BVVS

Basaveshwar Engineering College, Bagalkote

Department of Electronics and Communication Engineering

Vision, Mission Statements and Values

Vision

To achieve excellence in electronics and communication engineering through quality education and research for developing competent professionals.

Mission

1. Foster a dynamic teaching and learning process.
2. Encourage research through innovation and collaboration.
3. Imbibe moral, ethical values and social responsibilities.

Values

The values of the department are

1. Work is Worship
2. Ethics and Integrity
3. Empathy and Compassion
4. Indian Ethos
5. Mutual Respect

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SWOC Analysis

S:Strength:

1. Infrastructure
   - (i.) ICT enabled classrooms/seminar hall with good ambience.
   - (ii.) Well equipped laboratories to cater curriculum requirements.
   - (iii.) Department library with good number of titles and volumes.
   - (iv.) Scope for academic extension programmes.
2. Faculty
   - (i.) 75% of faculty with Ph.D.
   - (ii.) Faculty with minimum of 12 years teaching experience.
   - (iii.) Faculty retention ratio is 100 %.
3. Students
   - (i.) Students with academic and competitive bent of mind.
   - (ii.) 75% of the students are placed in reputed industries.
   - (iii.) 10% to 15% of the students are registering for B.E. Honours Degree.
4. Curriculum
   - (i.) Research and industry oriented adaptive curriculum.
   - (ii.) Curriculum with integrated courses.
5. Alumni
   - (i.) Alumni works in reputed organizations across the world.
   - (ii.) Alumni interactions with students and faculty to bridge the gap between campus and corporate.

W:Weakness:

1. IPR competencies are inadequate.
2. Relatively less number of memberships in professional bodies.
3. Limited collaborative activities.
4. Less number of inter-disciplinary courses and projects.
5. Less number of industry supported laboratories/courses.
6. Inadequate number of funded projects.
7. Less scope for co-curricular and cultural activities.

O:Opportunities:

1. Establishment of Distant Learning Center (DLC) using existing resources.
2. Participation in collaborative projects/ research work with allied institutions.
3. Fostering alumni participation in academics and placement activities.
4. Establishment of Skilling Centers for students.
5. Faculty exchange programs with academia and industry.
6. Organizing conferences.
7. Facilitating incubation centers for alumni.
8. Scope for academic extension programmes
9. Training on computer usage/ programming languages for general public.
10. Enhancing consultancy activities.

C:Challenges:

1. To incorporate experiential teaching learning process.
2. Adapting curriculum to future industry needs.
3. Fostering collaboration to enhance research, innovation and entrepreneurship activities.
4. Attracting diversified students.
5. Strategies to strengthen the placement activities for higher packages and core companies.
6. Secure additional research grants and consultancy opportunities.
7. Enhance quality publications and file patents.

Programme Outcomes

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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

c) **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.

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

e) **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.

f) **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.

g) **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.

h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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

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

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

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

Programme Specific Outcomes (PSOs)

1. Analyze and design systems for electronics, communication, and signal processing applications.
2. Use domain specific tools for design, analysis, synthesis, and validation of VLSI and embeddedsystems
3. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulationof computer networking and applications

Programme Educational Objectives (PEOs)

PEO1: Our graduates will be able to lead a successful career by solving complex Engineering Problems of society/industry

PEO2: Enable graduates to excel in academia, industry, entrepreneurship and engage in research and lifelong learning

PEO3: Graduates will be able to work effectively as individuals in multidisciplinary environments with high integrity, ethics, human values and societal responsibilities

PEO4: Graduates will be able to exhibit strong leadership, communication, and teamwork skills to succeed in dynamic professional environments and contribute to the global challenges

Basaveshwar Engineering College,Bagalkote

B.E. in Electronics and Communication Engineering

Scheme and Syllabus 2023-24 Batch

Proposed Curriculum Framework for BEC (Based on revised Guidelines from VTU
(For the Students admitted from 2022-2023 and 2023-2024)

S.N.	Category	VTU	AICTE	BEC
1.	**HSMC:** HSS (2 English, 1 Kannada, 1 UHV, 1 Constitution, 1 EV), 3 HRM (Offered by Dept) = 9 AEC (1 Scientific foundations of Health, 1 Innovation and design Thinking, 2 SS, 3 MOOCS, 3 Dept. specific) = 10	**16**	**15**	**19**
2.	**BSC:** Basic Science Courses (Physics, Chemistry and Mathematics)	**22**	**23**	**22**
3.	**ESC/ETC:** Engineering Science Courses (Basic Elect/Electronics/Computer/Mechanics/Workshop/Drawing etc.)	**24**	**17**	**18**
4.	**PCC:** Professional Core Courses	**59**	**61**	**56**
5.	**PEC:** Professional Elective Courses relevant to the branch with at least one course either fully or partially supported by industry	**12**	**12**	**12**
6.	**OEC**: Open Electives Courses/ Subjects from other technical/Arts/Commerce (3 MOOCS + 6)	**09**	**12**	**09**
7.	Mini (2) and Major projects (12)/Industrial Internships (10)	**20**	**20**	**24**
8.	Mandatory Course: PE, Yoga, NSS, Bridge course Maths 1 and 2 (lateral Entry)	**00**	**00**	**00**
Total		**160**		**160**

Break-up of Credits for B.E (Common to all Branches)
For the Students admitted from 2022-2023 and 2023-2024, as per NEP

Sem.	BSC	ESC/ETC	HSSM	AEC	PCC	PEC	OEC	Proj.	Int.	Total
1.	08	09	02	1						**20**
2.	08	09	02	1						**20**
3.	03			3 (Dep.)	14					**20**
4.	03		01		16					**20**
5.			01	2 (SS)	09	03	03	02		**20**
6.					14	03	03			**20**
7.			03		03	06		12		**24**
8.				3 (MOOCS)			3 (MOOCS)		10	**16**
Tot.	**22**	**18**	**09**	**10**	**56**	**12**	**09**	**14**	**10**	**160**

Basaveshwar Engineering College, Bagalkote
B.E. in Electronics and Communication Engineering
Scheme of Teaching and Examinations
AY: 2023-24

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22UMA312C	AV Mathematics-III for EC Engineering	MATHEMATICS	3	0	0	0	03	50	50	100	3
2	IPCC	22UEC311C	Digital System Design using Verilog	ECE DEPT.	3	0	2	0	03	50	50	100	4
3	IPCC	22UEC312C	Electronic Principles and Circuits	ECE DEPT.	3	0	2	0	03	50	50	100	4
4	PCC	22UEC313C	Network Analysis	ECE DEPT.	3	0	0	0	03	50	50	100	3
5	PCCL	22UEC314L	Analog and Digital Systems Design Lab	ECE DEPT.	0	0	2	0	03	50	50	100	1
6	ESC	22UEC315X	ESC/ETC/PLC	ECE DEPT.	3	0	0	0	03	50	50	100	3
7	UHV	22UHS317L	Social Connect and Responsibility	HSS DEPT.	0	0	2	0	01	100	---	100	1
8	AEC/ SEC	22UEC316X	Ability Enhancement Course/Skill EnhancementCourse– III	ECE DEPT.	If the course is a Theory				01	50	50	100	1
					1	0	0	0					
					If a course is a laboratory				02				
					0	0	2	0					
9	MC	22UHS001M	Yoga	YOGA TEACHER	0	0	2	0		25	---	25	0
		22UHS002M	National Service Scheme (NSS)	NSS COORDINATOR									
		22UHS003M	Physical Education (PE) (Sports and Athletics)	PHYSICAL EDUCATION DIRECTOR									
		22UHS004M	Music	MUSIC TEACHER									
				Total	**15/16**	**0**	**12**		**22**	**475**	**350**	**825**	**20**

Sl. No.	Ability Enhancement Course (AEC)	Subject Code	Engineering Science Course (ESC)	Subject Code	Skill Enhancement Course (SEC)	Subject Code
1.	C++ Basics	22UEC316A	Electronic Devices	22UEC315A	MATLAB Programming	22UEC316C
2.	IOT for Smart Infrastructure	22UEC316B	Computer Organization and Architecture	22UEC315B	LABVIEW programming	22UEC316D
3.			Sensors and Instrumentation	22UEC315C		
4.			Applied Numerical Methods for EC Engineers	22UEC315D		

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course(Non-credit),**AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course,**L:**Lecture,**T**:Tutorial,**P**:Practical**S=SDA**:SkillDevelopmentActivity,**CIE**:ContinuousInternalEvaluation,**SXX**:

Basaveshwar Engineering College, Bagalkote
B.E. in Electronics and Communication Engineering
Scheme of Teaching and Examinations
AY: 2023-24

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22UEC410C	Electromagnetic Theory	ECE DEPT.	3	0	0	0	03	50	50	100	3
2	IPCC	22UEC411C	Principles of Communication Systems	ECE DEPT.	3	0	2	0	03	50	50	100	4
3	IPCC	22UEC412C	Control Systems	ECE DEPT.	3	0	2	0	03	50	50	100	4
4	PCCL	22UEC413C	Communication Lab	ECE DEPT.	0	0	2	0	03	50	50	100	1
5	ESC	22UEC4XXC	ESC/ETC/PLC	ECE DEPT.	3	0	0	0	03	50	50	100	3
6	AEC/ SEC	22UEC4XXC	Ability Enhancement Course/Skill Enhancement Course- IV	ECE DEPT.	If the course is Theory				01	50	50	100	1
					1	0	0	0					
					If the course is a lab				02				
					0	0	2	0					
7	BSC	22UBT407C	Biology For Engineers	ECE DEPT.	3	0	0	0	03	50	50	100	3
8	UHV	22UHS424C	Universal human values course	ECE DEPT.	1	0	0	0	01	50	50	100	1
9	MC	22UHS001M	Yoga	YOGA TEACHER	0	0	2	0		25	---	25	0
		22UHS002M	National Service Scheme (NSS)	NSS COORDINATOR									
		22UHS003M	Physical Education (PE) (Sports and Athletics)	PHYSICAL EDUCATION DIRECTOR									
		22UHS004M	Music	MUSIC TEACHER									
				Total	**16/17**	**0**	**10**		**24**	**500**	**400**	**900**	**20**

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Sl. No.	Ability Enhancement Course AEC	Subject Code	Engineering Science Course ESC	Subject Code	Skill Enhancement Course (SEC)	Subject Code
1.	Octave Programming	22UEC415A	Data Structures using C	22UEC414A	Data Structures Lab using C	22UEC415C
2.	Programmable Logic Controllers	22UEC415B	Microcontrollers	22UEC414B	Microcontroller Lab	22UEC415D
3.			Industrial Electronics	22UEC414C		
4.			Operating Systems	22UEC414D		
5.			Signals and Systems	22UEC414E		

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	PCC	22UEC520C	Digital Signal Processing	ECE DEPT.	3	0	0	0	03	50	50	100	3
2.	PCC	22UEC521C	Computer Networks	ECE DEPT	3	0	0	0	03	50	50	100	3
3.	PCC	22UEC522C	Python Programming	ECE DEPT	2	0	0	0	03	50	50	100	1
4.	PEC	22UECXXXE	Professional Elective Course	ECE DEPT.	3	0	0	0	03	50	50	100	3
5.	OEC	22UECXXXN	Open Elective Course	ECE DEPT.	3	0	0	0	03	50	50	100	3
6.	AEC	22UHS522C	Qualitative Aptitude and Soft Skills	PT DEPT.	2	0	0	0	03	50	50	100	2
7.	HSSM	22UBTXXXC	Environmental Studies	BT DEPT.	1	0	0	0	03	50	50	100	1
8.	PCCL	22UEC523L	Computer Networks Laboratory	ECE DEPT.	0	0	2	0	03	50	50	100	1
9.	PCCL	22UEC524L	Digital Signal Processing Laboratory	ECE DEPT	0	0	2	0	03	50	50	100	1
10.	Proj	22UEC525P	Mini Project	ECE DEPT	0	0	4	0	03	50	50	100	2
11.	MC	22UHS001M	Yoga	YOGATEACHER	0	0	2			25	---	25	0
		22UHS002M	National Service Scheme(NSS)	NSSCOORDINATOR									
		22UHS003M	Physical Education (PE) (Sports and Athletics)	PHYSICAL EDUCATION DIRECTOR									
Total					**17**	**00**	**10**	**00**	**30**	**525**	**500**	**1025**	**20**

Professional Elective Course			Open Elective Course	
1.	Java Programming	22UEC526E	1. Sensor Technology	
2.	Mobile Communication	22UEC527E	2. Wireless Networks and Mobile Architecture	
3.	MEMS	22UEC528E	3.	
4.	Speech Processing	22UEC529E	4.	

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VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	PCC	22UEC620C	Digital Communication	ECE DEPT	3	0	0	0	03	50	50	100	3
2.	PCC	22UEC621C	CMOS Digital VLSI Design	ECE DEPT	3	0	0	0	03	50	50	100	3
3.	PCC	22UEC622C	Microwave and Antenna Theory	ECE DEPT	3	0	0	0	03	50	50	100	3
4.	PCC	22UEC623C	ARM Microcontroller	ECE DEPT.	2	0	0	0	03	50	50	100	2
5.	PEC	22UECXXXE	Professional Elective Course	ECE DEPT	3	0	0	0	03	50	50	100	3
6.	OEC	22UECXXXN	Open Elective Course	ECE DEPT.	3	0	0	0	03	50	50	100	3
7.	AEC	22UEC624C	Indian Knowledge System	ECE DEPT	1	0	0	0	01	50	50	100	1
8.	PCCL	22UEC625L	CMOS Digital VLSI Laboratory	ECE DEPT	0	0	2	0	03	50	50	100	1
9.	PCCL	22UEC626L	ARM Microcontroller Laboratory	ECE DEPT	0	0	2	0	03	50	50	100	1
10.	MC	22UHS001M	Yoga	YOGATEACHER	0	0	2			25	---	25	0
		22UHS002M	National Service Scheme(NSS)	NSSCOORDINATOR									
		22UHS003M	Physical Education(PE) (Sports and Athletics)	PHYSICALEDUCATION DIRECTOR									
Total					**18**	**0**	**6**	**0**	**25**	**475**	**450**	**925**	**20**

Sl. No.	Professional Elective Course (PEC)	Subject Code	Open Elective Course (OE)	Subject Code
1.	Multimedia Communication	22UEC627E	Nanotechnology	22UEC631N
2.	Robotics and Automation	22UEC628E	Aircraft Electronics and Systems	22UEC632N
3.	Advanced Python Programming	22UEC629E	Fuzzy Logic	22UEC633N
5.	Embedded System Design using Embedded C	22UEEC630E		

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VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSSM	22UEC710C	**Research Methodology and IPR**	ECE DEPT	2	0	0	0	03	50	50	100	2
2	PCC	22UEC711C	Information Theory and Coding	ECE DEPT	3	0	0	0	03	50	50	100	3
3	PCCL	22UEC712L	Advanced Communication Laboratory	ECE DEPT	0	0	2	0	03	50	50	100	1
4	PEC	22UECXXX	**Professional Elective Course - I**	ECE DEPT	3	0	0	0	03	50	50	100	3
5	PEC	22UECXXX	**Professional Elective Course – II**	ECE DEPT	3	0	0	0	03	50	50	100	3
6	PROJ	22UEC713P	**Major Project**	ECE DEPT	0	0	24	0	03	100	100	200	12
					11	0	26	0	18	**350**	**350**	**700**	**24**

Sl. No.	Professional Elective Course (PEC) - I	Subject Code	Professional Elective Course (PEC) - II	Subject Code
1.	Automotive Electronics	22UEC714E	Fiber Optics and Networks	22UEC718E
2.	Cyber Security	22UEC715E	Wireless and Mobile Architecture	22UEC719E
3.	Satellite Communication	22UEC716E	Operating Systems	22UEC720E
4.	Sensors and Actuators	22UEC717E	Deep Learning	22UEC721E

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VIII SEMESTER (Swappable VII and VIII SEMESTER)													
Sl. No	**Course and Course Code**		**Course Title**	**Teaching Department(TD) and Question Paper Setting Board (PSB)**	**Teaching Hours/Week**				**Examination**				**Credits**
					Theory Lecture	**Tutorial**	**Practical/ Drawing**	**SDA**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**	**S**					
1	AEC		**Ability Enhancement Course (Online Courses) MOOCS**		3	0	0	0	03	50	50	100	3
2	OEC		**Open Elective (Online Courses) MOOCS**		3	0	0	0	03	50	50	100	3
3	INT		**Internship (Industry/Research) (14-20weeks)**		0	0	20	0	03	100	100	200	10
			Total		6	0	20	0	09	**200**	**200**	**400**	**16**
Professional Elective Course													
	BOS Recommended Course					BOS Recommended Course							
	BOS Recommended Course					BOS Recommended Course							
Open Elective Courses													
	BOS Recommended Course					BOS Recommended Course							
	BOS Recommended Course					BOS Recommended Course							

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III Semester Syllabus

AV Mathematics-III for EC Engineering		Semester	3
Course Code	**22UMA312C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

1. Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis and to enable the student to express non-periodic functions to periodic functions using the Fourier series and Fourier transforms.
2. Analyze signals in terms of Fourier transforms
3. Develop the knowledge of solving differential equations and their applications in Electronics & Communication engineering.
4. To find the association between attributes and the correlation between two variables

Teaching-Learning Process Pedagogy
(General Instructions):

These are sample Strategies; teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methodsmay be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   i. As an introduction to new topics (pre-lecture activity).
   ii. As a revision of topics (post-lecture activity).
   iii. As additional examples (post-lecture activity).
   iv. As an additional material of challenging topics (pre-and post-lecture activity).
   v. As a model solution of some exercises (post-lecture activity).

Module-1: Fourier series and practical harmonic analysis

Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Half-range Fourier series. Triangle and half range expansions, Practical harmonic analysis, variation of periodic current. **(8 hours)**

Module-2: Infinite Fourier Transforms

Infinite Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms, discrete Fourier transform (DFT), Fast Fourier transform (FFT).
(8 hours)

Module-3: Z Transforms

Definition, Z-transforms of basic sequences and standard functions. Properties: Linearity, scaling, first and second shifting, multiplication by n. Initial and final value theorem. Inverse Z- transforms. Application to difference equations. **(8 hours)**

Module-4:

Ordinary Differential Equations of Higher Order

Higher-order linear ODEs with constant coefficients - Inverse differential operator, problems. Linear differential equations with variable Coefficients-Cauchy's and Legendre's differential equations–Problems. Application of linear differential equations to L-C circuit and L-C-R circuit. **(8 hours)**

Module-5:

Curve fitting, Correlation, and Regressions

Principles of least squares, Curve fitting by the method of least squares in the form $y = a + bx$, $y = a + bx + cx^2$, and $y = ax^b$. Correlation, Coefficient of correlation, Lines of regression, Angle between regressions lines, standard error of estimate, rank correlation. **(8 hours)**

Course outcome (Course Skill Set)

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

1. Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory.
2. To use Fourier transforms to analyze problems involving continuous-time signals
3. To apply Z-Transform techniques to solve difference equations
4. Understand that physical systems can be described by differential equations and solve such equations
5. Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data

Internal Assessment Test question paper is designed to attain the different levels ofBloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module(with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)Text Books:

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44thEd., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10thEd., 2018.

Reference Books:

1. **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. **Srimanta Pal & Subodh C.Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N.P Bali and Manish Goyal**: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw–HillBook Co., New York, 6th Ed., 2017.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I andII", McGraw Hill Education(India) Pvt. Ltd 2015.
6. **H.K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed.,2014.
7. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.

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

- Quizzes
- Assignments
- Seminar

Digital System Design using Verilog		Semester	3
Course Code	**22UEC311C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/Practical		

Course objectives:

This course will enable students to:

1. To impart the concepts of simplifying Boolean expression using K-map techniques and Quine- McCluskey minimization techniques.
2. To impart the concepts of designing and analyzing combinational logic circuits.
3. To impart design methods and analysis of sequential logic circuits.
4. To impart the concepts of Verilog HDL-data flow and behavioral models for the design of digital systems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world-and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials/Sample Videos prior to the class and have discussions on the topic in the succeeding classes.
10. Give Programming Assignments.

MODULE-1

Principles of Combinational Logic: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps up to 4 variables, Quine-McCluskey Minimization Technique. Quine-McCluskey using Don't Care Terms. (Section 3.1 to 3.5 of Text1).

MODULE-2

Logic Design with MSI Components and Programmable Logic Devices: Binary Adders and Subtractors, Comparators, Decoders, Encoders, Multiplexers, Programmable Logic Devices (PLDs) (Section 5.1 to 5.7 of Text 2)
MODULE-3
Flip-Flops and its Applications: The Master-Slave Flip-flops (Pulse-Triggered flip-flops): SR flip- flops, JK flip flops, Characteristic equations, Registers, Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers, Design of Synchronous mod-n Counter using clocked T, J K, D and SR flip-flops. (Section 6.4, 6.6 to 6.9 (Excluding 6.9.3) of Text 2), State diagrams.
MODULE-4
Introduction to Verilog: Structure of Verilog module, Operators, Data Types, Styles o Description. (Section 1.1 to1.6.2, 1.6.4 (only Verilog), 2 of Text 3) **Verilog Data flow description:** Highlights of Data flow description, Structure of Data flow description. (Section 2.1 to 2.2 (only Verilog) of Text 3)
MODULE-5
Verilog Behavioral description: Structure, Variable Assignment Statement, Sequential Statements, Loop Statements, Verilog Behavioral Description of Multiplexers (2:1, 4:1, 8:1). (Section 3.1 to 3.4 (only Verilog) of Text 3) **Verilog Structural description**: Highlights of Structural description, Organization of structural description, Structural description of ripple carry adder.(Section 4.1 to 4.2 of Text3)

PRACTICAL COMPONENT OF IPCC *(Experiments can be conducted either using any circuit simulation software or discrete components)*

Sl. No.	Experiments
1	To simplify the given Boolean expressions and realize using Verilog program
2	To realize Adder/Subtract or (Full/half) circuits using Verilog data flow description.
3	To realize 4-bit ALU using Verilog program.
4	To realize the following Code converters using Verilog Behavioral description a) Gray to binary and vice versa b) Binary to excess3 and vice versa
5	To realize using Verilog Behavioral description: 8:1 mux, 8:3 encoder, and Priority encoder
6	To realize using Verilog Behavioral description: 1:8 De-mux, 3:8 decoder, 2–bit Comparator
7	To realize using Verilog Behavioral description: Flip-flops: a) JK type b) SR type c) T type and d) D-type
8	To realize Counters-up/down (BCD and binary) using Verilog Behavioral description.
9	Write Verilog code for the given sequential circuit problem statement or state diagram.
Demonstration Experiments (For CIE only–not to be included for SEE) Use FPGA/CPLD kits for down loading Verilog codes and check the output for inter facing experiments.	
10	Verilog Program to interface a Stepper motor to the FPGA/CPL D and rotate the motor in the specified direction (by N steps).

11	Verilog programs to interface Switches and LEDs to the FPGA/CPLD and demonstrate its working.

Course outcomes (Course Skill Set):

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

1) Simplify Boolean functions using K-map and the Quine-McCluskey minimization technique.
2) Analyze and design combinational logic circuits.
3) Analyze the concepts of flip-flops (SR, D, T, and JK) and design synchronous sequential circuits using flip-flops.
4) Model combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Verilog descriptions.

Assessment Details (Both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50%, and the weightage for the Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 out of 50), and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50). A student is declared to have passed the course if he/she secures a minimum of 40% (40 marks out of 100) in the combined total of the CIE and SEE. The **IPCC** refers to the practical portion integrated with the theory of the course. CIE marks for the theory component are 25 marks, and the practical component is also 25 marks.

CIE for the Theory Component of the IPCC:

1. The 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (each test is 15 marks with duration of 1 hour) and 10 marks for other assessment methods mentioned in 22OB4.2. The first test is conducted after 40-50% of the syllabus is covered, and the second test after 85-90% of the syllabus is covered.
2. The scaled-down marks from the sum of the two tests and other assessment methods will be the CIE marks for the theory component of the IPCC (out of 25 marks).
3. The student must secure 40% of the 25 marks to qualify in the CIE for the theory component of the IPCC.

CIE for the Practical Component of the IPCC:

1. 15 marks are allocated for the conduction of experiments and the preparation of the laboratory record, and 10 marks are allocated for a test to be conducted after the completion of all laboratory sessions.
2. Upon completing each experiment/program in the laboratory, students will be evaluated, including a viva-voce, and marks will be awarded on the same day.
3. The CIE marks for the practical component will be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. The total marks for all experiment write-ups will be added and scaled down to 15 marks.
4. A laboratory test (duration of 2-3 hours) will be conducted after the completion of all experiments, with a maximum score of 50 marks, scaled down to 10 marks.
5. The scaled-down marks from the write-up evaluations and the test will be added to form the CIE marks for the laboratory component of the IPCC, out of 25 marks.
6. The student must secure 40% of the 25 marks to qualify in the CIE for the practical component of the IPCC.

SEE for IPCC:

The Theory SEE will be conducted by the university as per the scheduled timetable, with common question papers for the course (duration: 3 hours).

1. The question paper will have ten questions, each worth 20 marks.
2. There will be two questions from each module. Each of the two questions under a module (with a maximum of three sub-questions) will cover a mix of topics from that module.
3. Students must answer five full questions, selecting one full question from each module.
4. The marks scored by the student will be proportionally scaled down to 50 marks.

The theory portion of the IPCC will be assessed through both CIE and SEE, while the practical portion will have a CIE component only. Questions in the SEE paper may include content from the practical component.

1. The minimum marks required in CIE to be eligible for SEE are 10 (40% of the maximum marks—25) in the theory component and 10 (40% of the maximum marks—25) in the practical component. The laboratory component of the IPCC is assessed through CIE only, but SEE may include questions from the practical component. A maximum of 4-5 sub-questions from the practical component of the IPCC can be set, with a total weightage of no more than 20 marks.
2. SEE will be conducted for 100 marks, and students must secure 35% of the maximum marks to qualify for SEE. Marks scored in SEE will be scaled down to 50.
3. A student is declared to have passed the course if he/she secures a minimum of 40% (40 marks out of 100) in the combined total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination).

Suggested Learning Resources:

Books:

1. *Digital Logic Applications and Design* by John M. Yarbrough, Thomson Learning, 2001.
2. *Digital Principles and Design* by Donald D. Givone, McGraw Hill, 2002.
3. *HDL Programming: VHDL and Verilog* by Nazeih M. Botros, 2009 reprint, Dreamtech Press.

Reference Books:

1. *Fundamentals of Logic Design* by Charles H. Roth Jr., Cengage Learning.
2. *Logic Design* by Sudhakar Samuel, Pearson/Sanguine, 2007.
3. *Fundamentals of HDL* by Cyril P. R., Pearson/Sanguine, 2010.

Web links and Video Lectures (e-Resources):

www.chipverify.com

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

Programming assignments and mini-projects can be assigned to improve programming skills.

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	A	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO1: Simplify Boolean functions using K-map and the Quine-McCluskey minimization technique.	2	3	1	2	0	0	0	0	0	0	0	0	0	3	0
CO2: Analyze and design combinational logic circuits.	2	3	1	2	0	0	0	0	0	0	0	0	0	3	0
CO3: Analyze the concepts of flip-flops (SR, D, T, and JK) and design synchronous sequential circuits using flip-flops.	2	3	1	2	0	0	0	0	0	0	0	0	0	3	0
CO4: Model combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Verilog descriptions.	2	2	1	2	3	0	0	0	0	0	0	0	0	3	0

Electronic Principles and Circuits		Semester	3
Course Code	**22UEC312C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	
Examination nature (SEE)	Theory/Practical/Viva-Voce /Term-work/Others		

Course objectives:

This course will enable students to

1. Design and analyze the BJT circuits as an amplifier and voltage regulation.
2. Design of MOSFET Amplifiers and analyze the basic amplifier configurations using small signal equivalentcircuit models
3. Design of operational amplifiers circuits as Comparators, DAC and filters.
4. Understand the concept of positive and negative feedback.
5. Analyze Power amplifier circuits in different modes of operation.
6. Construct Feedback and Oscillator circuits using FET.
7. Understand the thyristor operation and the different types of thyristors.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such asthe ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE -1

Transistor Biasing: Voltage Divider Bias, VDB Analysis, VDB Load line and Q point, Two supply Emitter Bias, Other types of Bias.

BJT AC models: Base Biased Amplifier, Emitter Biased Amplifier, Small Signal Operation, AC Beta, AC Resistance of the emitter diode, two transistor models, Analyzing an amplifier, H parameters, Relations between R and H parameters.

Voltage Amplifiers: Voltage gain, Loading effect of Input Impedance.

CC Amplifiers: CC Amplifier, Output Impedance.

[Text1]

MODULE -2

MOSFET

Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, Drain to Gate feedback resistor. Small signal operation and modelling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, trans conductance, The T equivalent circuit model. MOSFET Amplifier configuration: Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance, The Common Gate Amplifier, Source follower. [Text 2]

MODULE-3

Linear Op-amp Circuits: Summing Amplifier and D/A Converter, Nonlinear Op-amp Circuits: Comparator with zero reference, Comparator with non-zero references. Comparator with Hysteresis.

Oscillator: Theory of Sinusoidal Oscillation, The Wein-Bridge Oscillator, RC Phase Shift Oscillator, The Colpitts Oscillator, Hartley Oscillator, Crystal Oscillator.

The 555 timer: Monostable Operation, Astable Operation. [Text1]

MODULE-4

Negative Feedback: Four Types of Negative Feedback, VCVS Voltage gain, Other VCVS Equations, ICVSAmplifier, VCIS Amplifier, ICIS Amplifier (No Mathematical Derivation).

Active Filters: Ideal Responses, First Order Stages, VCVS Unity Gain Second Order Low Pass Filters, VCVS Equal Component Low Pass Filters, VCVS High Pass Filters, MFB Band Pass Filters, Band stop Filters. [Text1]

MODULE-5

Power Amplifiers: Amplifier terms, two load lines, Class A Operation, Class B operation, Class B push pull emitter follower, Class C Operation.

Thyristors: The four-layer Diode, SCR, SCR Phase control, Bidirectional Thyristors, IGBTs, Other Thyristors.[Text1]

PRACTICAL COMPONENT OF IPCC *(Experiments can be conducted either using any circuit simulationsoftware or discrete components)*

Sl.NO	Experiments
1	Design and Test Bridge Rectifier with Capacitor Input Filter Zener voltage regulator
2	Design and Test Biased Clippers – a)Positive, b) Negative , c) Positive-NegativePositive and Negative Clampers with and without Reference.
3	Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductanceand amplification factor.
4	Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
5	Design and test Emitter Follower
6	Design and plot the frequency response of Common Source JFET/MOSFET amplifier
7	Test the Op-amp Comparator with zero and non-zero reference and obtain the Hysteresis curve.
8	Design and test Full wave Controlled rectifier using RC triggering circuit.
9	Design and test Precision Half wave and full wave rectifiers using Op-amp
10	Design and test RC phase shift oscillator

Course outcomes (Course Skill Set):

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

1. Understand the characteristics of BJTs and FETs for switching and amplifier circuits.
2. Design and analyze amplifiers and oscillators with different circuit configurations and biasing conditions.
3. Understand the feedback topologies and approximations in the design of amplifiers and oscillators.
4. Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers.
5. Understand the power electronic device components and its functions for basic power electronic circuits.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

The IPCC means the practical portion integrated with the theory of the course. CIE marks for the theory componentare **25 marks** and that for the practical component is **25 marks**.

CIE for the theory component of the IPCC

25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva- voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write- ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.

2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will

have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

1. The minimum marks to be secured in CIE to appear for SEE shall be 10 (40% of maximum marks-25) in the theory component and 10 (40% of maximum marks -25) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 sub-questions are to be set from the practical component of IPCC, the total marks of all questions should not be more than 20 marks.
2. SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify for the SEE. Marks secured will be scaled down to 50.
3. The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Suggested Learning Resources:

Books

1. Albert Malvino, David J Bates, Electronic Principles, 7th Edition, Mc Graw Hill Education, 2017, ISBN:978-0-07-063424-4.

Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6thEdition, Oxford,2015.ISBN:978-0-19-808913-1

Web links and Video Lectures (e-Resources):

1. Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, McGraw-Hill, 2015.
2. Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015.

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

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	A	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO1: Determine currents and voltages using source transformation / mesh/nodal analysis and reduce given network using star delta transformation.	3	2	1	2	1	1	0	1	1	1	1	1	3	0	0
CO2: Solve problems by applying Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions	3	3	1	2	1	1	0	1	1	1	1	1	3	0	0
CO3: Analyze the circuit parameters during switching transients	3	3	1	2	1	1	0	1	1	1	1	1	3	0	0
CO4: Apply Laplace transform to solve the given network	3	2	1	2	1	1	0	1	1	1	1	1	3	0	0
CO5: Evaluate the frequency response for resonant circuits and the network parameters for two port networks	3	2	1	2	1	1	0	1	1	1	1	1			
Course Contribution to POs	3.00	2.4	1	2	1	1	0	1	1	1	0	1	3	0	0

Network Analysis		Semester	3
Course Code	**22UEC313C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Module-1

Basic Concepts: Practical sources, Source transformations, Network reduction using Star - Delta transformation, Loop and node analysis with linearly dependent and independentsources for DC and AC networks.

Module-2

Network Theorems: Superposition, Millman's theorems, Thevenin's and Norton's theorems, Maximum Power transfer theorem.

Module-3

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

Module-4

Laplace Transformation &Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis.

Module-5

Two port network parameters: Definition of Z, Y, h and Transmission parameters, modeling with these parameters, relationship between parameters sets.

Resonance:

Series Resonance: Variation of Current and Voltage with Frequency, Selectivity and Bandwidth, Q-Factor, Circuit Magnification Factor, Selectivity with Variable Capacitance, Selectivity with Variable Inductance.

Parallel Resonance: Selectivity and Bandwidth, Maximum Impedance Conditions with C, L and f Variable, current in Anti-Resonant Circuit, The General Case-Resistance Present in both Branches.

Course outcomes

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

1. Determine currents and voltages using source transformation / mesh/ nodal analysis and reduce given network using star delta transformation.
2. Solve problems by applying Network Theorems and electrical laws to reduce circuit and to arrive at feasible solutions.
3. Analyze the circuit parameters during switching transients
4. Apply Laplace transform tosolve the given network
5. Evaluate the frequency response for resonant circuits and the network parameters for two port networks

Suggested Learning Resources:Books

1. M. E. Van Valkenburg (2000), Network Analysis, Prentice Hall of India, 3rdedition, 2000, ISBN:9780136110958.
2. Roy Choudhury-Networks and Systems, 2nd edition, New Age International Publications,2006,

ISBN: 9788122427677

Reference Books:

3. Hayt, Kemmerly and Durbin – "Engineering Circuit Analysis", **TMH** 7th Edition, 2010.
4. J. David Irwin/ R.Mark Nelms – "Basic Engineering Circuit Analysis", John Wiley, 8th Ed, 2006.
5. Charles K Alexander and Mathew, N. O. Sadiku- "Fundamentals of Electric Circuits", Tata
6. McGraw-Hill, 3rd Ed, 2009.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108105159
- https://nptel.ac.in/courses/108102042
- https://psim.software.informer.com/11.1/
- https://www.ni.com/multisim

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

1. Demonstrate the operation of the following circuits using suitable simulation software (Open source such as Psim, Pspice, Proteus, Simulink, eSim)

- Determination of current through each branch of a given network using mesh analysis
- Determination of current through each branch of a given network using nodal analysis
- Simplification of given network using source transformation and finding the current in load
- Verification of Superposition, Millman's, Thevenin's and, Maximum Power transfer theorems using practical based approach

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO1: Determine currents and voltages using source transformation / mesh/nodal analysis and reduce given network using star delta transformation.	3	2	1	2	1	1	0	1	1	1	1	1	3	0	0
CO2: Solve problems by applying Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions	3	3	1	2	1	1	0	1	1	1	1	1	3	0	0
CO3: Analyze the circuit parameters during switching transients	3	3	1	2	1	1	0	1	1	1	1	1	3	0	0
CO4: Apply Laplace transform to solve the given network	3	2	1	2	1	1	0	1	1	1	1	1	3	0	0
CO5: Evaluate the frequency response for resonant circuits and the network parameters for two port networks	3	2	1	2	1	1	0	1	1	1	1	1			
Course Contribution to Pos	3.00	2.4	1	2	1	1	0	1	1	1	0	1	3	0	0

Analog and Digital Systems Design Laboratory		Semester	**3**
Course Code	**22UEC314L**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Credits	01	Exam Hours	100
Examination type (SEE)	Practical/Viva-Voce		

Course objectives:

This laboratory course enables students to

1. Understand the electronic circuit schematic and its working
2. Realize and test amplifier and oscillator circuits for the given specifications
3. Realize the op-amp circuits for the applications such as DAC, implement mathematical functions and precision rectifiers.
4. Study the static characteristics of SCR and test the RC triggering circuit.
5. Design and test the combinational and sequential logic circuits for their functionalities.
6. Use the suitable ICs based on the specifications and functions.

Sl.NO	**Experiments (***All the experiments has to be conducted using discrete components***)**
1	Design and set up the BJT common emitter voltage amplifier with and without feedback and determine thegain- bandwidth product, input and output impedances.
2	Design and set-up BJT/FET i) Colpitts Oscillator, ii) Crystal Oscillator
3	Design and set up the circuits using op-amp: i) Adder, ii) Integrator, iii) Differentiator and iv) Comparator
4	Design 4-bit R – 2R Op-Amp Digital to Analog Converter (i) for a 4-bit binary input using toggle switches (ii) by generating digital inputs using mod-16
5	Design and implement (a) Half Adder & Full Adder using basic gates and NAND gates, (b) Half subtractor & Full subtractor using NAND gates, (c) 4-variable function using IC74151(8:1MUX).
6	Realize (i) Binary to Gray code conversion & vice-versa (IC74139), (ii) BCD to Excess-3 code conversion and vice versa
7	a) Realize using NAND Gates: i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop b) Realize the shift registers using IC7474/7495: (i) SISO (ii) SIPO (iii) PISO (iv) PIPO (v) Ring counter and (vi) Johnson counter.
8	Realize a) Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop b) Mod-N Counter using IC7490 / 7476 c) Synchronous counter using IC74192

	Demonstration Experiments (For CIE)
9	Design and Test the second order Active Filters and plot the frequency response, i) Low pass and High pass Filter ii) Band pass and Band stop Filter
10	Design and test the following using 555 timer i) Monostable Multivibraator ii) Astable Multivibrator
11	Design and Test a Regulated Power supply
12	Design and test an audio amplifier by connecting a microphone input and observe the output using a loudspeaker.

Course outcomes (Course Skill Set):

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

1. Design and analyze the BJT/FET amplifier and oscillator circuits.
2. Design and test Op-amp circuits to realize the mathematical computations, DAC and precision rectifiers.
3. Design and test the combinational logic circuits for the given specifications.
4. Test the sequential logic circuits for the given functionality.
5. Demonstrate the basic circuit experiments using 555 timer.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will beevaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in thesyllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural

knowledge will carry a weightage of 60% and the rest 40% for viva-voce.

- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%,Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be madezero. The minimum duration of SEE is 02 hours

Suggested Learning Resources:

1. David A Bell, "Fundamentals of Electronic Devices and Circuits Lab Manual", 5th Edition, 2009, OxfordUniversity Press.
2. Albert Malvino, David J Bates, Electronic Principles, 7th Edition, Mc Graw Hill Education, 2017.
3. Fundamentals of Logic Design, Charles H Roth Jr., Larry L Kinney, Cengage Learning, 7th Edition.

Electronic Devices		Semester	3
Course Code	22UEC315A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives: This course will enable students to:

1. Understand the basics of semiconductor physics and electronic devices.
2. Describe the mathematical models BJTs and FETs along with the constructional details.
3. Understand the construction and working principles of optoelectronic devices
4. Understand the fabrication process of semiconductor devices and CMOS process integration.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

These are sample Strategies, which teacher can use to accelerate the attainment of the various courseoutcomes.

1. Lecture method(L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Encourage collaborative(Group)Learning in the class.
3. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes criticalthinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skillssuch as the ability to evaluate, generalize, and analyze information rather than simply recall it.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come up withtheir own creative ways to solve them.
7. Discuss how every concept can be applied to the real-world and when that's possible, it helps improve the students' understanding.
8. Adopt Flipped class technique by sharing the materials/Sample Videos prior to the class and havediscussions on the topic in the succeeding classes.

Module-1

Semiconductors

Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirectsemiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift andResistance, Effects of temperature and doping on mobility, Hall Effect. **(Text1:3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.3, 3.2.4, 3.4.1, 3.4.2, 3.4.3, 3.4.5).**

Module-2

PN Junctions: Forward and Reverse biased Junctions-Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers. **(Text1:5.3.1, 5.3.3, 5.4, 5.4.1, 5.4.2, 5.4.3)** Optoelectronic Devices Photodiodes:

Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode: Light Emitting materials.
(Text1:8.1.1, 8.1.2, 8.1.3, 8.2, 8.2.1),

Module-3

Bipolar Junction Transistor

Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, the coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown.
(Text1:7.1, 7.2, 7.3, 7.5.1, 7.6, 7.7.1, 7.7.2, 7.7.3)

Module-4

Field Effect Transistors

Basic p-n JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFET-Two terminal MO S-structure- Energy band diagram, Ideal Capacitance
-Voltage Characteristics and Frequency Effects, Basic MOSFET Operation MOSFET structure, Current-VoltageCharacteristics.
(Text2:9.1.1, 9.4, 9.6.1, 9.6.2, 9.7.1, 9.7.2, 9.8.1, 9.8.2).

Module-5

Fabrication of p-n junctions

Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition,photolithography, Etching, metallization. **(Text 1: 5.1)**

Integrated Circuits

Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements. **(Text 1:9.1, 9.2, 9.3.1, 9.3.3).**

Course outcome (Course Skill Set)

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

1. Understand the principles of semiconductor Physics
2. Understand the principles and characteristics of different types of semiconductor devices
3. Understand the fabrication process of semiconductor devices
4. Utilize the mathematical models of semiconductor junctions for circuits and systems.
5. Identify the mathematical models of MOS transistors for circuits and systems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of

the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks

3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based thenonly one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at theend of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
4. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomyas per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers forthe course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximumof 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:Books

1. Ben. G. Streetman, Sanjay Kumar Banerjee, "Solid State Electronic Devices",7th Edition, PearsonEducation, 2016, ISBN978-93-325-5508-2.
2. Donald A Neamen, Dhrubes Biswas, "Semiconductor Physics and Devices", 4th Edition, McGraw **Hill** Education, 2012, ISBN 978-0-07- 107010-2.

Reference Books:

3. S.M. Sze, KwokK.Ng,"PhysicsofSemiconductorDevices",3rd Edition, Wiley,2018.
4. AdirBar-Lev,"SemiconductorandElectronicDevices",3rd Edition, PHI, 1993

Sensors and Instrumentation		Semester	3
Course Code	22UEC315C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

1. Understand various technologies associated in manufacturing of sensors
2. Acquire knowledge about types of sensors used in modern digital systems
3. Get acquainted about material properties required to make sensors
4. Understand types of instrument errors and circuits for multirange Ammeters and Voltmeters.
5. Describe principle of operation of digital measuring instruments and Bridges.
6. Understand the operations of transducers and instrumentation amplifiers.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various courseoutcomes.

1. Lecture method(L) does not mean only traditional lecture method, but different type ofteaching methods may be adopted to develop the outcomes.
2. Encourage collaborative(Group)Learning in the class.
3. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotescritical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recallit.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come upwith their own creative ways to solve them.
7. Discuss how every concept can be applied to the real-world and when that's possible, it helpsimprove the students' understanding.
8. Adopt Flipped class technique by sharing the materials/Sample Videos prior to the class and
9. have discussions on the topic in the succeeding classes.

Module-1

Introduction to sensor based measurement systems:

General concepts and terminology, sensor classification, Primary Sensors, material for sensors,
micro sensor technology. (Text 1)

Module-2

Self-generating Sensors-Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors. (Text 1)

Module-3

Principles of Measurement: Static Characteristics, Error in Measurement, Types of Static Error. (Text2: 1.2-1.6)
Multirange Ammeters, Multirange voltmeter. (Text2:3.2,4.4)
Digital Voltmeter: Ramp Technique, Dual slope integrating Type DVM, Direct Compensation typeand Successive Approximations type DVM (Text 2: 5.1-5.3, 5.5,5.6)

Module-4

Digital Multimeter: Digital Frequency Meter and Digital Measurement of Time, Function Generator. **Bridges:** Measurement of resistance: Wheatstone's Bridge, AC Bridges - Capacitance andInductance Comparison bridge, Wien's bridge.
(Text2:refer 6.2,6.3 up to 6.3.2, 6.4 up to 6.4.2, 8.8, 11.2, 11.8 -11.10, 11.14).

Module-5

Transducers: Introduction, Electrical Transducer, Resistive Transducer, Resistive position Transducer,Resistance Wire Strain Gauges, Resistance Thermometer, Thermistor, LVDT. (Text2:13.1-13.3,13.5, 13.6 up to 13.6.1,13.7,13.8,13.11).
Instrumentation Amplifier using Transducer Bridge, Temperature indicators using Thermometer,Analog Weight Scale(Text2:14.3.3, 14.4.1, 14.4.3).

Course outcome (Course Skill Set)

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

1. Understand the material properties required to make sensors
2. Understand the principle of transducers for measuring physical parameters.
3. Describe the manufacturing process of sensors
4. Analyze the instrument characteristics and errors.
5. Describe the principle of operation and develop circuits for multirange Ammeters, Voltmeters and Bridges to measure passive component values and frequency.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then onlyone assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at

the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

4. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common questionpapers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with amaximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. "Sensors and Signal Conditioning", Ramon Pallas Areny, JohnG. Webster,2nd edition, John Wiley and Sons,2000
2. H.S.Kalsi, "Electronic Instrumentation", Mc Graw Hill,3rd Edition,2012,ISBN:9780070702066.

Reference Books

1. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.
2. D. HelfrickandW.D. Cooper, "Modern Electronic Instrumentation and MeasuringTechniques", Pearson, 1stEdition, 2015, ISBN: 9789332556065.

Web links and Video Lectures (e-Resources):

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

Computer Organization and Architecture		Semester	3
Course Code	22UEC315B	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives: This course will enable students to:

1. Explain the basic sub systems of a computer, their organization, structure and operation.
2. Illustrate the concept of programs as sequences of machine instructions.
3. Demonstrate different ways of communicating with I/O devices
4. Describe memory hierarchy and concept of virtual memory.
5. Illustrate organization of simple pipelined processor and other computing systems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Encourage collaborative (Group) Learning in the class.
3. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world-and when that's possible,it helps improve the students' understanding.
8. Adopt Flipped class technique by sharing the materials/Sample Videos prior to the class and have discussions on the topic in the succeeding classes.

Module-1

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance -Processor Clock, Basic Performance Equation**(upto1.6.2ofChap1ofText).**

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, IEEE standard for Floating Point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing **(up to 2.4.6 of Chap 2 and 6.7.1 of Chap 6 of Text).**

Module-2

Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks andQueues, Subroutines, Additional Instructions **(from 2.4.7 of Chap2, except 2.9.3, 2.11 & 2.12 of Text).**

Module-3

Input/ Output Organization: Accessing I/O Devices, Interrupts -Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access
(up to 4.2.4 and 4.4 except 4.4.1of Chap 4 of Text).

Module-4

Memory System: Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage Magnetic Hard Disks **(5.1, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.5 (except 5.5.1 to** 5.5.4), 5.7 (except5.7.1), 5.9, 5.9.1 of Chap 5 of Text).

Module-5

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control **(up to 7.5 except 7.5.1 to7.5.6 of Chap 7 of Text).**

Course outcome (Course Skill Set)

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

1. Explain the basic organization of a computer system.
2. Describe the addressing modes, instruction formats and program control statement.
3. Explain different ways of accessing an input/ output device including interrupts.
4. Illustrate the organization of different types of semiconductor and other secondary storage memories.
5. Illustrate simple processor organization based on hard wired control and micro-Programmed control.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE(Semester End Examination) taken together.

Continuous Internal Evaluation:

1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks

3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments atthe end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall bescaled down to 25 marks)
4. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (witha maximum of 3 sub-questions), **should have a mix of topics** under that module.

Suggested Learning Resources:

Book

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGrawHill,2002.

Reference Books:

2. David A. Patterson, John L. Hennessy: Computer Organization and Design-The Hardware/ Software Interface ARM Edition, 4th Edition, Elsevier,2009.
3. William Stallings: Computer Organization &Architecture,7th Edition, PHI, 2006.
4. Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

Web links and Video Lectures (e-Resources):

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

Course Outcomes	Pos												PSOs		
	a	b	c	d	E	f	g	h	i	J	k	l	m	n	O
CO1: Explain the basic organization of a computer system.	2	2	2	1	2	-	-	-	-	-	2	1	2	-	2
CO2: Describe the addressing modes, instruction formats and program control statement.	3	2	1	1	1	-	-	-	-	-	2	1	1	1	2
CO3: Explain different ways of accessing an input/output device including interrupts.	2	1	2	1	1	-	-	-	-	-	2	1	2	1	1
CO4: Illustrate the organization of different types of semiconductor and other secondarystorage memories	1	2	3	1	3	1	-	-	-	-	2	1	2	1	-
CO5: Illustrate simple processor organization based on hard wired control and micro-programmed control.	1	2	2	1	2	-	-	-	-	-	2	1	3	-	1
Course Contribution to POs	**1.8**	**1.8**	**2**	**1**	**1.8**	**1**					**2**	**1**	**2**	**1**	**1.5**

Applied Numerical Methods for EC Engineers		Semester	3
Course Code	22UEC315D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	**Theory**		

Course objectives:

1. To provide the knowledge and importance of error analysis in engineering problems
2. To represent and solve an application problem using a system of linear equations
3. Analyze regression **data** to choose the most appropriate model for a situation.
4. Familiarize with the ways of solving complicated mathematical problems numerically
5. Prepare **to solve** mathematical models represented by initial or boundary value problems

Teaching-Learning Process Pedagogy
(General Instructions):

These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
    i. As an introduction to new topics (pre-lecture activity).
    ii. As a revision of topics (post-lecture activity).
    iii. As additional examples (post-lecture activity).
    iv. As an additional material of challenging topics (pre-and post-lecture activity).
    v. As a model solution of some exercises (post-lecture activity).

Module-1: Errors in computations and Root of the equations

Approximations and Round Off -Errors in computation: Error definitions, Round-Off errors, Truncation errors and the Taylor series-The Taylor series, Error Propagation, Total numerical error, Absolute, Relative and percentage errors, Blunders, Formulation errors and data uncertainty. Roots of equations: Simple fixed point iteration methods. Secant Method, Muller's method, and Graeffe's Roots Squaring Method. Aitkin's Method. **(8 hours)**

Module-2: Solution of System of Linear Equations

Rank of the matrix, Echelon form, Linearly dependent and independent equations, Solutions for linear equations, Partition method, Croute's Triangularisation method. Relaxation method. Solution of non-linear simultaneous equations by Newton-Raphson method. Eigen Values and properties, Eigen Vectors, Bounds on Eigen Values, Jacobi's method, Given's method for symmetric matrices. **(8 hours)**

Module-3: Curve Fitting
Least-Squares Regression: Linear Regressions, Polynomial regressions, Multiple Linear regressions, General Linear Least squares, Nonlinear Regressions, QR Factorization. Curve Fitting with Sinusoidal Functions Introduction to Splines, Linear Splines, Quadratic Splines, Cubic Splines. Bilinear Interpolation. **(8 hours)**
Module-4: **Numerical integration, Difference equations and Boundary Value Problems**
Romberg's method, Euler-Maclaurin formula, Gaussian integration for n = 2 and n=3. Numerical double integration by trapezoidal and Simpson's 1/3 rd rule. Solution of linear difference equations. Boundary-Value Problems, Introduction. The Shooting Method, Finite-Difference Methods. **(8 hours)**
Module-5: **Numerical solution of partial differential equations**
Classifications of second-order partial differential equations, Finite difference approximations to partial derivatives. Solution of: Laplace equation, Poisson equations, one-dimensional heat equation and wave equations. **(8 hours)**
Course outcome (Course Skill Set) At the end of the course, the student will be able to: 1. Explain and measure errors in numerical computations 2. Test for consistency and solve a system of linear equations. 3. Construct a function which closely fits given n- n-points of an unknown function. 4. Understand and apply the basic concepts related to solving problems by numerical differentiation and numerical integration. 5. Use appropriate numerical methods to study phenomena modelled as partial differential equations.
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the **CIE** (Continuous Internal Evaluation) and **SEE** (Semester End Examination) taken together. **Continuous Internal Evaluation:** 1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component. 2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks

3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project- based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
4. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

The Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)Text Books:

1. **Steven C. Chapra & Raymond P. Canale: "**Numerical Methods for Engineers and Scientists", McGraw Hill, 8th Edition, 2020.
2. **Steven C. Chapra**: "Applied Numerical Methods with MATLAB for Engineers and Scientists", McGraw Hill, Fifth Edition, 2023.
3. **B. S. Grewal**: "Numerical Methods in Engineering & Science with programs in C, C++and MATLAB", Khanna Publishers, 10hEd., 2015.

Reference Books:

1. **John H. Mathews & Kurtis D. Frank**: "Numerical Methods Using MATLAB", PHI Publications, 4th Edition, 2005.

Won Young Yang, Wenwu Cao, Tae Sang Chung, John Morris: "Applied Numerical Methods Using MATLAB**",** WILEY Inter science**,** Latest Edition, 2005.

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

- Quizzes
- Assignments
- Seminar

Lab VIEW Programming		Semester	3
Course Code	22UEC316D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Credits	01	Total	100
		Exam Hours	2
Examination type (SEE)	Practical		

Course objectives:

1. Aware of various front panel controls and indicators.
2. Connect and manipulate nodes and wires in the block diagram.
3. Locate various tool bars and pull-down menus for the purpose of implementing specific functions.
4. Locate and utilize the context help window.
5. Familiar with LabVIEW and different applications using it.

Sl. NO	VI Programs(using LabVIEW software)to realize the following:
1	Basic arithmetic operations: addition, subtraction, multiplication and division
2	Boolean operations: AND, OR, XOR, NOT and NAND
3	Sum of ‘n’ numbers using ‘for’ loop
4	Factorial of a given number using ‘for’ loop
5	Determine square of a given number
6	Factorial of a given number using ‘while‘ loop
7	Sorting even numbers using ‘while’ loop in an array
8	Finding the array maximum and array minimum
	Demonstration Experiments (For CIE)
9	Build a Virtual Instrument that simulates a heating and cooling system. The system must be able to be controlled manually or automatically.
10	Build a Virtual Instrument that simulates a Basic Calculator (using formula node).
11	Build a Virtual Instrument that simulates a Water Level Detector.
12	DemonstratehowtocreateabasicVIwhichcalculatestheareaandperimeterofacircle.

Course outcomes (Course Skill Set):

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

1. Use LabVIEW to create data acquisition, analysis and display operations
2. Create user interfaces with charts, graph and buttons
3. Use the programming structures and data types that exist in LabVIEW
4. Use various editing and debugging techniques.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will beevaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in thesyllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between

the schedule mentioned in the academic calendar of the University.

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%,Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be madezero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

1. Virtual Instrumentation using LABVIEW, Jovitha Jerome, PHI,2011
Virtual Instrumentation using LABVIEW, Sanjay Gupta, Joseph John, TMH, McGraw-Hill, Second Edition, 2011.

MATLAB Programming		Semester	3
Course Code	22UEC316C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	14	Total Marks	100
Credits	01	Exam Hours	1
Examination type (SEE)	Theory		

Course objectives:

- Understand the MATLAB commands and functions.
- Create and Execute the script and function files
- Work with built in function, saving and loading data and create plots.
- Work with the arrays, matrices, symbolic computations, files and directories.
- Learn MATLAB programming with script, functions and language specific features.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt Problem Based Learning (PBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recallit.
2. Give programming assignments.

Module-1

Introduction: Basics of MATLAB, Simple arithmetic calculations, Creating and working with arrays and numbers.

Module-2

Creating and printing simple plots, Creating, saving and executing a script file, Creating and executing a function file, Working with arrays and matrices.

Module-3

Working with anonymous functions, Symbolic Computations, Importing and exporting data, Working with files and directories.

Module-4

Interactive computations: Matrices and vectors, Matrix and array operations, Character strings, Command line functions, Built-in functions, Saving and loading data, Plotting simple plots.

Module-5

Programming in MATLAB: Script Files, Function Files, Language specific Features.

Course outcome (Course Skill Set)

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

1. Understand the syntax of MATLAB for arithmetic computations, arrays, matrices.
2. Understand the built in function, saving and loading data, and create plots
3. Create program using symbolic computations, Importing and exporting data and files
4. Create program using character strings, Command line functions and Built-in functions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

1. For the Assignment component of the CIE, there are 25 marks and for the Internal AssessmentTest component, there are 25 marks.
2. The first test will be administered after 40-50% of the syllabus has been covered, and the secondtest will be administered after 85-90% of the syllabus has been covered
3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based thenonly one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
4. For the course, CIE marks will be based on a scaled-down sum of two tests and other methods ofassessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomyas per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

1. The question paper will have ten questions. Each question is set for 10 marks.
2. There will be 2 questions from each module. Each of the two questions under a module may or may nothave the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
3. The students have to answer 5 full questions, selecting one full question from each module.
4. **The duration of the examinations shall be defined by the concerned board of studies**

Suggested Learning Resources: Book

1. Rudra Pratap, Getting Started with MATLAB – A quick Introduction for scientists and Engineers, Oxford University Press, 2010.

Web links and Video Lectures (e-Resources):

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

C++ Basics		Semester	4
Course Code	22UEC316A	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	24	Total Marks	100
Credits	1	Exam Hours	02
Examination nature (SEE)	Practical		

Course objectives:

- Understand object-oriented programming concepts, and apply them in solving problems.
- To create, debug and run simple C++ programs.
- Introduce the concepts of functions, friend functions, inheritance, polymorphism and function overloading.
- Introduce the concepts of exception handling and multithreading.

Sl. No	Experiments
1	Write a C++ program to find largest, smallest & second largest of three numbers using inline functions MAX & Min.
2	Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere using function overloading concept.
3	Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN, Name & the average marks of all the students.
4	Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading + and – operators respectively. Display the results by overloading the operator <<. If (m1 == m2) then m3 = m1 + m2 and m4 = m1 – m2 else display error
5	Demonstrate simple inheritance concept by creating a base class FATHER with data members: *First Name, Surname, DOB & bank Balance* and creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name & DOB. Create & initialize F1 & S1 objects with appropriate constructors & display the FATHER & SON details.
6	Write a C++ program to define class name FATHER & SON that holds the income respectively. Calculate & display total income of a family using Friend function.
7	Write a C++ program to accept the student detail such as name & 3 different marks by get_data () method & display the name & average of marks using display () method. Define a friend function for calculating the average marks using the method mark_avg ().
8	Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas two classes rectangle & triangle derived from polygon & they have area to calculate & return the area of rectangle & triangle respectively.

9	Design, develop and execute a program in C++ based on the following requirements: An EMPLOYEE class containing data members & members functions: i) Data members: employee number (an integer), Employee_ Name (a string of characters), Basic_ Salary (in integer), All_ Allowances (an integer), Net_Salary (an integer). (ii) Member functions: To read the data of an employee, to calculate Net_Salary & to print the values of all the data members. (All_Allowances = 123% of Basic, Income Tax (IT) =30% of gross salary (=basic_ Salary_All_Allowances_IT).
10	Write a C++ program with different class related through multiple inheritance & demonstrate the use of different access specified by means of members variables & members functions.
11	Write a C++ program to create three objects for a class named count object with data members
	such as roll no & Name. Create a members function set data () for setting the data values & display ( ) member function to display which object has invoked it using „this" pointer.
12	Write a C++ program to implement exception handling with minimum 5 exceptions classes including two built in exceptions.

Course outcomes (Course Skill Set):

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

1. Write C++ program to solve simple and complex problems
2. Apply and implement major object-oriented concepts like message passing, function overloading, operator overloading and inheritance to solve real-world problems.
3. Use major C++ features such as Templates for data type independent designs and File I/O to dealwith large data set.
4. Analyze, design and develop solutions to real-world problems applying OOP concepts of C++

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed bythe faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-upwill be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} weekof the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be madezero.

The duration of SEE is 03 hours Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Object oriented programming in TURBO C++, Robert Lafore, Galgotia Publications, 2002
2. The Complete Reference C++, Herbert Schildt, 4th Edition, Tata McGraw Hill, 2003.
3. Object Oriented Programming with C++, E Balaguruswamy, 4th Edition, Tata McGraw Hill, 2006.

IoT for Smart Infrastructure		Semester	3
Course Code	22UEC316B	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	14	Total Marks	100
Credits	01	Exam Hours	1
Examination type (SEE)	Theory/Practical		

Course objectives:

To provide an understanding of the concepts, principles, and applications of IoT in the context of smart infrastructure.

To explore the role of IoT technologies in transforming infrastructure into smart, efficient, and sustainable systems and analyze the challenges, opportunities, and considerations in implementingIoT for smart infrastructure.

To examine real-world case studies and successful implementations of IoT in smart cities, buildings, transportation, and energy management and explore future trends and emerging technologies shaping the field of IoT for smart infrastructure.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- **Interactive Lectures:** Conduct interactive lectures to present the theoretical concepts and foundational knowledge of IoT for smart infrastructure.
- **Case Studies and Group Discussions:** Utilize case studies to analyze real-world implementations of IoT in smart infrastructure projects. Divide students into groups and assign them specific cases to discuss and analyze.
- **Hands-on Workshops and Simulations:** Organize hands-on workshops or simulations where students can interact with IoT devices and technologies relevant to smart infrastructure.
- **Guest Lectures and Industry Experts:** Invite guest speakers or industry experts who have hands-on experience in implementing IoT in smart infrastructure projects. They can share their insights, challenges, and success stories, providing students with a real-world perspective
- **Project-Based Learning:** Assign students to work on individual or group projects relatedto IoT for smart infrastructure. Provide a project brief with specific objectives and deliverables. Students can apply their knowledge and skills to design, develop, or analyze IoT solutions for smart infrastructure challenges.

Module-1
Introduction to IoT and Smart Infrastructure Introduction to IoT: Definition of IoT and its basic components, Overview of IoT applications in various industries, Importance of IoT in transforming infrastructure. Smart Infrastructure Overview: Introduction to smart infrastructure and its key components, Benefits and challenges of implementing smart infrastructure, Case studies showcasing successful smart infrastructure projects. IoT Technologies for Smart Infrastructure: Sensors and actuators: Types, functionalities, and applications; Communication protocols: Wi-Fi, Bluetooth, cellular networks, and their use in IoT;
Cloud computing and data analytics in IoT for infrastructure; Edge computing: Real-time decision-making at the edge. Security and Privacy in IoT for Smart Infrastructure: Security challenges and threats in IoT, Privacy considerations and data protection in smart infrastructure, best practices and solutions for ensuring IoT security and privacy.
Module-2
IoT Applications in Smart Cities Introduction to Smart Cities - Definition and key features of smart cities, Role of IoT in transforming cities into smart cities, Benefits and challenges of smart city implementations. IoT Applications in Smart City Infrastructure - Smart transportation: Intelligent traffic management and transportation systems, Smart buildings: Energy management and occupant comfort; Smart grids: Optimizing energy distribution and consumption; Waste management, water management, and environmental monitoring. Case Studies of Smart City Implementations: Showcase of successful smart city projects around the world; Analysis of the IoT technologies and strategies implemented; Lessons learned from these case studies. Future Trends in Smart Cities: Emerging technologies shaping the future of smart cities, Role of IoT, AI, and 5G in advancing smart city infrastructure, Opportunities and challenges for future smart city developments.
Module-3
IoT Applications in Smart Buildings Introduction to Smart Buildings: Definition and key features of smart buildings, Benefits of IoTin improving energy efficiency and occupant comfort, Challenges and considerations in implementing smart building technologies. IoT Technologies for Smart Buildings: Building automation systems and controls; Energy management and monitoring using IoT devices; Indoor environmental quality monitoring and optimization; Smart lighting and HVAC systems. Case Studies of Smart Building Implementations: Showcase of successful smart building projects; Analysis of IoT technologies and solutions deployed; Lessons learned from these case studies. Future Trends in Smart Buildings: Emerging technologies for smart buildings; Integration of IoT with AI and machine learning; Potential impact of 5G on smart building applications.

Module-4

IoT Applications in Smart Transportation

Introduction to Smart Transportation: Definition and key features of smart transportation; Role of IoT in intelligent traffic management and transportation systems; Challenges and opportunities in implementing smart transportation solutions. IoT Technologies for Smart Transportation: Traffic sensors and monitoring systems; Intelligent transportation systems (ITS); Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication; Real-time data analysis and predictive analytics.

Case Studies of Smart Transportation Implementations: Showcase of successful smart transportation projects; Analysis of IoT technologies and solutions deployed; Lessons learned from these case studies.

Future Trends in Smart Transportation: Emerging technologies shaping the future of smart transportation; Role of IoT, AI, and autonomous vehicles; Potential impact of 5G on smart transportation applications.

Module-5

IoT for Smart Grids and Energy Management

Introduction to Smart Grids: Definition and key features of smart grids: Role of IoT in optimizing energy distribution and consumption; Benefits and challenges of smart grid implementations. IoT Technologies for Smart Grids: Smart meters and energy monitoring devices; Demand response and load management; Grid optimization and fault detection using IoT; Renewable energy integration and grid stability. Case Studies of Smart Grid Implementations: Showcase of successful smart grid projects, Analysis of IoT technologies and solutions deployed, Lessons learned from these case studies. Future Trends in Smart Grids and Energy Management: Emerging technologies for smart grids;Integration of IoT, AI, and block chain in energy management; Potential impact of 5G on smartgrid applications.

Course outcome (Course Skill Set)

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

- Define and explain the core concepts and components of IoT and its relevance to smart infrastructure. Identify and evaluate the key technologies and communication protocols used in IoT for smart infrastructure.
- Assess the benefits, challenges, and ethical considerations associated with implementing IoT in smart infrastructure projects and analyze & compare different IoT applications in smart cities, buildings, transportation, and energy management.
- Examine real-world case studies of successful IoT implementations in smart infrastructure and extract lessons learned. Demonstrate an understanding of security and privacy considerations in IoT for smart infrastructure.
- Discuss the impact of emerging technologies, such as artificial intelligence and 5G, on the future of IoT in smart infrastructure. Apply knowledge and critical thinking skills to propose IoT-based solutions for smart infrastructure challenges.
- Work effectively in teams to analyze, design, and present IoT projects related to smart

infrastructure and communicate effectively and articulate the potential benefits and limitations of IoT for smart infrastructure.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

Web links and Video Lectures (e-Resources): makes.mindmatrix.io

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

1. Sensor Deployment and Data Collection: Organize a hands-on activity where participants work in groups to deploy sensors in a simulated smart infrastructure environment.
2. Smart City Simulation Game: Develop a simulation game where participants take on different roles representing stakeholders in a smart city.
3. IoT Solution Design Challenge: Assign participants to design an IoT-based solution for a specific smart infrastructure problem. They can work individually or in teams to identify the problem, propose an IoT solution, outline the required components and technologies, and create a prototype or presentation.
4. Security and Privacy Risk Assessment: Conduct a group activity where participants analyse the security and privacy risks associated with IoT deployments in smart infrastructure.

Field Visit to Smart Infrastructure Project: Organize a field visit to a smart infrastructure project, such as a smart building, smart city district, or IoT-enabled transportation system.

SOCIAL CONNECT & RESPONSIBILITIES			
Course Code	**21SCR36**	**CIE Marks**	**50**
Teaching Hours week (L:T:P:S)	1: 0: 0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	03
Department	Management Studies / Engineering Department		
Offered for	3rd Semester		
Prerequisite	Nil		

Objectives: The Course will

- Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & The government and build solutions to alleviate these complex social problems through immersion, design & technology.
- Provide a formal platform for students to communicate and connect with their surroundings.
- Enable to create of a responsible connection with society.

Learning Outcomes: The students are expected to have the ability to :

1. Understand social responsibility
2. Practice sustainability and creativity
3. Showcase planning and organizational skills

Contents:

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 studentsinr interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed :

Module-I

Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

Module-II

Heritage walk and crafts corner: 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-III

Organic farming and waste management: usefulness of organic farming, wet waste managementin neighboring villages, and implementation in the campus.

Module-IV

Water Conservation: knowing the present practices in the surrounding villages and

implementation in the campus, documentary or photo blog presenting the current practices.

Module-V

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

Activities

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

PEDAGOGY

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

A total of 14-20 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into 10 groups of 35 each. Each group will be handled by two **faculty mentors**. Faculty mentors will design the activities (particularly Jammingsessions open mic ,and poetry)

Faculty mentors has to design the evaluation system.

Course Outcomes	Pos												PSOs		
	a	b	c	d	e	f	g	H	i	J	k	l	m	n	o
CO1: Understand social responsibility	-	-	-	-	-	-	2	1	3	3	-	3	-	-	-
CO2: Understand Indian culture and history	-	-	-	-	-	-	2	-	1	3	-	3	-	-	-
CO3: Understand smart agriculture	-	-	-	1	-	3	3	-	2	3	3	3	-	-	-
CO4: Practice sustainability and creativity	-	-	-	-	-	3	2	2	2	3	2	3	-	-	-
CO5: Showcase planning and organizational skills	-	-	-	-	-	1	1	-	2	3	-	3	-	-	-
Course Contribution to POs	**-**	**-**	**-**	**1**	**-**	**2.3**	**2**	**1.5**	**2**	**3**	**2.5**	**3**	**-**	**-**	**-**

Guideline forAssessment Process:

Continuous Internal Evaluation (CIE)

After completion of, the social connect, the student shall prepare, with daily **diary** as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed.

Marks allotted for the diary are out of 50.

Planning and scheduling the social connect

Information/Data collected during the social connect

Analysis of the information/data and report writing

Considering all above points allotting the marks as mentioned below-

Semester End Examination (SEE)

This Jamming session will be conducted at the end of the course for **50 marks**

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

Faculty mentor has to design the evaluation system for the Jamming session.

Excellent	80 to 100
Good	60 to 79
Satisfactory	40 to 59
Unsatisfactoryand fail	<39

Pedagogy (Guidelines) may differ depending on local resources available for the study

Module	Topic	Content	Group Size	Location	Magnitude	Activity	Reporting	Evaluation
I	Plantation and adoption ofa tree	Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.	03 – 05	Farmers Land or Road side or Community area or institution's campus, any one location to be selected.	One Students must monitor itfor three years	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 be hand writtenn or blog with paintings, sketches, poster, video and/or photograph with Geo tag.	Each module is evaluated for 50 Marks and average of all the five modules will be the final marks. **CIE Rubrics for 50 M** Planning and scheduling the social connect – 15 M Information/Data collected during the social connect – 15 M Analysis of the information/data and report writing – 20 M **SEE 50 M:** Presentation, Jamming session, Open mic, Group
II	Heritage walk and crafts corner	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.	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 theother can be heritage custom or practise	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.		
III	Waste management	Wet waste management in neighbouring villages, and implementation in the campus.	03 - 05 More than one group can be	Preferably in the nearby villages and within the campus.	One	Report on importance and benefits of Waste management. Report on segregation, collection, transportation and disposal.		

			assigne d one task based on magnitude of task.			Suggestion for composting. Visit nearby village/location to sensitize farmers andpublic about waste management and also document current practises.		discussion and debate.
III	Organic farming	Usefulness of organic farming in neighbouring villages, and implementationin the campus.	03 – 05	Visit to farming lands where organic farming is going on Campus Garden Roof top Garden or Vertical Garden or hydroponics if land is scarce.	One	Collect data on organic farming in the vicinity.Like types of crop, methodology etc.,. Suggestion for implementation at selected locations		
IV	Water Conservati on	Knowing the present practices in the surroundingvillages and implementationin the campus, documentaryor photo blog presenting thecurrent practices.	03 – 05	Rain water harvesting demonstration available in the campus or surroundings	One	Visit lakes/pond/river/dry well to involve on rejuvenation activity. Or Assessment of Water budget in the campus/village		

						Report on traditional water conservation practices (to minimize wastage)		
V	Food Walk	City's culinary practices, food lore, and indigenous materials of the region used in cooking.	03 - 05	Within the city where institution is located Food culture of student's resident region	One	Survey local food centres and identify the speciality Identify and study the food ingredients Report on the regional foods Report on Medicinals values of the local food grains, and plants.		

**Important recommendations requested; Special Appreciation from institution and university for students who take care of plants for three years.

IV Sem Syllabus

ELECTROMAGNETIC THEORY		Semester	IV
Course Code	**22UEC410C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	THEORY		

Course objectives:

This course will enable students to:

1. Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
2. Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
3. Understand the physical significance of Biot-Savart's, Ampere's Law and Stokes' theorem for different current distributions.
4. Infer the effects of magnetic forces, materials and inductance.
5. Know the physical interpretation of Maxwell's equations and applications for Plane waves for their behavior in different media.
6. Acquire knowledge of Poynting theorem and its application of power flow

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different types of teaching methods may be adopted to develop the outcomes.
2. Encourage collaborative (Group) Learning in the class.
3. Ask at least three HOTS (Higher Order Thinking) questions in the class, which promotes critical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come up with creative ways to solve them.
7. Discus show every concept can be applied to the real world and when that's possible, it helps improve the student's understanding.
8. Adopt the Flipped class technique by sharing the materials/Sample Videos before the class andhaving discussions on the topic in the succeeding classes.

Module-1

Revision of Vector Calculus – **(Text 1: Chapter 1)** **Coulomb's Law, Electric Field Intensity and Flux density**: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1)**
Module-2
Gauss's Law and Divergence: Gauss 'law, Application of Gauss' law to Point Charge, line charge, Surface charge and Volume Charge, Point (differential) form of Gauss law, Divergence. Maxwell's First Equation (Electrostatics), Vector Operator ▼and divergence theorem, Numerical Problems (**Text: Chapter 3.2 to 3.7).**Energy expended or work done in moving a point charge in an Electric field, The line integral (**(Text: Chapter 4.1 and 4.2)** Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**
Module-3
Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Examples of the solution of Laplace's equation, Numerical problems on Laplace's equation **(Text: Chapters 7.1 and 7.3)** **Steady Magnetic Field**: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem,Magnetic flux and magnetic flux density. (**Text: Chapters 8.1 to 8.5)**
Module-4
Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).** **Magnetic Materials**: Magnetization and permeability, Magnetic boundary conditions, the magnetic circuit, problems **(Text: Chapter 9.6 to 9.8)**
Module-5
Faraday's law of Electromagnetic Induction –Integral form and Point form, Numerical problems. Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.1 to 10.4)** **Uniform Plane Wave**: Wave propagation in free space, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Poynting's Theorem and wave power, Skin effect or Depth of penetration, Numerical problems. **(Text: Chapter 12.1, 12.3, 12.4)**

Course outcome (Course Skill Set)

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

1. Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
2. Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
3. Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
4. Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
5. Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

ssessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project based thenonly one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at theend of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
4. The final CIE marks of the course out of 50 will be the sum of the scale down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papersfor the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximumof 3 sub questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Book:

1. W.H. Hayt and J.A. Buck, ―Engineering Electromagnetics, 8th Edition, Tata McGraw- Hill, 2014, ISBN-978-93-392-0327-6.

Reference Books:

1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford University press, 4thEdn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balman, PHI, 2ndEdn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. N. Narayana Rao, ―Fundamentals of Electromagnetics for Engineering, Pearson

Web links and Video Lectures (e-Resources):

- NPTEL Video lectures: https://youtu.be/pGdr9WLto4A
- NPTEL Video lectures: https://youtu.be/xn2IpxI991M

ActivityBasedLearning(SuggestedActivitiesinClass)/Practical-Based Learning

- Group Discussion/Quiz
- Demonstration of Electromagnetic concepts.
- Case Study on Medical Imaging devices.

-Course Outcomes	**Pos**												**PSOs**		
	a	**B**	**c**	**d**	**E**	**f**	**g**	**h**	**i**	**J**	**k**	**l**	**m**	**n**	**O**
CO1: Develop a thorough understanding of different coordinate systems and Evaluate problems on electrostatic force and fields	2	2	3	2	2	-	-	-	-	-	-	2	2	-	-
CO2: Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.	2	3	2	2	2	1	-	-	-	-	-	2	3	-	-
CO3: Interpret the physical significance of Laplace's equation, Biot-Savart's law, Ampere's law, and Stokes' theorem for evaluating Magnetic field for different current configurations	3	2	3	3	2	1	-	-	-	-	-	2	3	-	-
CO4: Interpret magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.	2	3	2	2	3	1	-	-	-	-	-	2	3	-	-
CO5: Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves.	3	3	3	3	3	1	3	-	-	-	-	2	2	-	-
Course Contribution to POs	**2.4**	**2.6**	**2.6**	**2.4**	**2.4**	**1**	**3**	-	**-**	**-**	**-**	**2**	**2.6**	**-**	**-**

PRINCIPLES OF COMMUNICATION SYSTEMS		Semester	4
Course Code	**22UEC411C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/practical		

Course objectives:

This course will enable students to

- Understand and analyze concepts of Analog Modulation schemes viz; AM, FM
- Design and analyze the electronic circuits for AM and FM modulation and demodulation.
- Understand the concepts of random variable and random process to model communication systems.
- Understand and analyze the concepts of digitization of signals.
- Evolve the concept of SNR in the presence of channel induced noise

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE-1

Random Variables and Processes: Introduction, Probability, Conditional Probability, Random variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions, Gaussian Process: Gaussian Distribution Function. **[Text 2: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.9]**

MODULE-2
Amplitude Modulation Fundamentals: AM Concepts, Modulation index and Percentage of Modulation, Sidebands and the frequency domain, AM Power, Single Sideband Modulation. **AM Circuits:** Amplitude Modulators: Diode Modulator, Transistor Modulator, collector Modulator. AmplitudeDemodulators: Diode Detector, Balanced Modulators: Lattice Modulators. **Frequency Division Multiplexing:** Transmitter-Multiplexer, Receiver-DE multiplexer. **[Text1: 3.1, 3.2, 3.3, 3.4, 3.5, 4.2, 4.3, 4.4, 10.2]**
MODULE-3
Fundamentals of Frequency Modulation: Basic Principles of Frequency Modulation, Principles of Phase Modulation, Modulation index and sidebands, Noise Suppression Effects of FM, Frequency Modulation versus Amplitude Modulation. **FM Circuits:** Frequency Modulators: Voltage Controlled Oscillators., Frequency Demodulators: Slope Detectors, Phase Locked Loops. **Communication Receiver:** Super heterodyne receiver, Frequency Conversion: Mixing Principles, JFET Mixer. **[Text1: 5.1, 5.2, 5.3, 5.4, 5.5, 6.1, 6.3, 9.2, 9.3]**
MODULE-4
Digital Representation of Analog Signals: Introduction, Why Digitize Analog Sources? The Sampling process, Pulse Amplitude Modulation, Time-Division Multiplexing, Pulse Position Modulation: Generation and Detection of PPM wave. The Quantization Process. Pulse Code Modulation: Sampling, Quantization, Encoding, line Codes, Differential encoding, Regeneration, Decoding, filtering, multiplexing. **[Text2: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9]**
MODULE-5
Baseband Transmission of Digital signals: Introduction, Inter symbol Interference, Eye Pattern, Nyquistcriterion for distortion less Transmission, Baseband M-array PAM Transmission. **[Text2: 8.1, 8.4, 8.5, 8.6, 8.7]** **Noise:** Signal to Noise Ratio, External Noise, Internal Noise, Semiconductor Noise, Expressing Noise Levels, Noisein Cascade Stages. **[Text1:9.5]**

PRACTICAL COMPONENT OF IPCC *(Experiments can be conducted using MATLAB/SCILAB/OCTAVE)*

Sl. NO.	Experiments
1	Basic Signals and Signal Graphing: a) unit Step, b) Rectangular, c) standard triangle d) sinusoidal and e) Exponential signal.
2	Illustration of signal representation in time and frequency domains for a rectangular pulse.
3	Amplitude Modulation and demodulation: Generation and display the relevant signals and its spectrums.
4	Frequency Modulation and demodulation: Generation and display the relevant signals and its spectrums.
5	Sampling and reconstruction of low pass signals. Display the signals and its spectrum.
6	Time Division Multiplexing and DE multiplexing.

7	PCM Illustration: Sampling, Quantization and Encoding
8	Generate a) NRZ, RZ and Raised cosine pulse, b) Generate and plot eye diagram
9	Generate the Probability density function of Gaussian distribution function.
10	Display the signal and its spectrum of an audio signal.

Course outcomes (Course Skill Set):

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

1. Understand the principles of analog communication systems and noise modelling.
2. Identify the schemes for analog modulation and demodulation and compare their performance.
3. Design of PCM systems through the processes sampling, quantization and encoding.
4. Describe the ideal condition, practical considerations of the signal representation for baseband transmission of digital signals.
5. Identify and associate the random variables and random process in Communication system design.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

The IPCC means the practical portion integrated with the theory of the course. CIE marks for the theory componentare **25 marks** and that for the practical component is **25 marks**.

CIE for the theory component of the IPCC

1. 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
2. Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
3. The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

1. **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
2. On completion of every experiment/program in the laboratory, the students shall be evaluated including viva- voce and marks shall be awarded on the same day.
3. The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write- ups are added and scaled down to **15 marks**.
4. The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
5. Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
6. The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

a. The minimum marks to be secured in CIE to appear for SEE shall be 10 (40% of maximum marks-25) in the theory component and 10 (40% of maximum marks -25) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 sub-questions are to be set from the practical component of IPCC, the total marks of all questions should not be more than 20 marks.
b. SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify for the SEE. Marks secured will be scaled down to 50.
c. The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken
d. together.

Suggested Learning Resources:

Books

1. Louis E Frenzel, Principles of Electronic Communication Systems, 3rd Edition, Mc Graw Hill Education(India) Private Limited, 2016. ISBN: 978-0-07-066755-6.
2. Simon Haykin & Michael Moher, Communication Systems, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN:978-81-265-2151-7.

Reference Books

1. B P Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford University Press., 4th edition, 2010, ISBN: 97801980738002.
2. Herbert Taub, Donald L Schilling, Goutam Saha, "Principles of Communication systems", 4th Edition, Mc Graw Hill Education (India) Private Limited, 2016. ISBN: 978-1-25-902985-1

Web links and Video Lectures (e-Resources):

1. Principles of Communication Systems **https://nptel.ac.in/courses/108104091**
2. Communication Engineering **https://nptel.ac.in/courses/117102059**

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

1. Assignments and test – Knowledge level, Understand Level and Apply level
2. Experiential Learning by using free and open source software's SCILAB or OCTAVE
3. Open ended questions by faculty, Open ended questions from students

Control Systems			
Course Code	**22UEC412C**	CIE Marks	50
Teaching Hours/Week (L: T: P)	(3:0:2)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to:

1. Understand basics of control systems and design mathematical models using block diagramreduction, SFG, etc.
2. Understand Time domain and Frequency domain analysis.
3. Analyze the stability of a system from the transfer function
4. Familiarize with the State Space Model of the system.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type ofteaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different concepts of Linear Algebra & SignalProcessing.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotescritical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather thansimply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come upwith their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, ithelps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.
10. Give Programming Assignments.

Module-1

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems -Mechanical Systems, Electrical Systems, Analogous Systems. (Textbook 1: Chapter 1.1, 2.2)

Module-2
Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs. (Textbook 1: Chapter 2.4, 2.5, 2.6)
Module-3
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second Order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design). (Textbook 1: Chapter 5.3, 5.4, 5.5)
Module-4
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion. **Introduction to Root-Locus Techniques**, The root locus concepts, Construction of root loci. (Textbook 1: Chapter 6.1, 6.2, 6.4, 6.5, 7.1, 7.2, 7.3)
Module-5
Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. (Textbook 1: Chapter 4: 8.1, 8.2, 8.4) Mathematical preliminaries, Nyquist Stability criterion, (Stability criteria related to polar plots are excluded) (Textbook 1: 9.2, 9.3) **State Variable Analysis:** Introduction to state variable analysis: Concepts of state, state variable and state models. State model for Linear continuous –Time systems, solution of state equations. (Textbook 1: 12.2, 12.3, 12.6)

PRACTICAL COMPONENT OF IPCC

Using suitable simulation software (P-Spice/ MATLAB / Python / Scilab / OCTAVE / LabVIEW) demonstrate the operation of the following circuits:

Sl. No.	Experiments
1	Implement Block diagram reduction technique to obtain transfer function a control system.
2	Implement Signal Flow graph to obtain transfer function a control system.
3	Simulation of poles and zeros of a transfer function.
4	Implement time response specification of a second order Under damped System, for different damping factors.
5	Implement frequency response of a second order System.
6	Implement frequency response of a lead lag compensator.
7	Analyze the stability of the given system using Routh stability criterion.
8	Analyze the stability of the given system using Root locus.
9	Analyze the stability of the given system using Bode plots.
10	Analyze the stability of the given system using Nyquist plot.
11	Obtain the time response from state model of a system.
12	Implement PI and PD Controllers.
13	Implement a PID Controller and hence realize an Error Detector.
14	Demonstrate the effect of PI, PD and PID controller on the system response.

Course Outcomes

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

1. Deduce transfer function of a given physical system, from differential equationrepresentation or Block Diagram representation and SFG representation.
2. Calculate time response specifications and analyze the stability of the system.
3. Draw and analyze the effect of gain on system behavior using root loci.
4. Perform frequency response Analysis and find the stability of the system.
5. Represent State model of the system and find the time response of the system.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam(SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under thatmodule.
- The students have to answer 5 full questions, selecting one full question from eachmodule.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured out of 100 shall be reduced proportionally to 50.

Suggested Learning Resources:

Text Books

1. Control Systems Engineering, I J Nagrath, M. Gopal, New age international Publishers, Fifthedition.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108106098

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

Programming Assignments / Mini Projects can be given to improve programming skills

Communication Laboratory		Semester	4
Course Code	**22UEC413C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Credits	01	Exam Hours	03
Examination type (SEE)	Practical		

Course objectives:

This laboratory course enables students to

1. Understand the basic concepts of AM and FM modulation and demodulation.
2. Design and analyze the electronic circuits used for AM and FM modulation and demodulation circuits.
3. Understand the sampling theory and design circuits which enable sampling and reconstruction of analog signals.
4. Design electronic circuits to perform pulse amplitude modulation, pulse position modulation and pulse width modulation.

	Experiments (Experiments to be conducted using hardware components)
1	Design and test a high-level collector Modulator circuit and Demodulation the signal using diode detector.
2	Test the Balanced Modulator / Lattice Modulator (Diode ring)
3	Design a Frequency modulator using VCO and FM demodulator using PLL (Use IC566 and IC565).
4	Design and plot the frequency response of Pre-emphasis and De-emphasis Circuits
5	Design and test BJT/FET Mixer
6	Design and test Pulse sampling, flat top sampling and reconstruction
7	Design and test Pulse amplitude modulation and demodulation.
8	Generation and Detection of Pulse position Modulation
9	Generation and Detection of Pulse Width Modulation
10	PLL Frequency Synthesizer
11	Data formatting and Line Code Generation
12	PCM Multiplexer and DE multiplexer

Course outcomes (Course Skill Set):

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

1. Illustrate the AM generation and detection using suitable electronic circuits.
2. Design of FM circuits for modulation, demodulation and noise suppression.
3. Design and test the sampling, Multiplexing and pulse modulation techniques using electronic hardware.
4. Design and Demonstrate the electronic circuits used for RF transmitters and receivers.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will beevaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in thesyllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.

- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%,Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be madezero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

1. Louis E Frenzel, Principles of Electronic Communication Systems, 3rd Edition, Mc Graw Hill Education(India) Private Limited, 2016. ISBN: 978-0-07-066755-6.

MICROCONTROLLERS		Semester	4
Course Code	**22UEC414B**	CIE Marks	50
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type(SEE)	Theory		

Course objectives:

This course will enable students to:

- Understand the difference between Microprocessor and Microcontroller and embedded microcontrollers.
- Analyze the basic architecture of 8051microcontroller.
- Program 8051 microcontroller using Assembly Language and C.
- Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051
- Understand the interrupt structure of 8051 and Interfacing I/O devices using I/O ports of 8051.

Teaching-Learning Process (General Instructions)

The samples strategies, which the teacher can use to accelerate the attainment of the variouscourse outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but adifferent type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative(Group)Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical kills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world and when that's possible, it helps improve the students' understanding.
   Give Programming Assignments.

Module-1 (8 Hrs)

Microcontroller: Microprocessor Vs Microcontroller, Micro controller & Embedded Processors, Processor Architectures-Harvard Vs Princeton & RISC Vs CISC, 8051 Architecture- Registers, Pin diagram, I/Oports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. (Text book 1-1.1,Text book 2-1.0,1.1,3.0,3.1,3.2,3.3 Textbook 3-Pg 5-9)

Module-2 (8 Hrs)

Instruction Set: 8051 Addressing Modes, Data Transfer Instructions, Arithmetic instructions, Logical Instructions, Jump & Call Instructions Stack & Subroutine Instructions of 8051 (with examples in assembly Language). (Text book 2- Chapter 5,6,7,8, **Additional reading Refer Textbook 3, Chapter 3 for complete understanding of instructions with flow diagrams)**

Module-3 (8 Hrs)

Timers/Counters & Serial port programming:
Basics of Timers & Counters, Data types & Time delay in the 8051 using C, Programming 8051 Timers, Mode 1 & Mode 2 Programming, Counter Programming (Assembly Language only). (Text book 2- 3.4, Text book 1- 7.1, 9.1,9.2)
Basics of Serial Communication, 8051 Connection to RS232, Programming the 8051 to transfer data serially & to receive data serially using C.(Text book 2- 3.5, Text book 1- 10.1,10.2,10.3 except assembly language programs, 10.5)

Module-4 (8 Hrs)

Interrupt Programming: Basics of Interrupts, 8051 Interrupts, Programming Timer Interrupts, Programming Serial Communication Interrupts, Interrupt Priority in 8051(Assembly Language only) (Text book 2- 3.6, Text book 1- 11.1,11.2,11.4, 11.5)

Module-5 (8 Hrs)

I/O Port Interfacing & Programming: I/O Programming in 8051 C, LCD interfacing, DAC 0808 Interfacing, ADC 0804 interfacing, Stepper motor interfacing, DC motor control & Pulse Width Modulation (PWM) using C only. (Text book 1- 7.2, 12.1, 13.1, 13.2, 17.2, 17.3)

Course outcome (Course Skill Set)

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

1. Describe the difference between Microprocessor and Microcontroller, Types of Processor Architectures and Architecture of 8051Microcontroller.
2. Discuss the types of 8051 Microcontroller Addressing modes & Instructions with Assembly Language Programs.
3. Explain the programming operation of Timers/Counters and Serial port of 8051 Microcontroller.
4. Illustrate the Interrupt Structure of 8051 Microcontroller & its programming.
5. Develop C programs to interface I/O devices with 8051 Microcontroller.

.**Continuous Internal Evaluation:**

There are 25marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.

Each test shall be conducted for 25marks.The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks

1. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the courses hall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
2. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's

taxonomy as per the outcome defined for the course.Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common questionpapers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20marks.
2. There will be 2questions from each module. Each of the two questions under a module (with amaximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to50 marks

Suggested Learning Resources:

TEXT BOOKS

1. The "8051 Microcontroller and Embedded Systems – Using Assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollind. Mckinlay; Phi, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth j. Ayala, 3rd edition, Thomson/Cengage Learning.
3. "Programming And Customizing The 8051 Microcontroller".,Myke Predko Tata Mc Graw-Hill Edition 1999 (reprint 2003).

REFERENCEBOOKS:

1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.

"Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

Web links and Video Lectures(e-Resources):

https://youtu.be/pA6K5NgWTow?si=zQqqgXQq50dVL_-s

Industrial Electronics		Semester	IV
Course Code	**22UEC414C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40 hours	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives: This course will enable student to

- Explain broad types of industrial power devices, there structure, and its characteristics.
- Design and analyze the broad categories of power electronic circuits.
- Explain various types of MEMs devices, principle of operation and construction.
- Familiarize with soft core processors and computer architecture.
- Apply protective methods for devices and circuits.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes criticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with theirown creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Industrial Power Devices: General purpose power diodes, fast recovery power diodes, schottky power diodes, silicon carbide power diodes **(Text book 1: 2.5, 2.6)**, Power MOSFETs, Steady state characteristics, switching characteristics, silicon carbide MOSFETs, COOLMOS, Junction field effect transistors, operation and characteristics of JFETs, Silicon Carbide JFET structures, Bipolar Junction Transistors, Steady state characteristics, switching characteristics, silicon carbide BJTs, IGBT, silicon carbide IGBTs

(Text book 1: 4.3, 4.4, 4.6, 4.7

Module-2

Power Electronics Circuits:), Thyristor, Thyristor characteristics, two transistor model **(Text book 1: 9.2, 9.3, 9.4)**. Controlled Rectifiers – Single phase full converter with R and RL load, Single phase dual converters, and Three phase full converter with RL load **(Text book 1: 10.2,**

10.3, 10.4). Switching mode regulators – Buck Regulator, Boost regulator, Buck – Boost regulator, comparison of regulators.
(Text book 1: 5.9.1, 5.9.2, 5.9.3, 5.10)

Module-3

Inverters – Principle of operation, Single phase bridge inverter, Three phase inverter with 180 and 120 degree conduction, Current source inverter **(Text book 1: 6.3, 6.4, 6.5, 6.9)**.
AC voltage controllers – Single phase full wave controller with resistive load, single phase full wave controller with inductive load **(Text book 1: 11.3, 11.4)**.

Module-4

MEMS Devices: Sensing and Measuring Principles, Capacitive Sensing, Resistive Sensing, Piezoelectric Sensing, Thermal Transducers, Optical Sensors, Magnetic Sensors, MEMS Actuation Principles, Electrostatic Actuation, Thermal Actuation, Piezoelectric Actuation, Magnetic Actuation, MEMS Devices Inertial Sensors, Pressure Sensors, Radio Frequency MEMS: Capacitive Switches and Phase Shifters, Microfluidic Components, Optical Devices. **(Text book 2: 13.1, 13.3, 13.4)**
MEMS Applications: Introduction, Industrial, Automotive, Biomedical.
(**Text book 2:15.1, 15.2, 15.3, 15.4)**

Module-5

Protections of Devices and Circuits: Cooling and Heat sinks, Thermal Modeling of Power Switching Devices, Electrical Equivalent Thermal model, Mathematical Thermal Equivalent Circuit, Coupling of Electrical and Thermal Components, Snubber circuits, Voltage protection by Selenium Diodes and Metal oxide Varistors, Current protection, Fusing, Fault current with AC source, Fault current with DC source, Electromagnetic Interference, sources of EMI, Minimizing EMI Generation, EMI shielding, EMI standards.
(Text book 1: 17.2, 17.3, 17.4, 17.5, 17.6, 17.7, 17.8, 17.9).

Course outcome (Course Skill Set)

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

1. Explain different types of industrial power devices such as MOSFET, BJT, IGBT etc, therestructure, and its operating characteristics.
2. Design and analyze the power electronic circuits such as switch mode regulators, inverters,controlled rectifiers and ac voltage controllers.
3. Explain various types of MEMs devices used for sensing pressure, temperature, current,voltage, humidity, vibration etc...
4. Familiarize with soft core processors such as ASIC and FPGA.
5. Familiarize with computer hardware, software, architecture, instruction set, memory organization, multiprocessor architecture.
6. Apply protective methods for devices various industrial power devices based on thermal requirements and develop protective methods for the circuits against various electrical parameters.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based thenonly one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomyas per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers forthe course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximumof 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

1. Power Electronics: Devices, Circuits, and Applications, Muhammad H. Rashid, Pearson, 4th International edition.
2. Fundamentals of Industrial Electronics, Bogdan M. Wilamowski, J. David Irwin, CRC Press, 2011,

Reference Books

1. Thomas E. Kissell, Industrial Electronics: Applications for Programmable Controllers, Instrumentationand Process Control, and Electrical Machines and Motor Controls, 3rd edition, 2003, Prentice Hall.
2. Ned Mohan, T.M. Undeland and W.P. Robbins, "Power Electronics: Converters, Applications and Design", Wiley India Ltd, 2008.

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/102/108102145/
- https://nptel.ac.in/courses/117105082
- https://www.youtube.com/channel/UCKg8GNii0Q-ieXE56AXosGg/featured
- https://www.ieee-ies.org/

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

- Quiz and Seminars

OPERATING SYSTEM		Semester	4
Course Code	**22UEC414D**	CIE Marks	50
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type(SEE)	Theory		

Course objectives:

This course will enable students to:

- Understand the services provided by an operating system.
- Explain how processes are synchronized and scheduled.
- Understand different approaches of memory management and virtual memory management. Describe the structure and organization of the file system
- Understand inter-process communication and deadlock situations.

Teaching-Learning Process (General Instructions)

The samples strategies, which the teacher can use to accelerate the attainment of the variouscourse outcomes are listed in the following:

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Operating Systems: OS, Goals of an OS, Operation of an OS,Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems **(Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text).**

Module-2

Process Management: OS View of Processes, PCB, Fundamental State Transitions of aprocess, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS andSRN, Preemptive Scheduling- RR and LCN, Scheduling in Unix and Scheduling in Linux**(Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2, Selected scheduling topics from 4.2 and 4.3 , 4.6, 4.7 of Text).**
Module-3
Memory Management: Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, VM handler, FIFO, LRU page replacement policies, Virtual memory in Unix and Linux. **(Topics from Sections 5.5 to 5.9, 6.1 to 6.3 except Optimal policy and 6.3.1, 6.7,6.8 of Text)**
Module-4
File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access. **(Topics from Sections 7.1 to 7.8 of Text).**
Module5
Message Passing and Deadlocks: Overview of Message Passing, implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlock detection algorithm, Deadlock Prevention **(Topics from Sections 10.1 to 10.3, 11.1 to 11.5 of Text).**

Course outcome (Course Skill Set)

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

1. Explain the goals, structure, operation and types of operating systems.
2. Apply scheduling techniques to find performance factors.
3. Explain organization of file systems and IOCS.
4. Apply suitable techniques for contiguous and non-contiguous memory allocation.
5. Describe message passing, deadlock detection and prevention methods.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE)is 50%.The minimum passing mark for the CIE is 40%of the maximum marks(20marks out of 50) and forthe SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

There are 25marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.

Each test shall be conducted for 25marks.The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of thesyllabus. The average of the two tests shall be scaled down to 25 marks

Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the courses hall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks) The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Blo om's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20marks.
2. There will be 2questions from each module. Each of the two questions under a module (with amaximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to50 marks

Suggested Learning Resources:

TEXT BOOKS

Data Structures Using C		Semester	IV
Course Code	**22UEC414A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

COURSE OVERVIEW:

COURSE OBJECTIVES:

The objectives of this course are to:

1. Develop proficiency in designing and implementing fundamental data structures.
2. Learn various sorting and searching algorithms and analyze their time complexity.
3. Understand algorithmic problem-solving techniques, including recursion.
4. Explore advanced data structures like trees, graphs, and hash tables.
5. Apply data structures and algorithms knowledge to solve real-world programming challengesefficiently.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The lecturer's approach (L) does not have to be limited to traditional methods of teaching. It is possible to incorporate alternative and effective teaching methods to achieve the desired outcomes.
2. Utilize videos and animations to illustrate the functioning of different techniques used in themanufacturing of smart materials.
3. Foster collaborative learning exercises within the classroom to encourage group participationand engagement.
4. Pose a minimum of three Higher Order Thinking (HOT) questions during class discussions to stimulate critical thinking among students.
5. Implement Problem-Based Learning (PBL) as an approach that enhances students' analyticalskills and nurtures their ability to design, evaluate, generalize, and analyze information, rather than solely relying on rote memorization.

Module-1

Arrays:1D,2D and multidimensional. Pointers: Definition and Concepts, Array of pointers, Structures and unions. Array of structures, pointer arrays, pointer to structures. Passing pointer variable as parameter in functions Dynamic memory allocation: malloc (), calloc (), realloc () and free function.Introduction to data structures and algorithms Text book 1 -Chapter-1.1-1.3 except Rational Numbers. Text Book 2, chapter-2

Module-2
The Stack – Definition and examples, primitive operations, Example. Representing Stacks in C, Example: Infix, Postfix and Prefix, converting an Expression from Infix to Prefix and Program. Text Book -1-Chapter – 2.1-2.3 Recursion – Recursive Definition and Processes, Recursion in C, Writing Recursive Programs.Recursions - Text Book -1-Chapter – 3.1-3.3
Module-3
Queues and Lists – The Queue and its sequential representation, Linked Lists, Lists in C. Other Lists structures – Circular Lists, Stacks, Queues as circular list. The Josephus problem, doublylinked lists. Linked lists and Queues - Text Book -1-Chapter – 4.1-4.3, 4.5
Module-4
Trees – Binary Trees, binary tree representations, Huffman algorithm, Trees and their applications. Searching – Basic searching Techniques, Tree Searching. Trees - Text Book -1-Chapter – 5.1-5.3, 5.5, 7.1, 7.2
Module-5
Hashing – Introduction, Static Hashing, Dynamic HashingText Book 3 -8.1 – 8.3 Graphs - Graph representation, Elementary graph operations, Minimum cost spanning Trees –Kruskal's Algorithm, Prim's algorithm Text Book 3 - 6.1, 6.2, 6.3.1, 6.3.2

Course Outcomes (COs) (Course Skill Set)

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

1. Master the implementation and application of key data structures in programming.
2. Demonstrate the ability to analyze algorithm efficiency and optimize code.
3. Solve complex problems by applying algorithmic strategies and techniques.
4. Design and implement algorithms for tasks involving searching, sorting, and graph traversal.
5. Utilize data structures and algorithms to enhance software performance and scalability

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemedto have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal AssessmentTest component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and thesecond test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and othermethods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination (SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question

papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

Suggested Learning Resources:

TEXT BOOKS:

1. Data Structures using C and C++, Yedidyah, Augenstein, Tannenbaum, 2nd Edition, PearsonEducation, 2007.
2. Data Structures using C, Reema Thareja, 2nd Edition, Oxford University Press, 2011
3. Fundamentals of Data structures in C, 2nd Edition, Horowitz, Sahni, Anderson freedUniversities Press,2008

REFERENCEBOOKS:

1. Reema Thareja, Computer fundamentals and programming in C, second edition, OxfordUniversity Press.
2. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2ndEd,CengageLearning,2014.

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/106/102/106102064/
- https://archive.nptel.ac.in/courses/106/106/106106127/
- https://nptel.ac.in/courses/106102064
- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
- https://nptel.ac.in/courses/106/105/106105171/
- http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html
- https://nptel.ac.in/courses/106/101/106101060/

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

Real world problem solving using group discussion.

- Back/Forward stacks on browsers.
- Undo/Redo stacks in Excel or Word.
- Linked list representation of real-world queues -Music player, image viewer
- Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Peasant,wolf, goat, cabbage puzzle, Konigsberg bridge puzzle etc.,

Demonstration of solution to a problem through programming.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation(CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling thelaboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up willbeevaluatedfor10marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-upon time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted

Microcontrollers Lab		Semester	4
Course Code	**22UEC415D**	CIE Marks	50
Teaching Hours/Week(L:T:P)	0:0:2	SEE Marks	50
Credits	01	Total Marks	100
		Exam Hours	2
Examination type(SEE)	Practical		

Course objectives: This course will enable students to:

- Understand the basic programming of Microcontrollers.
- Developthe8051 Microcontroller-based programs for various applications using Assembly Language & CProgramming.
- Program8051Microcontrollertocontrolanexternalhardwareusingsuitable I/Oports.

Note	Execute the following experiments by using Keil Microvision Simulator (any 8051 Microcontroller can be chosen as the target) and Hardware Interfacing Programs using 8051 Trainer Kit.
Sl.No	**I. Assembly Language Programming**
Data Transfer Programs:	
1	Write an ALP to move a block of n bytes of data from source (20h) to destination (40h) usingInternal-RAM.
2	Write an ALP to move a block of n bytes of data from source (2000h) to destination (2050h) using External RAM.
3	Write an ALP to exchange the source block starting with address 20h, (Internal RAM) containing N (05) bytes of data with destination block starting with address 40h (Internal RAM).
4	Write an ALP to exchange the source block starting with address 10h (Internal memory), containingn (06) bytes of data with destination block starting at location 00h (External memory).
Arithmetic & Logical Operation Programs:	
5	Write an ALP to add the byte in the RAM at 34h and 35h, store the result in the register R5 (LSB)and R6 (MSB), using Indirect Addressing Mode.
6	Write an ALP to subtract the bytes in Internal RAM 34h &35h store the result in register R5 (LSB) & R6 (MSB).
7	Write an ALP to multiply two 8-bit numbers stored at 30h and 31h and store16- bit result in 32h and 33h of Internal RAM.
8	Write an ALP to perform division operation on 8-bit number by 8-bit number.
9	Write an ALP to separate positive and negative in a given array.
10	Write an ALP to separate even or odd elements in a given array.
11	Write an ALP to arrange the numbers in Ascending & Descending order.

12	Write an ALP to find Largest & Smallest number from a given array starting from 20h & store it in Internal Memory location 40h.
Counter Operation Programs:	
13	Write an ALP for Decimal UP-Counter.
14	Write an ALP for Decimal DOWN-Counter.
15	Write an ALP for Hexadecimal UP-Counter.
16	Write an ALP for Hexadecimal DOWN-Counter.
II. C Programming	
1	Write an 8051 C program to find the sum of first 10 Integer Numbers.
2	Write an 8051 C program to find Factorial of a given number.
3	Write an 8051 C program to find the Square of a number (1 to 10) using Look-Up Table.
4	Write an 8051 C program to count the number of Ones and Zeros in two consecutive memory locations.
III. Hardware Interfacing Programs	
1	Write an 8051 C Program to rotate stepper motor in Clock & Anti-Clockwise direction.
2	Write an 8051 C program to Generate Sine & Square waveforms using DAC interface.

Course outcomes (Course Skill Set): At the end of the course the student will be able to:

1. Write a Assembly Language / C program using 8051for solving simple problems that manipulate input data using different instructions.
2. Develop Testing and experimental procedures on 8051 Microcontroller, Analyze their operationunder different cases.
3. Developprogramsfor8051Microcontrollertoimplementreal world problems.
4. DevelopMicrocontrollerapplicationsusingexternalhardwareinterface.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and forthe SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ courseif the student secures a minimum of40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

CIEmarksforthepracticalcourseare**50Marks**.

The split-up of CIE marks for record/journalandtestareintheratio**60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up.Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10marks.
- Total marks scored by the students are scaled down to **30marks**(60%ofmaximummarks).
- Weightagetobegivenforneatnessandsubmissionofrecord/write-upontime.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write- up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20marks** (40%ofthemaximummarks). The Sum of scaled-down marks scored in the report write-up /journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation(SEE):

- SEE marks for the practical courseare50Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva- voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15%ofMarksallottedtotheprocedurepartaretobemadezero.The minimum duration of SEE is 02 hours

Suggested Learning Resources:

"The 8051 Microcontroller: Hardware, Software and Applications", V Udayashankara and M S Mallikarjuna Swamy, McGraw Hill Education,1st edition,2017.

PROGRAMMABLE LOGIC CONTROLLER (PLC)		Semester	IV
Course Code	**22UEC415B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	14 to 16 hours	Total Marks	100
Credits	01	Exam Hours	01
Examination type (SEE)	Theory		

Course objectives: This course will enable student to

- To understand the need for automation in the industry with basic controller mechanisms involved.
- To study programming concepts to achieve the desired goal or to define the various steps involved inthe automation.
- To understand programming involved with basic subroutine functions.
- To make use of the internal hardware circuits of automation circuit to control the devices duringvarious states by monitoring the timers and counters.
- To handle the data of the I/O devices to interface the data with the controller and auxiliary devices.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes criticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with theirown creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helpsimprove the students' understanding.

Module-1

Introduction: Programmable logic controller (PLC), role in automation (SCADA), advantages and disadvantages, hardware, internal architecture, sourcing and sinking **(Textbook 1: 1.1 to 1.4)**

I/O devices and Processing: list of input and output devices, examples of applications. I/O processing,input/output units, signal conditioning, remote connections, networks, processing inputs I/O addresses.

(TextBook1: 2.1 to 2.3 and 4.1 to 4.7).

Module-2

Programming: Ladder programming- ladder diagrams, logic functions, latching, multiple outputs, entering programs, functional blocks, program examples like location of stop and emergency switches. (**TextBook1: 5.1 to 5.7).**

Module-3

Programming Methods: Instruction Lists- Ladder programs and Instruction lists, Branch codes, Programming Examples- Signal lamp-valve operation task. Sequential Function Charts- Branching and convergence. **(TextBook1: 6.1 to 6.3).**

Module-4

Internal Relays: ladder programs, battery-backed relays, one-shot operation, set and reset, master controlrelay (**TextBook1: 7.1 to 7.6).**

Timers and counters: Types of timers, ON and OFF- delay timers, pulse timers, forms of counter, programming, up and down counters. **(TexBook1: 9.1 to 9.6).**

Module-5

Shift register and data handling: shift registers, ladder programs, registers and bits, data handling,arithmetic functions. **(TextBook1: 11.1 to 11.2 and 12.1 to 12.3)**

Course outcome (Course Skill Set)

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

1. Describe the PLC and how to construct PLC ladder diagrams.
2. Illustrate an application with programming.
3. Describe characteristics of registers and conversion examples.
4. Apply PLC functions to timing and counting applications.
5. Analyze the analog operation of PLC and demonstrate the robot applications with PLC.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimumpassing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned.
- The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the

sum of the two assignments shall be scaled down to 25 marks)

- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy
as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers forthe course (**duration 01 hours).**

1. SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions).
2. The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximummarks meant for SEE.

Suggested Learning Resources:

Textbooks:

1. Programmable Logic Controllers-W Bolton, 5th edition/6th edition, Elsevier- newness, 2009/2015.
2. Programmable logic controllers - principles and applications"-John W. Webb, Ronald A Reiss, Pearsoneducation, 5th edition, 2007.

Reference Books:

1 Programmable Logic Controllers"- E. A Paar, 3rd Edition, An Engineers Guide. Newness, 2003.

2 "Introduction to Programmable Logic Controller"- Garry Dunning, 3rd Edition, Thomson Asia Pte Ltd.Publication, 2006

3 "PLCs & SCADA - Theory and Practice"- Rajesh Mehra, Vikrant Vij, 2nd Edition, Laxmi publication, 2017

4 "PLC Programming for Industrial Automation"- Kevin Collins, 1st Edition, Kindle, 2016

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

- Quiz and Seminars

Octave Programming			
Course Code	**22UEC415A**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	12 Sessions	Total	100
Credits	01	Exam Hours	02

**Additional One hour may be considered for instructions ifrequired*

Course objectives:

- Apply theoretical knowledge of Octave programming to practical programming tasks.
- Gain hands-on experience in implementing and debugging octave Programming through codingexercises and projects.

Course Syllabus: Basic data structures in Octave – Vectors, Matrices, Cell Arrays. Special vecors. Linear sampling and logarithmic sampling. Accessing elements of vectors, matrices, and matrices. Mathematical operations on vectors and matrices. Addition, Multiplication, Subtraction, Division, Power, Square-Root, trigonometric operations. Dot Products and Cross Products of Vectors. Matrix multiplication, matrix inverse and matrixtranspose operations. Finding eigen values and vectors of a square matrix. Finding the solution of a system of linear equations. Linear programming and integer linear programming using glpk. Plotting in Octave. Subplots, Stem Plots, Semilog and Log-log plots. Packages in Matlab – symbolic, signal processing, control. Applications of Octave to solve problems in Electrical engineering, Electronics engineering,Control Systems, Signals and Systems/Signal Processing.

Sl..NO	Experiments

1

(a) Define the following matrices using Octave

i. A 4x4 identity matrix

ii. A 4x4 matrix of zeros

iii. A 4x4 matrix of ones

iv. The matrix U4 defined below.

```
1   2   3   4
2   3   1   4
1   3   2   4
4   3   1   2
```

v. Matrix D4 defined below. It is also called the Hadamard matrix of dimension 4.

```
1    1    1    1
1   -1    1   -1
1    1   -1   -1
1   -1   -1    1
```

vi. Matrix H4 defined below

$$\mathbf{H}_4 = \frac{1}{\sqrt{4}}\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ \sqrt{2} & -\sqrt{2} & 0 & 0 \\ 0 & 0 & \sqrt{2} & -\sqrt{2} \end{bmatrix}$$

vii. A 4x4 magic square G4

viii. A 4x4 matrix of random numbers selected from the range {-1,0,1}.

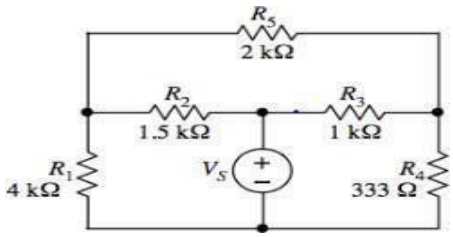
ix. A 4x4 matrix of random numbers in the range 0 to 1.

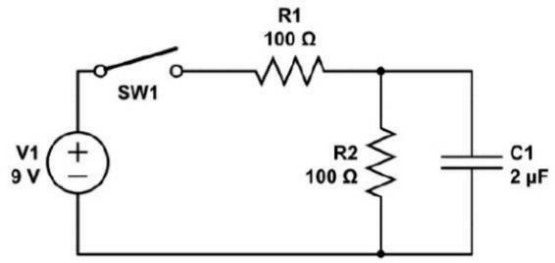
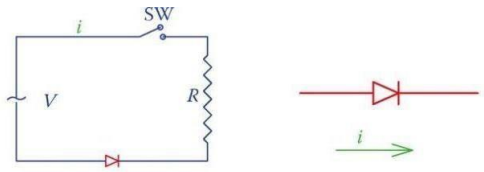
(b)

(i) How can you generate a 4x4 matrix of all 2's?

(ii) Find the transpose of U4.

(iii) Multiply D4 by its transpose and obtain the resulting matrix. How is

	related to the identify matrix? (iv) Find the inverse of H4 and verify that it is the inverse. (v) What is the determinant of D4? (vi) Extract the diagonal elements of H4. (vii) How can you reshape the elements of D4 into a 2x8 matrix? (viii) What is the magic sum of a 4x4 matrix? How can you verify that G4 is indeed a magic square? (ix) The matrix D4 mentioned above is a 4x4 matrix. We wish to extract the sub- matrix consisting of rows 1 and 4 and columns 1 and 4. [In other words, the four corners of D4.) Show Octave code for generating the submatrix SM. (x) Check if the H4 and D4 are orthogonal matrices.
2	You will have learnt Kirchhoff's current and voltage laws to solve the voltages and currents in a DC circuit.Given a circuit with n loops, we can write down n equations in n unknowns (loop currents). Alternately, given a circuit with n nodes, we can write down n equations in n unknowns (node voltages). These linear equations can be solved using Octave. (a) Write down the KCL and KVL for the following circuit and solve the node voltages and currents.Assume that Vs is 100V.  (b) Find the total power dissipated in the circuit. (c) Find the total power supplied by the voltage source. (d) Challenge – Instead of hardcoding the values of the resistors and the voltage source, can you allow the user to input R1, R2, R3, R4, R5, and Vs? Develop a complete Octave script which reads in the values of circuit parameters and prints the node voltages, node currents, and power dissipation. (e) Variations of the above exercises can be given to the students. For example, a resistor can be included in series with Vs. Alternately, a different circuit from a text book can be given. You can also change the problem by specifying the current through one of the resistors and asking the user to solve for Vs.

3	(a) Consider the RC circuit shown in the figure below. Plot the voltage across C and the charging current through C when the switch is turned on. (b) What is the rise time of the capacitor voltage?
	
4	 (a) The figure shows a diode-based rectifier. The diode conducts only when the input voltage is positive. Assume that it is an ideal diode. Plot the half-wave rectified waveform if the input to the rectifier is a 50-Hz sine wave of 200V RMS. Plot the output waveform for four cycles of the input. (b) Find the average of the Half wave-rectified output in Octave and verify your answerusing the formula for the average output. (c) Plot the output of a full-wave rectifier. (d) Find the RMS value of the Full wave-rectified output in Octave and verify youranswer using the formulafor the RMS value. (e) Assume that the input voltage is 2sin(500t) V and that the diode has a cut-in voltage of 0.6V. Plot thehalf-wave and full-wave rectified waveforms and find their average and RMS values.
5	(a) Given Z parameters, obtain the Y parameters using a function called Z2Y () Given Y parameters, obtain the Z parameters using afunction called Y2Z () (b) Find the Z and Y parameters for the T-network

	Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to havesatisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE). **Continuous Internal Evaluation(CIE):** CIE marks for the practical course is **50 Marks**. The split-up of CIE marks for record/journal and test are in the ratio **60:40**. • Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session. Record should contain all the specified experiments in the syllabus and each experiment write-up willbeevaluatedfor10marks. • Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks). • Weightage to be given for neatness and submission of record/write-upon time. • Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and these test shall be conducted after the 14thweek of the semester. • In each test, write-up, conduction of experiment, acceptable result, and procedural knowledge willcarry a weightage of 60% and the rest 40% for viva-voce. • The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book • The average of 02 tests is scaled down to **20 marks** (40%of the maximum marks). • The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the totalCIE marks scored by the student.
	Semester End Evaluation(SEE): SEE marks for the practical course is 50Marks. SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by theUniversity All laboratory experiments are to be included for practical examination. (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly byexaminers. Students can pick one question (experiment) from the question slot prepared by the internal/external examinersjointly. Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, write up-20%, Conduction procedure and result -60%, Viva-voce 20%of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be madezero. The duration of SEE is 03hours Rubrics suggested in Annexure-II of Regulation book

	Suggested Learning Resources: Textbooks: Dr. P.J.G. Long, Department of Engineering University of Cambridge, "Introduction to Octave," can be downloaded from octavetut.pdf (cam.ac.uk)

Data Structures Lab using C			
Course Code	22UEC415C	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	15 Sessions	Total	100
Credits	01	Exam Hours	03

Additional One hour may be considered for instructionsif required

Course objectives:

- Apply theoretical knowledge of data structures and algorithms to practical programming tasks.
- Gain hands-on experience in implementing and debugging data structures and algorithmsthrough coding exercises and projects.

Sl. NO.	Experiments
1	Write a C Program to create a Student record structure to store, N records, each record havingthe structure shown below: USN, Student Name and Semester. Write necessary functions a. To display all the records in the file. b. To search for a specific record based on the USN. In case the record is not found, suitable message should be displayed. Both the options in this case must be demonstrated. (Use pointer to structure for dynamic memory allocation)
2	Write a C Program to construct a stack of integers and to perform the following operations on it: a. Push b. Pop c. Display The program should print appropriate messages for stack overflow, stack underflow, and stack empty.
3	Write a C Program to convert and print a given valid parenthesized infix arithmetic expressionto postfix expression. The expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide).
4	Write a C Program to simulate the working of a queue of integers using an array. Provide thefollowing operations: a. Insert b. Delete c. Display
5	Write a C Program using dynamic variables and pointers to construct a stack of integers usingsingly linked list and to perform the following operations: a. Push b. Pop c. Display The program should print appropriate messages for stack overflow and stack empty.
6	Write a C Program to support the following operations on a doubly linked list where each nodeconsists of integers: a. Create a doubly linked list by adding each node at the front. b. Insert a new node to the left of the node whose key value is read as an input c. Delete the node of a given data, if it is found, otherwise display appropriate message. d. Display the contents of the list. (Note: Only either (a, b and d) or (a, c and d) may be asked in the examination)
7	Write a C Program a. To construct a binary search tree of integers. b. To traverse the tree usingall the methods i.e., in order, preorder and post order. c. To display the elements in the tree.

8	Write recursive C Programs for a. Searching an element on a given list of integers using theBinary Search method. b. Solving the Towers of Hanoi problem.
9	Write a program to traverse a graph using BFS method. Write a program to check whether given graph is connected or not using DFS method.
10	Design and develop a program in C that uses Hash Function H:K->L as H(K)=K mod m(reminder method) and implement hashing technique to map a given key K to the addressspace L. Resolve the collision (if any) using linear probing
Note: The students must be encouraged to create Leet code account and work on Leetcode platform to improve the competency.	

Course outcomes (Course Skill Set):

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

- Develop proficiency in coding and debugging complex algorithms and data structures.
- Acquire practical problem-solving skills by applying data structures and algorithms to real-world programmingchallenges.
- Develop a C program to perform arithmetic operation using data structure and operators.
- Understand the concept of graph theory and develop a C program for searching an element.
- Develop a C program to check the given graph is connected using different algorithms.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation(CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record / journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling thelaboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up willbeevaluatedfor10marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-upon time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of thesemester and these test shall be conducted after the 14^{th}week of the semester.
- In each test, write-up, conduction of experiment, acceptable result, and procedural knowledge will carry aweightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40%of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marksscored by the student.

Semester End Evaluation(SEE):

SEE marks for the practical course is 50Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the UniversityAll laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adheredto by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the question slot prepared by the internal/external examiners jointly.Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, write up-20%, Conduction procedure and result -60%, Viva-voce 20%of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. Theduration of SEE is 03hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

Textbooks:

- Data Structures using C, Reema Thareja, 2nd Edition, Oxford University Press, 2011
- Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009.Pearson.

- Online Courses:
  - Coursera: "Algorithms" by Princeton University (taught by Robert Sedgewick and Kevin Wayne).
  - edX: "Algorithmic Design and Techniques" (offered by UC San Diego and Higher School of Economics).
- Websites and Online Resources:
  - Geeks for Geeks: Offers a wide range of tutorials, practice problems, and coding challenges related todata structures and algorithms.

    Leet Code: Provides coding challenges that are frequently asked in technical interviews and cover a variety of algorithmic concepts.
  - Hacker Rank: Offers coding challenges and competitions with a focus on algorithms and data structures.
  - Top Coder: Provides algorithmic challenges and competitions for practicing and improving problem-solving skills.
- YouTube Channels:
  - My code school: Offers video tutorials on various data structures and algorithms topics.
  - The Coding Train: Provides interactive coding tutorials on algorithms and data structures.
- Coding Platforms:
  - Code forces: Offers competitive programming challenges to improve algorithmic problem-solving skills. Hackerearth: Provides coding competitions and challenges along with tutorials and practice problems.

5th Semester Syllabus

Course Code: 22UEC520C	Digital Signal Processing	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.

Discrete Fourier Transform: Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, DFT relationship with other transforms, properties of DFT, multiplication of two DFTs, circular convolution and additional properties of DFT. Application of DFT in linear filtering: overlap add and overlap save method.

Self Study Component: Study of spectrum of typical practical signals like speech, biomedical signals etc

UNIT–II	10 Hrs.

Fast Fourier Transform (FFT) Algorithms: Need for efficient computation of DFT, Radix 2 FFT algorithms for computation of DFT and IDFT: Decimation in time and decimation in frequency algorithms. Goertzel algorithm and chirp-Z transform algorithm.

Self Study Component: Study of computational complexity in FFT algorithms

UNIT–III	10 Hrs.

IIR filter design: Characteristics of analog filters – Butterworth and Chebyshev filters. Design of IIR filters from analog filters (i.e. Butterworth and Chebyshev), Transformation techniques: Impulse invariance method, Approximation of derivative (Backward difference and Forward difference) method. Bilinear transformation method.

Self Study Component: Stability and frequency analysis of IIR filtes

UNIT–IV	10 Hrs.

FIR filter design: Introduction to FIR filters, Design of FIR filters using windowing (Rectangular, Hamming, Hanning and Bartlet) method, FIR filter design using frequency sampling method. Implementation of discrete time systems - Structures for IIR and FIR systems: Direct form I, Direct form II, cascade and parallel realization.

Self Study Component: frequency analysis, group/phase delay analysis of IIR filters

Reference Books *

1. John G. Proakis and Manolakis, “Digital Signal Processing-Principles Algorithms and Applications” PHI Publication, III Edition, 1997.
2. Oppenheim and Schaffer, “Discrete Time Signal Processing” PHI Publication, III Edition, 2003.

Course Outcomes**

After completion of the course student will be able to

1. Compute and analyze DFT and IDFT of given functions.
2. Calculate DFT and IDFT of given signals using FFT algorithms.
3. Design and realize IIR digital filters using Butterworth and Chebyshev approximations.
4. Design and realize FIR digital filters using windowing and frequency sampling techniques.

Course Articulation Matrix

Course Outcomes	Programme Outcomes (POs)	Program Specific Outcomes (PSOs)

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1: Compute and analyze DFT and IDFT of given signals.	3	2	3	1	2	0	0	0	0	0	0	2	3	2	1
CO2: Calculate DFT and IDFT of given signals using FFT algorithms.	3	2	3	1	2	0	0	0	0	0	0	2	3	2	1
CO3: Design and realize IIR digital filters using Butterworth and Chebyshev approximations.	3	2	3	1	2	0	0	0	0	0	0	2	3	2	1
CO4: Design and realize FIR digital filters using windowing and frequency sampling methods.	3	2	3	1	2	0	0	0	0	0	0	2	3	2	1
Course Contribution to POs and PSOs	**3**	**2**	**3**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**2**	**1**

Course Code: 22UEC521C	Computer Networks	Credits:03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week:03		SEEMarks:50

UNIT-I	10 Hrs.
Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Data Link Control: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC, PPP.	
UNIT–II	**10Hrs.**
Multiple Accesses: Random access, Controlled access, Channelization, Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Connecting LANs, Backbone and Virtual LANs	
UNIT–III	**10 Hrs.**
Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols.	
UNIT–IV	**10 Hrs.**
Transport layer Process to process Delivery, UDP, TCP, Application Layer: Domain name system, Name Space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Resolution, DNS messages, Types of Records, Registrars, Dynamic Domain Name System, Encapsulation.	

Reference Books *

1. Data Communication and Networking, "Behrouz A. Forouzan", 4th Edition, TMH, India, 2006.
2. Andrew S. Tanenbaum, "Computer networks", Prentice-Hall, 2010.
3. William Stallings, "Data and Computer Communications", Prentice-Hall, 2007.

Course Outcomes**

After completion of the course student will be able to

1. **Master the terminology and concepts of the OSI reference model and the TCP/IP reference model**
2. **Master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks**
3. **Identify, compare and contrast different techniques and design issues of core functions such as addressing, routing, internetworking, switching, multiplexing, error and flow control, medium access and coding.**
4. **Become familiar with widely- used Internet protocols such as TCP/IP, UDP and DNS in the Internet**

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1. Master the terminology and concepts of the OSI reference model and the TCP/IP reference model	3	2	3	**2**	1	1	**1**	**1**	-	-	-	**1**	-	**3**

2. Master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks	3	3	2	**2**	1	1	**1**	**1**				**1**	**-**	**3**
3. Identify, compare and contrast different techniques and design issues of core functions such as addressing, routing, internetworking, switching, multiplexing, error and flow control, medium access and coding.	3	2	3	**2**	1	1	**1**	**-**	1	**1**	**1**	1	**-**	**3**
4. Become familiar with widely- used Internet protocols such as TCP/IP, UDP and DNS in the Internet	3	3	3	**2**	1	1	**1**	**1**	1	**1**	**1**	**1**	**-**	**3**

Course Title: Python Programming		Course Code: 22UEC522C
Credits: 1 (2-0-0)	**Teaching Hours: 20 Hrs** **Lab Hr:**	**Contact Hours: 2hrs/week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engineering
Designation : Core

Course Objectives:

The students should be able to learn the

1.To acquire programming skills incore Python.
2.Toacquireprogramming Skills functions inPython
3.To handle Exceptions and files in Python
4. To acquire skills in Object Oriented Programming with Python.

Course Outcomes:

At the end of thecourse,studentsareableto:

1. Explainsyntaxandsemanticsofdifferentstatementsandfunctions inPython.
2. Demonstratetheuseofstrings,files,lists,dictionariesandtuplesinsimpleapplications.
3. Demonstrate Exception Handling and file operations.
4. Explain class,objects, polymorphism,inheritance.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (05 hrs)

Data types in python: comments in python, Docstrings, How python sees variables, Datatypes in python, Sequences in python, Literals in python, Determing the data type of a variable, Identifiers and reserved words, Naming conventions in python

OperatorsinPython: Operator,operatorprecedenceandassociativity,Mathematicalfunctions

InputandOutput: Outputstatements,Inputstatements,CommandLinearguments

Control Statements Strings and Characters

Unit II (05 hours)

Functions: Defining a function, calling a function, Returning Results from a function, Returning multiple values from a function, Formal and actual arguments, local and global variables, passing a group of elements to a function, recursive functions, the special variable nam.

Lists and tuples: lists, tuple , Dictionaries.

Unit III (05 hours)

Exceptions:exceptions,exceptionhandling,typesofexceptions,userdefinedexceptions

Filesinpython:files,typesoffilesinpython,openingafile,closingafile,workingwithtext files containing strings,working with binary files,pickle in python.

Unit IV (05 hours)

Object OrinetedProgramming: Classes and Objects, Creating Classes in Python, Creating Objects in Python,TheConstructorMethod,ClasseswithMultipleObjects,ClassAttributesversusDataAttributes, Encapsulation, Inheritance, The Polymorphism.

Text Books

1. CorePythonProgramming by Dr. R.NageswawaRao, Dreamtechpress, 2nd Edition2018.

Reference Books

1. Introduction to PythonProgramming by GowrishankarS. Veena A. , CRC Press Taylor&Francis Group, 1st Edition2019.

2. PythonProgramming by Michael Urban andJoelMurach , Mike Murach ElizabethDrake, 1st Edition,2016

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**H**	**i**	**j**	**K**	**L**	**m**	**n**	**O**
CO1: Data types in python OperatorsinPython InputandOutputControl Statements StringsandCharacters	3	3	0	0	0	2	1	0	0	0	0	1	2	0	2
CO2:Functions Listsandtuples:lists,tuple , Dictionaries**.**	3	2	0	0	0	1	1	0	0	0	0	2	2	0	2
CO3:Exceptions and Files in Python.	3	3	0	0	0	1	1	0	0	0	0	3	2	0	2
O4:Object Oriented programming in Python.	3	2	0	0	0	1	2	0	0	0	0	3	2	0	2
Course Contribution to POs	**3**	**2.50**	**0**	**0**	**0**	**1.25**	**1.25**	**0**	**0**	**0**	**0**	**2.25**	**2**	**0**	**2**

Professional Elective Courses

Course Code: 22UEC529E	Speech Processing	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.

Digitalrepresentationofspeechsignal.Waveformrepresentationandparametricrepresentation. Sampling rate conversion.
Introduction, the process of speech production and classification and basics of phonetics, phonetic descriptionofphonemes,theacoustictheoryofspeechproduction,digitalmodelsforspeech–vocal tract,radiation,excitationthecomplete model.

UNIT–II	10 Hrs.

Introduction,timedependentprocessingofspeech,shorttimeenergyand averagemagnitude,short timeaveragezerocrossingrate,voiced/unvoiced/silencedetection.Pitchperiodestimation(Rabiner and Gold method), short time autocorrelation function, short time average magnitude difference function, u/v/speech/silence detection.

UNIT–III	10 Hrs.

Introduction, definitions and properties of short time Fourier transform (STFT), Fourier transform interpretation of STFT, linear filtering interpretation of STFT, sampling of STFT, speech analysis and synthesis systems (Vocoders), phase vocoder, channel vocoder.

UNIT–IV	10 Hrs.

Introduction, homomorphic transformation, frequency domain representation of homomorphic systems, inverse Cepstrum transformation, the complex Cepstrum of speech, Cepstral vocoder, processing applications of Cepstral analysis.

Reference Books

1. L. R. Rabiner and R.W. Schafer**,** "Digital Processing of Speech Signals", PearsonEducation (Asia) Pvt. Ltd., 2004.
2. D. O'Shaughnessy, "Speech Communications Human and Machine", University Press,2001.
3. B. Gold and N. Morgan, "Speech and Audio Signal Processing: processing andperceptionof speech and music' Pearson Education, 2003.

Course Outcomes

After completion of the course student will be able to analyze

1. Speech production and perception mechanism.
2. Speech signals in time domain.
3. Speech signals in frequency domain.
4. Speech signal using homomorphic transformation and LPC.

Course Articulation Matrix

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1: Analyze speech production	3	2	3	1	2	0	0	0	0	0	0	2	3	2	1

and perception mechanism.															
CO2: Analyze speech signals in time domain.	3	2	3	1	2	0	0	0	0	0	0	2	3	2	1
CO3: Analyze speech signals in frequency domain.	3	2	3	1	2	0	0	0	0	0	0	2	3	2	1
CO4: Analyze speech signal using homomorphic transformation and LPC.	3	2	3	1	2	0	0	0	0	0	0	2	3	2	1
Course Contribution to POs and PSOs	**3**	**2**	**3**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**2**	**1**

SUBJECT CODE: 22UEC526E	JAVA Programming	Credits: 03
3:T:P -N_L : N_T: N_P		CIEMarks:50
Total Hours/Week:03		SEEMarks:50

UNIT-I	xx Hrs.

Introducing classes, Objects and Methods: Introducing Classes, Class Fundamentals,The General Form of a Class, A Simple Class, Declaring Objects,A Closer Look at new,Assigning Object Reference Variables, Introducing Methods, Adding a Method to the Box Class, Returning a Value, Adding a Method That Takes Parameter , Constructors, Parameterized Constructors, The thisKeyword,Thefinalize( )Method,A StackClass.

A Closer Look at Methods and Classes : Overloading Methods , Overloading Constructors, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion,Introducing Access Control,Understanding static, Introducing final, Arrays Revisited, Introducing Nested and Inner Classes, Exploring the String Class, Using Command-Line Arguments.

UNIT–II	xx Hrs.

Inheritance:Inheritance, Inheritance Basics, Member Access and Inheritance, Example, A Superclass Variable Can Reference a Subclass Object,Using super, Using super to Call Superclass Constructors,A Second Use for super, Creating a Multilevel Hierarchy, When Constructors Are Called, MethodOverriding, Dynamic Method Dispatch, Why Overridden Methods?, Applying Method Overriding. Using Abstract Classes, Using final with Inheritance, Using final to Prevent Overriding, Using final to Prevent Inheritance, The ObjectClass.

Packages and Interfaces: Packages, Defining a Package, Finding Packages and CLASSPATH, A Short Package Example, Access Protection,An Access Example, Importing Packages,Interfaces, Defining an Interface, Implementing Interfaces,Nested Interfaces.

UNIT–III	xx Hrs.

Exception Handling : Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Displaying a Description of an Exception, Multiple catch Clauses , Nested try Statements, throw, throws, finally, Java's Built-in Exceptions , Creating Your Own Exception Subclasses, Using Exceptions .

Multithreaded Programming : The Java Thread Model, Thread Priorities, Synchronization,Messaging,The Thread Class and the Runnable Interface,The Main Thread, Creating a Thread, Implementing Runnable, Extending Thread, Creating Multiple Threads, UsingisAlive( ) and join( ).

UNIT–IV	xx Hrs.

Multithreaded Programming Continuous:Thread Priorities, Interthread Communication, Deadlock, Suspending, Resuming, and Stopping Threads, Suspending, Resuming, and Stopping Threads.

The Applet Class :Two Types of Applets, Applet Basics, The Applet Class, Applet Architecture, An Applet Skeleton, Applet Initialization and Termination, Overridingupdate( ), Simple Applet Display Methods, A Simple Banner Applet, Using the Status Window, The HTML APPLET Tag, Passing Parameters to Applets, getDocumentBase( ) and getCodeBase( ), AppletContext and showDocument( ), The AppletStubInterface .

Reference Books *

1) From Complete Reference, "The Complete Reference" 7th edition publisher Pearson

2) E. Balagururusamy, "Program with JAVA" 4th edition. publisher Pearson

3) Herbert Schildt, Dale Skrien, "Java Fundamentals A Comprehensive Introduction"

McGrawHill.

Course Outcomes**

After completion of the course student will be able to

1. Use fundamentals of class, objects, methods,operators,constructors.
2. Write programs using Inheritance, Superclass, methods overriding, objectclass,final key, Packages & interfaces in java code.
3. Handling Exceptions fundamentals, exception hierarchy ,exceptionJAVA Programming fundamentals & Multithreaded Programming concepts.
4. Establish Inter thread communication , set thread priorities, solve deadlock ,operations of suspend(), resume(), Stop(). Programming for applets

*Books to be listed as per the format with decreasing level of coverage of syllabus
** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	0	0	0	2	1	0	0	0	0	1	2	0	2
CO2	3	2	0	0	0	1	1	0	0	0	0	2	2	0	2
CO3	3	3	0	0	0	1	1	0	0	0	0	3	2	0	2
CO4	3	2		0	0	1	2	0	0	0	0	3	2	0	2

Course Title: Mobile Communications			Course Code: 22UEC528E
Credits: 03	**L-T-P:3-0-0**	**Contact Hours / Week:03**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Elective

Course Objectives:

1. To provide foundational knowledge of **wireless and mobile communication technologies** and introduce different **channel access techniques**.
2. To explore various **telecommunication systems** and provide an overview of **satellite and broadcast systems** that support mobile communications.
3. To study the **network architectures and protocol layers** used in mobile communication systems.
4. To understand the operation of the **mobile network layer and transport layer**, and the principles of **mobility support mechanisms**, including Mobile IP and handover strategies.

A student who successfully completes this course will be able to:

1. **Explain and compare** different **generations of mobile communication systems** and various **channel access techniques** (FDMA, TDMA, CDMA, OFDMA).
2. **Examine telecommunication systems** and **explain the interface** between **satellite communication** and **digital broadcast systems** in mobile environments.
3. **Interpret the architecture and functional layers** of mobile communication networks.
4. **Analyze protocols** at the **network and transport layers**, and evaluate **mobility support mechanisms** including handoff strategies and Mobile IP.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)

Introduction to: Evolution and Deployment of Cellular Telephone Systems, Different generations of wireless cellular networks,1G,2G,2.5G,3G,4G cellular systems and beyond, wireless standard organizations. Wireless transmission: Frequencies for radio communication, signals, antennas, signal propagation. Medium access control: Motivation for specialized MAC, SDMA, FDMA, TDMA, CDMA.

Unit II (10 hours)

Telecommunication systems: GSM, UMTS and IMT2000, 4G LTE networks, 5G networks overview. Satellite systems: History, applications, basics, routing, localization and handover. Broadcast system: Overview, cyclical repetition of data, digital audio broadcasting, and digital video broadcasting.

Unit III (10 hours)

Wireless LAN: IEEE 802.11- system architecture, protocol architecture, physical layer, medium access control layer, MAC management, 802.11b, and 802.11a, HIPERLAN, Bluetooth: user scenarios, architecture, radio layer. Mobile network layer: Mobile IP.

Unit IV (10 hours)

Dynamic host configuration protocol, mobile Ad hoc network. Mobile transport layer: Traditional TCP, classical TCP improvement, TCP over 2.5/3G wireless network, performance enhancing proxies. Support for mobility: world wide web, wireless application protocol.

Textbook:

1. Jochen Schiller, "Mobile Communications", second edition Pearson Education, 2003.
2. Gary J Mullett, "Introduction to wireless telecommunication systems and networks", Cengage learning,2006.

Reference Book:

1. William Stallings, "Wireless Communication and Networks", Pearson Education, 2002.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	O
1.Explain and compare different generations of mobile communications and different channel accessing techniques.	1				3				1	3		2	1		3
2 Examine different telecommunication systems and explain interface between satellite communications, digital broadcast systems	1				3				1	3		2	1		3
3 Interpret different network architectures and layers for mobile system	1				3				1	3		2	1		3
4 Analyze network layer protocol; transport layer protocol and mobility support system	1				3				1	3		2	1		3
Course Contribution to POs and PSOs	1				3				1	3		2	1		3

COURSE CODE: 22UEC528E	Micro Electro Mechanical Systems	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction to MEMS Technology: Basic definitions, history and evolution of MEMS. Feynman's vision, microelectronics and MEMS, microsensors, microactuators and microsystems, Types of MEMS, Applications of MEMS in various disciplines. Commercial MEMS products.
Multiphysics-MultiengineeringaspectsofMEMS:Introductiontodesign,modelingand simulation, optimization, fabrication, reliability and packaging of MEMS.
Scalingissuesinmicrosystems,examplesandnumericalproblemsbasedonscalinglaws.

UNIT–II	10 Hrs.

Design and Working Principles of MEMS: Transduction principles in microdomain- Biomedical sensor & biosensor and DNA sensor, chemical sensor, optical sensor, pressure sensor, thermal sensor. Actuation using thermal force, shape-memory alloy, piezoelectric and electrostatic forces.Mechanical sensors and actuators – beams and cantilevers, accelerometers. Electrostatic sensors and actuators – parallel plate capacitors, comb drive sensor and actuator. Optical MEMS – DLP mirror; construction and working.

UNIT–III	10 Hrs.

Modeling and Simulation of MEMS: Basic modeling elements in mechanical systems, electrical systems, microfluidic systems, thermal systems, magnetic domain and electrostatic systems. Measurement tools in microsystems: AFM, SEM and optical inferometry. Characterizationmethods.SimulationofMEMS:Needforsimulation,FEM,MEMSdesignandrealizationtools– ANSYS/Multiphysics, CoventorWare, COMSOL. AFM as a measurement tool in microsystems. Case Studies: Microcantilever based sensor, electrothermal actuator, electrostatic actuator.

UNIT–IV	10 Hrs.

Microfabrication/Micromachining: Overview of micro fabrication, silicon wafer extraction and cleaning, structural and sacrificial materials in microfabrication, lithography, deposition, doping, etching, Introduction to MEMS fabrication methods like surface, bulk, LIGA and wafer bonding methods.

Reference Books *

1. G.K.Ananthasuresh,K.J.Vinoy,S.Gopalkrishnan,K.N.Bhat,V.K.Atre,"Microand smart systems", Wiley, India, 2010.
2. N.P.Mahalik,"MEMS",TataMcGraw-Hill, 2007.
3. Tai,RanHsu,"MEMSandmicrosystems:designandmanufacture",TMH,2002.
4. James J. Allen, "Micro Electro Mechanical System design", CRCPress, Taylor &FrancisGroup, 2005.
5. ChangLiu,"FoundationsofMEMS",Pearsoneducationinternational,2007.
6. StephenD.Senturia,"Microsystemdesign",SpringerInternationaledition,2001.

Course Outcomes**

After completion of the course student will be able to

1. Comprehend thefundamentalsofMEMSandexposestudentstothebasic scaling lawsas applied to micro domain.
2. Designandunderstandtheworkingprincipleofvariousmicrosensingandactuating devices.
3. Mathematicallymodelandsimulatethevarioustypesofmicro-systems
4. Comprehend the various steps involved inmicrofabricationandmicromachining of microdevices, structures and systems.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1: Fundamentalsof MEMS and expose students to the basic scaling laws asappliedtomicrodomain.	3	3	1	1	0	0	1	0	0	0	2	0	3	3	0
CO2:Thedesignand working principle of variousmicrosensingandactuatingdevices.	3	3	3	3	0	0	2	0	0	0	3	0	3	3	0
CO3: The modeling and simulation of various types ofmicro-systems.	3	2	2	2	3	0	0	0	0	0	3	0	3	3	1
CO4: Microfabrication and micromachining of microdevices, structuresandsystems.	3	2	2	3	0	0	0	0	0	0	3	0	3	3	0

Open Elective Courses

Course Code:	Sensor Technology	Credits: 03
L:T:P - 3 : 0 : 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Sensor Fundamentals: Introduction, Definition, Types, and Sensor Characteristics. **Principles of Sensing**: Capacitive, Magnetic, Inductive, Resistive, Piezoelectric, Piezoresistance, Pyroelectric, Hall effect. **Interfacing Electronic Circuits:** Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, A to D Converters, Bridge Circuits, Data Transmitters, Batteries for low power sensors.	
UNIT–II	**10 Hrs.**
Overview of Sensor Materials: Sensor materials and material properties, Surface Processing of materials for development of Sensors. **Sensor Technologies:** Micro technology**,** Micro-Electro-Mechanical Systems Technology, Nanotechnology **Sensor Applications:** Displacement Sensing, level & Velocity Sensors, Accelerometers, Tactile Sensors, Pressure Sensors, Temperature Sensors, Combdrive Sensors.	
UNIT–III	**10 Hrs.**
Mechanical and Electromechanical sensor: Definition, principle of sensing & transduction, classification. Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity. **Strain gauge:** Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature. **Capacitive sensors:** Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect **Case Study:** Piezoelectric and capacitive pressure sensors, cantilever based DNA sensor, CNT based pressure sensor.	
UNIT–IV	**10 Hrs.**
Microfabrication/Micromachining of sensors: Overview of micro fabrication, silicon wafer extraction and cleaning, structural and sacrificial materials in microfabrication, lithography, deposition, doping, etching, Introduction to MEMS fabrication methods like surface, bulk, LIGA and wafer bonding methods.	

Reference Books *

1. Jacob Fraden, “Handbook of Modern Sensors: Physical Design & Applications”, AIP Press, Springer.
2. D. Patranabis, “Sensors & Transducers”, PHI Publication New Delhi.
3. Frank Vahid, Tony Givargis, “Embedded system Design”,JohnWieley& Sons, Inc, 2002
4. H.K.P. Neubert, “Instrument transducers”,Oxford University press.
5. E.A.Doebelin, “Measurement systems: application &design”,McGraw Hill.
6. Tai, Ran Hsu,”MEMS and microsystems: design and manufacture”, TMH, 2002.

Course Outcomes**

After completion of the course student will be able to

1. Define sensor, demonstrate different sensing principles and various interfacing circuits
2. Identify appropriate sensor materials and technology while designing sensors
3. Comprehend working principle of mechanical, strain gauge and capacitive sensors
4. Comprehend the fabrication of various sensors

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1: Define sensor, demonstrate different sensing principles and various interfacing circuits	3	3	2			2		2		1		2	3	1	3
CO2: Identify appropriate sensor materials and technology while designing sensors	3	1	2			3				1		3	3	2	3
CO3: Comprehend working principle of mechanical, strain gauge and capacitive sensors	3	3	3		2	2			2	1		2	3	2	3
CO4: Comprehend the fabrication of various sensors	3	3	1	2	3	3	3	3		1		3	3	3	3

Wireless Networks and Mobile Network Architecture

Contact hours/week	**: 03**	**Credits**	**: 03**
Total lecture hours	**: 40**	**CIE marks**	**: 50**
Sub. Code	**:**	**SEE marks**	**: 50**

Department : Electronics and Communication Engg.
Designation : Core
Prerequisites : --

Course Objectives

1. To understand the architecture and functioning of wireless and mobile communication systems.
2. To learn protocols and technologies used in mobile and wireless networks.
3. To study mobility management techniques and handoff strategies.
4. To explore emerging trends in LTE, 5G, and mobile IP.

Course outcomes

A student who successfully completes this course should be able to

1. Describe the architecture and functioning of various wireless and cellular networks.
2. Analyze mobile network protocols and their challenges in wireless environments.
3. Explain mobility, handoff mechanisms, and QoS concepts in mobile communication.
4. Evaluate modern wireless technologies such as LTE and 5G.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)
Fundamentals of Wireless and Mobile Networks: Overview of wireless networks: WLAN, WPAN, WMAN, WWAN, Cellular concepts: Frequency reuse, handoff, sectoring, cell splitting, GSM architecture, components, and protocols: TDMA, FDMA, GPRS and EDGE: Evolution and features. (Refer Content Chapter 1, 2, 3 and 4 of T. S. Rapaport)
Modern Wireless Technologies – LTE, 5G, and Beyond: LTE architecture and protocol stack, IMS architecture, VoLTE, and IP multimedia subsystems (Refer Content: LTE Architecture & Protocols: Chapter 9, IMS architecture, VoLTE :Chapter 10)
Unit II (10 hours)
Mobile Network Protocols and Communication Standards :Mobile IP: Agent discovery, registration, tunneling, TCP issues in mobile networks: Indirect TCP, Snooping TCP, Mobile TCP, Wireless Application Protocol (WAP) architecture and protocol stack, CDMA and UMTS architecture Refer: Mobile IP: Chapter 11, TCP: Chapter 10, WAP Protocol Stack: Chapter 11, CDMA and UMTS Architecture: 9
Unit III (10 hours)
Mobility and Resource Management: Handoff techniques: Hard handoff, soft handoff, vertical handoff, Mobility models and location management, Quality of Service (QoS) in mobile and wireless networks, Power control and resource allocation **Reference:** Handoff Techniques: chapter and 10, Mobility Models & LM: Chapter 10, QoS in Mobile Networks: Chapter 10, Power Control & Resource Allocation: Chapter 3 and 12
Unit IV (10 hours)
Modern Wireless Technologies – LTE, 5G, and Beyond: LTE architecture and protocol stack, IMS architecture, VoLTE, and IP multimedia subsystems **(Refer Content: LTE Architecture & Protocols: Chapter 9, IMS architecture, VoLTE :Chapter 10)**

Reference Books

Sl. No	Authors	Title, publisher, edition, year
1	T. S. Rapport	Wireless Communication: Principle and Practice, 2nd Edition, Pearson Education, 2002.
2	William C. Y. Lee	Mobile Cellular Telecommunications, 2nd Edition, McGraw Hill International Editions, 1995.
3	V. K. Garg and J. E. Wilkes	Wireless and Personal Communication systems, Prentice Hall, 1996.

Assignments

• Assignment 1: Write a report on the evolution of wireless technologies from 1G to 5G (min. 5 pages with diagrams).
• Assignment 2: Prepare a comparative chart of GSM, CDMA, UMTS, LTE, and 5G technologies.
• Assignment 3: Perform a detailed case study on how handoff is managed in LTE networks. Submit with flow diagrams.

CO-PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								1		1
CO2	3	3	2	2	2					1		
CO3	3	2	2		2					1		1
CO4	3	2	2		3					2		2

Subject Code: 22UHSXXXC	Quantitative Aptitude and Professional Skills - II	Credits: 02
L:T:P - 2:0:0		**CIE Marks:** 50
Total Hours/Week:26		**SEE Marks:** 50

Course Objectives:

1. To develop and augment written English language vocabulary and comprehension skills
2. To augment the ability to understand and analyse a problem and find its solution through analysis of data given
3. To fine-tune the quantitative analysis and problem-solving skills

UNIT-I	**07 Hrs.**
Numbers, Proportion& Finance: Number System, Factors & Multiples, Unit digit, Trailing zeros, LCM & HCF, Percentages, Profit & Loss, Discount, Interest:- Simple interest & Compound Interest, Ratio & Proportion-Variation, Partnership Mixture & Allegation, The God of Math – Linear Equation- Problems on age, coin, tow digit number	
UNIT–II	**06 Hrs.**
Average, Time, Speed & Distance, Time & Work: Average, Time Speed, & Distance, Problems on train, Boat & Stream, Races & Tracks,Time & Work, Pipe & cistern, **Permutation & combination, Probability:** Permutations & Combinations, Probability, Mensuration	
UNIT–III	**07 Hrs.**
Logical reasoning:- Clocks and Calendars, Cryptarithmetic, Blood Relations, Direction Tests, **Data Interpretation, Data Sufficiency:** DI & syllogism, Venn diagram **Analytical, and Visual Reasoning:** Coding Decoding, Visual Reasoning, Cube cuboid & Dice Related problems, Analytical Puzzles, Arrangement & Classification Puzzles, Non-verbal reasoning,	
UNIT–IV	**06 Hrs.**
Vocabulary Development: Vocabulary Building Techniques, Root Words, Antonyms & Synonyms, Sentence Completion, Error Detection & Correction, Reading Comprehension **Communication Skills, Interview Preparation, resume building**	

Reference Books:

1. R. S. Aggarwal, “A Modern Approach to Verbal and Non – Verbal Reasoning”, Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, “Quantitative Aptitude”, Sultan Chand and Sons, New Delhi, 2018
3. Chopra, “Verbal and Non – Verbal Reasoning”, MacMillan India
4. M Tyra, “Magical Book on Quicker Maths”, BSC Publications, 2018
5. George J Summers, “The Great Book of Puzzles & Teasers”, Jaico Publishing House, 1989
6. Shakuntala Devi , “Puzzles to Puzzle You”, Orient Paper Backs, New Delhi, 1976
7. R. S. Aggarwal, “A Modern Approach to Logical Reasoning”, Sultan Chand and Sons, New Delhi, 2018
8. Cambridge Advanced Learner’s Dictionary, Cambridge University Press.
9. Kaplan’s GRE guide

Course Outcomes (COs):

After active participation in this course, the student will be able to:

CO1: Enhance vocabulary and apply techniques to further improve it.
CO2: Apply effective strategies to improve verbal ability**.**
CO3: Analyze given problems step by step and develop systematic methods for solving them.
CO4: Strengthen and apply skills in solving quantitative problems.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		1							2	3		1
CO2		1							2	3		
CO3		2	2	3								1
CO4		1		2							2	1

Course Code: 22UBTXXXC	Environmental Studies	01 - Credits (1: 0 : 0)
Hours / Week : 01		CIE Marks : 50
Total Hours : 15		SEE Marks : 50

UNIT – 1	04 Hrs.

Natural Resources:

Human activities and their impacts. Environmental Impact Assessment, **Renewable Energy**: Solar energy, Wind energy, Hydropower, Tidal energy, Ocean thermal energy, Geo thermal energy, Biomass energy, Biogas, Biodiesel, Bioethanol, Hydrogen as fuel.

Non renewable Energy: Coal, Petroleum, Natural gas, Nuclear energy.

UNIT – 2	04 Hrs.

Environmental Pollution:

Water pollution, water quality standards, water borne diseases, Fluoride problem, Air pollution, Noise pollution. Effect of electromagnetic waves.

Sustainable future: Concept of sustainable development, threats to sustainability, strategies for sustainable development. Environment economics – concept of green building, Circular Economy.

UNIT – 3	03 Hrs.

Current Environmental Issues of concern:

Greenhouse Effect- Greenhouse gases and Global Warming, Climate change, ozone layer depletion, Acid rain, Eutrophication

Environmental policy legislation rules & regulations

UNIT – 4	04Hrs.

Fundamentals of Waste management:

Solid waste management: Sources, classification, characteristics, collection & transportation, disposal, and processing methods. Hazardous waste management and handling.

Concept of waste water treatment, Bioremediation.

Industrial waste management (Case studies: Cement, plastic, chemical, E–waste, food & construction industry waste management).

REFERENCES

1. Benny Joseph "Environmental Studies" Tata McGraw Hill, 2005
2. Dr. D. L. Manjunath, "Environmental Studies" Pearson Education, 2006
3. Koushik and Koushik "Environmental Science & Engineering" New Age International Publishers, New Delhi, 2006
4. Meenakshi "Environmental Science & Engineering" Pranticce Hall of India, 2006

COURSE OUTCOMES

After completion of the course the students shall be able to,

1. Identify natural resources and its uses.
2. Understand pollution and its effects on environment and to implement sustainable future in the work place.
3. Analyze current environmental issues.
4. Apply the waste management techniques in various fields.

Course Outcomes	Program Outcomes												Program Specified Outcomes		
	1	2	3	4	5	6	7	8	9	10	11		1	2	3
CO 1	**2**		**2**			**3**					**3**		**3**		**3**
CO 2	**2**		**2**			**3**					**3**		**3**		**3**

CO 3	**2**		**2**			**3**					**3**		**3**		**3**
CO 4	**2**		**2**			**3**					**3**		**3**		**3**

Question Paper Pattern for SEE:

Question is of Objective type
Duration of exam is 1 hour
50 questions covering all the four units. Each question carries one mark.

SUBJECTCODE: 22UEC523L	Computer Networks Laboratory	Credits: 1
L:T:P-0 : 0 :2		CIE Marks:50
TotalHours/Week: 02		SEE Marks: 50

Sl.No.	LISTOFEXPERIMENTS
1.	Studyofdifferenttypesofnetworkcablesandpracticallyimplementthecross-wired cable and straight through cable using clamping tool
2.	Study of networkcomponents/devices:i)NICii)Hubiii)Switch
3.	ConnectingcomputersonLocalAreaNetwork(LAN)
4.	Studyofpackettracer
5.	Configurationofdifferentnetworktopologiesusingpackettracer
6.	ConfigurationofswitchandestablishingLANusingpackettracer
7.	CreationofVirtualLAN(VLAN)usingpackettracer
8.	ConfigurationOfBasicRoutingUsingPacketTracer
9.	ConfigurationofanetworkusingRoutingInformationProtocol(RIP)usingpacket Tracer
10.	ConfigurationofanetworkusingOpenShortestpathFirst(OSPF)usingpackettracer
11.	ConfigurationofDHCPusingpackettracer
12.	ConfigurationofNATusingCISCOpackettracer

CourseOutcomes**

Aftercompletionofthecoursestudentwillbeableto

1. ToApplytheconceptsofDataCommunicationandNetworking
2. TodoInternetworking&devices
3. ToDevelopNewRoutingtechniques
4. PracticallyKnowTheFunctionalityofdevicesusingRIP,OSPF,DHCP,andNAT

***Bookstobelistedaspertheformatwithdecreasinglevelofcoverageofsyllabus**

****Each COtobewrittenwithproperactionwordandshouldbeassessableandquantifiable**

CourseOutcomes	ProgrammeOutcomes(POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3

Course Code: 22UEC524L	Digital Signal Processing Laboratory	Credits: 01
L:T:P - 0 : 0 : 2		CIE Marks:50
Total Hours/Week: 02		SEE Marks:50

List of Experiments

Sl. No	Title of the Experiment
1	Generation of different analog and digital signals (impulse, step, ramp, sine, cosine, square, rectangular and triangular) with given amplitude, frequency, phase and duration.
2	Verification of sampling theorem.
3	Implementation of amplitude scaling, time scaling, time reversal and time shift operations on given continuous time and discrete time signal.
4	Response of continuous time and discrete time LTI systems to a given input.
5	Fourier series of given continuous time and discrete time periodic signals.
6	Fourier transform of given continuous time and discrete time aperiodic signals.
7	N point DFT of a given sequence of length L when (a) N < L (b) N = L and (c) N > L, corresponding IDFT and analysis of the result.
8	Verification of time shift, conjugate symmetry and convolution property of DFT.
9	Implementation of linear convolution and circular convolution using DFT and IDFT.
10	Design and frequency response analysis of IIR filter to meet given specifications using different S $\longrightarrow$ Z transformation techniques.
11	Design and frequency response analysis of FIR filter to meet given specifications using different windows.
12	Implementation of linear and circular convolution using DSP processor.

Course Outcomes

After completion of the course students will be able to

1. Analyze algorithms implemented to generate different functions of time and frequency.
2. Analyze algorithms implemented to perform various operations on signal.
3. Design, implement and analyze IIR and FIR filters to meet given specifications.
4. Implement and analyze convolution algorithms implemented using DSP processor.

Course Articulation Matrix

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1. Analyze algorithms implemented to generate different functions of time and frequency.	3	3	3	2	3	0	0	0	0	0	2	3	1	0
CO2. Analyze algorithms implemented to perform various operations on signal.	3	3	3	2	3	0	0	0	0	0	2	3	1	0
CO3. Design, implement and analyze IIR and FIR filters to meet given specifications.	3	3	3	2	3	0	0	0	0	0	2	3	1	0
CO4. Implement and analyze convolution algorithms implemented using DSP processor.	3	3	3	2	3	0	0	0	0	0	2	3	1	0
Course Contribution to POs and PSOs	**3**	**3**	**3**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**1**	**0**

Rubrics for Mini-project in BE Program

Semester V
Code: 22UEC525P

Rubrics for	Phase	Period (Duration)	Rubric#	Marks	Evaluation by
CIE	Evaluation -I	Within ONE MONTH from the start of 5th /6th semester of BE Program	R1	15	Committee consisting of HoD/ Nominee + Coordinator + Guide(s)
	Review	Before 15 days from the end of 5th /6th semester of BE Program	R2	15	
	Evaluation by guide	Before one week from the end of 5th /6th semester of BE Program	R3	20	Guide(s)
SEE	Semester End Examination	During SEE of 5th /6th semester of BE Program	R4	50	External + Internal Examiners

R1: Rubrics to evaluate mini-project in the beginning of semester: Within ONE MONTH from the start of 6th semester BE

Evaluation Criteria	Needs improvements (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Very good) (5)	Total marks	Evaluated by
Articulate problem statements and identify objectives	• Problem statement and objectives are not clear	• Problem statement isclear and objectives arenotinline with problem statement	• Problem statement is clear and objectives are not completely defined.	• Problem statement is clear and objectives are completely defined	15	Committee consisting of (s), HoD, Mini-project coordinator and guide Each will evaluate for 15 marks and average of all the
Identify existing processes/ solution methods for solving the problem, including forming justified approximations and assumptions	• Not able to identify existing solution for solving the problem. The assumptions, approximations and justifications are identified butnot clear	• Not able to identify existing solution for solving the problem. But assumptions and approximations are aligned to the objectives.	• Able to identify existing solution for solving the problem. Assumptions, and approximations are clear	• Able to identify existing solution for solving the problem. and assumptions, approximations and justifications are clear		

Compare and contrast alternative solution processesto select thebest process-	• Not able to compare alternative solution processes	• Able to compare alternative solution processes but could not contrast clearly	• Able to compare alternative solution processes and contrast clearly but not able to select best process	• Able to compare alternative solution processes, contrast it and also able to select best process		three is the marks awarded

R2: Rubrics to review mini-project: Before 15 days from the end of 6th semester of B.E.

Evaluation Criteria	Needs improvements (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Very good) (5)	Total marks	Evaluated by
Apply formal idea generation tools to develop multiple engineering design solutions and Identify suitable criteria for evaluation of alternate design solutions	• Able to identify but not able to use it effectively • Abletoidentify criteria but not abletousethem	• Abletousethe tool but not abletogenerate engineering designs • Able to use criteria but not able to compare alternatives	• Able to generate engineering designs but not able to justify • Not able to justify the comparison with criteria	• Able to generate engineering designs with justification • Able to justify the comparison with criteria	15	Committee consisting of (s), HoD, Mini-project coordinator and guide Each will evaluate for 15 marks and average of all the three is the marks awarded
Apply formal decision-making tools to select optimal engineering design solutions for further development	• Able to identify but not able to choose optimum one	• Able to identify optimum onebut notabletouseit	• Able to use optimum one but not able to justify	• Able to use optimum one with justification		
Build models/ prototypes to develop diverse set of design solutions and develop drawings	• Able to choose the tool but not able to use it effectively	• Able to use the tool but not able to generate alternatives	• Abletogenerate alternatives butnotableto justifythebest solution	• Able to generate and justify the best solution		

R3: Rubrics for evaluation by the guide(s): Before one week from the end of 6th semester of B.E.

Evaluation Criteria	Score/Marks				Total Marks	Evaluated by
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Identify engineering systems, variables, and parameters	• Engineering systems are identified but not clear. Variables, and parameters to solve the problems are not defined	• Engineering systems are clear. Variables, and parameters to solve the problems are not defined	• Engineering systems are identified. Variables, and parameters to solve the problems are partially defined	• Engineering systems are identified. Variables, and parameters to solve the problems are completely defined		

to solve the problems						
Technical Knowledge and Awareness related to the Project	• Poor knowledge and no awareness related to project	• Lacks sufficient knowledge and Awareness	• Fair knowledge and awareness related to the project	• Extensive knowledge and awareness related to the project	20	Guide(s)
Regularity and Attendance	• Irregular and inconsistent in work	• Reports to the guide but lacks consistency	• Reports to the guide very often but not very consistent	• Reports to the guide regularly and consistent in work		
Read, understandand interpret technical and non-technical information	• Able to identify non-technical information	• Able to read technical and non-technical information, but could not understand and interpret	• Able to read, understand technical and non-technical information, but could not interpret	• Able to read, understand and interpret technical and non-technical information		

R4: Rubrics for SEE evaluation

Evaluation Criteria	Very poor (2)	Poor (4)	Average (6)	Good (8)	Very good (10)	Total marks	Evaluated by
Generate information through appropriate tests to improve or revise design	• Not able to identify suitable teststobedone	• Abletoidentify butnotableto follow testing procedure	• Able to follow testing procedures but not able to collect information	• Able to collect information but not able to apply it for improvement	• Able to apply information for the improvement		
Use appropriate procedures, tools and techniques to conduct experiments and collect data	• Not able to identify tools, techniques and procedures	• Abletoidentify but notable to conduct experiments	• Able to conduct experiments but not able to follow procedure	• Able to follow procedure but not able to collect data	• Able to collect dataasperthe standards		
Analyze data for trendsand correlations,stating possibleerrorsand limitations	• Not able to understand data	• Able to understand but not able to analyze data	• Able to analyze data but not able to correlate them	• Able to correlate but not able to identify errors and limitations	• Able to identify errors and limitations	50	External + Internal Examiners

Deliver effective oral presentations to technical and non-technical audiences	• Could not deliver effective presentations.	• Could not deliver presentation, but presentation was prepared and attempted.	• Able to deliver fair presentation but not able to answer to the audiences	• Deliver effective presentations but able to answer partially to the audience queries.	• Deliver effective presentation and able to answer all queries of the audience.		
Present resultsas a team, with smooth integration of contributions from all individualefforts	• No Contribution from an individual to a team	• Contributions from an individual to a team is minimal	• Contributions from an individual to a team is moderate	• A contribution from an individual to a team is good but not well groomed in team.	• Contribution from an individual to a team is good and results in an integrated team presentation.		

Course Code:	**YOGA** **(Common to All Branches)**	Credit :	00
Hours/Week : (L:T:P:S) : 0:0:2:0		CIE Marks :	100
Total Hours Per Semester : 26hrs		SEE Marks :	00

Semester V	
Patanjali'sAshtanga Yoga its need andimportance.	
Ashtanga Yoga1.Asana2.Pranayama3.Pratyahara	
Asana its meaning by name, technique, precautionary measures and benefits of each asana	
Different types of Asanas	
Sitting	1.Ardha Ushtrasana 2.Vakrasana 3.Yogamudr a in Padmasana
Standing	1.UrdhvaHastothanasana 2.Hastapadasa 3.ParivrittaTrikonasana 4.Utkatasana
Prone line	1.Padangushtha Dhanurasana 2.Poorna Bhujangasana/ Rajakapotasan
Supine line	1.Sarvangasana 2.Chakraasan 3.Navasana/Noukasana 4.Pavanamuktasana
Revisi on of practice 60 strokes/min 3 rounds	
Meaning by name, technique, precautionary measures and benefits of each Pranayama	
1	Ujayi
2	Sheetali
3	Sheektari

Course Code: BHSB560M	National Service Scheme (NSS) (COMMON TO ALL BRANCHES)	Credit : 00
Hours/Week (L:T:P:S) : 0:0:2:0		CIE Marks : 100
Total Hours Per Semester : 26		SEE Marks : 00

Course objectives:

National Service Scheme(NSS)will enable the students to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem–solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their. Knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gains kills In mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters &practice national integration and social harmony in general.

General Instructions-Pedagogy:

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students'theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning home work, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS)–Contents

1. Organic farming ,Indian Agriculture(Past,Present and Future) Connectivity for marketing.
2. Waste management–Public, Private and Govtorganization,5R's.
3. Settingoftheinformationimpartingclubforwomenleadingtocontributioninso cialandeconomicissues.
4. Waterconservationtechniques–Roleofdifferentstakeholders–Implementation.
5. Preparinganactionablebusinessproposalforenhancingthevillageincomeandapp roachforimplementation.
6. Helpinglocalschoolstoachievegoodresultsandenhancetheirenrolmentin Higher/ technical vocation.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. ContributiontoanynationallevelinitiativeofGovernmentofIndia.Foreg.DigitalIndia, SkillIndia,SwatchBharat, Atma nirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9. Spreadingpublicawarenessunderruraloutreachprograms.(minimum5programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integrationandsocial harmonyevents/workshops/seminars.(Minimum02programs).
13. Govt.schoolRejuvenationandhelpingthemtoachieve goodinfrastructure.
14. NOTE:

15. Student/s in individual or in agroup Should select any one activity in the beginning of each semester till end of thatrespective semester for successful completion as per the instructions of NSS officer with the consent of HOD of thedepartment.
16. Attheendofevery semester,activityreportshouldbesubmittedforevaluation.

Distribution of Activities – Semester wise from 3rd to 6th semester

Sem	Topics/Activities to be Covered
3rdSemfor 25Marks	1. Organic farming,Indian Agriculture (Past,PresentandFuture)Connectivity formarketing. 2. Waste management–Public, Private and Govtorganization,5R's. 3. Setting of the in formation imparting club for women leading to contributionin social and economic issues.
4thSemfor 25Marks	4. Water conservationtechniques –Role of different take holders–Implementation. 5. Preparinganaction ablebusinessproposal for enhancing the village in come and approach for implementation. 6. HelpinglocalschoolstoachievegoodresultsandenhancetheirenrolmentinHigher/ technical/vocationaleducation.
5thSemfor25Marks	7. Developing Sustainable Water management system forruralareas and implementationapproaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, SkillIndia,Swachh Bharat, Atmanirbhar Bharath, MakeinIndia,Mudrascheme,Skilldevelopmentprogramsetc. 9. Spreading publicawareness underruraloutreachprograms.(minimum5programs). 10. Social connect and responsibilities.
6thSemfor 25Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize Nation alintegration and social harmonyevents/workshops/seminars.(Minimum02programs). 13. Govt.school Rejuvenation and helping them to achieve good infrastructure.

Pedagogy–Guidelines,itmaydifferdependingonlocalresourcesavailableforthestudyaswellas environmentand climaticdifferences,locationand timeof execution.

SINo	Topic	Groups ize	Location	Activityexecution	Reporting	EvaluationOftheTopic
1.	Organicfarming,Indian Agriculture (Past,Present and Future)Connectivity formarketing.	May beindividual orteam	Farmers land/Villages/roadside /communityarea/ Collegecampusetc…..	Siteselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
2.	Waste management– Public,PrivateandGovtorganization,5 R's.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Siteselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
3.	Setting of theinformation impartingclub forwomenleadingtocontributioninsocial andeconomicissues.	May beindividual orteam	Women empowermentgroups/ ConsultingNGOs & Govt Teams /Collegecampusetc…..	Groupselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
4.	Water conservationtechniques – Role ofdifferentstakeholders–Implementation.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	siteselection /properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
5.	Preparinganactionablebusiness proposal forenhancing the villageincome and approachforimplementation.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Groupselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer

6.	Helpinglocalschoolstoachievegoodresultsand enhance theirenrolmentin Higher/ technical/vocationaleducation.	May beindividual orteam	Local government /private/ aidedschools/Government Schemesofficers/ etc…..	Schoolselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
7.	Developing SustainableWater managementsystem for rural areasand implementationapproaches.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	siteselection/propersonsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
8.	Contribution to anynational level initiativeofGovernment ofIndia.For eg. Digital India,Skill India, SwachhBharat, AtmanirbharBharath, Make inIndia,Mudraschem e,Skill developmentprogram setc.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Groupselection/properconsultation/Continuous monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
9.	Spreading publicawareness under ruraloutreachprograms.(minimum5programs).////Socialconnect andresponsibilities.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Groupselection/properconsultation/Continuous monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
10.	Plantationandadoptionof plants. Know yourplants.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Placeselection/properconsultation/Continuous monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer

11.	Organize Nationalintegrationa ndsocialharmonyeve nts /workshops /seminars.(Minimum0 2 programs).	May beindivid ual orteam	Villages/CityAreas/G rama panchayat/publicassoci ations/GovernmentSche mesofficers/ campusetc…..	Placeselection/proper consultation/Continuou s monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedev aluationauthorit y	Evaluation asper the rubricsOf scheme andsyllabusbyNS Sofficer
12.	Govt. schoolRejuvenati on andhelping them toachievegoodinf rastructure.	May beindivid ual orteam	Villages/CityAreas/G rama panchayat/publicassoci ations/GovernmentSche mesofficers/ campusetc…..	Placeselection/proper consultation/Continuou s monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedev aluationauthorit y	Evaluation asper the rubricsOf scheme andsyllabusbyNS Sofficer

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	PracticeSessionDescription
1	LecturesessionbyNSSOfficer
2	StudentsPresentation onTopics
3	Presentation- 1,Selectionoftopic,PHASE-1
4	Commencementofactivityanditsprogress-PHASE- 2
5	Executionof Activity
6	ExecutionofActivity
7	ExecutionofActivity
8	ExecutionofActivity
9	ExecutionofActivity
10	CasestudybasedAssessment,Individualperformance
11	Sectorwise study anditsconsolidation
12	Videobasedseminarfor10minutes byeachstudent Attheendofsemesterwith Report.

- Ineverysemester from3rdsemesterto6thsemester,Eachstudentshoulddoactivitiesaccordingtothescheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for theassignedactivityprogress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiledreportshould be submitted as per theinstructions.

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

CO1:	Recognize and understand their roles and responsibilities towards society for its betterment.
CO2:	Analyze environmental and societal issues and design effective and sustainable solutions
CO3:	Assess existing systems critically and propose practical, innovative solutions to promote sustainable development
CO4:	Plan and implement government-led or self-initiated projects efficiently for community and societal welfare
CO5:	Develop the ability to respond to emergencies and natural disasters, while fostering national integration, social harmony, and unity.

AssessmentDetails forCIE(bothCIE andSEE)

Weightage	**CIE– 100%**	• Implementationstrategiesoftheproject(NSSwork). • The last report should be signed byNSSOfficer,theHODandprincipal. • Atlastreportshould beevaluated bytheNSSofficer ofthe institute. • Finallytheconsolidatedmarkssheetshouldbesent to the university and also to be madeavailableat LICvisit.
Presentation -1 Selectionoftopic,PHASE-1	10Marks	
Commencementofactivityand itsprogress-PHASE-2	10Marks	
Casestudybased Assessment Individualperformance	10Marks	
Sectorwisestudyand itsconsolidation	10Marks	
Videobasedseminarfor10minutesbyeach studentAttheendofsemesterwithReport.	10Marks	
Totalmarksforthecourseineachsemester	**50Marks**	

Marksscoredfor50bythestudentsshouldbeScaledownto25marksIneachsemester for CIEentryintheVTUportal.

25marksCIEentry will beenteredinUniversity IAmarksportalattheendofeachsemester3rdto6th sem,Reportandassessmentcopyshouldbe madeavailableinthedepartmentsemesterwise.

Studentsshouldpresenttheprogressoftheactivitiesasperthescheduleintheprescribedpracticalsessioninthefield.Thereshouldbepositive progressinthevertical order for thebenefitof societyingeneral.

Suggested Learning Resources:

Books:

1. **NSS CourseManual,** PublishedbyNSSCell,VTUBelagavi.
2. GovernmentofKarnataka,NSS cell,activitiesreportsanditsmanual.
3. GovernmentofIndia,nsscell,Activitiesreportsanditsmanual.

CO-PO Mapping

	Course Code : BHSC560M **Hours/Week (L:T:P:S) :** 0:0:2:1 **Total Hours Per Semester :** 26hrs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	PHYSICAL EDUCATION AND SPORTS (PE) **(Common to All Branches)**										**Credits : 1** **CIE Marks : 100** **SEE Marks : 00**					
No	Programme Outcomes Course Outcomes															
After successful completion of the course the students will be able to:																
1	Recognize and understand their roles and responsibilities towards society for its betterment.	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-
2	Analyze environmental and societal issues and design effective and sustainable solutions	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-
3	Assess existing systems critically and propose practical, innovative solutions to promote sustainable development	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-
4	Plan and implement government-led or self-initiated projects efficiently for community and societal welfare	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-
5	Develop the ability to respond to emergencies and natural disasters, while fostering national integration, social harmony, and unity.	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-

Course Outcomes: At the end of the course, the student will be able to	
1.	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2.	Familiarization of health- related Exercises, Sports for overall growth and development
3.	Create a foundation for the professionals in Physical Education and Sports
4.	Participate in the competition at regional/state/national/international levels.
5.	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
6.	Understand and practice of Traditional Games

Module I: Orientation	**4Hours**
A.	Lifestyle

B.	Health & Wellness
C.	Pre-Fitness test.
Module II: General Fitness & Components of Fitness	**4Hours**
A. Warming up (Free Handexercises)	
B. Strength–Push-up/ Pull-ups	
C. Speed–30Mtr Dash	
Module III: Specific games (Any one to be selected by the student)	**16Hours**
1. Kabaddi–Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.	
2. Kho-Kho–GivingKho,Single Chain,Pole dive,Pole turning,3-6Up.	
Module IV: Orientation	**4Hours**
A.	Postural deformities.
B.	Stress management
Module V : Specific Games (Any one to be selected by the student)	**16Hours**
A.	Throw ball
B.	Table Tennis
C.	Athletics (Field Events-Jumps)–Any event as per availability of Ground.
Module VI: Aerobics	**4 Hours**

Scheme and Assessment for auditing the course and Grades:

Sl.No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes–2,each of 15marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

Course Outcomes:
1.Identify and Understand common postural deformities and apply stress management techniques in the context of sports and athletics
2.Participate Confidently in competitions at regional, state, national, and international levels
3.Demonstrate Proficiency in specific games and athletic jumping events through regular practice and skill development.
4.Understand and Perform various Aerobic exercises for fitness and endurance enhancement.
5.Acquire Skills and Practice specific games and athletic throwing events with proper techniques and strategies

Module I: Ethics and Moral Values	**4Hours**
A.	Ethics in Sports
B.	Moral Values in Sports and Games
Module II: Specific Games (Any one to be selected by the student)	**16Hours**
A.	Volley ball–Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
B.	Athletics (TrackEvents) –Any event as per availability of Ground
Module III: Role of Organisation and administration	**4Hours**

		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

No	Programme Outcomes / Course Outcomes															
After successful completion of the course the students will be able to:																
1	**Identify and Understand** common postural deformities and apply stress management techniques in the context of sports and athletics	-	-	1	-	-	1	1	-	-	-	-	1			
2	**Participate Confidently** in competitions at regional, state, national, and international levels	-	-	1	-	-	1	1	-	-	-	-	1			
3	**Demonstrate Proficiency** in specific games and athletic jumping events through regular practice and skill development.	-	-	1	-	-	1	1	-	-	-	-	1			
4	**Understand and Perform** various Aerobic exercises for fitness and endurance enhancement.	-	-	1	-	-	1	1	-	-	-	-	1			
5	**Acquire Skills and Practice** specific games and athletic throwing events with proper techniques and strategies	-	-	1	-	-	1	1	-	-	-	-	1			

6th Semester Syllabus

Course Code: 22UEC620C	Digital Communication	Credits: 03
L:T:P - N_L : N_T: N_P		CIEMarks:50
Total Hours/Week: 40		SEEMarks:50

UNIT-I	10 Hrs.
Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM. Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability. Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams of Transmitter and Receiver, Probability of error performance measures of BPSK,ASK,BFSK system	
UNIT–II	**10 Hrs.**
Signaling Communication through Band Limited AWGN Channels: Signalling over AWGN Channels-Introduction, Geometric representation of signals, Gram- Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel (without statistical characterization), Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver. Linear Equalization,Decision feedback equalization.	
UNIT–III	**10 Hrs.**
Fading Channel I: Characterization and Signaling: Characterization of Fading Multipath Channels, the effect of signal Characteristics on the choice of channel model, Frequency, -Nonselective, slowly fading channel, Diversity Techniques for fading Multipath Channels, The Rake Demodulator.	
UNIT–IV	**10 Hrs.**
Spread Spectrum Signals for Digital Communication: Model of Spread Spectrum Digital Communication system, Direct Sequence Spread Spectrum signal, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA system, Spread Spectrum applications.	

Reference Books *

1. Simon Haykin, “Digital Communication Systems”, John Wiley & sons, First Edition, 2014, ISBN 978-0- 471-64735-5.
2. John G Proakis and Masoud Salehi, “Fundamentals of Communication Systems”, 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.

Course Outcomes**

After completion of the course student will be able to

1. **Analyze and compute performance of digital modulation techniques like BPSK, QPSK, M-ary schemes.**
2. **Apply signal space concepts to model and optimize communication through AWGN channels.**
3. **Demonstrate understanding of fading channels and diversity techniques such as RAKE receivers.**
4. **Describe and evaluate spread spectrum and CDMA systems in digital communication applications.**

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Pso3

CO1	3	2	2	1	2	2	3	2	2	2	3	1	1
CO2	3	2	2	1	2	2	3	2	2	2	3	1	1
CO3	3	2	2	1	2	2	3	2	2	2	3	1	1
CO4	3	2	2	1	2	2	3	2	2	2	3	1	1

SUBJECTCODE: 22UEC621C	CMOS Digital VLSI Design	Credits:03
L:T:P –3-0-0		CIEMarks:50
TotalHours/Week:03		SEEMarks:50

UNIT-I	10 Hrs.

Introduction: A Brief History, Preview, MOS Transistors, CMOS Logic, CMOS Fabrication and Layout, Design Partitioning. **MOS Transistor Theory:** Introduction, Long- Channel I-V Characteristics,C-VCharacteristics(simpleMOScapacitancemodels),NonidealI-VEffects,DC Transfer Characteristics. **CMOS Processing Technology:** Introduction, CMOS Technologies.

UNIT–II	10 Hrs.

Delay: Introduction, Transient Response, RC Delay Model, Linear Delay Model (Logical effort, parasitic delay, delay in logic gate, drive), Logical Effort of Paths, **Power:** Introduction, Dynamic Power, Static Power.

UNIT–III	10 Hrs.

Interconnect: Introduction (wire Geometry), Interconnect Modeling, Interconnect Impact (Delay, Energy, Cross talk). **Combinational Circuit Design:** Introduction, Circuit families, Silicon-On-InsulatorCircuitDesign.

UNIT–IV	10 Hrs.

Sequential Circuit Design: Introduction, Circuit Design of Latches and Flip Flops (conventional CMOS latches, conventional CMOS flip flops, pulsed latches, resettable latches and flip flops, enabled latches and flipflops, incorporating logic into latches, dual edge triggered flipflops. **Array Subsystems:** Introduction, SRAM (SRAM cells, ROW circuitry, column circuitry),Read-Only Memory, Serial Access Memories, Content Addressable Memory, Programmable Logic Arrays.

Reference Books*

Text Book:

1. NeilH.E.Weste, David Harris “CMOS VLSI Design A Circuits and Systems Perspective” Pearson Education Publisher, FourthEdition,2015.

Reference Books:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic “Digital Integrated Circuits A Design Perspective” Pearson Education Publisher, Second Edition.2010.
2. John P Uyemura “Introduction to VLSI Circuits and Systems” Wiley Publication 2002.
3. R. Jcob Baker, Harry W. Li and David E Boyce “CMOS Circuit Design, Layout, and Simulation”

Course Outcomes**

After completion of the course, the student will be able to:

1. Draw the layout of CMOS circuits; apply the knowledge of fabrication processes and MOSFET transistors in VLSI design.
2. Draw RC equivalent circuit of CMOS circuits and estimate delay and power.
3. Model & design of interconnects in chips, design of combinational circuits.
4. Design basic buildings of sequential and memory blocks using MOSFET transistors.

Course Outcomes	Programme Outcomes(POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	0	0	0	0	0	0	0	0	0	3	1	0
CO2	3	3	3	0	0	0	0	0	0	0	0	0	3	2	0
CO3	3	3	3	0	0	0	0	0	0	0	0	0	3	2	0
CO4	3	3	3	0	0	0	0	0	0	0	0	0	3	2	0

Course Code: 22UEC622C	Microwave and Antenna Theory	Credits: 03
L:T:P - 3 :0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.

Introduction to microwaves: Microwave frequencies, IEEE microwave frequency bands. **Microwave transmission lines and rectangular waveguides**: Introduction, transmission line equations, characteristic and input impedances, reflection and transmission coefficients, standing wave and SWR. Introduction to rectangular waveguides, TE and TM modes in rectangular waveguides.

Microwave vacuum tube device: Introduction, reflex klystron oscillator (mechanism of oscillation, mode of oscillation, power output and efficiency, mode curve), two cavity klystron amplifier (mechanism of operation).

UNIT–II	10 Hrs.

Microwave network theory and passive devices: Introduction, S-matrix representation of multiport network, properties of S-matrix, matched terminations, rectangular to circular waveguide transition, attenuators, precision phase shifter, waveguide tees, E-plane tee, H-plane tee, magictee, applications of magic tee, faraday rotation isolator, four-port circulator, 2-hole directional coupler.

Microwave application: Microwave radar systems (radar equation, pulsed radar, CW doppler radar, FMCW radar).

UNIT–III	10 Hrs.

Fundamental Parameters of Antennas: Introduction, radiation pattern, radiation power density, radiation intensity, beam width, directivity, antenna efficiency, gain, beam efficiency, bandwidth, polarization, effective height, input impedance, antenna radiation efficiency, maximum directivity and maximum effective area, Friis transmission equation.

Antenna arrays: Array of two point sources, broad side array, end fire array, n-isotropic array, pattern multiplication. binomial and Chebyshev arrays, phased array.

UNIT–IV	10 Hrs.

Antenna Aperture: aperture concept, types of aperture, maximum effective aperture of short dipole and half wave dipole.

Antenna practice: Yagi-Uda antenna, turnstile antenna, log periodic antenna, helical antenna, rhombic antenna, horn antenna, parabolic reflector antennas, micro strip antenna and their feed systems.

Reference Books *

1. AnnapurnaDas,SisirK.Das,"MicrowaveEngineering",TMH,2nd Ed,NewDelhi,2009.
2. SamuelY.Liao,"MicrowaveDevicesandCircuits",PearsonEducation,3rd Ed,NewDelhi, 2003.
3. JohnD.Krauss,RonaldJ.Marhefka,AhmadSKhan,"AntennasandWave Propagation", McGrawHill, 5thEd, NewDelhi, 2017.
4. ConstantineA.Balanis,"AntennaTheory:AnalysisandDesign",JohnWiley,4thEd, New Delhi, 2016
5. K.D.Prasad,"Antenna& Wave Propogation",Satyaprakshan,5th Ed,NewDelhi2009.
7. P.E.Collins,"AntennasandRadioPropagation",McGraw-Hill,NewDelhi,1985

Course Outcomes**

After completion of the course student will be able to

1. Acquire the knowledge of transmission line theory, rectangular waveguides and describe microwave vacuum tube device.
2. Analyze microwave passive devices with scattering parameters, and apply microwave application in radar systems.

3	Compute basic antenna parameters using radiation patterns, analyzeand design antenna arrays.
4	Analyze The Importance Of Antenna Aperture, explain the working principle of different antennas and their usage in real time field.

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1	3	2	1	-	2	1	1	-	-	-	-	1	3	-	-
CO2	3	3	2	1	2	1	1	-	-	1	-	1	3	-	-
CO3	3	2	2	1	3	1	1	-	-	1	-	1	3	-	-
CO4	3	2	2	1	2	1	1	-	-	1	-	1	3	-	-

Syllabus (Course Structure)

Course Code		**:**	**22UEC623C**	**ARM Microcontroller**	**Semester**	**:**	**06**
L:T:P		**:**	**3:0:0**		**Course Type**	**:**	**Theory**
Hours/Sem.	**Teaching**	**:**	**42 Hrs**		**CIE Marks**	**:**	**50**
	Learning (TW+SL)	**:**	**42 Hrs**		**SEE Marks**	**:**	**50**
	Exam	**:**	**06 Hrs**		**Total Marks**	**:**	**100**
	Total Hrs.	**:**	**90 Hrs**		**Credits**	**:**	**02**

Professional Competency:

Basic knowledge of ARM architecture, registers, and instruction set fundamentals. Ability to write and understand simple ARM programs for embedded system applications.

Course Outcomes:

After completion of the course, student will be able to:

CO1: Demonstrate proficiency in utilizing ARM development tools to write and debug assembly language programs, showing a deep comprehension of the ARM programmer's model.

CO2: Exhibit competence in writing and executing simple ARM assembly language programs, incorporating data processing, data transfer, and control flow instructions effectively.

CO3: Demonstrate skill in using the ARM instruction set to perform various operations, including branching, data processing, and coprocessor instructions.

CO4: Apply ARM instruction sets to implement data processing operations, control structures (loops and branches), and table-based techniques such as lookup tables, jump tables, and binary search.

UNIT–I **12 Hrs**

ARM Architecture and Assembly Language Programming

The General Purpose Registers in the ARM : The ARM Memory Map : Load and Store Instructions in ARM : ARMCPSR(Current Program Status Register) : ARM Data Format and Directives : Introduction to ARM Assembly Programming : Assembling an ARM Program : The Program Counter and Program ROM Space in the ARM : Some ARM Addressing Modes .

Text Book 1: **2.1 To 2.9**

UNIT–II **10 Hrs**

Arithmetic and Logic Instructions and Programs

Arithmetic Instructions : Logic Instructions : Rotate and Barrel Shifter :Shift and Rotate Instructions in ARM Cortex(Case Study) : BCD and ASCII Conversion.

Text Book 1: **3.1 to 3.5**

UNIT-III **10 Hrs**

Branch, Call, and Looping in ARM

:Looping and Branch Instructions : Calling Subroutine with BL : ARM Time Delay and Instruction Pipeline : Conditional Execution

Text Book 1: **4.1 to 4.4**

UNIT-IV **10 Hrs**

ARMMemoryMap,MemoryAccess,andStack : ARM Memory Map and Memory Access : Stack and Stack Usage in ARM .

Text Book 1: **6.1 to 6.2**

Text Books:

1. Muhammad Ali Mazidi , Sarmad Naimi , Sepehr Naimi , Janice Mazidi **Copyright © 2013 Mazidis and Naimis All rights reserved** (A portion of this book was taken from "The 80x86 IBM PC & Compatible Computers Vol 1 &2: 4th edition" and was previously published by Pearson Education, Inc.)

ReferenceBooks*

1. William Hohl ,(2009), ARM Assembly Language(Fundamentals and Techniques (1st edition), Publisher CRCPress
2. Steve Furber, (2000) , Arm System Onchip Architecture , Edition 2 Pearson publication.

Table: Matrix to describe the mapping of COs with POs (considering WKs) and PSOs

Course Outcomes (COs)	Program Outcomes and (WKs)											Program Specific Outcomes (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3 (WK 1, WK2, WK3, and WK4)	3 (WK 1, WK2, WK3, and WK4)	3 (WK1, WK2, WK3, and WK4)	1	1 (w4)	1 (w4)	1 (WK 1, WK4 and WK6)	1	1	1	0		2
CO2	(WK 1, WK2, WK3)	2 (WK 1, WK2, WK3, and WK4)	3 (WK4)		3 (WK6)	1 (WK 1, WK4 and WK7)	1 (WK 6)	1	1		1 (WK 6)		2
CO3	(WK 1, WK2, WK3)	2 (WK 1, WK2, WK3, and WK4)	3 (WK6)		3 (WK6)	1 (WK 1, WK6 and WK7)		1	1		1 (WK 6)		2
CO4		2 (WK 1, WK2, WK3, and WK4)	2 (WK6)			1 (WK 1, WK6 and WK7)		1	1		1 (WK 8)		2

Professional Elective Courses

SUBJECT CODE- 22UEC627E	MULTIMEDIA COMMUNICATIONS	Credits: 03
L:T:P - N_L : 3 N_T: 0 N_P 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction, Multimedia information representation, Multimedia networks, Multimedia applications. Introduction, Digitization principles, Text, Images, Audio, Video.	
UNIT–II	**10 Hrs.**
Text and Image Compression: Introduction, Compression principles, Text compression, image compression	
UNIT–III	**10 Hrs.**
Audio and Video Compression: Introduction, Audio compression, Video compression,	
UNIT–IV	**10 Hrs.**
Multimedia Network Communications: Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-demand, Multimedia over Wireless Networks.	

Reference Books *

Text Books:

1. Multimedia Communications- Fred Halsall, Pearson Education, 2001, ISBN -9788131709948.
2. Fundamentals of Multimedia- Ze-Nian LI, Marks. Drew Pearson Education, ISBN -
3. Multimedia Communication Systems- K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, Pearson Education, 2004. ISBN -9788120321458.

Course Outcomes**

After completion of the course student will be able to

1. **Identify the latest technological trends in multimedia communication to develop multimedia applications**
2. **Design and develop digital forms of text and image information of multimedia application.**
3. **Design and develop digital forms of audio and video information of multimedia application.**
4. **Identify the QoS parameters of deferent networks of multimedia**

***Books to be listed as per the format with decreasing level of coverage of syllabus**

****** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1:. Identify the latest technological trends in multimedia communication to develop multimedia applications	0	1	0	0	1	0	1	0	0	1	1		1		1
CO2: Design and develop digital forms of text and image	0	1	0	1	1	0	0	0	1	1	1		1		1

information of multimedia application.															
CO3: Design and develop digital forms of audio and video information of multimedia application.	1	1	0	0	1	0	0	0	0	1	1	1	1	1	1
CO4: Identify the QoS parameters of deferent networks of multimedia	1	1	0	0	1	0	1	0	0	1	1		1		1

Course Code: 22UEC629E	Advanced Python Programming	Credits: 03
3:T:P - N_L : N_T: N_P		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Basic of python data structure - Dictionary, Tuple and Set : Introduction to Strings, Lists , Set , Sets in Python,Create a Set, Accessing Python Sets, Delete from sets, Update Sets , Python Set Operations , Tuple , Tuples in Python , Creating Tuples Accessing Tuple , Iterate over tuples , Slicing tuples , Tuples are Immutable , Python Tuple Operations,Built-In Tuple Functions and methods , Dictionary , Dictionaries in Python ,Creating Dictionaries ,Accessing Items in Python Dictionaries ,Add, Update, Remove in Dictionaries ,Properties of Dictionary Keys Built-In Dictionary Methods and functions .	
UNIT–II	**xx Hrs.**
Modules and Packages : Introduction to module , Creating user defined module , Importing a module in python , Normal import , From import , From import with * , Module search path , Introduction to Packages , Creating user defined package , Importing a package in python , Normal import , From import ,From import with * , Intra-package References , Installing PIP , Installing/uninstalling python packages .	
UNIT–III	**xx Hrs.**
Exception handling : Introduction to Exception , Types of Exceptions , Built-in Exceptions , User defined Exceptions , Raising Exceptions , Handling Exceptions , Try clause , Except clause , Finally clause.	
UNIT–IV	**xx Hrs.**
Files Handling : Introduction to files and its types. , Binary files , Text files , Opening and Closing Text File , Reading and Writing Files , Setting Offsets in File , Object Serialization - Pickle Module .	

Reference Books *

1. Cody Jackson , Learn Programming in Python with Cody Jackson , Packt Publishing, 2018, ISBN : 9781789531947
2. David Amos, Dan Bader et. al. , Python Basics: A Practical Introduction to Python 3 , Real Python, 2021 ISBN : 9781775093329
3. E. Balagurusamy , Introduction to Problem Solving with Python ,Mc Graw Hill India, New Delhi, 2017 ISBN: 9789352602582
4. James Payne , Beginning Python , Wiley, 2010 ISBN: 9780470414637
5. Allen Downey , Think Python , O'Reilly, USA, 2016, ISBN : 978-9352134755

Course Outcomes**

After completion of the course student will be able to

1. Develop python programs by applying data structures - dictionary, tuple, and set concepts.
2. Develop modules and packages in python programs for modular programming approach.
3. Implement error handling techniques using exception handling.
4. Develop python programs using file input/output operations.

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	2	-	2	3	-	-	-	-	-	2	-
CO2	3	2	3	2	-	2	3	-	-	-	-	-	2	-
CO3	3	2	3	2	-	3	3	-	-	-	-	-	2	-
CO4	3	2	3	2	-	3	3	-	-	-	-	-	2	-

Course Code: 22UEC630E	Embedded System Design using C	Credits: 3
L: T : P - 3 : 0 : 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

Course objectives:

This course will enable students to:

1. Understand the architecture, classifications, applications, and quality attributes of embedded systems, and compare them with general-purpose systems.
2. Develop foundational embedded firmware using Embedded C with emphasis on control flow, data operations, and memory usage.
3. Analyze and apply advanced Embedded C programming features for robust and efficient real-time embedded software development.
4. Design and write Embedded C programs for digital and analog interfacing using 8051 microcontroller and peripheral devices.

UNIT-I	10 Hrs.
Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems VS. General Computing Systems, Classification of Embedded Systems, Major application areas of embedded systems, Purpose of embedded systems, **Block diagram of embedded system**: Input/output ports, memory, communication interfaces, Microprocessor and Microcontrollers. **Characteristics of an embedded system**, Operational and non-operational quality attributes. (Section 1.1,1.2,1.4,1.5,1.6, 2.1 to 2.2 (selected topics), 3.1 to 3.2 of Text book 1)	
UNIT–II	**10 Hrs.**
Embedded Firmware Design and Development: Embedded firmware design approaches embedded firmware development languages, **Programming in embedded C**: 'C' v/s. 'Embedded C', Compiler vs. Cross-Compiler. **Using 'C' in 'Embedded C':** Keywords and identifiers, Data types, Storage class, Arithmetic operations, Logical operations, Relational operations, Branching instructions, Looping instructions, Arrays and pointers, Characters and strings, Functions, Function pointers. (Section 9.1 to 9.3.3.12 of Text book 1)	
UNIT–III	**10 Hrs.**
Programming in embedded C: Structures and unions, Pre-processors and Macros, Constant declarations, The 'Volatile' type qualifier, Delay generation and infinite loops, Bit manipulation operations, Coding Interrupt Service Routines (ISR), Recursive functions, Re-entrant functions, Dynamic memory allocation. (Section 9.3.3.13 to 9.3.3.22 of Text book 1)	
UNIT–IV	**10 Hrs.**
8051 pin configuration: General-Purpose Input Output (GPIO) control, Writing embedded C code for digital I/O operations, Interfacing and programming of LEDs, switches, buzzers and LCDs, Analog Interfacing and Programming: Interfacing ADC and sensors, DAC interfacing and waveform generation using embedded C. (Chapters 4, 8, 12, and 13 (selected topics) of Text book 2)	
Reference Books *	
Book: 1. *Introduction to embedded systems by Shibu K V, McGraw Hill Education (India) Private Limited, Second Edition.* 2. *The 8051 Microcontroller* A Systems Approach by Mazidi McKinlay Mazidi, Pearson New	

International Edition, First edition.

Reference Books:

1. *Embedded System Design: A Unified Hardware/Software Approach by Frank Vahid and Tony Givargis, Wiley India Pvt. Limited, 2001*
2. *Programming Embedded Systems with C and GNU Development Tools by Michael Barr, Anthony Massa.*
3. *Embedded Software Development with C by Kai Qian, David Den Haring, Li Cao, Springer US, July 28, 2009*

Course Outcomes**

After completion of the course student will be able to

1. Analyze key components and characteristics of embedded systems and evaluate their roles in real-time applications.
2. Implement basic embedded applications using Embedded C constructs like loops, functions, arrays, and pointers.
3. Develop optimized code using ISRs, memory management, bit manipulations, and reentrant functions for time-critical tasks.
4. Design interfacing solutions with 8051 for devices like LEDs, switches, LCDs, ADCs, and DACs using Embedded C.

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Articulation Matrix:

Course Outcomes	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1:	2	3	1	1	0	0	0	0	0	0	0	0	3	0
CO2:	2	3	1	2	0	0	0	0	0	0	0	0	3	0
CO3:	2	3	2	2	0	0	0	0	0	0	0	0	3	0
CO4:	2	3	2	2	3	0	0	0	0	0	0	0	3	0

Open-Elective Courses

SUBJECT CODE: 22UEC631N	Nanotechnology	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction: The Canvas of nano-science and nanotechnology: - Nano and nature, Evolution of various technologies of the 20th century, Beginning of Nano. Introduction to Fullerenes: Introduction to fullerenes, Synthesis & purification of fullerenes, Conductivity &superconductivity in Fullerenes, Introduction, synthesis & purification of CNT's, filling & mechanism of growth of CNT's, Electronic structure, mechanical and physical properties of CNT's, applications of CNT's	
UNIT–II	**10 Hrs.**
Semiconductor quantum dots: Introduction, synthesis of quantum dots, electronic structure ofnano-crystals. Nano shells: Introduction, types of nano-shells, properties and characterization.Nano sensor's: Introduction, Nano sensors, Nano sensors based on quantum size effects, electrochemical sensors, Nano biosensors and smart dust.	
UNIT–III	**10 Hrs.**
Molecular Nano-machines: Introduction, covalent and non-conventional approaches, molecular motors and machines, molecular devices, single molecule devices. Nano-tribology: Introduction, studying tribology at the nano-scale, nano-tribology applications. Case study: Design and developmentofCNTbasednanopiezo-resistivepressuresensor,Siliconnano-wire-based sensors.	
UNIT–IV	**10 Hrs.**
Investigation & characterization methods in the nano-scale: Electron Microscopes, ScanningProbe Microscopes, optical microscopes for nontechnology, other microscopes, X-ray diffraction, AFM. Societal implications of nano-science & nontechnology: From first industrial revolution to the nano revolution, implications of nano-science and nontechnology on society, nanotech andwar, public perception and involvement in the nano discourse, harnessing nontechnology for economic and social development.	
Reference Books *	
1. T. Pradeep, "NANO: The Essentials", McGraw-Hill Education, 2007 Edition. 2. Rainer Waser, "Nano-electronics and Information Technology",Wiley-VCH, 3rd Edition, 2012.	
Course Outcomes**	
After completion of the course student will be able to 1. Comprehendthefundamentalsofnontechnologyanddevelopanunderstandingof various nano-materials and synthesis technology. 2. Understandquantumdots,nanoshells,designanddevelopmentofNanosensors 3. Comprehend the knowledge of molecular nanomechanics &Nano-tribology 4. Analyzeandcharacterizenano-devices,nanostructuresandcomprehendthesocietalimplications of nontechnology.	

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)	Program Specific Outcomes (PSOs)

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1: Comprehend the fundamentalsof nontechnology and develop an understanding ofvarious nano-materials and synthesistechnology.	3	2	0	0	0	0	0	0	0	3	0	2	3	1	0
CO2: Understand quantumdots, nanoshells,designand developmentofNano sensors	3	0	2	0	2	0	0	0	0	3	0	2	3	2	0
CO3:Comprehend theknowledge aboutmolecularnanomechanics &Nano-tribology.	3	0	2	0	2	0	0	0	0	3	0	2	3	2	0
CO4: Understand various characterizationmethodsin nanotechnologyandcomprehendthe societal impactionsof nontechnology	3	3	1	2	3	3	3	3	0	2	2	3	3	3	0

Course Code: 22UEC632N	FUZZY LOGIC	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: **3 Hrs/Week**		SEEMarks:50

UNIT-I	**10 Hrs.**

Classical sets: Operations and properties of classical sets, Mapping of classical sets to the functions. Fuzzy sets - Membership functions, Fuzzy set operations, Properties of fuzzy sets. **Classical and Fuzzy relations:** Cartesian product, crisp relations-cardinality, operations and properties of crisp relations. Fuzzy relations-cardinality, operations, properties of fuzzy relations, fuzzy Cartesian product and composition, Fuzzy tolerance and equivalence relations, value assignments and other format of the composition operation.

UNIT–II	**10 Hrs.**

Fuzzification and Defuzzification: Features of the membership functions, various forms, fuzzification, defuzzification to crisp sets, - cuts for fuzzy relations, Defuzzification to scalars. Fuzzy logic and approximate reasoning, Other forms of the implication operation.

UNIT–III	**10 Hrs.**

Fuzzy Systems: Natural language, Linguistic hedges, Fuzzy (Rule based) System, Aggregation of fuzzy rules, Graphical techniques of inference, Membership value assignments: Intuition, Inference, rank ordering, Fuzzy Associative memories.

UNIT–IV	**10 Hrs.**

Fuzzy decision making: Fuzzy synthetic evaluation, Fuzzy ordering, Preference and consensus, Multi objective decision making, Fuzzy Bayesian, Decision method, Decision making under Fuzzy states and fuzzy actions.

Reference Books *

1) Timothy J.Ross - Fuzzy logic with engineering applications, 3rd edition, Wiley,2010.
2) George J.KlirBo Yuan - Fuzzy sets and Fuzzy logic theory and Applications, PHI, New Delhi,1995.

Course Outcomes**

After completion of the course student will be able to

1. **Apply**and**analyze** classical and fuzzy sets and relations to **model** systems with uncertainty using appropriate operations and properties.
2. Analyze fuzzification process and defuzzification of membership functions to **transform** fuzzy information into crisp outputs.
3. Design fuzzy rule based system and inference techniques to **solve** problems involving approximate reasoning.
4. Apply fuzzy decision making techniques to **analyze** multi-objective problems under uncertainty.

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO1: Understand and analyze	3	2	2	0	1	1	1	0	0	0	0	0	2	2	0

communication systems and amplitude modulation techniques															
CO2: Visualize angle and pulse modulation systems.	3	2	2	0	1	1	1	0	0	0	0	0	2	2	0
CO3: Explain different digital communication systems and radio transmitters/receivers	3	3	1	0	1	1	1	0	0	0	0	0	2	2	0
CO4: Categorize broadband and optical fiber communication systems	2	2	1	0	1	1	2	0	0	0	0	0	2	2	0
Course Contribution to POs	**2.75**	**2.25**	**1.5**	**0**	**1**	**1**	**1.25**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**

SUBJECT CODE: 22UEC632N	Aircraft Electronics and Systems	Credits: 03
L:T:P - 3 : 0 : 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.

Basics of Aircraft, forces, moments and angle of attack, engines avionics, history of aircraft design and characteristics, modern aircraft systems.

UNIT–II	10 Hrs.

Aircraft Instruments, display types, grouping of displays, glass cockpit of modern aircraft, electronic flight instrument system (EFIS), introduction to air data instruments, types of air data instruments, two types viz pneumatic and air data instruments, temperature compensation, errors in ALTI, VSI and IVSI.

UNIT–III	10 Hrs.

Engine instruments, engine speed measurement, torque measurement, pressure measurement, EGT indicator, Engine vibration measurement and monitoring.

UNIT–IV	10 Hrs.

Engine fuel indicator, fuel quantity indicator, fuel quantity by weight, fuel flow rate indicator, electronic flight instrument system, FDS, ADI, HIS.

Reference Books *

1. "Aircraft Instrumentation and systems", S.Nagabhushana, L.K.Sudha. I.K. International Publishing House Pvt., Ltd., S-25, Green Park Extensions, Uphaar Cinema Market, New Delhi – 110016(India), Info@ik international .com, ISBN : 978-93-80578-35-4

2. Pallett, E.B.J ., : "Aircraft Instruments -Principles and applications", Pitman and sons, 1981.

Course Outcomes**

After completion of the course student will be able to

CO1	Describe the fundamental concepts and working principles of aircraft electronic systems, including their role in modern aviation.
CO2	Classify and explain various electronic subsystems used in aircraft, such as navigation, communication, flight control, and monitoring systems.
CO3	Analyze the performance, functionalities, and integration of aircraft electronic systems in real-time operational scenarios.
CO4	Design and develop solutions collaboratively for aircraft electronic system challenges through team-based projects involving simulation, prototyping, and testing.
CO5	Communicate technical information effectively through oral presentations, technical reports, and documentation related to aircraft electronics.

Course Outcomes	Programme Outcomes (POs)	Program Specific Outcomes (PSOs)

	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	2	3	2	1
CO2	3	3	-	-	-	-	-	-	-	-	2	2	2	1
CO3	2	3	3	-	2	-	-	-	-	-	2	3	3	1
CO4	1	2	3	3	3	-	-	3	2	2	3	2	2	1
CO5	-	-	0	0	-	-	-	2	3	2	2	2	2	1

Course Code: BHSXXXXC	**Indian Knowledge System (Common to all Branches)**	Credits	01
Hours/Week (L:T:P: S): 1:0:0:0		CIE Marks	50
Total Hours of Pedagogy (Theory + Lab) 15		SEE Marks	50

UNIT-I **(3 Hrs.)**

Indian Knowledge Systems (IKS)

Overview, Vedic Corpus, Philosophy in Indian Knowledge system

UNIT-II **4 Hrs.)**

Traditional Knowledge in Mathematics

Introduction to Indian Mathematics, Unique aspects of Indian Mathematics, Indian Mathematicians and their Contribution. Number Systems and Units of Measurement.

UNIT-III **(4 Hrs.)**

Traditional Knowledge in Science

Measurements for time, distance and weight, Astronomy, Indian contributions in astronomy, Astrology, The celestial coordinate system, Elements of the Indian calendar, Notion of years and month, Panchanga – The Indian calendar system.

UNIT-IV **4 Hrs.)**

Traditional Knowledge in Professional domain

Town Planning and Architecture, Agriculture, Governance and Public Administration.

Reference Books

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi (2022**).** Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
2. Sampad and Vijay "The Wonder that is Sanskrit", Sri Aurobindo Society, Puducherry. (2011).
3. Acarya, P.K. Indian Architecture, MunshiramManoharlal Publishers, New Delhi. (1996).
4. Kapoor Kapil, Singh Avadhesh "Indian Knowledge Systems Vol – I & II", Indian Institute of Advanced Study, Shimla, H.P. (2021).
5. Dasgupta,S. A History of Indian Philosophy- Volume 1, Motilal Banarsidass, New Delhi. (1975).
6. PLofker, K. (1963). Mathematics in India, Princeton University Press, New Jeresy, USA"

Suggested Web Links:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/
3. http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4. https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5. https://unctad.org/system/files/official-document/ditcted10_en.pdf
6. http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdfdevelopmentgoals/?gclid=EAIaIQobChMInpJtb_p8gIVTeN3Ch2
7. https://unfoundation.org/what-we-do/issues/sustainable-developmentgoals/?gclid=EAIaIQobChMInpJtb_p8gIVTeN3Ch27LAmPEAAYASAAEgIm1vD_BwELAmPEAAYASAAEgIm1vD_BwE

Course Outcomes:

At the completion of the course student will be able to:

CO1: Provide an overview of the concept of the Indian Knowledge System and its importance

CO2: Appreciate the need and importance of protecting traditional knowledge.

CO3: Recognize the relevance of Traditional knowledge in different domains.

CO4: Establish the significance of Indian Knowledge systems in the contemporary world.

Course Outcomes	Programme Outcomes(POs)										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CO1	2	2	-	1	-	2	1	3	-	2	2
CO2	1	2	-	-	-	3	2	3	-	1	2
CO3	2	2	1	-	1	3	3	3	-	2	2
CO4	2	2	2	-	1	3	2	3	1	2	3

SUBJECTCODE: 22UEC625L	CMOS Digital VLSI Laboratory	Credits:01
L:T:P –0-0-3		CIEMarks:50
TotalHours/Week: 03		SEEMarks: 50

NAME OF THE EXPERIMENT
*Design following CMOS/TG based circuits with given specifications and complete the VLSI design flow mentioned below using appropriate tool:** **a) Draw the schematic and verify the following:** i) DC Analysis ii) Transient Analysis **b) Draw the Layout and verify the DRC, ERC** **c) Check for LVS** **d) Extract RC and backannotate the same and verify the design.** **Circuits to be Designed:** 1. CMOS inverter 2. CMOS two input NAND gate 3. CMOS two input NOR gate 4. CMOS two input OR gate 5. CMOS two input AND gate 6. TG based two input XOR and XNOR gates 7. Negative edge triggered D flip flop using TGs and inverters 8. 4:1 MUX using TGs and inverters 9. 3-Bit up counter 10. 3-Bit SISO shift register ***An appropriate constraint should be given.***
Course Outcomes**
After completion of the course, the student will be able to: **1.** Design CMOS/ TG based gates, MUX, flip flops, counters and shift register. **2.** Draw the layout, run DC and transient analysis for designed CMOS standard cells.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes(PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	0	2	0	3	0	0	0	0	0	0	0	3	0	0
CO2	1	0	2	0	3	0	0	0	0	0	0	0	3	0	0

Course Title: ARM Microcontroller Lab		Course Code: 22UEC626L
Credits:		Contact Hours: 3 Hrs/Week
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Course Objectives:

- To have hands-on experience in using ARM7TDMI/LPC2148. family microcontrollers.
- To provide practical knowledge of ARM7TDMI/LPC2148. assembly language programming.
- To have exposure in using Keil compiler and embedded C programming.
- To understand different inbuilt peripherals in ARM7TDMI/LPC2148.family and their interfacing.
- To encourage the students in building embedded applications.

Course Outcomes:

- Able to get fundamental concepts of ARM7TDMI/LPC2148. microcontroller from practical point of view.
- Able to write efficient programs in assembly level language of the RM7TDMI/LPC2148. microcontroller.
- Able to carry out interface between the ARM7TDMI/LPC2148.microcontroller and peripheral devices so that they can design and develop a complete microcontroller based systems (projects).
- Able to develop the ability to use embedded C language to perform a defined task.

Suggested Simulation/Modelling/Design/Verification/Hardware Boards/etc. (preferably open sources):

- Develop and test Program using ARM7TDMI/LPC2148.
- Conduct the experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' & Keil Uvision-4 tool/compiler.

Sl. No.	Experiments
	Part-A
1	Write a program to multiply two 16 bit binary numbers.
2	Write a program to find the sum of first 10 integer numbers.
3	Write a program to find factorial of a number.
4	Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM
5	Write a program to find the square of a number (1 to 10) using look-up table.
6	Write a program to find the largest/smallest number in an array of 32 numbers.
7	Write a program to arrange a series of 32 bit numbers in ascending/descending order.
8	Write a program to count the number of ones and zeros in two consecutive memory locations.
	Part-B
9	Display “Hello World” message using Internal UART.
10	Interface and Control a DC Motor.

11	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
12	Determine Digital output for a given Analog input using Internal ADC of ARM controller.
13	Interface a DAC and generate Triangular and Square waveforms.
14	Interface a 4x4 keyboard and display the key code on an LCD.
15	Demonstrate the use of an external interrupt to toggle an LED On/Off.
16	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	1	3	1	1	1	2	1	0	1	**0**	3	0
CO2	3	3	3	1	3	1	1	1	2	1	0	1	**0**	3	0
CO3	3	3	3	1	3	1	1	1	2	1	2	1	**0**	3	0
CO4	3	2	3	1	3	1	1	1	2	1	2	1	**0**	3	0
CO5	3	2	2	1	3	1	1	1	2	1	1	2	0	3	0

Course Code: 22UHS001M	**YOGA**	Credit :	00
Hours/Week : (L:T:P:S) : 0:0:2:0		CIE Marks :	100
Total Hours Per Semester : 26hrs	**(Common to All Branches)**	SEE Marks :	00

Semester VI	
Ashtanga Yoga 1. Dharana 2. Dhyana (Meditation) 3. Samadhi	
Asana by name, technique, precautionary measures and benefits of each asana	
Different types of Asanas	
Sitting	1.Bakasana 2.Hanumanasana 3.Ekapada Rajakapotasana 4.Yogamudra in Vajrasana
Standing	1.Vatayanasana 2.Garudasana
Balancing	1.Veerabhadrasana 2. Sheershasana
Supine line	1.Sarvangasana 2.Setubandha Sarvangasana 3. Shavasanaa (Relaxation poisture).
Revision of Kapalabhati practice 80 strokes/min - 3 rounds Different types. Meaning by name, technique, precautionary measures and	
benefits of eachPranayama 1. Bhastrika 2. Bhramari	
Meaning, Need, importance of Shatkriya. Different types. Meaning by name,	
technique, precautionary measures and benefits of each Kriya 1. Jalaneti & sutraneti	
2. Nouli (only formen) 3. Sheetkarma Kapalabhati	

Course Code: 22UHS002M	National Service Scheme (NSS) (COMMON TO ALL BRANCHES)	Credit : 00
Hours/Week (L:T:P:S) : 0:0:2:0		CIE Marks : 100
Total Hours Per Semester : 26		SEE Marks : 00

Course objectives:

National Service Scheme(NSS)will enable the students to:

6. Understand the community in general in which they work.
7. Identify the needs and problems of the community and involve them in problem–solving.
8. Develop among themselves a sense of social & civic responsibility & utilize their. Knowledge in finding practical solutions to individual and community problems.
9. Develop competence required for group-living and sharing of responsibilities & gains kills In mobilizing community participation to acquire leadership qualities and democratic attitudes.
10. Develop capacity to meet emergencies and natural disasters &practice national integration and social harmony in general.

General Instructions-Pedagogy:

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

6. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students'theoretical and applied social and cultural skills.
7. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
8. Support and guide the students for self-planned activities.
9. You will also be responsible for assigning home work, grading assignments and quizzes, and documenting students' progress in real activities in the field.
10. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS)–Contents

17. Organic farming ,Indian Agriculture(Past,Present and Future) Connectivity for marketing.
18. Waste management–Public, Private and Govtorganization,5R's.
19. Settingoftheinformationimpartingclubforwomenleadingtocontributioninso cialandeconomicissues.
20. Waterconservationtechniques–Roleofdifferentstakeholders–Implementation.
21. Preparinganactionablebusinessproposalforenhancingthevillageincomeandap proachforimplementation.
22. Helpinglocalschoolstoachievegoodresultsandenhancetheirenrolmentin Higher/ technical vocation.
23. Developing Sustainable Water management system for rural areas and implementation approaches.
24. ContributiontoanynationallevelinitiativeofGovernmentofIndia.Foreg.DigitalIndia, SkillIndia,SwatchBharat, Atma nirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
25. Spreadingpublicawarenessunderruraloutreachprograms.(minimum5programs).
26. Social connect and responsibilities.
27. Plantation and adoption of plants. Know your plants.
28. Organize National integrationandsocial harmonyevents/workshops/seminars.(Minimum02programs).
29. Govt.schoolRejuvenationandhelpingthemtoachieve goodinfrastructure.
30. NOTE:

31. Student/s in individual or in agroup Should select any one activity in the beginning of each semester till end of thatrespective semester for successful completion as per the instructions of NSS officer with the consent of HOD of thedepartment.
32. Attheendofevery semester,activityreportshouldbesubmittedforevaluation.

Distribution of Activities – Semester wise from 3rd to 6th semester

Sem	Topics/Activities to be Covered
3rdSemfor 25Marks	4. Organic farming,Indian Agriculture (Past,PresentandFuture)Connectivity formarketing. 5. Waste management–Public, Private and Govtorganization,5R's. 6. Setting of the in formation imparting club for women leading to contributionin social and economic issues.
4thSemfor 25Marks	7. Water conservationtechniques –Role of different take holders–Implementation. 8. Preparinganaction ablebusinessproposal for enhancing the village in come and approach for implementation. 9. Helpinglocalschoolstoachievegoodresultsandenhancetheirenrolmentin Higher/ technical/vocationaleducation.
5thSemfor25Marks	11. Developing Sustainable Water management system forruralareas and implementationapproaches. 12.Contribution to any national level initiative of Government of India. Foreg. Digital India, SkillIndia,Swachh Bharat, Atmanirbhar Bharath, MakeinIndia,Mudrascheme,Skilldevelopmentprogramsetc. 13. Spreading publicawareness underruraloutreachprograms.(minimum5programs). 14. Social connect and responsibilities.
6thSemfor 25Marks	14. Plantation and adoption of plants. Know your plants. 15. Organize Nation alintegration and social harmonyevents/workshops/seminars.(Minimum02programs). 16. Govt.school Rejuvenation and helping them to achieve good infrastructure.

Pedagogy–Guidelines,itmaydifferdependingonlocalresourcesavailableforthestudyaswellas environmentand climaticdifferences,locationand timeof execution.

SINo	Topic	Groups ize	Location	Activityexecution	Reporting	EvaluationOftheTopic
1.	Organicfarming,Indian Agriculture (Past,Present and Future)Connectivity formarketing.	May beindividual orteam	Farmers land/Villages/roadside /communityarea/ Collegecampusetc…..	Siteselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
2.	Waste management– Public,PrivateandGovtorganization,5 R's.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Siteselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
3.	Setting of theinformation impartingclub forwomenleadingtocontributioninsocial andeconomicissues.	May beindividual orteam	Women empowermentgroups/ ConsultingNGOs & Govt Teams /Collegecampusetc…..	Groupselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
4.	Water conservationtechniques – Role ofdifferentstakeholders–Implementation.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	siteselection /properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
5.	Preparinganactionablebusiness proposal forenhancing the villageincome and approachforimplementation.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Groupselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer

6.	Helpinglocalschoolstoachievegoodresultsand enhance theirenrolmentin Higher/ technical/vocationaleducation.	May beindividual orteam	Local government /private/ aidedschools/Government Schemesofficers/ etc…..	Schoolselection/properconsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
7.	Developing SustainableWater managementsystem for rural areasand implementationapproaches.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	siteselection/propersonsultation/Continuous monitoring/Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
8.	Contribution to anynational level initiativeofGovernmentofIndia.For eg. Digital India,Skill India, SwachhBharat, AtmanirbharBharath, Make inIndia,Mudraschem e,Skill developmentprogramsetc.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Groupselection/properconsultation/Continuous monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
9.	Spreading publicawareness under ruraloutreachprograms.(minimum5programs).////Socialconnect andresponsibilities.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Groupselection/properconsultation/Continuous monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer
10.	Plantationandadoptionof plants. Know yourplants.	May beindividual orteam	Villages/CityAreas/Grama panchayat/publicassociations/GovernmentSchemesofficers/ campusetc…..	Placeselection/properconsultation/Continuous monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedevaluationauthority	Evaluation asper the rubricsOf scheme andsyllabusbyNSSofficer

11.	Organize Nationalintegrationa ndsocialharmonyeve nts /workshops /seminars.(Minimum0 2 programs).	May beindivid ual orteam	Villages/CityAreas/G rama panchayat/publicassoci ations/GovernmentSche mesofficers/ campusetc…..	Placeselection/proper consultation/Continuou s monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedev aluationauthorit y	Evaluation asper the rubricsOf scheme andsyllabusbyNS Sofficer
12.	Govt. schoolRejuvenati on andhelping them toachievegoodinf rastructure.	May beindivid ual orteam	Villages/CityAreas/G rama panchayat/publicassoci ations/GovernmentSche mesofficers/ campusetc…..	Placeselection/proper consultation/Continuou s monitoring /Informationboard	Reportshouldbe submitted byindividual to theconcernedev aluationauthorit y	Evaluation asper the rubricsOf scheme andsyllabusbyNS Sofficer

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	PracticeSessionDescription
1	**LecturesessionbyNSSOfficer**
2	**StudentsPresentation onTopics**
3	**Presentation- 1,Selectionoftopic,PHASE-1**
4	**Commencementofactivityanditsprogress-PHASE- 2**
5	**Executionof Activity**
6	**ExecutionofActivity**
7	**ExecutionofActivity**
8	**ExecutionofActivity**
9	**ExecutionofActivity**
10	**CasestudybasedAssessment,Individualperformance**
11	**Sectorwise study anditsconsolidation**
12	**Videobasedseminarfor10minutes byeachstudent Attheendofsemesterwith Report.**

- Ineverysemester from3rdsemesterto6thsemester,Eachstudentshoulddoactivitiesaccordingtothescheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for theassignedactivityprogress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiledreportshould be submitted as per theinstructions.

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

CO1:	Recognize and understand their roles and responsibilities towards society for its betterment.
CO2:	Analyze environmental and societal issues and design effective and sustainable solutions
CO3:	Assess existing systems critically and propose practical, innovative solutions to promote sustainable development
CO4:	Plan and implement government-led or self-initiated projects efficiently for community and societal welfare
CO5:	Develop the ability to respond to emergencies and natural disasters, while fostering national integration, social harmony, and unity.

AssessmentDetails forCIE(bothCIE andSEE)

Weightage	**CIE– 100%**	• Implementationstrategiesoftheproject(NSSwork). • The last report should be signed byNSSOfficer,theHODandprincipal. • Atlastreportshould beevaluated bytheNSSofficer ofthe institute. • Finallytheconsolidatedmarkssheetshouldbesent to the university and also to be madeavailableat LICvisit.
Presentation -1 Selectionoftopic,PHASE-1	10Marks	
Commencementofactivityand itsprogress-PHASE-2	10Marks	
Casestudybased Assessment Individualperformance	10Marks	
Sectorwisestudyand itsconsolidation	10Marks	
Videobasedseminarfor10minutesbyeach studentAttheendofsemesterwithReport.	10Marks	
Totalmarksforthecourseineachsemester	**50Marks**	

Marksscoredfor50bythestudentsshouldbeScaledownto25marksIneachsemester for CIEentryintheVTUportal.

25marksCIEentry will beenteredinUniversity IAmarksportalattheendofeachsemester3rdto6th sem,Reportandassessmentcopyshouldbe madeavailableinthedepartmentsemesterwise.

Studentsshouldpresenttheprogressoftheactivitiesaspertheschedule inthe prescribedpracticalsessioninthefield.Thereshouldbepositive progressinthevertical order for thebenefitof societyingeneral.

Course Code : 22UHS003M		Credits :	00

Suggested Learning Resources:

Books:

4. **NSS CourseManual,** PublishedbyNSSCell,VTUBelagavi.
5. GovernmentofKarnataka,NSS cell,activitiesreportsanditsmanual.
6. GovernmentofIndia,nsscell,Activitiesreportsanditsmanual.

CO-PO Mapping

		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
No	Programme Outcomes / Course Outcomes															
After successful completion of the course the students will be able to:																
1	Recognize and understand their roles and responsibilities towards society for its betterment.	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-
2	Analyze environmental and societal issues and design effective and sustainable solutions	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-
3	Assess existing systems critically and propose practical, innovative solutions to promote sustainable development	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-
4	Plan and implement government-led or self-initiated projects efficiently for community and societal welfare	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-
5	Develop the ability to respond to emergencies and natural disasters, while fostering national integration, social harmony, and unity.	-	-	1	-	-	1	2	1	1	1	2	1	-	-	-

Hours/Week (L:T:P:S) : 0:0:2:0		**CIE Marks :**	100
Total Hours Per Semester : 26hrs		**SEE Marks :**	00

Course Outcomes: At the end of the course, the student will be able to	
1.	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2.	Familiarization of health- related Exercises, Sports for overall growth and development
3.	Create a foundation for the professionals in Physical Education and Sports
4.	Participate in the competition at regional/state/national/international levels.
5.	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
6.	Understand and practice of Traditional Games

Module I: Orientation		**4Hours**
A.	Lifestyle	
B.	Health & Wellness	
C.	Pre-Fitness test.	
Module II: General Fitness & Components of Fitness		**4Hours**
D.	Warming up (Free Handexercises)	
E.	Strength–Push-up/ Pull-ups	
F.	Speed–30Mtr Dash	
Module III: Specific games (Any one to be selected by the student)		**16Hours**
2.	Kabaddi–Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.	
2.	Kho-Kho–GivingKho,Single Chain,Pole dive,Pole turning,3-6Up.	
Module IV: Orientation		**4Hours**
A.	Postural deformities.	
B.	Stress management	
Module V : Specific Games (Any one to be selected by the student)		**16Hours**
A.	Throw ball	
B.	Table Tennis	
C.	Athletics (Field Events-Jumps)–Any event as per availability of Ground.	
Module VI: Aerobics		**4 Hours**

Scheme and Assessment for auditing the course and Grades:

Sl.No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes–2,each of 15marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

Course Outcomes:
1.Identify and Understand common postural deformities and apply stress management techniques in the context of sports and athletics
2.Participate Confidently in competitions at regional, state, national, and international levels
3.Demonstrate Proficiency in specific games and athletic jumping events through regular practice and skill development.
4.Understand and Perform various Aerobic exercises for fitness and endurance enhancement.

5.Acquire Skills and Practice specific games and athletic throwing events with proper techniques and strategies	
Module I: Ethics and Moral Values	**4Hours**
A.	Ethics in Sports
B.	Moral Values in Sports and Games
Module II: Specific Games (Any one to be selected by the student)	**16Hours**
A.	Volley ball–Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
B.	Athletics (TrackEvents) –Any event as per availability of Ground
Module III: Role of Organisation and administration	**4Hours**

		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
No	Programme Outcomes / Course Outcomes															
After successful completion of the course the students will be able to:																
1	**Identify and Understand** common postural deformities and apply stress management techniques in the context of sports and athletics	-	-	1	-	-	1	1	-	-	-	-	1			
2	**Participate Confidently** in competitions at regional, state, national, and international levels	-	-	1	-	-	1	1	-	-	-	-	1			
3	**Demonstrate Proficiency** in specific games and athletic jumping events through regular practice and skill development.	-	-	1	-	-	1	1	-	-	-	-	1			
4	**Understand and Perform** various Aerobic exercises for fitness and endurance enhancement.	-	-	1	-	-	1	1	-	-	-	-	1			
5	**Acquire Skills and Practice** specific games and athletic throwing events with proper techniques and strategies	-	-	1	-	-	1	1	-	-	-	-	1			