programming	**2**	**NA**
	PART-A		
1	Write a Program to print a message (without including whitespace or newline) given by the user in the console as input.	2	21CEL555.1 21CEL555.2
2	Write a program which uses all kinds of data types and in-built functions for manipulating them, used in golang.	2	21CEL555.1 21CEL555.2
3	Write a program to perform various arithmetic operations and display their result.	2	21CEL555.2
4	Write a program to print natural numbers using for loop	2	21CEL555.2
5	Write a program to print the day of the week using switch case with fallthrough.		21CEL555.1 21CEL555.2
6	Write a program to assign grades (A, B, C) based on marks obtained by a student. a) if the percentage is above 90, assign grade A b) if the percentage is above 75, assign grade B c) if the percentage is above 65, assign grade C	2	21CEL555.2
	PART-B		
7	Write a Program to copy the marks value of one student to the other with the help of pointer.	2	21CEL555.2 21CEL555.3
8	Write a Program to print the highest of n numbers using function.	2	21CEL555.2
9	Write a program to create 2 slices for odd and even numbers from 1-10 and append both the splices and display the prime numbers alone.	2	21CEL555.3
10	Write a program to create a shape structure as an interface including some functions which is implemented by shapes like rectangle, square.	2	21CEL555.4
11	Write a program to create a channel in golang to send and receive data.	2	21CEL555.4
12	Write a program to create multiple channel and select any one to communicate using select statement	2	21CEL555.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- Develop a Golang program to replace all occurrences of a word with another word in the given string.

https://www.youtube.com/watch?v=vFqjpJfCG6Q

- Develop a calculator program using switch cases in Golang. https://www.youtube.com/watch?v=ca8xBxKWXsM
- Develop bubble sort implementation in Golang. https://www.youtube.com/watch?v=98yDJ5vao5Q

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Textbook:

1. Introducing Go by Google Inc, January 2016 Publisher(s): O'Reilly Media, Inc. ISBN: 9781491941959

Suggested Learning Resources:

Web links and e- learning resources:

1) https://www.emertxe.com/embedded-systems/data-structures/ds-projects/
2) https://www.youtube.com/watch?v=MJd8KrbxYv4

MINI PROJECT

Course Code	**21CEE56**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEE56.1	Analyze the real world problem through survey of existing problems
21CEE56.2	Design the modules for solving the problems identified
21CEE56.3	Implement the design modules with suitable programming language
21CEE56.4	Test the working modules at different levels

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE56.1	3	2	3	2	3	-	1	1	3	-	-	2	3	2
21CEE56.2	3	2	3	2	1	-	1	1	3	-	-	3	3	2
21CEE56.3	3	2	3	2	2	-	1	1	3	-	-	3	3	2
21CEE56.4	3	2	3	2	3	-	2	1	3	-	-	3	3	2

The student shall be capable of identifying a problem related to the field of Computer Engineering and carry out a mini project on the problem defined. Each student is expected to do the mini project individually. The code developed towards the project will be reviewed by a panel of experts during the course of the semester. Plagiarized projects will automatically get an "F" GRADE and the student will be liable for further disciplinary action. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Synopsis Presentation-Review-0	Review-1	Final Review	Report Submission with plagiarism certificate
		5	**15**	**20**	**10**
L1	Remember	-	-	-	
L2	Understand	-	-	-	10
L3	Apply	5	5	5	-
L4	Analyze	-	5	5	-
L5	Evaluate	-	5	-	-
L6	Create	-	-	10	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	10
L4	Analyze	10
L5	Evaluate	15
L6	Create	15

RESEARCH METHODOLOGY AND IPR

Course Code	**21CEK57**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course outcomes:
At the end of the course, the student will be able to:

21CEK57.1	Characterize the significance and suitability of research in engineering applications
21CEK57.2	Demonstrate the various processing techniques of research
21CEK57.3	Evaluate the research in the development of engineering materials, process and tools
21CEK57.4	Analyze criteria to fit own intellectual work in particular form of IPR
21CEK57.5	Apply statutory provisions to protect particular form of research
21CEK57.6	Develop the art of scholarly writing and evaluate its quality

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEK57.1	3	3	3	-	-	-	-	-	3	3	2	3	2	2
21CEK57.2	3	3	3	1	2	-	-	-	3	3	2	3	2	2
21CEK57.3	3	3	3	1	2	-	-	2	3	3	2	3	2	2
21CEK57.4	3	3	-	-	-	-	-	2	3	3	2	3	2	2
21CEK57.5	3	-	-	-	-	-	-	2	3	3	2	3	2	2
21CEK57.6	3	3	3	1	2	-	-	1	3	3	2	3	2	2

MODULE-1	**RESEARCH FORMULATION AND DESIGN**	**21CEK57.1, 21CEK57.2**	**3 Hours**

Definition and objective of research, types of research, steps in research process, research design, concept and types of research design, defining and formulating the research problems, importance of literature review-primary and secondary sources, reviews, monographs, patent, research database, web sources, identifying gap areas from the literature and research data base, surveying synthesis, Interpretation.

Self-study / Case Study / Applications	Do the survey on different types research database.
Text Book	Text Book 1: Ch. 1, 2& 6

MODULE-2	**SAMPLING & DATA INTERPRETATION**	**21CEK57.2, 21CEK57.3**	**3 Hours**

Mathematical tools for analysis, statistical analysis of data, regression analysis, correlation, concept of best fit and exact fit, exact fit, theory, examples from linear regression with one and more unknowns.

Text Book	Text Book 1: Ch. 4& 7

MODULE-3	**PATENT RIGHTS AND IPR**	**21CEK57.3, 21CEK57.4**	**3 Hours**

Patents and its basics, process of filing patent at national and international level, Introduction and significance of intellectual property rights, commercialization, royalty, copyright, trade related aspects of IPR, Administration of patent system in India, licensing and transfer of technology, case studies.

Self-study / Case Study / Applications	Do survey on different patent right.
Text Book	Text Book 2: Ch. 1 & 2/ IPR India website

MODULE-4	RESEARCH AND PUBLICATIONETHICS	21CEK57.4, 21CEK57.5	3 Hours
Research and Integrity, Scientific mis conduct: Falsification, Fabrication and Plagiarism (FFP), Conflict of research, Predatory publishers and Journals, Open access publication, citation and acknowledgement, reproducibility and accountability, software tools for similarity check			
Self-study / Case Study / Applications	Do survey on different plagiarism tools available and compare.		
Text Book	Text Book 1: Ch. 14 & 15		
MODULE-5	**REPORT WRITING**	**21CEK57.5, 21CEK57.6**	**3 Hours**
Structure and components of research report, types of report, layout of research report, mechanism of writing a research report, referencing in academic writing, Abstracting, Bibliography			
Text Book	Text Book 1: Ch. 14		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Kothari, C.R., "Research Methodology: Methods and Techniques". New Age International, 2018, ISBN-13: 978-8122436235
2) Ramakrishna Chintakunta, A Text book of Intellectual Property rights, Blue Hill Publication, ASIN: B09T6YDB5N, 2022

Reference Books:

1) Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K, An introduction toResearch Methodology, RBSA Publishers. 2015, ISBN-13:978-8176111652
2) Ranjith Kumar, Research methodology, Saga publications,4th edition, 2014, ISBN-13- 978-9351501336Anderson, T. W., "An Introduction to Multivariate Statistical Analysis", Wiley Eastern Pvt., Ltd., New Delhi, 2011, ISBN-13: 978-8126524488
3) Montgomary, Douglas C. &Runger, George C. (2016) 6/e, Applied Statistics & probability for Engineers (Wiley India) ISBN-13: 978-1118539712
4) Montgomary, Douglas C. (2012) 8th edition, Design and Analysis of Experiments (Wiley India) ISBN: 978-1-118-14692-7
5) Sinha, S.C. and Dhiman, A.K., 2012. Research Methodology, EssEss Publications. 2 volumes. ISBN : 81-7000-324-5, 81-7000-334-2.

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes & Assignments
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Flowcharts andHandouts
- Organizing Group wise discussions on issues and seminars

INNOVATION AND DESIGN THINKING

Course Code	**21CEK58**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**01**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**01**

Course outcomes:
At the end of the course, the student will be able to:

21CEK58.1	Articulate a comprehensive understanding of the concept of Design Thinking
21CEK58.2	Apply Design Thinking methodologies to solve complex and ambiguous problems effectively
21CEK58.3	Utilize design thinking tools for creative solutions
21CEK58.4	Implement design thinking in IT that showcase the ability to drive meaningful innovation
21CEK58.5	Develop strategic innovation for Business Model Design
21CEK58.6	Create the Minimum Viable Product to solve societal needs using Design Thinking

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEK58.1	3	-	-	-	-	-	-	-	3	3	-	3	2	2
21CEK58.2	3	3	2	-	-	-	-	-	3	3	-	3	2	2
21CEK58.3	3	3	2	-	2	-	-	-	3	3	-	3	2	2
21CEK58.4	3	3	2	2	2	-	-	-	3	3	-	3	2	2
21CEK58.5	3	3	2	2	-	-	-	-	3	3	-	3	2	2
21CEK58.6	3	3	2	2	2	1	1	1	3	3	1	3	2	2

MODULE-1	**UNDERSTANDING DESIGN THINKING**	**21CEK58.1 21CEK58.2**	**3 Hours**

Definition, Origin and features of Design Thinking, Design thinker in organization, Principles and stages of Design thinking. Design Shared model in team-based design, Theory and practice in Design thinking. Collaborative design thinking. Live examples of MVP or Prototyping

MODULE-2	**TOOLS FOR DESIGN THINKING**	**21CEK58.3**	**3 Hours**

Visualization, Journey mapping, Value Chain Analysis, The mind map, Rapid Concept development, Assumption testing, Prototype, Co creation, Learning launches and Storytelling.

MODULE-3	**DESIGN THINKING IN IT**	**21CEK58.4**	**3 Hours**

Business process modelling (BPM). Agile in Virtual collaboration environment. Scenario based Prototyping. Case studies on Design thinking

Self-study / Case Study / Applications	Identify suitable case study for scenario based prototyping and explain.

MODULE-4	**DESIGN THINKING FOR STRATEGIC INNOVATION**	**21CEK58.5**	**3 Hours**

Strategic management and Innovation management, Types of Innovations, Features and Scope of strategic innovations, Design thinking and strategic innovation, Practices of integrating Design thinking in Strategic Innovation.

MODULE-5	**DESIGN THINKING WORK SHOP**	**21CEK58.6**	**3 Hours**

Focus, Need and stages of Design thinking workshop. Empathize, Design, Ideate, Prototype and Test

Self-study / Case Study / Applications	Survey different design thinking workshop and Identify the different uses of it. .

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)(15)	Assignment (10)	Seminar/ Activity (25)
		15	10	25
L1	Remember	5	-	-
L2	Understand	5	-	5
L3	Apply	5	5	5
L4	Analyze	-	5	10
L5	Evaluate	-	-	5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	25
L3	Apply	15
L4	Analyze	--
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

1. Christian Mueller-Roterberg, Handbook of Design Thinking - Tips & Tools for how to design thinking.
2. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design",Cengage learning (International edition) Second Edition, 2013.
3. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage",Harvard Business Press, 2009.
4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand - Improve - Apply", Springer, 2011
5. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", CengageLearning, SecondEdition, 2011.
6. Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia BusinessSchool Publishing) Hardcover - 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author)

Web links and Video Lectures (e-Resources):

- **https://www.ibm.com/design/thinking/**
- **https://www.ideou.com/pages/design-thinking**
- **https://www.youtube.com/watch?v=3RemkU4BH8U**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes & Assignments
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues, Seminars

SEMESTER VI

(SYLLABUS)

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT			
Course Code	**21CEE61**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE61.1	Understand the phases in a software project
21CEE61.2	Apply the fundamental concepts of requirements engineering and Analysis Modelling.
21CEE61.3	Describe the various software design and coding methodologies
21CEE61.4	Analyze various testing and maintenance measures
21CEE61.5	Demonstrate various project testing activities
21CEE61.6	Evaluate various project management activities

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE61.1	3	3	1	2	1	-	-	-	-	-	-	-	2	2
21CEE61.2	2	2	1	2	1	-	-	-	-	-	-	-	1	3
21CEE61.3	2	2	3	2	2	1	-	-	-	-	-	3	2	3
21CEE61.4	2	2	3	3	3	-	-	-	-	-	-	-	2	1
21CEE61.5	1	2	1	2	3	-	-	-	-	-	-	-	2	2
21CEE61.6	1	2	1	2	2	-	-	-	-	-	2	-	1	2

MODULE-1	**Introduction**	**21CEE61.1**	**8 Hours**
Software Engineering; Software Processes:Life Cycle Models, Unified process; Agile Process Modeldevelopment; Extreme Programming, Aspect-orientedsoftware engineering and process			
Text Book	Text Book 1: Chapter 1		
MODULE-2	**Requirements**	**21CEE61.2**	**8 Hours**
Requirements: Software Requirements, Feasibility study,Requirements elicitation and analysis; Requirements Specification, validation and management.			
Text Book	Text Book 1: Chapter 2, 3		
MODULE-3	**Software Design**	**21CEE61.3, 21CEE61.4**	**8 Hours**
Data Design, Architectural Design; Component Level Design, User Interface Design, ObjectOriented Design, Software Design Notations.			
Text Book	Text Book 2: Chapter 1, 3		
MODULE-4	**Software Coding and Testing**	**21CEE61.5**	**8 Hours**
Features of Software Code, Coding Guidelines, Coding Methodology, Programming Practice,Code verification Techniques, Coding Tools, Code Documentation **Software Testing:** Software Testing basics, Test Plan, Levels of Software Testing, Testing Techniques, Debugging. Safety, Security and reliability			
Text Book	Text Book 2: Chapter 3		
MODULE-5	**Configuration Management**	**21CEE61.6**	**8 Hours**
Change management, Distributed Version Control Systems Project Management: Project planning; Project scheduling; Risk management, Management activities.			
Self-study/ Case Study/ Applications	Survey of Project Management - A case studies		
Text Book	Text Book 2: Chapter 4,6		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	-	-	-
L2	Understand	5	7.5	5
L3	Apply	5	-	-
L4	Analyze	10	7.5	-
L5	Evaluate	5	-	5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Roger S. Pressman, Bruce Maxim, "Software Engineering - A Practitioner's Approach", McGraw Hill; 8th edition, 2014, ISBN-13: 978-0078022128
2. Ian Somerville, "Software Engineering", Pearson Education, Tenth edition, ISBN-13: 978-9332582699

Reference Books:

3. Pankaj Jalote, "An Integrated Approach to Software Engineering", Wiley India, Narosa, 2009, ISBN-13: 978-8173197024
4. Hans Van Vliet: Software Engineering: Principles and Practices, Wiley India, Third edition 2010 ISBN-13: 978-8126527373
5. Richard Fairley: Software Engineering Concepts, McGraw Hill, 2018, ISBN-13: 978-0070199026

Web links and Video Lectures (e-Resources):

- https://www.tutorialspoint.com/software_engineering/index.htm
- https://www.computerscience.org/careers/software-engineer/
- https://www.javatpoint.com/software-engineering-tutorial
- https://www.guru99.com/what-is-software-engineering.html
- https://www.geeksforgeeks.org/software-engineering/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of various commands used in Software Engineering
- Video demonstration of latest trends in networks
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to work with packet tracer
  - Organizing Group wise discussions on issues in network connectivity

MULTI CORE ARCHITECTURE

Course Code	**21CEE62**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**3**

Course outcomes:
At the end of the course, the student will be able to:

21CEE62.1	Explain Multicore architecture and thumb technology.
21CEE62.2	Utilize the knowledge of Cortex M3 architecture to develop a solution for the given problem statement
21CEE62.3	Apply Cortex M3 instructions set to solve a problem.
21CEE62.4	Develop assembly language and embedded C language applications.
21CEE62.5	Analyze the memory management schemes present in Cortex M3.
21CEE62.6	Utilize exceptions and interrupt concepts to develop an application

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE62.1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
21CEE62.2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
21CEE62.3	-	3	3	-	3	-	-	-	-	-	-	-	2	-
21CEE62.4	-	-	3	-	3	-	-	-	-	-	-	3	2	-
21CEE62.5	-	3	-	-	-	-	-	-	-	-	-	-	2	-
21CEE62.6	3	-	-	-	-	-	-	-	-	-	-	-	2	-

MODULE-1	**Multicore Cortex Processors**	**21CEE62.1**	**8 Hours**

Introduction, Overview of Multicore family Processor Evolution, Introduction to embedded system design, Cortex-Mfamily processor, Architecture, Thumb-2 Technology.

Self-study / Case Study / Applications	Investigate the Challenges of different ARM processors and compare
Text Book	Text Book 1: 1.1, 1.2, 1.3, 1.5. T e x t Book 2: Chapter 2, Chapter 3, Chapter 6

MODULE-2	**Fundamentals of Cortex-m3 Architecture**	**21CEE62.2**	**8 Hours**

Registers, Special Registers, Operation Mode, Memory Map, Stack Memory Operations.

Self-study / Case Study / Applications	Using Keil software, observe the various registers, dump, CPSR, with a simple ALP programme.
Text Book	Text Book 1: 3.1, 3.2 , 4.1 , 4.2 , 4.3 , 4.4

MODULE-3	**Instruction Sets**	**21CEE62.3 21CEE62.4**	**8 Hours**

Data Transfer, Branch Instructions, Barrier Instructions, Other Instructions, Cortex-M3 assembly Programming, CMSIS.

Self-study / Case Study / Applications	Encourage the students to come up with their own creative ways to solve the given problem.
Text Book	Text Book 1: 5.1, 5.2, 5.3, 5.4, 5.6. Text Book 3: 3.1 - 3.9

MODULE-4	**Introduction to Embedded c**	**21CEE62.3 21CEE62.4**	**8 Hours**

C-looping structures, Register allocation, Function calls, Pointer aliasing, structure arrangement, bit fields, unaligned data, inline functions and inline assembly, portability issues, Embedded Systems programming in C

Self-study / Case Study / Applications	Survey the Different Optimization techniques while writing the code to improve the performance of the system.
Text Book	Text Book 4: Chapter 5

MODULE-5	Interrupts & Memory Functions	21CEE62.5 21CEE62.6	8 Hours
Memory System Features Overview, Memory Maps, Memory endianness, Memory Access Attributes, Default Memory Access Permissions, Exception Types, Interrupt Management, Priorities, Exception sequence, NVICand SCB registers for exception control, Interrupt Masking			
Self-study / Case Study / Applications	Survey the memory management techniques adopted in the new generation of ARM processor.		
Text Book	Text Book 1: 6.1,6.2, 6.5, 6.9, 6.8, 7.2, 7.3, 7.4, 7.7, 7.8, 7.9, 7.10		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	-	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	-	5
L5	Evaluate	5	-	-
L6	Create	5	10	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	**10**
L3	Apply	**10**
L4	Analyze	**10**
L5	Evaluate	**10**
L6	Create	**10**

Suggested Learning Resources:

Text Books:

1) Joseph Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex M4 Processor, 3rd Edition, 2018, Newness Publication. ISBNe13: 978-0-12-408082-9
2) James A Langbridge, Professional Embedded ARM Development, John wiley & sons, 2014. ISBN: 978-1-118-78894-3
3) Trevor Martin, The Designer's Guide to the Cortex-M Processor Family - A Tutorial Approach, 2nd Edition , 2013, Newness Publication. ISBN: 978-0-08-098296-0
4) Andrew N Sloss, D. Symes and C. Wright, ARM system developers guide, Morgan Kauffman/ Elsevier, 2006. ISBN: 1-55860-874-5
5) Michael J. Pont, Embedded C, Pearson Education, 1st Edition, 2007, ISBN-13: 9780201795233

Reference Books:

6) Steve Furber, ARM System On Chip Architecture, 2nd edition, 2012, Pearson Education. ISBN 10: 0201675196.

Web links and Video Lectures (e-Resources):

- https://developer.arm.com/documentation/dui0552/latest/
- https://archive.nptel.ac.in/courses/106/105/106105193/
- https://www.coursera.org/learn/arm-cortex-m-processors-overview-course1

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues, Seminars

MULTI CORE ARCHITECTURE LAB

Course Code	**21CEL62**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEL62.1	Explain the instruction set of 32- bit ARM Cortex M3 and the software tool required for programming in assembly and C language.
21CEL62.2	Develop assembly language programs for different problem statements.
21CEL62.3	Develop C language programs for different applications.
21CEL62.4	Perform floating-point operations, Interface external hardware with ARM Cortex M3.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEL62.1	3	-	-	-	3	-	-	-	-	-	-	-	3	-
21CEL62.2	-	-	3	-	3	-	-	-	-	-	-	-	3	-
21CEL62.3	3	3	-	-	3	-	-	-	-	-	-	-	3	-
21CEL62.4	3	3	-	-	3	-	-	-	-	-	-	-	3	-

Exp. No./ Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments		
	• Explore the working of keil tool	2	
	PART – A		
1	Program to perform addition, Subtraction, multiplication, and division operations	2	21CEL62.1 21CEL62.2
2	Program to sort a given array of N elements in ascending / descending order using bubble sort	2	21CEL62.1 21CEL62.2
3	Program to generate Fibonacci series of N numbers	2	21CEL62.1 21CEL62.2
4	Program to search given number in an array	2	21CEL62.1 21CEL62.2
5	Program to compute factorial of a number	2	21CEL62.1 21CEL62.2
6	Program to compute n C r using recursion	2	21CEL62.1 21CEL62.2
	PART – B		
7	Program to perform floating point addition and Subtraction	2	21CEL62.1 21CEL62.4
8	Program to find square and cube of a floating-point number	2	21CEL62.1 21CEL62.4
9	Program to display a message using Internal UART	2	21CEL62.1 21CEL62.3 21CEL62.4
10	Program to Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction	2	21CEL62.1 21CEL62.3 21CEL62.4
11	Program to Interface a DAC and generate square waveform	2	21CEL62.1 21CEL62.3 21CEL62.4
12	Program to display the given message on a 7-segment LED interface, with an appropriate delay in between them.	2	21CEL62.1 21CEL62.3 21CEL62.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- Characterize the temperature sensor (RTD)
  https://sl-coep.vlabs.ac.in/exp/characterize-temperature-sensor/
- Simulate the performance of a bio-sensor
  https://sl-coep.vlabs.ac.in/exp/performance-bio-sensor/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	10
L3	Apply	5	10
L4	Analyze	10	10
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	15
L3	Apply	15
L4	Analyze	20
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Reference Books:

1) Joseph Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex M4 Processor, 3rd Edition, 2018, Newness Publication. ISBNe13: 978-0-12-408082-9

2) Trevor Martin, The Designer's Guide to the Cortex-M Processor Family - A Tutorial Approach, 2nd Edition , 2013, Newness Publication. ISBN: 978-0-08-098296-0

Web links and Video Lectures (e-Resources):

- **https://developer.arm.com/documentation/dui0552/latest/**
- **https://archive.nptel.ac.in/courses/106/105/106105193/**

MACHINE LEARNING			
Course Code	**21CEE63**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE63.1	Determine the problems for machine learning and gather Knowledge based on machine learning.
21CEE63.2	Apply Classification concepts for solving machine learning problems
21CEE63.3	Illustrate Artificial Neural Networks (ANN's)
21CEE63.4	Implementation of association rule mining in data mining
21CEE63.5	Evaluating Mathematical Models for Machine Learning algorithms
21CEE63.6	Illustrate Convolution Neural Networks and implementation for solving machine learning problems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE63.1	3	3	3	2	2	-	-	-	-	-	-	2	3	2
21CEE63.2	3	3	3	3	2	-	-	-	-	-	-	2	3	2
21CEE63.3	3	3	3	3	2	-	-	-	-	-	-	2	3	2
21CEE63.4	3	3	3	3	2	-	-	-	-	-	-	2	3	2
21CEE63.5	3	3	3	3	2	-	-	-	-	-	-	2	3	2
21CEE63.6	3	3	3	3	2	-	-	-	-	-	-	2	3	2

MODULE-1	Introduction	**21CEE63.1**	**8 Hours**

Introduction: Introduction to Machine Learning, Supervised Learning, Unsupervised Learning and Reinforcement Learning, Goals and Challenges of machine learning, Gradient (Steepest) Descent (OR) Learning Rule , LASSO and RidgeRegression, Prescriptive Analytics : Linear Programming model building

Text Book	Text Book1 - Chapter 1, 4, 6 Text book3 - Chapter 11, Reference Book2 - Chapter 1

MODULE-2	Decision Trees and SVM	**21CEE63.2**	**8 Hours**

Chi-Square Automatic Interaction Detectors (CHAID), Classification and Regression Tree (CART), C4.5. Support Vector Machine: Kernel Function and Kernel SVM.

Text Book	Text Book1 - Chapter 3, 5

MODULE-3	**Association Rule Mining and Correlations**	**21CEE63.3**	**8 Hours**

Association Rule Mining: Apriori, FP – Growth, Correlations: Basic Concepts and Methods, Pattern Mining in Multilevel, Multidimensional Space, Sequential Pattern Mining.

Case Study	*Case Study: A – priori algorithm with any sample data set.*
Text Book	Text Book1 - Chapter 9, Text book3 - Chapter 3,

MODULE-4	Artificial Neural Networks	**21CEE63.4** **21CEE63.5**	**8 Hours**

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate Problems, Perceptron, Back Propagation algorithm, Introduction to deep learning.

Case Study	*Case Study - Feed Forward Back Propagation and Cascade Forward Back Propagation Algorithms - using Data set(patient and healthy people – all gender with different age)*
Text Book	Reference Book2 - Chapter 1

MODULE-5	Convolutional Neural Networks (CNN)	**21CEE63.6**	**8 Hours**

Convolutional Neural Networks (CNN): Convolutional, Pooling and Soft-Max Layers, Training CNNs, activation functions, initialization, Batch Normalization.

Case Study	*A case study on aggregate mining for concrete production – using CNN or Convolutional Neural Networks for object recognition on mobile devices.*
Text Book	Reference Book2 - Chapter 12

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	5
L3	Apply	5	5	5
L4	Analyze	5	5	-
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books

1. Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning using Python", Wiley, First Edition, 2020, ISBN 978-81-265-7990-7.
2. Tom M. Mitchell, "Machine Learning", McGraw Hill Education, Indian Edition, 2017, ISBN 9780072299144.
3. EthemAlpaydin, "Introduction to Machine Learning", MIT press, Second Edition, 2010, ISBN 9780262043793.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer Series in Statistics, Second Edition, 2017, ISBN 9781280187438.
2. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, "Practical Machine Learning with Python-A Problem-Solver's Guide to Building Real-World Intelligent Systems", A Press, First Edition, 2018, ISBN 978-1-4842-3206-4.
3. Simon Haykin, "Neural Networks and Learning Machines", Pearson, Third Edition, 2016, ISBN 9780133002553
4. Kevin P. Murphy , Francis Bach , "Machine Learning: A Probabilistic Perspective", Massachusets Institute of Technology, First Edition, 2012, ISBN 9780262044660.

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=NWONeJKn6kc**
- **https://www.youtube.com/watch?v=i_LwzRVP7b**
- **https://www.youtube.com/watch?v=GwIo3gDZCVQ**
- **https://www.youtube.com/watch?v=ukzFI9rgwfU**
- **https://www.youtube.com/watch?v=f_uwKZIAeM0**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Case study
- Presentation on latest topics related to machine learning

MACHINE LEARNING LAB

Course Code	**21CEL63**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21CEL63.1	Demonstrate machine Learning concept using various learning algorithm.
21CEL63.2	Implement Concept Decision tree algorithm.
21CEL63.3	Model the Association Rule Mining algorithms with real world problems.
21CEL63.4	Illustrate Artificial Neural Networks and Convolutional Neural Networks to solve machine learning problems

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEL63.1	3	3	3	2	3	-	-	-	-	-	-	1	3	2
21CEL63.2	3	3	3	2	3	-	-	-	-	-	-	1	3	3
21CEL63.3	3	3	3	2	3	-	-	-	-	-	-	1	2	2
21CEL63.4	3	3	3	2	3	-	-	-	-	-	-	1	3	3

Pgm. No.	List of Programs	Hours	COs
	Prerequisite Experiments		
	• Python program to print pattern • ands on python libraries like Numpy, pandas, scikit-learn,Tensorflow, keras	**2**	
	PART – A		
1	Implement and demonstrate the Principal Component Analysis for dimensionality reduction. Read the training data set from a .CSV file.	**2**	**21CEL63.1**
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Document classifier using Naive Bayes.	**2**	**21CEL63.1**
3	Develop a program to demonstrate the working of the decision tree based CHAID algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	**2**	**21CEL63.2**
4	Develop a program to demonstrate the working of the Regression tree based CART algorithm. Use an appropriate data set for building the decisiontree and apply this knowledge to classify a new sample.	**2**	**21CEL63.2**
5	Develop a program to demonstrate the working of the Gradient Descent algorithm. Use an appropriate data set for building the model and apply this knowledge to predict a value for a test case.	**2**	**21CEL63.2**
6	Develop a program to construct Support Vector Machine considering a Sample Dataset.	**2**	**21CEL63.2**
	PART – B		
7	Implement a program in python to illustrate the Bias Variance Trade-off in a machine learning model	**2**	**21CEL63.3**
8	Implement and demonstrate the Association Rule Mining using Apriori Algorithm.	**2**	**21CEL63.3**
9	Implement and demonstrate the Association Rule Mining using FP-Growth Algorithm.	**2**	**21CEL63.3 21CEL63.4**
10	Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.	**2**	**21CEL63.3**
11	Build a Convolutional Neural Networks and test the same using appropriate data sets.	**2**	**21CEL63.4**
12	Implement Q learning algorithm.	**2**	**21CEL63.2**

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- Data clustering and kmean and MST Based.
  https://cse20-iiith.vlabs.ac.in/exp/mst-based/

CIE Assessment Pattern (50 Marks – lab)

RBT Levels		Test (s)	Weekly Assessment
		25	25
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	15	15
L4	Analyze	5	5
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	30
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Web links and Video Lectures (e-Resources):

- https://materialsvirtuallab.org/
- **https://lakshya.vcetputtur.ac.in/#Find_S**

Reference Books:

1. Dipanjan Sarkar,Raghav Bali ,Tushar Sharma, "Practical Machine Learning with Python-A Problem- Solver's Guide to Building Real-World Intelligent Systems", A Press, First Edition, 2018, ISBN 978-1-4842- 3206-4.

CRYPTOGRAPHY AND NETWORK SECURITY

Course Code	**21CEE641**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE641.1	Describe the concepts and explain symmetric encryption techniques
21CEE641.2	Apply various public key cryptographic techniques
21CEE641.3	Analyze the authentication and hash algorithms.
21CEE641.4	Examine the authentication applications using cryptographic techniques
21CEE641.5	Choose the intrusion detection and its solutions to overcome the attacks
21CEE641.6	Construct the basic concepts of system-level-security

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE641.1	3	-	2	-	-	-	-	2	-	-	-	-	3	2
21CEE641.2	2	-	3	-	-	-	-	-	-	-	-	-	3	2
21CEE641.3	-	3	2	-	-	-	-	-	-	-	-	-	3	2
21CEE641.4	-	3	-	-	-	-	-	-	-	-	-	-	3	2
21CEE641.5	3	-	-	-	-	-	-	-	-	-	-	-	3	2
21CEE641.6	-	3	-	-	-	-	-	-	-	-	-	-	3	2

MODULE-1	**Introduction**	**21CEE641.1 21CEE641.2 21CEE641.3**	**8 Hours**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography.

Self-study / Case Study / Applications	Investigate the Challenges of conventional crypto system and explore about the modern cryptosystem.
Text Book	Text Book 1: Chapter 1, Chapter 2

MODULE-2	**Symmetric Key Cryptography**	**21CEE641.1 21CEE641.2 21CEE641.3**	**8 Hours**

Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields-Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

Self-study / Case Study / Applications	Explore the application which uses the modern symmetric key cryptography.
Text Book	Text Book 1: Chapter 4 , Chapter 3 , Chapter 5 , Chapter 6

MODULE-3	**Asymmetric Key Cryptography**	**21CEE641.3**	**8 Hours**

Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

Self-study / Case Study / Applications	Explore the application which uses the modern asymmetric key cryptography.
Text Book	Text Book 1: Chapter 8, Chapter 9 , Chapter 10.

MODULE-4	Authentication And Integrity	21CEE641.4 21CEE641.5	8 Hours
Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Authentication applications - Kerberos, X.509, Public Key Infrastructure			
Self-study / Case Study / Applications	Demonstrate the integrity through any one of the Hash algorithms		
Text Book	Text Book 1: Chapter 11, Chapter 12, Chapter 13, Chaptter14,		
MODULE-5	**Ip And System Security**	**21CEE641.6**	**8 Hours**
Electronic Mail security – PGP, S/MIME – IP security – SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.			
Self-study / Case Study / Applications	Survey on recent malicious software and viruses		
Text Book	Text Book 1: Chapter 15, Chapter 16, Chapter 18, Chapter 19, Chapter 20		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	**10**
L2	Understand	**10**
L3	Apply	**20**
L4	Analyze	**10**
L5	Evaluate	**--**
L6	Create	**--**

Suggested Learning Resources:

Text Books:

1)William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006. ISBN: 13: 978-0130914293

Reference Books:

1) C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd, 2011, ISBN-13 978-8126522859

2) BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007. ISBN 0-13-046019-2.

3) Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/106/105/106105162/
- https://www.coursera.org/browse/computer-science/computer-security-and-networks

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues
- Seminars

CLOUD COMPUTING

Course Code	**21CEE642**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEE642.1	Describe the basic concepts of cloud computing and its architecture
21CEE642.2	Analyze the importance of Virtualization using hypervisors
21CEE642.3	Understand the various cloud service models and deployment models suitable for Business Model.
21CEE642.4	Design appropriate services to build an application
21CEE642.5	Investigate the cloud services and necessary security issues in cloud environments
21CEE642.6	Analyze various cloud computing models and apply them to solve problems on the cloud.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE642.1	3	2	2	-	-	-	-	-	-	-	-	3	3	3
21CEE642.2	3	3	2	-	-	-	-	-	-	-	-	3	3	2
21CEE642.3	3	2	2	-	-	-	-	-	-	-	-	3	3	2
21CEE642.4	3	3	3	-	-	-	-	-	-	-	-	3	3	2
21CEE642.5	3	3	3	-	-	-	-	-	-	-	-	3	3	3
21CEE642.6	3	3	3	-	-	-	-	-	-	-	-	3	3	3

MODULE-1	**Introduction**	**21CEE642.1**	**8 Hours**

History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Characteristic of Cloud Computing, Cloud Concepts & Technologies - Virtualization, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring, Map Reduce, Identity & Access Management, Service Level Agreements, Billing. Cloud Computing Architecture: Cloud Architecture, Anatomy of the Cloud, Managing the Cloud, Migrating Application to Cloud.

Self-study / Case Study / Applications	Survey on Cloud Migrations and its importance
Text Book	Text Book 1: 1.1 – 1.8, Text Book 2: 1.1 – 1.3, 2.1 – 2.4

MODULE-2	**Virtualization and Hypervisors**	**21CEE642.2**	**8 Hours**

Virtualization opportunities, Processor Virtualization, Memory Virtualization, Storage Virtualization, Network Virtualization, Data Virtualization, and Application Virtualization. Approaches of Virtualization: Hardware-Assisted Virtualization. Hypervisors: Types of Hypervisors, High Availability (HA), Disaster Recovery (DR), Security Issues and Recommendations.

Text Book	Text Book 2: 3.1, 3.2,3.3,3.4,3.5,3.6

MODULE-3	**Cloud Service and Deployment Models**	**21CEE642.3, 21CEE642.4**	**8 Hours**

Cloud Service Models-Infrastructure as a Service, Characteristics of IaaS, Suitability of IaaS, Pros and Cons of IaaS. Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS. Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Other Cloud Service Models. Cloud Deployment Models: Private Cloud, Public Cloud, Hybrid Cloud, Community Cloud - Characteristics, Suitability, Issues, Advantages.

Text Book	Text Book 2: 4.1,4.2,4.3,4.4,4.5

MODULE-4	**Cloud Services and Security**	**21CEE642.5**	**8 Hours**

Compute Services, Storage Services, Database Services, Application Services, Content DeliveryServices, Analytics Services, Deployment & Management Services, Identity & Access Management Services, Open-source private cloud software. Cloud Security**:** Introduction, Cloud Security Architecture, Authentication, Authorization.

Text Book	Text Book 3: 3.1 – 3.9, 12.1, 12.2, 12.3, 12.4

MODULE-5	Cloud Computing for Applications	21CEE642.6	8 Hours

Cloud Computing for Healthcare, Cloud Computing for Energy Systems, CloudComputing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud Computing for Education. Cloud Sim: Create Data center, Data broker, Virtual Machines, Cloudlet

Self-study / Case Study / Applications	Cloud Applications in Human wellbeing
Text Book	Text Book 3: 13.1, 13.2, 13.3, 13.4, 13.5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, First Edition, Willey2014, ISBN-10: 9788126541256
2. Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, "Mastering Cloud. Computing", McGraw Hill Education, First Edition, 2017, ISBN-10: 9781259029950
3. Arshdeep Bahga, Vijay Madisetti, Cloud Computing a Hands on Approach, The Orient Blackswan, Universities Press 2014, ISBN-10 : 0996025502

Reference Books:

1. Dan C Marinescu, "Cloud Computing Theory and Practice", Elsevier(MK) 2013, ISBN-13: 978-0124046276
2. John W Rittinghouse, James F Ransome, "Cloud Computing implementation, Management and Security", CRC Press Inc; 1st edition, 2009, ISBN-13: 978-1439806807.

Web links and Video Lectures (e-Resources):

- **https://nptel.ac.in/courses/106105183**
- **https://www.youtube.com/watch?v=-6Uoku-M6oY**
- **https://www.youtube.com/watch?v=PYFqhGDejM4**
- http://www.cloudbus.org/cloudsim/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Cloud Computing scenario can be practiced using cloudsim
- Demonstration of Cloud based application with data center
- Video demonstration of latest trends in Cloud Computing

NATURAL LANGUAGE PROCESSING

Course Code	**21CEE643**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEE643.1	Describe the concepts of Basic NLP and its techniques.
21CEE643.2	Apply the concepts of n-gram modelling for the given scenario.
21CEE643.3	Analyze various Context free grammar in representing structure.
21CEE643.4	Design natural language computing by applying techniques of AI
21CEE643.5	Illustrate the concept of supervised/unsupervised machine learning for NLP.
21CEE643.6	Develop programming skill in PROLOG for needed applications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE643.1	2	3	3	2	2	-	-	-	-	-	-	-	3	2
21CEE643.2	1	2	2	1	2	-	-	-	-	-	-	-	3	3
21CEE643.3	1	1	-	1	1	-	-	-	-	-	-	-	3	2
21CEE643.4	1	1	1	1	1	-	-	-	-	-	-	-	3	2
21CEE643.5	2	1	2	3	1	-	-	-	-	-	-	-	3	2
21CEE643.6	1	2	3	3	2	-	-	-	-	-	-	-	3	3

MODULE-1	**Origins and challenges of NLP**	**21CEE643.1**	**8 Hours**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance algorithm.

Text Book	Text Book 1: Chapter 1
Case Study/ Self Study / Applications	https://ocw.mit.edu/courses/res-ec-001-exploring-fairness-in-machine-learning-for-international-development-spring-2020/pages/module-four-case-studies/case-study-on-nlp/

MODULE-2	**Unsmoothed N-grams**	**21CEE643.2**	**8 Hours**

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Applications	*Report on various n-gram models and some applications where it is used*
Text Book	Text Book 1: Chapter 3
Case Study/ Self Study / Applications	https://link.springer.com/chapter/10.1007/978-3-030-36826-5_14

MODULE-3	**Context-Free Grammars**	**21CEE643.3**	**8 Hours**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing– Probabilistic CFG,Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

Applications	Applications of various types of parsing and feature structures.
Text Book	Text Book 1: Chapter 17

MODULE-4	**Requirements For Representation**	**21CEE643.4**	**8 Hours**

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selection restrictions – WordSense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

Text Book	Text Book 1: Chapter 19

MODULE-5	**Discourse Segmentation**	**21CEE643.5**	**8 Hours**

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Book	Text Book 1: Chapter 26, 27

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014. 978-9332518414.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O Reilly Media, 2009. 9780596516499

Reference Books:

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015. 9781783284672
2. Richard M Reese, —Natural Language Processing with Java", O Reilly Media, 2015.. 9781784391799.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010. 9781498798105.
4. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval", Oxford University Press, 2008. 978-0195692327

Web links and Video Lectures (e-Resources):

- **https://onlinecourses.nptel.ac.in/noc19_cs56/preview**
- **https://www.youtube.com/watch?v=CMrHM8a3hqw**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Case study
- Organizing Group wise discussions on issues
- Seminars

BIG DATA ANALYTICS

Course Code	**21CEE644**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEE644.1	Describe the fundamentals of Big Data analytics.
21CEE644.2	Understand the knowledge Hadoop in Distributed File system.
21CEE644.3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
21CEE644.4	Examine the Map Reduce programming model to process the big data along with Hadoop tools.
21CEE644.5	Apply machine Learning algorithms for real world big data., web contents and Social Networks to provide analytics with relevant visualization tools.
21CEE644.6	Evaluate relationship between variances and document it.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE644.1	2	-	-	-	-	-	-	-	-	-	-	1	3	2
21CEE644.2	2	-	1	-	-	-	-	-	-	-	-	1	3	2
21CEE644.3	2	-	1	-	-	-	-	-	-	-	-	1	3	2
21CEE644.4	2	1	2	-	-	-	-	-	-	-	-	1	3	3
21CEE644.5	2	2	2	-	-	-	-	-	-	-	-	1	3	3
21CEE644.6	2	2	2	-	-	-	-	-	-	-	-	1	3	3

MODULE-1	**Introduction to Big Data Analytics**	**21CEE644.1**	**8 Hours**

Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications

Text Book	Text book 1: Chapter 1: 1.2 -1.7

MODULE-2	**Introduction to Hadoop**	**21CEE644.2, 21CEE644.4**	**8 Hours**

Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. HDFS Design Features, Components, HDFS User Commands. Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.

Text Book	Text book 1: Chapter 2 :2.1-2.6 Text Book 2: Chapter 3 Text Book 2: Chapter 7

MODULE-3	**NoSQL Big Data Management**	**21CEE644.3**	**8 Hours**

MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases

Self-study / Case Study / Applications	Analyze how online entertainment company's 148 million subscribers give it a massive BI advantage.
Text Book	Text book 1: Chapter 3: 3.1-3.7

MODULE-4	**Hive and Pig: Introduction**	**21CEE644.3, 21CEE644.4**	**8 Hours**

MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations andAlgorithms, Hive, HiveQL, Pig

Text Book	Text book 1: Chapter 4: 4.1-4.6

MODULE-5	Machine Learning Algorithms	21CEE644.5, 21CEE644.6	8 Hours

Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining. Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics

Self-study / Case Study / Applications	Logistics startup with an objective to become the "Uber of the Trucking Sector" with the help of data analytics, Summarize about this.
Text Book	Text book 1: Chapter 6: 6.1 to 6.5 Text book 1: Chapter 9: 9.1 to 9.5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education, 2016. ISBN-13: 978-9332570351

Reference Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672.
2. Boris Lubinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1stEdition, Wrox Press, 2014ISBN-13: 978-8126551071.
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261.
4. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc20_cs92/preview
- https://onlinecourses.swayam2.ac.in/arp19_ap60/preview

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Case study
- Organizing Group wise discussions on issues
- Seminars

BIO INSPIRED DESIGN AND INNOVATION

Course Code	**21CEE645**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21CEE645.1	Verify the biomimetics principles in relation to the needs at that moment
21CEE645.2	Evaluate the bio-material properties for health care applications
21CEE645.3	Investigate novel bioengineering initiatives by evaluating design and development principles
21CEE645.4	Formulate bio-based solutions for socially vital issues with critical thought
21CEE645.5	Comprehend the bio computing optimization through research and experiential learning
21CEE645.6	Review the fundamental biological ideas through pertinent industrial applications and case studies

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE645.1	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21CEE645.2	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21CEE645.3	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21CEE645.4	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21CEE645.5	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21CEE645.6	3	3	3	3	2	-	-	-	1	1	-	2	3	3

MODULE-1	**Bio-Inspired Design And Engineering**	**21CEE645.1**	**8 Hours**

Bio-Inspired Engineering and design, History, Evolution, Basics of Biomimetics and other Disciplines, Rawling's Classifications, Need for Bio-Inspired Designs. Bio inspired Additive manufacturing techniques, (self-healing, self-assembly).

Self-study / Case Study / Applications	Investigate the Challenges of Bio inspired design, Compare with traditional areas of science and engineering.
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16

MODULE-2	**Bio Materials And Bio Healthcare Design**	**21CEE645.2**	**8 Hours**

Biomaterials, Design of Forms- (Hexagonal unit cells, Intrinsic disorder, anisotropy), Design of materials- (Hierarchy, fracture tough materials, structural colours, Actuating Materials, Bio-Compatible Materials). Bio-Mechanics, Applications of Biomaterials and Bio systems in Health care design (Human Prosthetics, Parasitic Wasp-Inspired Needle, Octopus-Inspired Sucker for Tissue Grafting, Peacock-Inspired Biosensors, Gecko-Inspired Surgical Glue) Robotics, Marine and Aeronautical.

Self-study / Case Study / Applications	Investigate Bio-Compatible alloys and polymers for human implants and health care applications.
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15

MODULE-3	**Bio Sustainable Development**	**21CEE645.3, 21CEE645.4**	**8 Hours**

Innovations in Energy (Termite mound inspired shopping malls), Innovations in Resource-Air (purification, filtration), Dew water collection systems, water purification, desalination, Management of spaces, designs for megastructures.

Self-study / Case Study / Applications	Explore the Bio inspired environmental constructions and development.
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10

MODULE-4	Bio Computing And Optimisation	21CEE645.5	8 Hours
No Free Lunch Theorem, Bat Algorithm, Flower Pollination Algorithm, Genetic Algorithm- Crossover and Mutation Operations. Bio-Inspired Optimisation, Ant Colony Optimisation (ACO), Swam Intelligence-Particle Swam Optimisation (PSO).			
Self-study / Case Study / Applications	Scrutinize the Different types of Optimization techniques, genetic research.		
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
MODULE-5	**Applications Of Bio-Inspired Innovations**	21CEE645.6	**8 Hours**
Bioinspired innovations in- Automotive, Automation, Materials and Manufacturing, Sensors, Controllers, Communications, Healthcare, Agriculture, food production, and Sports, Environment infrastructure. Carbon Neutral Solutions (Coral Reefs, Eco-cements), Carbon Free Solutions (Lotus leaf inspired paints), eco-restorations (Eco-friendly pesticide).			
Self-study / Case Study / Applications	Survey on Bio inspired Innovations, design, applications and case studies of the same.		
Text Book	Text Book 2: 12.1 to 12.10		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	10	5
L4	Analyze	5	5
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Helena Hashemi Farzaneh, Udo Lindemann, "A Practical Guide to Bio-inspired Design", Springer Vieweg, 1st edition 2019, ISBN-10 : 366257683X, ISBN-13 : 978-3662576830
2) Torben A. Lenau, Akhlesh Lakhtakia," Biologically Inspired Design: A Primer (Synthesis Lectures on Engineering, Science, and Technology)", Publisher: Morgan & Claypool Publishers, 2021, ISBN-10: 1636390471, ISBN-13: 978-1636390475

Reference Books:

1. French M, "Invention and evolution: Design in nature and engineering", Publisher: Cambridge University Press, 2020, ISBN-10 : 0521314925.
2. Pan L., Pang S., Song T. and Gong F. eds, "Bio-Inspired Computing: Theories and Applications", 15th International Conference, BIC-TA 2020, Qingdao, China, October 23-25, 2020, Revised Selected Papers (Vol. 1363). Springer Nature, 2021.
3. Wann D, "Bio Logic: Designing with nature to protect the environment", Wiley Publisher, 1994, ISBN: 155566122X.

Web links and Video Lectures (e-Resources):

- **https://onlinecourses.nptel.ac.in/noc22_ge24/preview**
- **https://biodesign.berkeley.edu/bioinspired-design-course/**
- https://www.youtube.com/watch?v=cwxXY9Qe8ss
- **https://www.youtube.com/watch?v=V2GvQXvjhLA**
- **https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report_2232327_October%202022_Final.508.pdf**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes & Assignments
- Visit to any manufacturing/aero/auto industry or any power plant
- Demonstration of lathe/milling/drilling/CNC operations
- Demonstration of working of IC engine/refrigerator
- Demonstration of metal joining process
- Video demonstration of latest trends in mobility/robotics
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

SOCIAL CONNECT & RESPONSIBILITY

Course Code	**21CEK65**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course outcomes:

At the end of the course, the student will be able to:

21CEK65.1	Realize social responsibility through societal activities
21CEK65.2	Review the history and culture of city through community interaction
21CEK65.3	Develop responsible connection for societal benefits
21CEK65.4	Cultivate the best practices for diverse scenarios
21CEK65.5	Build planning and organizational skills
21CEK65.6	Develop deep drive into societal challenges being addressed by NGO(s), social enterprises & the Government

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEK65.1	_	-	-	-	-	3	2	2	3	2	-	1	-	-
21CEK65.2	_	-	-	-	-	3	2	2	3	2	-	1	-	-
21CEK65.3	_	-	-	-	-	3	2	2	3	2	-	1	-	-
21CEK65.4	_	_	-	-	-	3	2	2	3	2	-	1	-	-
21CEK65.5	_	_	-	-	-	3	2	2	3	2	-	1	-	-
21CEK65.6	_	-	-	-	-	3	2	2	3	2	-	1	-	-

MODULE-1	**PLANTATION AND ADOPTION OF A TREE**	**21CEK65.1, 21CEK65.2**	**3 Hours**

Plantation of a tree that will be adopted for four years by a group of B.E students. They will also execute a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

MODULE-2	**HERITAGE WALK AND CRAFTS CORNER**	**21CEK65.1, 21CEK65.2, 21CEK65.3**	**3 Hours**

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.

MODULE-3	**ORGANIC FARMING AND WASTE MANAGEMENT**	**21CEK65.4, 21CEK65.5**	**3 Hours**

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus

Self-study / Case Study / Applications	Write down the procedure to implement the wet waste management and mention about its advantages and disadvantages.

MODULE-4	**WATER CONSERVATION**	**21CEK65.4, 21CEK65.5, 21CEK65.6**	**3 Hours**

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.

Self-study / Case Study / Applications	Visit any one villages, observe best practices present there and submit a report about it.

MODULE-5	**FOOD WALK**	**21CEK65.3, 21CEK65.4**	**3 Hours**

City's culinary practices, food lore, and indigenous materials of the region used in cooking.

Self-study / Case Study / Applications	**Visit nearby village, observe best culinary practices followed their and submit a report about it.**

CIE Assessment Pattern (50 Marks – Activity based) –

- **Each module is evaluatedfor50 Marks and average of all the five modules will be the final marks.**

CIE component for each module	Marks
Planning and scheduling the social connect	15
Information/Data collected during the social connect	15
Analysis of the information/data and report writing	20
Total (each module)	**50**

SEE Assessment Pattern (50 Marks – Activity based)

SEE	Marks
Presentation	20
Jamming session / Open Mic	15
Group discussion / debate	15
Total	**50**

Activity-Based Learning / Practical Based learning

- Platform to connect to others and share the stories with others:
  - Jamming session
  - Open mic
  - Poetry
- Share the experience of Social Connect.
- Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

Pedagogy:

- The students will be divided into groups. Each group will be handled by faculty mentor.
- Faculty mentor will design the activities (particularly Jamming sessions, open mic and poetry)
- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.
- Studentsshouldpresenttheprogressoftheactivitiesaspertheschedulintheprescribedpracticalsessioninthefield.
- There should be positive progress in the vertical order for the benefit of society in general through activities.

Plan of Action:

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty mentor for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.
- Practice Session Description:
  - Lecture session in field to start activities
  - Students Presentation on Ideas
  - Commencement of activity and its progress
  - Execution of Activity
  - Case study-based Assessment, Individual performance
  - Sector/ Teamwise study and its consolidation
  - Videobasedseminarfor10minutes by each student at the end of semester with Report.

Module Name	Group Size	Location	Magnitude	Activity	Reporting

Plantation and adoption of a tree	03–05	Farmers Land or Roadside or Community area or institution's campus, anyone location to be selected.	Students must monitor till end of B Tech degree	Site selection Select suitable species in consultation with horticulture, forest or agriculture department. Interact with NGO/Industry and community to plant Tag the plant for continuous monitoring	Report shall behand written with paintings, sketches, poster, video and/or photograph with Geotag.
Heritage walk and crafts corner	03-05	Preferably Within the city where institution is located or home town of the student group	One or two: One can be a structure or a heritage building the other can be heritage custom or practice	Survey in the form of questioner by connecting to the people and asking. No standard questioner to be given by faculty and has to be evolved involving students. Questions during survey can be asked in local language but report language is English.	
Waste management	03-05 More than one group Can be assigned one task based on magnitude of task.	Preferably in the near by villages and within the campus.	One	Report on importance and benefits of Waste management. Report on segregation, collection, transportation and disposal. Suggestion for composting. Visit near by village/location to sensitize farmers and public about waste management and also document	
Water Conservation	03–05	Rain water harvesting demonstration available in the campus or surroundings	One	Visit lakes/pond/river/drywell to involve on rejuvenation activity. Or Assessment of Water budget in the campus / village Report on traditional water conservation practices(to minimize wastage)	
Food Walk	03-05	Within the city where institution is located Food culture of student's resident region	One	Survey local food centers and identify the specialty Identify and study the food ingredients Report on the regional foods Report on Medicinals values of the local food grains, and plants.	

MINI PROJECT

Course Code	**21CEE67**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

21CEE67.1	Analyze the real world problem through the survey of existing problems
21CEE67.2	Design the modules for solving the problems identified.
21CEE67.3	Implement the design modules with suitable programming language
21CEE67.4	Test the working modules at different levels.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CEE67.1	3	2	3	2	3	-	1	1	3	-	-	2	3	2
21CEE67.2	3	2	3	2	1	-	1	1	3	-	-	3	3	2
21CEE67.3	3	2	3	2	2	-	1	1	3	-	-	3	3	2
21CEE67.4	3	2	3	2	3	-	2	1	3	-	-	3	3	2

The student shall be capable of identifying a problem related to the field of Computer Engineering and carry out a mini project on the problem defined. Each student is expected to do the mini project individually. The code developed towards the project will be reviewed by a panel of experts during the course of the semester. Plagiarized projects will automatically get an "F" GRADE and the student will be liable for further disciplinary action. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Synopsis Presentation-Review-0	Review-1	Final Review	Report Submission with plagiarism certificate
		5	**15**	**20**	**10**
L1	Remember	-	-	-	
L2	Understand	-	-	-	10
L3	Apply	5	5	5	-
L4	Analyze	-	5	5	-
L5	Evaluate	-	5	-	-
L6	Create	-	-	10	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	10
L4	Analyze	10
L5	Evaluate	15
L6	Create	15

NATIONAL SERVICE SCHEME (NSS)

Course Code	**21NSS84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**2**

Course outcomes:
At the end of the course, the student will be able to:

21NSS84.1	Understand the importance of his / her responsibilities towards society
21NSS84.2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
21NSS84.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
21NSS84.4	Implement government or self-driven projects effectively in the field.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21NSS84.1	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.2	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.3	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.4	-	-	-	-	-	3	1	1	3	2	**2**	1

Semester	CONTENT	HOURS
5th to 8th	**PART A** ONENSS-CAMP @College/University/State or Central Govt Level/ NGO's/General Social Camps **PART B** 1. Organic farming, Indian Agriculture (Past, Present and Future)Connectivity for marketing 2. Waste management-Public, Private and Govtorganization,5R's. 3. Setting of the information imparting club for women leading tocontribution in social and economic issues. 4. Water conservation techniques-Role of different stakeholders-Implementation. 5. Preparing an actionable business proposal for enhancing the villageincome and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolmentin Higher/technical/vocational education. 7. Developing Sustainable Water management system for rural areas and implementation approaches.	Total 32 Hrs/ Semester 2 Hrs/week
	8. Contribution to any national level initiative of Government of India. For. eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.(minimum5programs). 10. Organize National integration and social harmony events/workshops / Seminars. (Minimum02programs). 11. Govt. school Rejuvenation and helping them to achieve good infrastructure.	

CIE Assessment Pattern (50 Marks – Practical) –

1. **PART A:** Compulsorily students have to attend one camp.
2. **PART B:** Students have to take up anyone activity on the above said topics and have to prepare contentfor awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same.
3. CIE will be evaluated based on their presentation, approach and implementation strategies.

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)

Course Code	**21PES84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**02**

Course outcomes:

At the end of the course, the student will be able to:

21PES84.1	Demonstrate the starting and finishing positions of different track and jump events.
21PES84.2	Demonstrate the holding and releasing stances in various throwing events, and takeoff and landing position in various jumping events of Athletics.
21PES84.3	Demonstrate the specific skills and techniques of the selected game/event.
21PES84.4	Demonstrate and describe the rules and regulations of specific games.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21PES84.1	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.2	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.3	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.4	-	-	-	-	-	-	-	1	2	-	-	1

Semester	CONTENT	HOURS
5th	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 1. Track -Sprints: a. Starting Techniques: Standing start and Crouch start(its variations)use ofStarting Block. b. Acceleration with proper running techniques. c. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Kabaddi OR Kho-Kho** **Kabaddi:** A. Fundamental skills 1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials. **Kho-Kho:** A Fundamental skills 1. Skills in Chasing: Sit on the box (Parallel &Bullet toe method),Getup from the box(Proximal & Distal foot method),Give Kho(Simple,Early, Late& Judgment),Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul. 2. Skills in running: Chain Play, Ring play and Chain & Ring mixed play. 3. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials.	Total 32 Hrs/ Semester 2 Hrs/week

6th	**Athletics**: 1. Track -110 Mtrs and 400Mtrs: a. Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Overthe Hurdles b. Crouch start (its variations)use of Starting Block. c. Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Volleyball OR Throw Ball** **Volleyball:** A. Fundamental skills 1. Service: Under arm service, Side arm service, Tennis service, Floating service. 2. Pass: Under arm pass, Over-head pass. 3. Spiking and Blocking. 4. Game practice with application of Rules and Regulations B. Rules and their interpretation and duties of officials. **Throw Ball:** A. Fundamental skills: Over hand service, Side arm service, two hand catching, one hand over head return, side arm return. B. Rules and their interpretations and duties of officials **Football OR Hockey** **Football:** A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition. 5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations. C. Rules and their interpretation and duties of officials. **Hockey:** A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 4. Penalty stroke practice. 5. Penalty corner practice. 6. Tackling: Simple Tackling, Slide Tackling. 7. Goal Keeping, Ball clearance- kicking, and deflecting. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	

7th	**Athletics**: 1. Track -Relay Race: a. Starting, Baton Holding/Carrying, Baton Exchange in between zone, andFinishing b. Crouch start (its variations) use of Starting Block. c. Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- Triple Jump: Approach Run, Take-off, Flight in the Hop, Step, Jump andLanding 3. Throws- Javelin Throw: Grip, Carry, and Recovery (3/5 Impulse stride). Release **Cricket OR Baseball** **Cricket:** A. Fundamental skills 1. Batting- Forward Defense Stroke, Backward Defense Stroke, OffDrive, On Drive, Straight Drive, Cover Drive, Square Cut. 2. Bowling-Out-swing, In-swing Off Break, Leg Break and Googly. 3. Fielding: Catching - The High Catch, The Skim Catch, The Close Catch and throwing at the stumps from different angles. Long Barrier and Throw, Short Throw, Long Throw, Throwing on the Turn. 4. Wicket Keeping B. Rules and their interpretation and duties of officials. **Baseball:** A. Fundamental skills: 1. Player Stances - walking, extending walking, L stance, cat stance Grip - standard grip,choke grip 2. Batting - swing and bunt. 3. Pitching 4. Baseball: slider, fast pitch, curve ball, drop ball, rise ball, change up, knuckle ball, screw ball B. Rules and their interpretations and duties of officials **Basketball OR Net Ball** **Basketball:** A. Fundamental Skills 1. Passing: Two hand Chest Pass, Two hands Bounce Pass, One hand Baseball Pass, Side arm Pass, Overhead Pass, Hook Pass. 2. Receiving: Two hand receiving, One hand receiving, Receiving in stationary position, Receiving while Jumping and Receiving while Running. 3. Dribbling: How to start dribble, drop dribble, High Dribble, Low Dribble, Reverse Dribble, Rolling Dribble. 4. Shooting: Lay-up shot and its variations, One hand set shot, Two hands jump shot, Hook shot, Free Throw. 5. Rebounding: Defensive rebound and Offensive rebound. 6. Individual Defence: Guarding the player with the ball and without the ball, Pivoting. 7. Game practice with application of Rules and Regulations. **Netball:** A. Fundamental Skills 1. Catching: one handed, two handed, with feet grounded and in flight. 2. Throwing (Different passes and their uses): One hand passes (shoulder, high shoulder, underarm, bounce, lob), two hand passes (Push, overhead and bounce). 3. Footwork: Landing on one foot, landing on two feet, Pivot, Running pass. 4. Shooting: One hand, forward step shot, and backward step shot. 5. Techniques of free dodge and sprint, sudden sprint, sprint and stop, sprinting with change at speed. 6. Defending: Marking the player, marking the ball, blocking, inside the circle, outside the circle. Defending the circle edge against the passing. 7. Intercepting: Pass and shot. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	

8th	**Athletics**: A. Track -Combined Events: a. Heptathlon all the 7 events b. Decathlon: All 10 Events B. Jumps- Pole Vault: Approach Run, Planting the Pole, Take-off, Bar Clearance andLanding. C. Throws- Hammer Throw: Holding the Hammer, Initial Stance Primary Swing,Turn, Release and Recovery (Rotation in the circle). **Shuttle Badminton OR Table TennisShuttle** **Badminton:** A. Fundamental skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot,Net shot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. **Table Tennis:** A.Fundamental skills: 1. Basic Knowledge: Various parts of the Racket and Grip(Shake Hand &PenHold Grip). 2. Stance: Alternate & Parallel. 3. Push and Service: Backhand &Forehand. 4. Chop: Backhand & Forehand. 5. Receive: Push and Chop with both Backhand & Forehand. 6. Game practice with application of Rules and Regulations. B.Rules and their interpretations and duties of officials **Handball OR Ball Badminton** **Handball:** A.Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from twowings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B.Rules and their interpretations and duties of officials **Ball badminton:** A.Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot,Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Sports and Athleticsactivities learnt in the semester.

CIE	Marks
5th Semester	10
6th Semester	10
7th Semester	15
8th Semester	15
Total	**50**

SEE Assessment Pattern (50 Marks – Practi)cal

SEE	Marks
Athletics	20
Kabaddi OR Kho-Kho	05
Volleyball / Throw ball	05
Football/Hockey	05
Netball/Basketball	05
Shuttle Badminton / Table Tennis	05
Handball/ Badminton	05
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay,K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, etal. Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma,P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, NewDelhi.
5. Jain,R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket ,Khel Sahitya Kendra, NewDelhi.
7. Saha,A.K.Sarir SiksherRitiniti,RanaPublishingHouse,Kalyani.
8. Bandopadhyay,K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, NewDelhi.
10. Dubey,H.C. Basketball, Discovery Publishing House, NewDelhi.
11. RachanaJain, Teach Yourself Basketball, Sports Publication.
12. JackNagle,Power Pattern Offences for Winning basketball,ParkerPublishingCo.,NewYork.
13. RenuJain, Play and Learn Basketball, Khel Sahitya Kendra,NewDelhi.
14. SallyKus, Coaching Volleyball Successfully, HumanKinetics.
15. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
16. Bandopadhyay, K.Sarir Siksha Parichay, Classic Publishers, Kolkata

YOGA			
Course Code	**21YOG84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**02**

Course outcomes:
At the end of the course, the student will be able to:

21YOG84.1	Use Yogasana practices in an effective manner
21YOG84.2	Become familiar with an authentic foundation of Yogic practices
21YOG84.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas
21YOG84.4	Use the teachings of Patanjali in daily life.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21YOG84.1	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.2	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.3	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.4	-	-	-	-	-	3	-	-	2	-	-	1

Semester	CONTENT	HOURS
5th	**Introduction of Yoga:** Aim and Objectives of yoga, Prayer: Yoga,its origin ,history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer **Brief introduction of yogic practices for common man:** Yogic practices for common man to promote positive health **Rules and regulations:** Rules to be followed during yogic practices by practitioner **Misconceptions of yoga:** Yoga its misconceptions, Difference between yogic and non-yogic practices. **Suryanamaskara:** 1. Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar. 2. Suryanamaskar 12 count,2rounds **Kapalabhati:** Meaning, importance and benefits of Kapalabhati - 40strokes/min3rounds **Different types of Asanas**: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana **Patanjali's Ashtanga Yoga**: Yama, Niyama **Pranayama:** Suryanuloma -Viloma, Chandranuloma-Viloma	Total 32 Hrs/ Semester 2 Hrs/week
6th	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Kapalabhati:** Revision of Kapalabhati -60strokes/min3rounds **Different types of Asanas**: 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana **Patanjali's Ashtanga Yoga**: Asana, Pranayama **Pranayama:** Chandra Bhedana, Nadishodhana, Surya Bhedana	
7th	**Suryanamaskara:** Suryanamaskar 12 count,8rounds **Kapalabhati:** Revision of Kapalabhati - 80strokes/min3rounds	

	Different types of Asanas: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	
8th	**Suryanamaskara:** Suryanamaskar 12 count,12rounds **Kapalabhati:** Revision of Kapalabhati - 100strokes/min3rounds **Different types of Asanas**: 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Mayurasana 4. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 5. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Yogasana learnt in the semester.

CIE	Marks
5th Semester	10
6th Semester	10
7th Semester	15
8th Semester	15
Total	**50**

SEE Assessment Pattern (50 Marks – Practical)

SEE	Marks
Suryanamaskara	10
Kapalabhati	10
Asanas	10
Patanjali's Ashtanga Yoga	10
Pranayama / Shat Kriyas	10
Total	**50**

Suggested Learning Resources:

Reference Books:

12. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
13. Tiwari, O P: Asana Why and How
14. Ajitkumar: Yoga Pravesha (Kannada)
15. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
16. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
17. Nagendra H R: The art and science of Pranayama
18. Tiruka: Shatkriyegalu (Kannada)
19. Iyengar B K S: Yoga Pradipika (Kannada)
20. Iyengar B K S: Light on Yoga (English)

APPENDIX A

LIST OF ASSESSMENT PATTERNS

1. Assignment

2. Group Discussions

3. Case Studies

4. Practical Orientation on Design Thinking, Creativity & Innovation

5. Participatory & Industry-Integrated Learning

6. Practical activities/Problem Solving exercises

7. Class Presentations

8. Analysis of Industry/Technical/Business Reports

9. Reports on Industrial Visits

10. Industrial/Social/Rural Projects

11. Participation in external Seminars/Workshop

12. Online/Offline Quiz

APPENDIX B

OUTCOME BASED EDUCATION

Outcome-based education (OBE) is an educational theory that bases each part of and educational system aroundgoals (outcomes). By the end of the educational experience each student should have achieved the goal. There isno specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separatelylisted in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum.Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes:

APPENDIX C

THE GRADUATE ATTRIBUTES OF NBA

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineeringspecialization to the solution of complex engineering problems.

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

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.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved inmany ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that oftenrequire use of modern computational concepts and tools.

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.

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.

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.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and normsof the engineering practice.

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

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

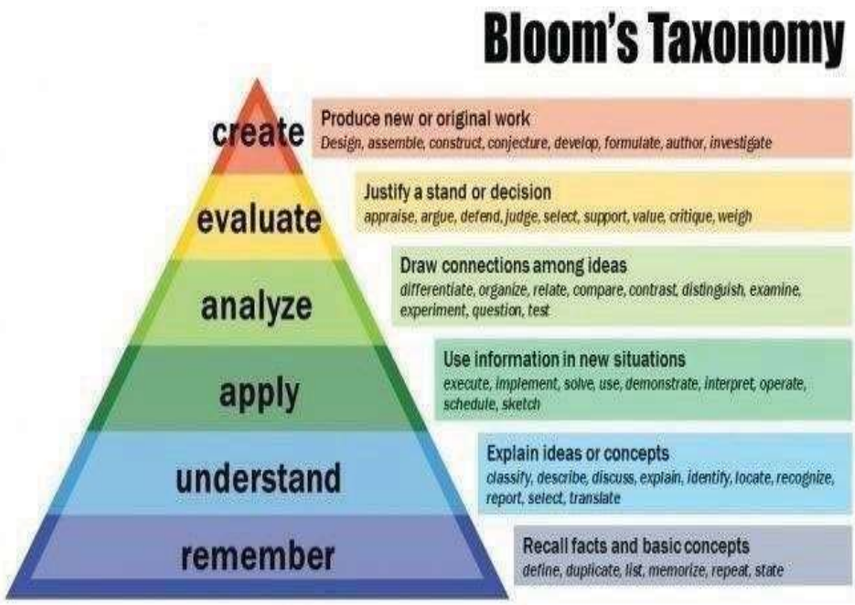
Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi- disciplinary environments.

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

APPENDIX D

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.



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