ECE -2022 SCHEME (III –VIII SEMESTER)

(EFFECTIVE FROM THE ACADEMIC YEAR 2022-23)

GLOBAL ACADEMY OF TECHNOLOGY

(Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited CS, E&C, E&E, MECH, CV and IS branches)
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098

HEAD OF THE DEPARTMENT
Dept. of Electronics & Communication Engg
Global Academy of Technology
Rajarajeshwarinagar, Bangalore-98

H.P. Rajasekaran Sharma
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Global Academy of Technology, Bengaluru

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Electronics and Communication Engineering Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022-23)

III Semester

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			Credits
					L	T	P	CIE	SEE	Total	
1	22MAT31E	Transforms, Complex Variables and Special Functions	BS	MAT	2	2	0	50	50	100	3
2	22ECE32	Analog Electronic Circuits	IPC	Respective Department	3	0	2	50	50	100	4
3	22ECE33	Design and Analysis of Digital Circuits	PC		3	0	0	50	50	100	3
4	22ECE34	Network Analysis	PC		2	2	0	50	50	100	3
5	22ECE35	Object Oriented Programming using C++	ESC/ETC/PLC		2	0	2	50	50	100	3
6	22ECE36	Sensors and Instrumentation	AEC		3	0	0	50	50	100	3
7	22ECEL37	Digital System Design Laboratory	PCL		0	0	2	50	50	100	1
Total								**350**	**350**	**700**	**20**

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.
Global Academy of Technology
Bengaluru-98

H.M. Rajashekhara Swamy
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Global Academy of Technology, Bengaluru

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Electronics and Communication Engineering

Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022-23)

IV Semester

Sl. No.	Course Code	Course Title	Course Type	Teaching Dept.	Teaching Hours/Week			Examination			Credits
					L	T	P	CIE	SEE	Total	
1	22MAT41E	Advanced Linear Algebra and Probability	BS	MAT	2	2	0	50	50	100	3
2	22ECE42	Principles of Communication Systems(Integrated)	IPC	Respective Department	3	0	2	50	50	100	4
3	22ECE43	Control Systems	PC		3	0	0	50	50	100	3
4	22ECE44	Signals and Systems	PC		2	2	0	50	50	100	3
5	22ECE45	Data Structures using C++	ESC/ETC/PLC		2	0	2	50	50	100	3
6	22ECE46	Verilog HDL	AEC		2	2	0	50	50	100	3
7	22ECEL47	HDL Laboratory	PCL		0	0	2	50	50	100	1
Total								**350**	**350**	**700**	**20**

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.
Global Academy of Technology
Bengaluru-98

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Global Academy of Technology, Bengaluru

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Electronics and Communication Engineering Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022-23)

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	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	22ECE51	Engineering Economics and Management	ECE	3	0	0		03	50	50	100	3
2	IPCC	22ECE52	Digital Communication Systems (Integrated)	ECE	2	2	2		03	50	50	100	4
3	PCC	22ECE53	Digital Signal Processing	ECE	3	2	0		03	50	50	100	4
4	PCCL	22ECEL54	Digital Signal Processing Laboratory	ECE	0	0	2		03	50	50	100	1
5	PEC	22ECE55*	Professional Elective - I	ECE	3	0	0		03	50	50	100	3
6	PROJ	22ECE56	Mini Project	ECE	0	0	4		03	100		100	2
7	AEC	22RMIK57	Research Methodology and IPR	Any Department	2	2	0		03	50	50	100	3
8	MC	22CIVK58	Environmental Studies	TD: CV/Env/Chem PSB:CV	2	0	0		02	50	50	100	2
9	MC	22NSK59	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		22PEK59	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOK59	Yoga	Yoga Teacher									
									Total	**550**	**350**	**900**	**22**

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.
Global Academy of Technology
Bengaluru-98

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Professional Elective Course - I			
22ECE55A	Programming in Java	22ECE55C	Engineering Electromagnetics
22ECE55B	Operating Systems	22ECE55D	Satellite Communication

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**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to al the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course.

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

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

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.
Global Academy of Technology
Bengaluru-98

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Global Academy of Technology, Bengaluru

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Electronics and Communication Engineering Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022-23)

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	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22ECE61	Embedded Systems (Integrated)	ECE	2	2	2		03	50	50	100	4
2	PCC	22ECE62	CMOS VLSI Design	ECE	3	2	0		03	50	50	100	4
3	PEC	22ECE63X	Professional Elective - II	ECE	3	0	0		03	50	50	100	3
4	OEC	22ECE64X	Open Elective -I	ECE	3	0	0		03	50	50	100	3
5	PROJ	22ECEP65	Major Project Phase - I	ECE	0	0	4		03	100	-	100	2
6	PCCL	22ECEL66	CMOS VLSI Design Laboratory	ECE	0	0	2		03	50	50	100	1
7	AEC/ SDC	22ECE67X	Ability Enhancement Course/ SkillDevelopment Course - III	ECE	If the course is offered as a Theory: 1	0	0		01	50	50	100	1
					If course is offered as a practical: 0	0	2						
8	MC	22NSK68	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	--	100	0
		22PEK68	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOK68	Yoga	Yoga Teacher									
9	IKS	22IKSK69	Indian Knowledge System		1	0	0		01	50	50	100	0
10	UHV	22UHV69	Universal Human Values	Any Department	1	0	0		01	50	50	100	0
									Total	**600**	**400**	**1000**	**18**

Professional Elective Course-II

22ECE63A	Digital Image Processing	22ECE63C	Information Theory and Coding
22ECE63B	Machine Learning with Python	22ECE63D	Microwave and Radar

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.
Global Academy of Technology

H.P. Rajadeva
Dean Academics
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Open Elective Course-I			
22ECE64A	Communication Engineering Systems	22ECE64C	Electronic Circuits with Verilog
22ECE64B	Micro Electro Mechanical Systems	22ECE64D	Introduction to Digital Image Processing
Ability Enhancement Course / Skill Enhancement Course - III			
22ECE67A	Communication Simulink Toolbox	22ECE67C	Multimedia Communication
22ECE67B	Digital Image Processing Laboratory	22ECE67D	Internet of Things and Cloud Computing

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**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K:** The letter in the course code indicates common to all the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg
Global Academy of Technology

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Global Academy of Technology, Bengaluru

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Electronics and Communication Engineering Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022-23)

Scheme A- 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	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22ECE71	Computer Communication Networks (Integrated)	ECE	3	0	2		03	50	50	100	4
2	IPCC	22ECE72	Antenna and Wavepropagation (Integrated)	ECE	3	0	2		03	50	50	100	4
3	PCC	22ECE73	Cryptography	ECE	3	2	0		03	50	50	100	4
4	PEC	22ECE74x	Professional Elective-III	ECE	3	0	0		03	50	50	100	3
5	OEC	22ECE75x	Open Elective- II	ECE	3	0	0		01	50	50	100	3
6	PROJ	22ECEP76	Major Project Phase-II	ECE	0	0	12		03	100	100	200	6
									Total	**350**	**350**	**700**	**24**

Professional Elective Course-III

22ECE74A	Advanced VLSI	22ECE74C	Optical Fiber Communication
22ECE74B	High Performance Computer Networks	22ECE74D	Biomedical Signal Processing

Open Elective Course-II

22ECE75A	Wireless and Mobile Networks	22ECE75C	Smart Sensors & Instrumentation
22ECE75B	Automotive Electronics	22ECE75D	Multimedia Communication

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T:** Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester.

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg
Global Academy of Technology

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Professional Elective Courses (PEC):

A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (22ECEP76):

The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To install responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

[1]. **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

[2]. **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work:

SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.
Global Academy of Technology
Bengaluru-98

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Global Academy of Technology, Bengaluru

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Electronics and Communication Engineering Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2022-23)

Scheme A- 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	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	22ECE81x	Professional Elective -IV (Online Courses)	ECE	3	0	0		03	50	50	100	3
2	OEC	22ECE82x	Open Elective - III (Online Courses)	ECE	3	0	0		03	50	50	100	3
3	INT	22ECEI83	Internship (Industry/Research) (14 - 20 weeks)	ECE	0	0	12		03	100	100	200	10
									Total	**200**	**200**	**400**	**16**

Professional Elective Course-IV (Online courses)

22ECE81A	BOS Recommended Course	22ECE81C	BOS Recommended Course
22ECE81B	BOS Recommended Course	22ECE81D	BOS Recommended Course

Open Elective Course-III (Online Courses)

22ECE82A	BOS Recommended Course	22ECE82C	BOS Recommended Course
22ECE82B	BOS Recommended Course	22ECE82D	BOS Recommended Course

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD**- Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the programSwapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester.
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.
Global Academy of Technology

A.P. Rajashekhar Shenoy
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, centre of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **University shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.
Global Academy of Technology
Bengaluru-98

H.N. Rajashekar
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Global Academy of Technology

(An Autonomous Institution, affiliated to VTU, Belagavi, recognized by Karnataka and Approved by AICTE, New Delhi.)

B.E. in Electronics and Communication Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

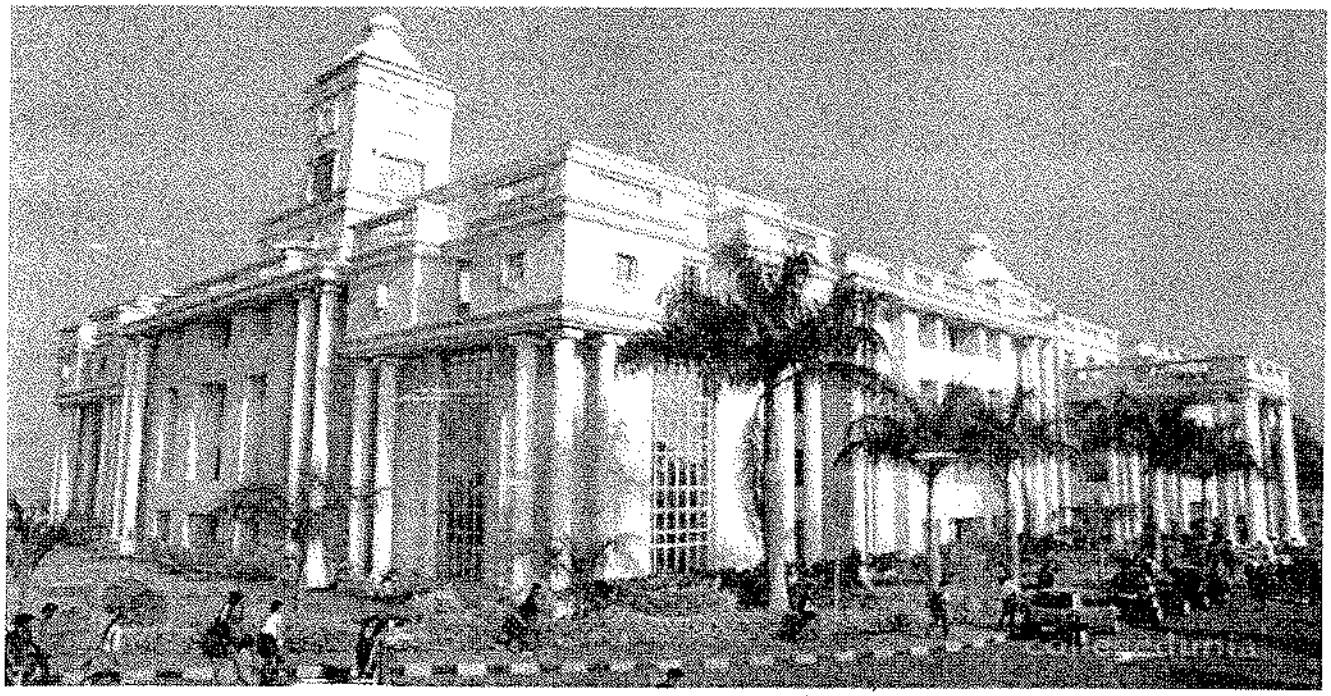
Scheme B: VII and VIII semesters for the candidates who seek an internship with project work

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 inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22ECE71	**Computer Communication Networks (Integrated)** To be completed in 5th/6th semester	TD: ME PSB:ME	3	0	2		03	50	50	100	4
2	PCC	22ECE72	**Antenna and Wavepropagation (Integrated)** To be completed in 5th /6th semester	TD: ME PSB:ME	3	0	2		03	50	50	100	4
3	PCC	22ECE73	**Cryptography** To be completed in the 6th semester	TD: ME PSB: ME	4	0	0		03	50	50	100	3
4	PEC	22ECE74x	Professional Elective Course (MOOC Courses)	TD: ME PSB: ME	3	0	0		03	50	50	100	3
5	OEC	22ECE75x	Open Elective Courses (MOOC courses)	TD: ME PSB: ME	3	0	0		01	50	50	100	3
1	PEC	22ECE81x	Professional Elective -IV (Online Courses)	TD: ME PSB:ME	3	0	0		03	50	50	100	3
2	OEC	22ECE82x	Open Elective - III (Online Courses)	TD: ME PSB:ME	3	0	0		01	50	50	100	3
3	PROJ	22ECEI83	Project – Outcome of Training	TD: ME PSB:ME	0	0	12		03	100	100	200	9
4	INT	22ECE81x	Internship (Industry/Research) (02 semesters)	TD: ME	0	0	12		03	100	100	200	10
									Total	**550**	**550**	**1100**	**42**

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.

Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

II-YEAR ECE SYLLABUS-2022 SCHEME



Department of Electronics and Communication Engineering

GLOBAL ACADEMY OF TECHNOLOGY

(Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited CS, E&C, E&E, MECH, CV and IS branches)
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.

HEAD OF THE DEPARTMENT
Dept. of Electronics & Communication Engg.
Global Academy of Technology
Rajarajeshwarinagar, Bangalore-98

SEMESTER – III

Course: Transforms, Complex Variables and Special Functions (For ECE)

Course Code	22MAT31E	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: To enable students to apply the knowledge of Mathematics in various fields of engineering by making them to learn:

CLO1	Laplace Transforms
CLO2	Fourier series of periodic functions
CLO3	Fourier Transforms
CLO4	Analytic functions and complex line integrals
CLO5	Bessel's and Legendre differential equations

Content	No. of Hours / RBT levels
Module 1 Laplace transforms of elementary functions, Laplace transforms of Periodic functions, unit-step function and Dirac delta function. Inverse Laplace Transform, Convolution theorem (without Proof), Solution of second order linear differential equations using Laplace transforms.	**08 Hours** **L2, L3**
Module 2 Fourier series of periodic functions, Complex form of Fourier series. Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms.	**08 Hours** **L2, L3**
Module 3 Function of a complex variable, Analytic Functions-Cauchy-Riemann equations in Cartesian and polar forms. Construction of analytic functions using Milne Thompson method. Properties of analytic functions.	**08 Hours** **L2, L3**
Module 4 Conformal Transformations, Bilinear transformations. Complex line integrals, Cauchy's theorem, Cauchy's integral formula. Singularities, poles, residues, Cauchy's residue theorem.	**08 Hours** **L2, L3**
Module 5 Series solution of Bessel's differential equation leading to Jn(x)-Bessel's function of first kind. Basic properties and orthogonality. Series solution of Legendre's differential equation leading to Pn(x)-Legendre Polynomials. Rodrigue's formula (without proof), problems.	**08 Hours** **L2, L3**

Course Outcomes: Upon completion of this course, student will be able to:

CO31.1	Determine Laplace and inverse Laplace transforms of given functions leading to the solution of linear differential equations
CO31.2	Apply Fourier series to transform periodic signals into fundamental frequencies
CO31.3	Apply Fourier Transforms to transform continuous time signals from time domain to frequency domain and vice versa
CO31.4	Apply Cauchy Riemann equations to study different properties of analytic functions
CO31.5	Evaluate complex line integrals
CO31.6	Apply the knowledge of Infinite Series to solve Bessel's and Legendre differential equations

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers 44th Edition, 2017
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2006

Reference Books:

1. E. Kreyszig , Advanced Engineering Mathematics, John Wiley & Sons 10th Edition, 2016
2. N.P.Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications 6th Edition, 2014

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component and 10 marks would be exclusively for assignments. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs) and three tests. Some possible AATs: seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			**100**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1									3		
CO2	3	2	1									3		
CO3	3	2	1									3		
CO4	3	2	1									3		
CO5	3	2	1									3		
CO6	3	2	1									3		
Average	3	2	1									3		

Low-1: Medium-2: High-3

SEMESTER – III

Course: Analog Electronic Circuits (Integrated)

Course Code	22ECE32	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Working, characteristics and biasing of FET
CLO2	JFET small signal model for various biasing circuits.
CLO3	Performance BJT Power amplifiers
CLO4	Applications of Operational Amplifiers and Wave form generators.
CLO5	Active filters and Data Converters.

Content	No. of Hours / RBT levels
Module 1 **Field Effect Transistors:** Introduction, Construction and Characteristics - of JFETs, Transfer Characteristics, Depletion type MOSFET, Enhancement type MOSFET and CMOS inverter. **FET Biasing:** Introduction, Fixed bias configuration, Self-bias configuration Voltage-Divider biasing. (Text-1:6.1, 6.2, 6.3, 6.7, 6.8, 6.11, 7.1, 7.2, 7.3 & 7.4)	8 Hours L3
Module 2 **FET Amplifiers:** Introduction, JFET small signal model, Fixed- bias configuration, self-bias configuration (bypassed and unbypassed Rs) Voltage divider configuration, source follower, Low frequency response- FET amplifier, Miller effect capacitance, High frequency response- FET amplifier. (Text-1: 8.1, 8.2, 8.3, 8.4, 8.5, 8.7, 9.9, 9.10 & 9.12)	8 Hours L3
Module 3 **Power Amplifiers:** Amplifier types, Series fed class A amplifier, Transformer coupled class A amplifier, Class B amplifier operation and Class B Amplifier Circuits-Transformer coupled push-pull circuit and Complementary-symmetry circuits, Amplifier distortion, Class C and Class D amplifiers. (Text-1: 12.1, 12.2, 12.3, 12.4, 12.5, 12.6 & 12.8)	8 Hours L3
Module 4 **Operation Amplifier Applications:** Instrumentation amplifier, Op-Amp circuits using diodes-Half Wave Rectifier, Full Wave rectifier, Peak Detector, Clipper and Clamper, Sample and Hold circuit, Log and Antilog amplifier. (Text-2: 4.3, 4.6, 4.7 & 4,8) **Comparators and Waveform Generators:** Comparator- Non-inverting and inverting, Zero Crossing detector, Schmitt Trigger, Basic principles of sine wave oscillators-RC phase shift oscillators and Wien Bridge Oscillator.(Text-2: 5.2, 5.3 & 5.7)	8 Hours L3
Module-5 **Active Filters:** Introduction, RC Active Filters- First order and Second order low pass filters, High pass Filter, Band-pass Filter, Band Rejection Filter. (Text 2: 7.1, 7.2- 7.2.1, 7.2.2, 7.2.4, 7.2.5 & 7.2.6)	8 Hours L3

D-A and A-D Converters: Basic DAC Techniques- Weighted Resistor DAC, R-2R Ladder DAC, A-D converters: Parallel Comparator (Flash) A/D Converter, Successive Approximation Converter and DAC/ADC Specifications (Text 2: 11.2.1, 11.2.2, 11.3, 11.3.1, 11.3.4 &11.4)	

Practical Component of IPC	
List of Experiments (use Hardware components and simulation tool)	
1	Conduct an experiment to draw the Drain and Transfer characteristics of MOSFET
2	Simulate an experiment to draw the Drain and Transfer characteristics of JFET.
3	Simulate Class-B push pull power amplifier and demonstrate its output waveform for the given specific input.
4	Design and Conduct Half wave and Full wave Precision Rectifier
5	Design and conduct an experiment for Clippers using Op-Amp
6	Design and conduct an experiment for Sample and Hold circuit using Op-Amp
7	Design and Conduct Schmitt Trigger for given UTP and LTP
8	Design and simulate First/ Second order active Low-Pass Filter (LPF) and High-Pass Filter (HPF) for a given cut-off frequencies.
9	Design and simulate RC phase shift oscillator using Op-Amp.
10	Design and Conduct R-2R type Digital to Analog Converter.

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Explain** operation and performance parameters of FET and MOSFET.
CO2	**Analyze** the performance of FET amplifiers
CO3	**Evaluate** the performance of Power Amplifiers
CO4	**Describe** the various applications of Operational Amplifiers
CO5	**Analyze** the different types of active filters, Data Converters.

Textbooks:

1. Robert L. Boylestad and Louis Nashelsky, Electronics devices and Circuit theory, 10/11th Edition, Pearson,2021
2. D Roy Choudhury and Shail B Jain, Linear Integrated Circuits, 5th Edition, New age International Limited, 2015.

Reference Books:

1. J. Millman and C. C. Halkias, Integrated Electronics, 2nd Edition, Tata Mc-Graw Hill Publishing Company Limited,2017
2. Behzad Razavi, Fundamentals of Microelectronics, John Weily, 2013

E-Books / Web References:

1. http://www.springer.com/engineering/electronics/book/978-0-387-25746-4,Analog Circuit Design: A Tutorial Guide to Applications and solutions.
2. https://www.tutorialspoint.com/linear integrated circuits applications/index.htm
3. https://www.scribd.com/book/282535091/Linear-Integrated-Circuits

MOOCs:

https://nptel.ac.in/courses/108/106/108106084/
https://nptel.ac.in/courses/108/102/108102095/
https://nptel.ac.in/courses/117/103/117103063/
https://www.khanacademy.org/

Scheme of Examination: (Integrated courses)

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment of Integrated courses would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30 and CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation and 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester. The Evaluation pattern for integrated courses is shown in the Table-1

Table-1: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
		Grand Total	100

CO-PO and PSO mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	2	1
CO2	3	2	2	1	-	-	-	-	-	-	-	-	2	1
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	1	2	1
CO5	3	2	2	1	-	-	-	-	-	-	-	1	2	1
Average	3	2	2	1	-	-	-	-	-	-	-	1	2	1

Low-1: Medium-2: High-3

SEMESTER – III

Course: Design and Analysis of Digital Circuits

Subject Code	**22ECE33**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**03**

Course Learning Objectives: Students will be taught;

CLO1	Concepts of simplifying Boolean expression using K-map techniques and Quine Mc Cluskey minimization techniques.
CLO2	Adders, Subtractors, Encoders, Decoders, Multiplexers and Comparators.
CLO3	Methods and analysis of sequential logic circuits.
CLO4	State diagrams of synchronous sequential circuits.
CLO5	PLDs, and Hazards in Combinational Networks.

Content	No. of Hours / RBT levels
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-Mc Cluskey Minimization Technique. (Text 1:3.1, 3.2, 3.3, 3.4 & 3.5)	8 Hours **L3**
Module 2 **Logic Design with MSI Components:** Binary Adders and Subtractors, Decimal Adders, Comparators, Decoders, Encoders, and Multiplexers. (Text 2: 5.1.1, 5.1.2, 5.2, 5.3, 5.4, 5.5 & 5.6)	8 Hours L3
Module 3 **Flip-Flops and their Applications:** The Master-Slave Flip-flops (Pulse-Triggered flip-flops): SR flip-flops, JK flip-flops, Characteristic equations, Registers, Counters, Design of Synchronous Mod-N Counter using clocked T, JK, D, and SR flip-flops. (Text 2: 6.4.1, 6.4.2, 6.6, 6.7, 6.8, 6.9.1 & 6.9.2)	8 Hours L3
Module 4 **Sequential Circuits Design and Analysis II:** Mealy and Moore Models, State Machine notation, Synchronous Sequential Circuit Analysis. Construction of State Diagrams, and Counter design. (Text 1:6.1, 6.2, 6.3, 6.4 & 6.5)	8 Hours L3
Module 5 **Programmable Logic Devices & Hazards in Combinational Networks:** Programmable Logic Devices, Programmable Read-only Memories, Programmable Logic Arrays, Programmable Array Logic, Static and Dynamic Hazards in Combinational networks, Essential Hazards. (Text-2:5.7, 5.8, 5.9, 5.10, 9.9 & 9.10)	8 Hours L3

Course Outcomes: After studying this course, students will be able to;

CO1	**Simplify** Boolean functions using K-map and Quine-McCluskey minimization techniques.
CO2	**Design** of Combinational logic circuits.
CO3	**Explain** the operation of Flip Flops (SR, D, T, and JK) and design the synchronous sequential circuits using Flip Flops.
CO4	**Design** and develop Mealy & Moore models and state diagrams of synchronous sequential circuits.
CO5	**Describe** various types of PLDs and Hazards in Combinational Networks.

Textbooks:

1. John M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2001.
2. Donald D. Givone, Digital Principles, and Design, Tata McGraw Hill Education, 2002.

Reference Books:

1. Charles H Roth Jr. Fundamentals of Logic Design, Cengage Learning,
2. Sudhakar Samuel, Logic Design, Pearson/ Sanguine, 2007.

Scheme of Examination:

Semester End Examination (SEE):

SEE **Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50.** There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminars/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. The Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			**100**

CO- PO and PSO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		-	-	-	-	-	-	-	-	-	2	1
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-
Average	2	2	2	-	-	-	-	-	-	-	-	-	2	2

Low-1: Medium-2: High-3

SEMESTER – III

Course: Network Analysis

Course Code	22ECE34	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Kirchhoff's Law and Laplace Transforms

Course Learning Objectives: Students will be taught;

CLO1	Mesh and Nodal techniques to solve electrical networks.
CLO2	Concept of Network theorems to solve the electrical networks.
CLO3	Network parameters for two port networks.
CLO4	Transient behavior of electrical circuit during switching.
CLO5	Graphical method to solve electrical networks.

Content	No. of Hours/ RBT levels
Module 1 **Basic circuit analysis concepts:** Practical Sources, Source transformation, Star-Delta Conversion, Mesh analysis and Node analysis with dependent and independent sources for DC and AC networks. Concepts of super node and super mesh. (Text?)	8 Hours L3
Module 2 **Network Theorems:** Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem and Millman's theorem. (Text2)	8 Hours L3
Module 3 **Two port Network Parameters:** Definition of Z, Y, h and Transmission parameters, Modeling with these parameters and relationship between parameters. (Text2)	8 Hours L3
Module 4 **Transient behaviour and initial conditions**: Behaviour of circuit elements under switching condition and their representation of initial and final conditions in RL, RC and RLC circuits for DC excitations, Application of Laplace for RLC Circuits. (Text3)	8 Hours L3
Module 5 **Graph Theory and Network equations**: Graph of a network, Trees, Co-trees and Loops, Incidence Matrix, Cut-set Matrix, Tie-set Matrix and loop currents, Number of possible trees of a graph and Duality. (Text1)	8 Hours L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Determine** the current and/or voltage by simplifying an electrical network using mesh and node analysis.
CO2	**Solve** the electrical networks by applying theorems to reduce circuit complexities.
CO3	**Determine** Z, Y, h and T parameters and their inter relationship for a given two port networks.
CO4	**Analyze** the initial behaviour of the electrical circuit and find the network solution using Laplace transform
CO5	**Estimate** the current and/or voltage for the given electrical networks using Graph theory.

Textbooks:

1. D. Roy Choudhury, Networks and Systems, 2nd Edition, New Age International Pvt Ltd, 2010.
2. Ravish R. Singh, Electrical Networks, Tata McGraw-Hill Education, 2009.
3. VanValkenburg M. E. Network Analysis, 3rd Edition, Prentice Hall of India Pvt Ltd, 2002.

Reference Books:

1. Mahmood Nahvi, Joseph A. Edminister. Schaum's Outline of Electric Circuits, 6th Edition, McGraw-Hill Education, 2014.
2. Hayt, Kemmerly and Durbin, Engineering Circuit Analysis, 6th Edition, Tata McGraw-Hill Education, 2002.

MOOCs:

https://nptel.ac.in/courses/108/105/108105159/

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. The Evaluation pattern for regular courses is shown in Table 1

Table 1: **Distribution of weightage for CIE & SEE of Regular courses**

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	1	2	-
CO2	2	3	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	3	2	-	-	-	-	-	-	-	-	1	2	-
Average	3	3	2	-	-	-	-	-	-	-	-	1	2	-

Low-1: Medium-2: High-3

SEMESTER – III

Course: Object Oriented Programming using C++

Course Code	22ECE35	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning **Objectives:** Students will be taught;

CLO1	Features of object-oriented programing.
CLO2	Data abstraction and encapsulation.
CLO3	Constructors, destructors and operator overloading.
CLO4	Inheritance and virtual functions.
CLO5	Templates and exception handling.

Content	No. of Hours / RBT levels
Module 1 **Beginning with C++ and its features:** What is C++?, Applications and structure of C++ program, Different Data types, variables, Different Operators, expressions, operator overloading and control structures in C++. (Text 1: 2.1-2.3, 3.1-3.24)	8 Hours L2
Module 2 **Functions, classes and Objects:** Functions, Inline function, function overloading, friend and virtual functions, specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions. (Text 1: 4.1 - 4.11, 5.3- 5.5, 5.9, 5.10, 5.13-5.15 & 5.18)	8 Hours L3
Module 3 **Constructors and Destructors:** Constructors, parameterized constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors. **Operator overloading:** Defining operator overloading, Overloading Unary and binary operators, Overloading Binary operators Using Friends, rules for overloading operators. (Text 1: 6.1-6.8, 7.1 - 7.5,7.8)	8 Hours L3
Module 4 **Inheritance and Polymorphism:** Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions. (Text 1: 8.2-8.6, 9.3 -9.8)	8 Hours L3
Module 5 **Templates:** Class Templates, class templates with multiple parameters, Function Templates, Function templates with multiple parameters, overloading of template functions, member function templates. **Exception Handling:** Basics of Exception handling, Exception handling Mechanism, Throwing an Exception, Catching an exception, Rethrowing an exception, Specifying Exceptions. (Text 1: 12.2-12.7, 13.2 – 13.7)	8 Hours L2

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Describe** the basic concepts of object-oriented programming language.
CO2	**Implement** the classes and objects using functions.
CO3	**Explain** constructors and destructors and develop programs to overload operators.
CO4	**Develop** programs by using inheritance and polymorphism.
CO5	**Develop** programs by using templates and exception handling mechanisms in C++.

Textbooks:

1. E. Balaguruswamy, Object Oriented Programming with C++, 7th Edition, Tata McGraw Hill, 2018.

Reference Books:

1. Robert Lafore, Object Oriented Programming using C++, 4th Edition, Galgotia publication, 2010.
2. Herbert Schildt, C++ The Complete Reference, 4th Edition, McGraw Hill Education, 2017.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	1	1	1	-	1	-	1
CO2	3	2	-	-	-	-	-	1	1	1	-	1	-	1
CO3	3	2	-	-	-	-	-	1	1	1	-	1	-	1
CO4	3	2	-	-	-	-	-	1	1	1	-	1	-	1
CO5	3	2	-	-	-	-	-	1	1	1	-	1	-	1
Average	3	2	-	-	-	-	-	1	1	1	-	1	-	1

Low-1: Medium-2: High-3

SEMESTER – III

Course: Sensors and Instrumentation

Course Code	22ECE36	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Concepts of Sensors and its classification.
CLO2	Self-Generating and Digital and Intelligent Sensors.
CLO3	Concepts of Measurement and Working of Digital Voltmeter and Instruments
CLO4	Measurement of various parameters using Bridges.
CLO5	Operations of Oscilloscopes, Signal Generators and Wave Analyzers.

Content	No. of Hours / RBT levels
Module 1 **Introduction to sensor-based measurement systems:** General concepts and terminology, Sensor classification, Primary Sensors-Temperature sensors, Pressure Sensors, Level sensors, Resistive Sensors-Potentiometer, Strain Gauge, Resistive Temperature detector, Thermistors. (Text 1: 1.1, 1.2, 1.7, 2.1, 2.2.1, 2.3 & 2.4.1)	8 Hours L2
Module 2 **Self-generating Sensors:** Thermoelectric sensors, Piezoelectric sensors, Pyroelectric sensors, Photovoltaic sensors, electrochemical sensors. **Digital and Intelligent Sensors:** Resonant Sensors- Sensor based on Quartz resonators, Digital Quartz Thermometer, Frequency Measurement, Period and Time Interval Measurement. (Text 1: 6.1.1, 6.2.1, 6.2.2, 6.3.1, 6.4.1, 6.5, 8.2.1, 8.2.1.1, 8.5.1 & 8.5.2)	8 Hours L2
Module 3 **Principles of Measurement:** Static Characteristics, Error in Measurement, Types of Static Error, Source of Error. **Digital Voltmeter:** Introduction, Ramp Technique, Dual slope, integrating Type DVM, and Successive Approximations type DVM. **Digital Instruments:** Digital tachometer, Digital pH meter, Digital phase meter. (Text 2: 1.3, 1.4, 1.5, 1.6, 5.1, 5.2, 5.3, 5.4, 5.6, 6.9, 6.10 & 6.12)	8 Hours L3
Module 4 **Bridges:** Wheatstone's Bridge, Kelvin's Bridge, AC Bridges – Capacitance Comparison bridge, Inductance Comparison bridge, Maxwell's Bridge, Wien's bridge. (Text2: 11.2, 11.2.1, 11.2.2, 11.2.3, 11.2.4, 11.2.5, 11.3, 11.8, 11.9, 11.10, 11.11 & 11.14)	8 Hours L3
Module 5 **Oscilloscopes:** Introduction, Basic Principle, CRT Features, Block diagram of oscilloscope, Dual beam CRO, Dual Trace oscilloscope, Storage oscilloscope, **Signal Generators:** Standard Signal Generator, Function Generator, Random Noise Generator.	8 Hours L2

Wave Analyzers: Basic wave analyzer, heterodyne wave analyzer, Spectrum Analyzer. (Text 2: 7.1, 7.2, 7.3, 7.4, 7.14,7.15, 7.18, 8.5, 8.8, 8.10, 9.2, 9.4 & 9.6)	

COURSE OUTCOMES: Upon completion of this course, student will be able to:

CO1	**Understand** the concept of Sensors and operation of primary sensors.
CO2	**Describe** the operation of various self-generating Digital and Intelligent Sensors.
CO3	**Explain** the operation of measurements and the operation of Digital voltmeter and Instruments.
CO4	**Evaluate** various measurement parameters using various bridges.
CO5	**Elaborate** the working of Oscilloscopes, Signal Generators and Wave Analyzers.

Textbooks:

1. Sensors and Signal Conditioning, Ramon Pallas Areny, John G. Webster,2nd edition, John Wiley, and Sons, 2000

2. Electronic Instrumentation, H S Kalsi, Mc Graw Hill, 3rd edition, 2012

Reference book:

1. Electronic Instrumentation & Measurements, David Bell, Oxford University Press PHI, 2nd Edition, 2006.
2. Modern Electronic Instrumentation and Measuring Techniques, D. Helfrick and W.D. Cooper Pearson, 1stEdition, 2015.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			**100**

CO-PO and PSO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO2	1	1	1	-	-	-	-	-	-	-	-	-	1	1
CO3	1	2	-	-	-	-	-	-	-	-	-	1	1	-
CO4	3	3	2	-	-	-	-	1	-	-	-	1	2	1
CO5	2	1	-	-	-	-	-	1	-	-	-	1	2	1
Average	**2**	**2**	-	-	-	-	-	**1**	-	-	-	**1**	**2**	1

Low-1: Medium-2: High-3

SEMESTER –III

Course: Digital System Design Laboratory

Subject Code	22ECEL37	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Credits	1	Examination Hours	03

Course Objectives: Students will be taught;

CLO1	Implementation of Boolean Expressions using Logic Gates.
CLO2	Implementation of various Combinational circuits.
CLO3	Implementation of various sequential circuits.
CLO4	Design of flip-flops and shift registers.
CLO5	Design of counters.

Sl. No.	Experiments	RBT levels
	List of Experiments to be conducted using Hardware components/ Multisim/ PSpice	
1.	Realization of Boolean Expressions using logic gates.	L2, L3
2.	Realization of Binary Adder and Subtractor using Universal Gates.	L2, L3
3.	Implementation of Boolean functions using IC 74153 and IC 74139.	L2, L3
4.	Conversion of Binary to Gray Code and Vice-Versa using Ex-OR gates.	L2, L3
5.	Design a 2-bit Magnitude Comparator using logic gates and a 4-bit comparator using IC 7485.	L2, L3
6.	Verification of truth tables of Master-Slave JK, T, and D flip-flops using NAND gates.	L2, L3
7.	Verify the following operations using IC 7495 i) SISO (ii)SIPO (iii) PISO (iv) PIPO	L2, L3
8.	Design and verify the Johnson and Ring counter using IC 7495.	L2, L3
9.	a. Realize Asynchronous Mod–N counter using IC-7490, IC-74193, b. Realize Synchronous 3-bit UP/DOWN counter using IC 7476.	L2, L3
10.	Use simulation tool for the realization of Binary Adder and Subtractor using IC 7483.	L2, L3
11.	Use a simulation tool to verify the truth table of Master-Slave JK, T, and D flip-flops using NAND gates.	L2, L3
12.	Use a simulation tool for the realization of Asynchronous Mod –N counter using IC, 7490, IC 74193.	L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Illustrate** the simplification of Boolean Expressions using Logic Gates.
CO2	**Design** of Binary Adders, Subtractors, and Comparators.
CO3	**Implement** the various Boolean functions.
CO4	**Construct** various types of flipflops and shift registers
CO5	**Design** and Realize the counters.

Textbooks:

1. Donald D. Givone, Digital Principles, and Design, Tata Mc-Graw Hill Publishing Company Limited, 2016.

Reference Books:

1. John M Yarbrough, Digital Logic Applications and Design, Cengage Learning, 2016.
2. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Publication, 2000.

MOOCs:

1. https://www.edx.org/course/digital-design-2
2. https://www.coursera.org/learn/digital-systems
3. https://onlinecourses.nptel.ac.in/noc19_ee51/preview

Scheme of Examination:

Semester End Examination (SEE):

All laboratory experiments are to be included for practical examination. Students can pick one experiment from the questions lot prepared by the examiners. Change of experiment is allowed only once and 15% Marks allotted to the write up part to be made zero.

Semester End Examination Evaluation		
SL.NO	ACTIVITY	MARKS
1	Write-Up	15
2	Conduction	70
3	Viva Voce	15
TOTAL		100

Note: The marks scored will be proportionately reduced to 50

Continuous Internal Evaluation (CIE):

As part of CIE process, progressive continuous evaluation is done for laboratory work on weekly basis of conduct of experiment by student either individually or in group based on the laboratory. The breakup of the marks allocated is given in the TABLE-1

TABLE-1 WEEKLY EVALUATION OF CONDUCT OF EXPERIMENT		
SL.NO	ACTIVITY	MAX MARKS
1	Conduct of experiment and documentation	10
2	Analysis & interpretation of results	5
3	Viva voce	5
TOTAL		20

Internal examination is conducted at the end of the semester or on completion of a predefined set of experiments based on the laboratory. The evaluation detail of the laboratory internal exam is given in TABLE-2

TABLE-2 LAB INTERNAL EXAMINATION		
SL.NO	ACTIVITY	MAX MARKS
1	Detailed write-up about the experiment with relevant procedure and calculation.	5
2	Conduction of experiment	20
3	Viva voce	5
TOTAL		30

TABLE-3 FINAL CIE CALCULATION		
SL.NO	METRICS USED	MAX MARKS
1	Average of all weekly evaluations of conduct of an experiment	20
2	Lab Internal Examination	30
TOTAL		50

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	-	-	-	-	-	1	-	-	-	2	-
CO2	2	2	1	-	-	-	-	-	1	-	-	-	2	-
CO3	2	2	1	-	-	-	-	-	1	-	-	-	2	-
CO4	2	2	1	-	2	-	-	-	1	-	-	-	2	-
CO5	2	2	1	-	2	-	-	-	-	-	-	-	2	-
Average	2	2	1	-	2	-	-	-	1	-	-	-	2	-

Low-1: Medium-2: High-3

SEMESTER –IV

Course: Advanced Linear Algebra and Probability (For ECE)

Course Code	22MAT41E	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: To enable students to apply the knowledge of Mathematics in various fields of engineering by making them to learn:

CLO1	Probability distributions
CLO2	Stochastic process and Markov chains
CLO3	Sampling distributions and testing of hypothesis
CLO4	Linear Transformation
CLO5	Singular value decomposition

Content	No. of Hours/ RBT levels
Module 1 Probability, Axioms of probability, Conditional probability, Bayes theorem, Discrete and continuous random variables, Moments, Moment generating functions, Binomial, Exponential, Poisson, Normal distributions.	08 Hours L2, L3
Module 2 Joint distributions of two discrete random variables, Marginal and conditional distributions, Expectation and Covariance. Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-problems.	08 Hours L2, L3
Module 3 Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, student's t-distribution, chi-square distribution as a test of goodness of fit, F Test.	08 Hours L2, L3
Module 4 Linear transformations, algebra of transformations, representation of transformations by matrices, linear functional, Non-singular Linear transformations, inverse of a linear transformation, Problems on Rank-Nullity theorem.	08 Hours L2, L3
Module 5 Eigen values and Eigenvectors, Diagonalization, quadratic Forms, constrained optimization, Singular value decomposition.	08 Hours L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO41.1	Solve problems associated with random variables using probability distributions
CO41.2	Solve problems related to testing of hypothesis
CO41.3	Solve problems on linear transformations
CO41.4	Use computational techniques and algebraic skills essential for the study of Eigenvalues and Eigenvectors, and diagonalization

Textbooks:

1. T Veerarajan, Probability, Statistics and Random Processes for Engineers, Tata McGraw Hill, 3rd Edition, 2008
2. Gilbert Strang, Linear Algebra and its Applications, Cengage Learning, 4th Edition, 2006

Reference Books:

1. Richard H Williams, Probability, Statistics and Random Processes for Engineers, Cengage Learning, 1st Edition, 2003
2. David C Lay, Linear Algebra and its applications, Pearson, 4th Edition, 2012.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO41.1	3	2	1									3		
CO41.2	3	2	1									3		
CO41.3	3	2	1									3		
CO41.4	3	2	1									3		
Average	3	2	1									3		

Low-1: Medium-2: High-3

SEMESTER – IV

Course: Principles of Communication Systems(Integrated)

Course Code	22ECE42	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Generation and detection of Amplitude modulation.
CLO2	Angle modulation and Demodulation.
CLO3	Noise in Communication systems.
CLO4	Sampling and Quantization techniques.
CLO5	Base band Modulation techniques.

Content	No. of Hours / RBT levels
Module-1 **Amplitude Modulation**: Introduction, AM- Time domain and frequency domain description, Single Tone Modulation, Generation of AM wave- Switching modulator, Detection of AM waves- Envelop detector. Double Side Band Suppressed Carrier Modulation-Time domain and Frequency domain description, Generation of DSBSC waves - Ring modulator, Coherent detection of DSBSC modulated wave and Costas loop receiver. (Text-1: 3.1, 3.2 and 3.3)	8 Hours L3
Module-2 **Sideband Modulation:** Single sideband Modulation, Vestigial Side Band Modulation, and frequency Translation. (Text-1: 3.5 and 3.7) **Angle Modulation:** Introduction, Basic Definitions, Properties of angle Modulated waves, Frequency Modulation- Narrow-Band FM, Wide-Band FM, Transmission bandwidth of FM signal and Generation of FM signals. (Text-1: 4.1, 4.2 and 4.3)	8 Hours L3
Module-3 **Angle Demodulation:** Demodulations of FM signals: Balanced frequency discriminator, Phase-Locked Loop, Linear Model of the Phase-Locked Loop and Super Heterodyne Receiver. (Text 1: 4.3, 4.4 and 4.6) **Noise in Analog Modulation:** Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth, Noise figure, Noise temperature, SNR, Receiver Model, Noise in DSBSC Receivers, Noise in AM receivers and threshold effect. (Text-1: 5.10, 6.2, 6.3, and 6.4)	8 Hours L3
Module-4 **The Transition from Analog to Digital:** Introduction, Why Digitize Analog Sources? The Sampling process, Pulse Amplitude Modulation, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, Bandwidth noise tradeoff, Quantization Process, Quantization Noise. (Text-1: 7.1, 7.2, 7.3, 7.4, 7.6 and 7.8)	8 Hours L3

Module-5	
Base Band Modulation Techniques: Pulse Code Modulation-Sampling, Quantization, Companding-A Law and μ Law Companding, Encoding - line codes, T1 system, Regeneration, Decoding, Filtering, Multiplexing-: Time Division Multiplexing and Frequency Division Multiplexing, Delta modulation and Delta Sigma Modulation. (Text-1: 7.9, 7.5, 3.8 7 & 7.10)	8 Hours L3

Practical Component of IPC		
Sl. No.	Experiments	RBT levels
	List of Experiments to be conducted using Hardware components/ simulation Tools	
1.	Conduct an Experiment to Generate standard Amplitude Modulated wave and demodulate the same	L3, L4
2.	Conduct an Experiment to generate DSBSC wave and demodulate the same	
3.	Conduct an Experiment to Generate Frequency Modulated wave using 8038 and demodulate the same	L3, L4
4.	Conduct an Experiment to Generate Pulse Amplitude Modulated wave and demodulate the same	L3, L4
5.	Conduct an Experiment to Generate Pulse width modulation	L3, L4
6.	Conduct an Experiment to Generate Pulse position modulation	L3, L4
7.	Conduct an experiment to Verify sampling theorem	L3, L4
8.	Simulation of Amplitude modulation and frequency domain analysis using MATLAB	L3, L4
9.	Simulation of Frequency modulation and frequency domain analysis using MATLAB	L3, L4
10.	Simulate to verify Sampling theorem using MATLAB	L3, L4

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Illustrate** the process of generation and detection of amplitude modulation techniques used in analog communication systems.
CO2	**Apply** the concept of angle modulation for generation and detection of FM signals.
CO3	**Describe** the various types of noises and its performance on modulation techniques.
CO4	**Analyze** the digital representation of analog signals on modulation techniques.
CO5	**Elaborate** the operation of base band modulation techniques.

Textbooks:

1. Simon Haykins and Moher, Communication Systems, 5th Edition, John Willey, India Pvt. Ltd, 2010.

Reference books:

1. Simon Haykins, An Introduction to Analog and Digital Communication, John Wiley India Pvt. Ltd., 2008
2. K. Sam Shanmugam, Digital and Analog Communication systems, Willey, India Pvt. Ltd, 2015.

E-Books / Web References NPTEL Courses

1. https://nptel.ac.in/courses/108/104/108104091/
2. https://nptel.ac.in/courses/108/104/108104098/

Scheme of Evaluation: (Integrated courses)

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE **Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50.** There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment of Integrated courses would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester. The Evaluation pattern for integrated courses is shown in the Table-1

Table-1: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
		Grand Total	100

CO-PO and PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	1	-	1	2	1
CO2	3	2	1	-	-	-	-	-	-	1	-	1	2	1
CO3	3	2	1	-	-	-	-	-	-	1	-	1	2	1
CO4	3	2	1	-	-	-	-	-	-	1	-	1	2	1
CO5	3	2	1	-	-	-	-	-	-	1	-	1	2	1
Average	3	2	1	-	-	-	-	-	-	1	-	1	2	1

Low-1: Medium-2: High-3

SEMESTER – IV

Course: Control Systems

Course Code	22ECE43	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Transforms, Complex Variables, and Special Functions

Course Learning Objectives: Students will be taught;

CLO1	Fundamental concepts and applications of control systems.
CLO2	Mathematical modeling of Mechanical, Electrical, and Electro–Mechanical systems.
CLO3	Time and frequency response of the system.
CLO4	Stability of the system using graphical techniques.
CLO5	Concept of state variable and state model for continuous time systems.

Content	No. of Hours/ RBT levels
Module-1 **Introduction to Control Systems:** Introduction, Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems–Mechanical Systems, Electrical Systems, Electromechanical systems and Analogous Systems. (Text-1: 1.1, 2.1.2.2)	8 Hours L3
Module-2 **Block diagrams and signal flow graphs:** Transfer functions, Block diagram, algebra, and Signal Flow graphs, Illustrative examples. (Text-1: 2.4 to 2.7)	8 Hours L3
Module-3 **Time Response of Feedback Control Systems:** Introduction, 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. (Text-1: 5.1 to 5.5, 5.7)	8 Hours L3
Module-4 **Stability analysis:** The Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis, More on the Routh stability criterion. **Root Locus and Bode plots:** Introduction to Root-Locus Techniques, Root Locus Concepts, Construction of Root loci and Bode Plots. (Inverse Bode Plot Excluded) (Text-1: 6.1 to 6.6, 7.1 to 7.3, 8.4)	8 Hours L3
Module-5 **Stability in Frequency Domain:** Introduction to Polar Plots, (Inverse Polar Plots excluded) Mathematical preliminaries, Nyquist Stability criterion, (Systems with transportation lag excluded). **Introduction to State variable analysis:** Introduction, Concepts of state, state variable and state models for electrical systems, Solution of state equations. (Text-1: 8.3, 9.1, 9.2, 9.3, 12.1 to 12.3)	8 Hours L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Explain** the concepts of control systems and their applications.
CO2	**Analyze** the mechanical and electrical systems using block diagram reduction techniques and Signal Flow graphs to find the overall transfer function.
CO3	**Describe** quantitative analysis of the transient response of first and second-order systems.
CO4	**Compute** the RH criteria, Root locus, Bode plots, and Nyquist criterion to check the stability of the systems.
CO5	Analyze the state variable and state model for continuous time systems.

Textbooks:

1. I.J. Nagrath and M.Gopal, Control Systems Engineering, 5th edition, New Age International(P) Limited, 2011.

Reference Books:

1. Benjamin C. Kuo, Automatic Control Systems, 8th edition, John Wiley India Pvt. Ltd., 2008.
2. Ogata, Modern Control Engineering, 4th edition, Pearson Education, 2002.

MOOCs:

https://nptel.ac.in/courses/107/106/107106081/
https://nptel.ac.in/courses/108/106/108106098/

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			**100**

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	2
CO3	2	1	2	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	2	1	1	-	-	-	-	-	-	1	3	2
CO5	2	2	2	1	1	-	-	-	-	-	-	1	2	2
Average	2	2	2	1	1	-	-	-	-	-	-	1	2	2

Low-1: Medium-2: High-3

SEMESTER – IV

Course: Signals and Systems

Course Code	22ECE44	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Transforms, Complex Variables and Special Functions

Course Learning Objectives: Student will be taught;

CLO1	Mathematical description of continuous and discrete time signals and systems
CLO2	LTI Systems and properties
CLO3	Fourier Representation of Signals and LTI Systems
CLO4	Non periodic signals using Fourier Transforms.
CLO5	Z-Transforms and its properties.

Content	No. of Hours/ RBT levels
Module-1 **Introduction and Classification of signals:** Definition of signal and systems, Classification of signals. **Basic Operations on signals:** Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal. **Elementary signals/Functions:** Exponential, sinusoidal, step, impulse, and ramp functions.	8 Hours L2
Module-2 **Properties of Systems:** Linear-nonlinear, Time variant-invariant, causal, non-causal, static-dynamic, stable-unstable, invertible. **Time domain representation of LTI Systems:** Impulse response, convolution sum, convolution integral. Computation of convolution sum and convolution integral using graphical method for unit step and unit step, unit step and exponential.	8 Hours L3
Module-3 **Fourier Representation of Signals and LTI Systems:** Discrete- Time Periodic Signals: The Discrete-Time Fourier Series, Continuous-Time Periodic Signals: The Fourier Series, basic problems. CTFS and DTFS properties (Analytical treatment).	8 Hours L3
Module-4 **Fourier Representation of Non-Periodic Signals:** Introduction, Discrete-Time Non-Periodic Signals: The Discrete-Time Fourier Transform, Continuous-Time Non-Periodic Signals: The Fourier Transform, Inverse Fourier Transforms. **Properties of Fourier Transform** (Analytical treatment), problems on properties of Fourier Transform.	8 Hours L3
Module-5 **Z-Transforms:** Z-transform, properties of the Region of Convergence, properties of the Z-transform, Inverse Z-transforms, unilateral Z-transform and Transform Analysis of LTI systems-pole-Zero plots, causality and stability in terms of Z- transforms	8 Hours L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Solve** the both Continuous time Discrete time signals with various operations.
CO2	**Compute** the response of a Continuous and Discrete LTI system using convolution integral and convolution sum.
CO3	**Analyze** the frequency response of a given arbitrary periodic CTS/ DTS using Fourier series and its properties.
CO4	**Determine** frequency response of a given arbitrary Non-periodic CTS/DTS using Fourier transforms and its properties.
CO5	**Compute** the Z-transforms, inverse Z- transforms and transfer functions of complex LTI systems.

Textbooks:

1. Simon Haykin and Barry Van Veen, Signals and Systems, 2nd edition, Wiley India. 2008.

Reference books:

1. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, Signals and Systems, 2nd edition, Pearson Education, 2002.
2. Michael Roberts, Fundamentals of Signals and Systems, 2nd edition, Tata McGraw-Hill, 2010

NPTEL:

1. https://nptel.ac.in/courses/108/104/108104100/
2. https://nptel.ac.in/courses/108/106/108106163/
3. https://nptel.ac.in/courses/117/101/117101055/

MOOCs

https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO-PO & PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	1	-	-	1	-	-
CO2	3	1	-	-	-	-	-	-	1	-	-	1	2	1
CO3	2	1	-	-	-	-	-	-	-	-	-	1	2	1
CO4	3	1	-	-	-	-	-	-	-	-	-	1	2	1
CO5	3	1	-	-	-	-	-	-	-	-	-	1	2	1
Average	3	1	-	-	-	-	-	-	1	-	-	1	2	1

Low-1: Medium-2: High-3

SEMESTER – IV

Course: Data Structures Using C++

Course Code	22ECE45	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Objectives: Students will be taught.

CLO1	Types of data structures, Searching and sorting Algorithms.
CLO2	concepts of dynamic memory allocation and linked lists.
CLO3	Stack and Queues, its primitive operations.
CLO4	Binary trees representation.
CLO5	Graph representation and implementation of Shortest path algorithms.

Content	No. of Hours/ RBT levels
Module 1 **Introduction:** Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations. **Searching:** linear search, binary search, recursive binary search. **Sorting:** Bubble sort, selection sort, insertion sort, quick sort, binary tree sort, merge sort, heap sort. ((Text 1: 6.1, 6.2, Text 2: Chapter 9 full)	8 Hours L2
Module 2 **Dynamic Memory Allocation:** Introduction, Dynamic Memory Allocation, Allocating a Block of Memory: malloc, Allocating multiple blocks of Memory: calloc, Releasing the Used Space: Frec, Altering size of the block: realloc, **Linked List:** What is linked list, operation on linked list, more linked lists, reversing the links, A few more operations, Recursive operations on linked lists, Doubly linked lists. (Text 1: Chapter 6.3, Text 2: Chapter 3 full)	8 Hours L3
Module 3 **Stacks:** stack as an array, stack as a linked list, Applications of stacks, Infix to postfix conversion, postfix to prefix conversion, other interconversions, Evaluation of postfix expression. **Queues:** Queue as an array, Queue as a linked list, circular Queue, Deque, priority queue. (Text 2: Chapter 5 and 6 full).	8 Hours L3
Module 4 **Trees:** Binary Trees, Representation of binary trees in memory, Linked representation of binary trees, Array representation of binary trees, Binary search trees, Operations on binary search trees, Reconstruction of binary tree, Threaded Binary trees, AVL Trees, Binary Heap. (Text 2: Chapter 7 full)	8 Hours L3
Module 5 **Graphs:** Definition and terminology, graph representations, graph traversal, spanning tree, shortest path, topological sorting. (Text 2: Chapter 8 full)	8 Hours L2

COURSE OUTCOMES: Upon completion of this course, student will be able to;

CO1	**Comprehend** different types of data structures and apply algorithms to perform searching and sorting..
CO2	**Discribe** primitive operations on linked lists.
CO3	**Explain** the operational aspects of stacks and queues.
CO4	**Implement** operations on Binary Trees.
CO5	**Implement** shortest path algorithms using graphs.

Text Books:

1. Seymour Lipschutz, Data Structures with C, Schaum's Outlines, Special Indian Edition, 13th reprint, Tata McGraw Hill Education, 2015.
2. Data Structures Through C++, Yashavant P Kanetkar, 3rd Edition, BPB Publication.

References:

1. D. S. Malik, Data Structures Using C++, 2nd edition, Cengage Learning.
2. Varsha H Patil, Data Structures Using C++, Oxford University Press,2012

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least one **full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is **added to test component**. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. Some **possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE and SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	1	-	-	-	1	-	2
CO2	3	3	3	-	-	-	-	1	-	-	-	1		2
CO3	3	3	3	-	-	-	-	1	-	-	-	1	-	2
CO4	3	3	3	-	-	-	-	1	-	-	-	1	-	2
CO5	3	3	3	-	-	-	-	1	1	-	-	1	-	2
Average	3	3	3	-	-	-	-	1	1	-	-	1	-	2

Low-1: Medium-2: High-3

SEMESTER – IV

Course: Verilog HDL

Course Code	22ECE46	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Different modeling concepts in Verilog.
CLO2	Verilog based design using Gate Level and Data Flow Modeling Styles.
CLO3	Behavioral description, Tasks and Functions in Verilog.
CLO4	Programming concept for Digital Circuits using state machine charts.
CLO5	Logic Synthesis and its effects in Verification.

Content	No. of Hours / RBT levels
Module-1 **Overview of Digital Design with Verilog HDL**: Evolution of CAD, emergence of HDLs, typical HDL-flow, why Verilog HDL? trends in HDLs. Hierarchical Modeling Concepts: Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text 1: 1.1 to 1.6, 2.1 to 2.6) **Basic Concepts**: Lexical conventions, data types, system tasks, compiler directives. Modules and Ports: Module definition, port declaration, connecting ports. (Text 1: 3.1 to 3.3, 4.1 to 4.2)	8 Hours L1, L2
Module-2 **Gate-Level Modeling**: Gate Types, Gate Delays: rise, fall and turn-off delays, min, max, and typical delays, Delay Example (Text 1: 5.1 and 5.2) Dataflow Modeling: Continuous assignments, delay specification, expressions, operators, operands, operator types, Examples :4 to 1 MUX, 4 Bit Full adders: Full adder data flow model, full adder with carry look ahead-Verilog Programs. (Text 1: 6.1 to 6.5)	8 Hours L1, L2
Module-3 **Behavioral Modeling**: Structured procedures, initial and always, blocking and non-blocking statements, conditional statements, Multiway branching, loops. (Text 1: 7.1 to 7.2 and 7.4 to 7.6) **Tasks and Functions**: Differences between tasks and functions, Task: Declaration and Invocation-Syntax, Task Example. Function: Declaration-Syntax, Example-Parity calculation(Text 1: 8.1 to 8.3)	8 Hours L1, L2
Module-4 **Design Examples:** BCD to 7 segment Display Decoder, Traffic Light Controller, Synchronization and Debouncing, Shift and Add Multiplier: Design and Verilog program, Signed/Fraction Multiplier-Design and Verilog program. (Text 2 :4.1, 4.4, 4.7, 4.8 &4.10) **State Machine Charts:** SM Charts, Derivation of SM Charts: Binary Multiplier, Dice Game-SM chart Realization of SM Charts. (Text 2 : 5.1 and 5.2)	8 Hours L2, L3

Module-5	8 Hours
Modeling Techniques: Procedural Continuous Assignments, Overriding Parameters, Conditional Compilation and Execution, Time Scales. (Text 1: 9.1 to 9.4) Logic Synthesis with Verilog: Logic Synthesis, Impact of Logic Synthesis, Verilog HDL Synthesis, Synthesis Design Flow and Verification of Gate Level Netlist. (Text 1:14.1 to 14.5)	L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Analyze** the Verilog programs using different abstract levels.
CO2	**Design** and Verify the functionality using test benches.
CO3	**Develop** a Verilog program with tasks and functions.
CO4	**Apply** the SM Charts to realize the digital circuits.
CO5	**Interpret** the verification of digital circuit using logic synthesis.

Textbooks:

1. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Pearson Education, 2nd Edition, Reprint 2020.
2. Charls H. Roth Jr, Lizy K, John and Byeong K. Lee, Digital Systems Design Using Verilog, Cengage Learning,1st Edition, 2016.

Reference Books:

1. Michel D. Ciletti , Advanced Digital Design with the Verilog HDL, Pearson Education, 2nd Edition, 2011.
2. Peter J. Ashenden, Digital Design: An Embedded Systems Approach using Verilog, Elsevier,2015.
3. Stephen Brown and Zvonkoc Vranesic, Fundamentals of Digital Logic with Verilog Design, Mc-Graw Hill Publication,2003,

MOOCs

https://www.mitzon.com/mooc/digital-design-using-verilog-hdl-programming-with-practical/

https://www.coursera.org/learn/fpga-hardware-description-languages

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE and SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3		1			1	2	1	2	1	2	2
CO2	3	2	3					1	2	1	2	1	2	2
CO3	3	2	3	2	3			1	2	1	2	1	2	2
CO4	3	2	3	1	3			1	2	1	2	1	2	2
CO5	2	2	2	3	3			1	2	1	2	1	2	2
Average	3	2	3	3	3			1	2	1	2	1	2	2

Low-1: Medium-2: High-3

SEMESTER – IV

Course: HDL Laboratory

Subject Code	22ECEL47	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Credits	1	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Dataflow modeling style in Verilog
CLO2	Implementation of Behavioral and structural modeling style in Verilog HDL.
CLO3	Verification of combinational and sequential circuits using simulator
CLO4	Simulation of Test bench using simulator.

List of Experiments	
Write a Verilog Code to verify the functionality of the following Digital Circuits using simulation CAD tool(Xilinx) or cadence tool.	
1	Full Adder Circuit using Two Half adders.
2	2 to 4 Decoder using NAND Gates only (Structural model)
3	8 to 3 Encoder with priority & without priority (Behavioral Model)
4	8 to 1 Multiplexer using case statements and if statements.
5	4-bit Binary to Gary Code converter.
6	SR, D and JK flip-flops.
7	4-bit Binary Counter.
8	4- bit BCD counter.
9	8- bit ALU to perform addition, subtraction, multiplication and logical operations.
10	4- bit Ripple carry adder using structural model.

Course Outcomes: Upon successful completion of this course, student will be able to:

CO1	Develop Verilog HDL code for combinational circuits.
CO2	Verify sequential circuits using modelsim simulator.
CO3	Analyze the digital circuits using test bench.
CO4	Apply sequential statements to implement digital circuits.
CO5	Apply Structural modeling style to digital circuits.

Textbook:

1. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Pearson Education, 2nd Edition, Reprint 2020.

Scheme of Examination:

Semester End Examination (SEE):

All laboratory experiments are to be included for practical examination. Students can pick one experiment from the questions lot prepared by the examiners. Change of experiment is allowed only once and 15% Marks allotted to the write up part to be made zero.

Semester End Examination Evaluation		
SL.NO	ACTIVITY	MARKS
1	Write-Up	15
2	Conduction	70
3	Viva Voce	15
TOTAL		100

Note: The marks scored will be proportionately reduced to 50

Continuous Internal Evaluation (CIE):

As part of CIE process, progressive continuous evaluation is done for laboratory work on weekly basis of conduct of experiment by student either individually or in group based on the laboratory. The breakup of the marks allocated is given in the TABLE-1

TABLE-1 WEEKLY EVALUATION OF CONDUCT OF EXPERIMENT		
SL.NO	ACTIVITY	MAX MARKS
1	Conduct of experiment and documentation	10
2	Analysis & Interpretation of results	5
3	Viva voce	5
TOTAL		20

Internal examination is conducted at the end of the semester or on completion of a predefined set of experiments based on the laboratory. The evaluation detail of laboratory internal exam is given in TABLE-2

TABLE-2 LAB INTERNAL EXAMINATION		
SL.NO	ACTIVITY	MAX MARKS
1	Detailed write-up about the experiment with relevant procedure and calculation.	5
2	Conduction of experiment	20
3	Viva voce	5
TOTAL		30

TABLE-3 FINAL CIE CALCULATION		
SL.NO	METRICS USED	MAX MARKS
1	Average of all weekly evaluation of conduct of experiment	20
2	Class Internal Examination	30
TOTAL		50

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	1	-	-	-	1	-	-	1	2	1
CO2	3	3	2	-	1	-	-	-	1	-	-	1	2	1
CO3	3	3	2	-	1	-	-	-	1	-	-	1	2	1
CO4	3	3	2	-	1	-	-	-	1	-	-	1	2	1
CO5	3	3	2	-	1	-	-	-	1	-	-	1	2	1
Average	3	3	2	-	1	-	-	-	1	-	-	1	2	1

Low-1: Medium-2: High-3

III- YEAR ECE SYLLABUS-2022 SCHEME

Department of Electronics and Communication Engineering

GLOBAL ACADEMY OF TECHNOLOGY

(Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited CS, E&C, E&E, MECH, CV and IS branches)

Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.

HEAD OF THE DEPARTMENT
Dept. of Electronics & Communication E
Global Academy of Techn
Rajarajeshwarinagar, Bangalore-

SEMESTER – V

Course: Engineering Economics and Management

Course Code	22ECE51	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Importance of management and planning
CLO2	Characteristics of organization and leadership Styles.
CLO3	Importance of project management
CLO4	Fundamentals of economic concepts and value of money.
CLO5	Breakeven analysis and risk analysis.

Content	No. of Hours / RBT levels
Module-1 **Management:** Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art &Profession. **Planning:** Nature, Importance and Purpose of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making. (Text 1)	8 Hours L2
Module-2 **Organizing and Staffing:** Meaning, Characteristics of Organization – Process of Organization, Principles of Organization, Span of Management, Departmentalization, Meaning, Process of Departmentalization, Purpose of Departmentalization, Committees – meaning, Types of Committees, Importance of Staffing, Manpower planning, Sources of Recruitment, Process of Selection. **Directing and Controlling:** Meaning, Requirement of Effective Direction, Giving order, Motivation. Communication – Meaning and Purpose of communication Coordination- Meaning and Need, Types and Techniques of Coordination. Controlling – Meaning, Steps in Controlling. (Text 1)	8 Hours L2
Module-3 **Leadership:** Meaning, Characteristics of Leadership, Functions of Executive Leader, Traditional Approaches to Leadership. **Social Responsibilities of Business:** Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. (Text 1)	8 Hours L3
Module-4 **Introduction to Engineering Economy:** Introduction, Problem solving and decision making, Engineering Economic Decision Maze. **Time Value of Money:** Interest and value of money, Reasons for interest, Simple interest, Compound interest, Compound interest factors, Cash flow diagram, Calculation of time-value Equivalences. (Text 2)	8 Hours L3
Module-5 **Break Even Analysis:** Basic concepts, Linear break-even analysis, break even charts;	8 Hours

algebraic relationships, break-even point alternatives, dumping, multiproduct alternatives and multiple alternatives, Nonlinear Break-even analysis: marginal revenue and profit, marginal cost and average unit cost, Inflation and its effects, Inflation, its causes and consequences. Effects of inflation on Breakeven Analysis. **Risk Analysis:** Recognizing Risk, Including risk in Economic Analyses, Probability concepts for economic Analysis, Applications of Probability concepts. (Text 2)	L2

Course Outcomes: Upon completion of this course, student will be able to:

CO 1	**Explain** the importance of Management and Planning
CO 2	**Describe** the characteristics of organization and direction
CO 3	**Discuss** the fundamentals of leadership styles and Social Responsibility of Business
CO 4	**Understand** the concept of Engineering Economics and Time value of Money.
CO 5	**Explain** the concepts Break-Even Analysis and Risk analysis

Textbooks:

1. Principles of Management P.C. Tripathi, P.N.Reddy McGraw Hill, 6th Edition, 2017
2. Engineering Economics by, James L. Riggs, David D. Bedworth, Sabah U. Randhawa McGraw Hill Education, 4th Edition, 2004.

Reference Books:

1. Essentials of Management: An International, Innovation and Leadership perspective Harold Koontz, Heinz Weihrich McGraw Hill 10thEdition 2016

E-Books / Web References:

https://www.youtube.com/watch?v=8GFXOWxlySs

MOOCs:

https://onlinecourses.nptel.ac.in/noc20_mg58/preview

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		-	-	-	-	-	-		3	3	1		-	-
CO2		-	-	-	-	-	-		3	3	1		-	-
CO3		-	-	-	-	2	2		-	-	1		-	-
CO4		-	-	-	-	2	2		-	-	1		-	-
CO5		-	-	-	-	2	-	2	-	-	3		-	-
Average		-	-	-	-	2	2	2	3	3	2		-	-

Low-1: Medium-2: High-3

SEMESTER – V

Course: Digital Communication Systems (Integrated)

Course Code	22ECE52	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Representation of baseband signals and line codes.
CLO2	Signals over AWGN Channels, optimum receivers.
CLO3	Digital Modulation Techniques.
CLO4	Data Transmission through band limited channels.
CLO5	Principles of Spread Spectrum.

Content	No. of Hours / RBT levels
Module-1 **Bandpass Signal to Equivalent Low pass:** Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems. (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12) **Line codes:** Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities. (Text 1: 6.10) Overview of HDB3, B3ZS, B6ZS (Reference Text 1: 7.2.5)	8 Hours L3
Module-2 **Signalling over AWGN Channels:** Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver (Text 1: 7.1 to 7.4).	8 Hours L3
Module-3 **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 treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) (Text 1: 7.6, 7.7 & 7.8)	8 Hours L3
Module-4 **Communication through Band Limited Channels**: Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI–The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals, **Probability of error for detection of Digital PAM**: Probability of error for detection of Digital PAM with Zero ISI, Symbol–by–Symbol detection of data with controlled ISI **Channel Equalization**: Linear Equalizers (Text 2: 10.1, 10.2, 10.3, 10.4 & 10.5.2)	8 Hours L3

Module-5	8 Hours
Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, 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 based on IS-95 (Text 2: 15.1, 15.2, 15.3, 15.4 & 15.5)	L2, L3

Practical Component of IPC	
List of Experiments	
1	Conduct an experiment to generate FSK and PSK modulated signals and demodulate the same.
2	Conduct an experiment to Measure of frequency, guide wavelength, power, VSWR and attenuation in microwave test bench.
3	Conduct an experiment to Obtain the Radiation Pattern and Measurement of directivity and gain of micro strip dipole and Yagi antennas.
4	Conduct an experiment to Determine: a. Coupling and isolation characteristics of micro strip directional coupler. b. Resonance characteristics of micro strip ring resonator and computation of dielectric constant of the substrate. c. Power division and isolation of micro strip power divider.
5	Simulate NRZ, RZ, half-sinusoid and raised cosine pulses and generate eye diagram for binary polar signaling using MATLAB.
6	Simulate Pulse code modulation and demodulation system using MATLAB.
7	Simulate Computations of the Probability of bit error for coherent binary ASK, FSK and PSK for an AWGN Channel and compare them with their Performance curves using MATLAB.
8	Simulate Digital Modulation Schemes i) DPSK Transmitter and receiver, ii) QPSK Transmitter and Receiver using MATLAB.

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Represent** the signals in various forms.
CO2	**Explain** the concept of source and channel coding techniques.
CO3	**Generate** and detect various Digital Modulation techniques.
CO4	**Compute** performance parameters of band limited channels.
CO5	**Explain** the concept of Spread spectrum communication system.

Textbooks:

1. Simon Haykin, Digital Communication Systems, 1st edition, John Wiley & sons, 2014.
2. John G Proakis and Masoud Salehi, Fundamentals of Communication Systems, 2nd edition, Pearson Education, 2014.

Reference Books:

1. B.P. Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, 4th Edition, Oxford University Press, 2010.
2. Ian A Glover and Peter M Grant, Digital Communications, 3rd Edition, Pearson Education, 2010.
3. Bernard Sklar and Ray, Digital Communications - Fundamentals and Applications, 3rd edition, Pearson Education, 2014.

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester. Typical Evaluation pattern for integrated courses is shown in the Table1

Table1: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
		Grand Total	100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO2	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO3	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO4	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO5	3	2	1	-	-	-	-	-	-	-	-	3	2	2
Average	3	2	1	-	-	-	-	-	-	-	-	3	2	2

Low-1: Medium-2: High-3

SEMESTER – V

Course: Digital Signal Processing

Course Code	22ECE53	CIE	50
Hours/Week(L:T:P)	3:2:0	SEE	50
No. of Credits	4	Examination Hours	03

Prerequisites: Signals and systems

Course Learning Objectives: Students will be taught:

CLO1	Frequency domain sampling and reconstruction of discrete-time signals and their properties.
CLO2	DFT and its properties.
CLO3	FFT algorithms and linear filtering approach.
CLO4	Digital IIR filters and their realization.
CLO5	Digital FIR filters and their realization.

Content	No. of Hours / RBT levels
Module-1 **Discrete Fourier Transforms (DFT):** Frequency domain sampling and Reconstruction of Discrete Time Signals. DFT as a linear transformation its relationship with other transforms. Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular convolution. (Text 1: 7.1, 7.2.1, 7.2.2)	8 Hours L3
Module-2 **Additional DFT properties:** Time Reversal, Circular Time Shift, Circular Frequency Shift, Complex Conjugate & Parseval's Theorem. Use of DFT in Linear Filtering: Overlap-save and overlap-add method. Direct computation of DFT, Need for Efficient Computation of the DFT (FFT algorithms). (Text 1: 7.2.3, 7.3 & 8.1.1)	8 Hours L3
Module-3 **Fast Fourier Transform (FFT) algorithms:** Radix-2 FFT algorithms for the computation of DFT and IDFT – Decimation in Time and Decimation in Frequency algorithms. Goertzel algorithm, and Chirp Z Transform. (Text 1: 8.1.3, 8.3)	8 Hours L3
Module-4 **Analog filters:** Characteristics of commonly used analog filters – Butterworth filters, Design of analog filter, frequency transformations in analog domain. (Text 1: 10.3.4, 10.3.1, 10.3.2, 10.3.3, 10.3.5, 10.4.1) **Digital Low Pass IIR Filter:** Analog to Digital transformations; Impulse invariance Technique, Bilinear transformation. Design of digital IIR Filters using Impulse invariance and Bilinear transformation. (Text 1:10.3.2, 10.3.3) Structure for IIR Systems: Direct Form-I, Direct form-II, Cascade form, Parallel form structures. (Text 1: 9.3.1, 9.3.3, 9.3.4)	8 Hours L4
Module-5 **FIR Filters:** Characteristics of practical frequency selective filters, Symmetric and anti-symmetric FIR filters, Window functions: Rectangular, Hanning and	8 Hours L2

Hamming, Design of FIR filters using Rectangular, Hamming and Hanning, Blackmann and Kaiser. (Text 1:10.1.2, 10.2.1, 10.2.2, 10.2.3) **Realization of FIR Filter:** Direct Form I & II and Cascade form, (Text 1:9.2.1, 9.2.2, 9.2.4.)	

Course Outcomes: Upon completion of this course, students will be able to:

CO1	**Describe** the frequency domain sampling and reconstruction of DT signals and its properties.
CO2	**Evaluate** the DFT using properties.
CO3	**Compute** DFT using FFT algorithms and linear filtering approach.
CO4	**Design** and implementation of FIR filters.
CO5	**Design** and implementation of IIR filters.

Textbook:

1. Johan G. Proakis and Dimitris G. Manolakins, "Digital Signal Processing –Principles, Algorithms and Applications", Fourth Edition, Pearson Education, New Delhi, 2007.

Reference Books:

1. Sanjit K Mithra, Digital signal Processing, A Computer Based approach, 4th edition, McGraw Hill Education, 2013.

MOOCs:

https://nptel.ac.in/courses/117102060
https://nptel.ac.in/courses/108106151

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. CIE is executed by way of two quizzes /Alternate Assessment Tools (AATs) and three tests. **Some possible AATs:** seminar/assignments/ mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			**100**

CO-PO & PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1	1	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	2
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	2
Average	3	2	2	-	-	-	-	-	-	-	-	1	2	2

Low -1: Medium -2: High-3

SEMESTER – V

Course: Digital Signal Processing Laboratory

Course Code	22ECEL54	CIE Marks	50
Hours/Week (L:T:P)	0:0:2	SEE Marks	50
No. of Credits	1	Examination Hours	03

Course Learning Objectives: Student will be taught;

CLO1	Generate standard test signals and verify Sampling Theorem.
CLO2	DFT of a discrete signal and verify its properties.
CLO3	Difference equation and compute convolution & correlation.
CLO4	Implement digital filters.
CLO5	Perform computations using DSP hardware.

Sl. No.	Content	RBT levels
List of Experiments to be conducted using Hardware Components/Simulation Tools		
	PARTA: Experiments Using MATLAB	
1.	Write a MATLAB program to verify Sampling Theorem for different conditions.	L3
2.	Write a MATLAB program to perform Linear and Circular Convolution of two given sequences.	L3
3.	Write a MATLAB program to perform Auto and Cross Correlation of two sequences and verification of their properties.	L3
4.	Write a MATLAB program to Solve a given difference equation to find step and steady state responses.	L3
5.	Write a MATLAB program to Compute N point DFT of a given sequence and plot magnitude and phase spectrum.	L3
6.	Write a MATLAB program to i) Verify DFT properties (Linearity and Parseval's Theorem). ii) Compute DFT of Square pulse and Sinc function.	L3
7.	Write a MATLAB program to Design and implement Low pass FIR filter for the given specifications: Normalized cutoff frequency = 0.48 Order of the filter = 34	L3
8.	Write a MATLAB program to Design and implement digital Low Pass IIR filter to meet given specifications: Passband edge frequency = 2000Hz Stopband edge frequency = 3000Hz Passband attenuation = - 3dB Stopband attenuation = - 15dB Sampling frequency = 8000 samples/sec	L3

PART-B: Experiments Using DSP Starter Kit		
9.	Write a C program to Generate Sine Wave and Standard Test Signals using DSP starter kit.	L3
10.	Write a C program to Compute Linear Convolution of two sequences using DSP starter kit.	L3
11.	Write a C program to Compute the N- point DFT of a given sequence using DSP starter kit.	L3
12.	Write a C program to Determine the impulse response of second order system using DSP starter kit.	L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Apply** sampling theorem to verify different conditions of sampling.
CO2	**Obtain** output response of the system using Linear Convolution, circular convolution, autocorrelation and cross correlation of the sequences.
CO3	**Determine** FFT of given sequence and verify its properties.
CO4	**Design** and implement the digital FIR/IIR filter for the specifications of Passband edge frequency, Stopband edge frequency, sampling frequency and attenuation.
CO5	**Determine** the output response of the system using DSP Processor.

Scheme of Examination:

Semester End Examination (SEE):

All laboratory experiments are to be included for practical examination. Students can pick one experiment from the questions lot prepared by the examiners. Change of experiment is allowed only once and 15% Marks allotted to the write up part to be made zero.

Semester End Examination Evaluation		
SL.NO	ACTIVITY	MARKS
1	Write-Up	**15**
2	Conduction	**70**
3	Viva Voce	**15**
TOTAL		**100**

Note: The marks scored will be proportionately reduced to 50

Continuous Internal Evaluation (CIE):

As part of CIE process, progressive continuous evaluation is done for laboratory work on weekly basis of conduct of experiment by student either individually or in group based on the laboratory. The breakup of the marks allocated is given in the TABLE-1

TABLE-1 WEEKLY EVALUATION OF CONDUCT OF EXPERIMENT		
SL.NO	ACTIVITY	MAX MARKS
1	Conduct of experiment and documentation	10
2	Analysis & interpretation of results	5
3	Viva voce	5
TOTAL		20

Internal examination is conducted at the end of the semester or on completion of a predefined set of experiments based on the laboratory. The evaluation detail of the laboratory internal exam is given in TABLE-2

TABLE-2 LAB INTERNAL EXAMINATION		
SL.NO	ACTIVITY	MAX MARKS
1	Detailed write-up about the experiment with relevant procedure and calculation.	5
2	Conduction of experiment	20
3	Viva voce	5
TOTAL		30

TABLE-3 FINAL CIE CALCULATION		
SL.NO	METRICS USED	MAX MARKS
1	Average of all weekly evaluations of conduct of an experiment	20
2	Lab Internal Examination	30
TOTAL		50

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			1			2	1			1	1	1
CO2	3	2			1			2	1			1	1	1
CO3	3	2			1			2	1			1	1	1
CO4	3	2			1			2	1			1	1	1
CO5	3	2			1			2	1			1	1	1
Average	3	2			1			2	1			1	1	1

Low-1: Medium-2: High-3

SEMESTER – V

Professional Elective-I

Course: Programming in JAVA

Course Code	22ECE55A	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Features of object-oriented programing.
CLO2	Set up Java JDK environment to create, debug and run simple Java programs
CLO3	Learn object oriented concepts using programming examples
CLO4	Create multi-threaded programs and event handling mechanism
CLO5	Introduce event driven Graphical User Interface(GUI) programming using swings

Content	No. of Hours/ RBT levels
Module-1 **Introduction to JAVA:** Java's magic: the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements. **Classes & Objects:** Classes fundamentals; Declaring objects; Constructors, this keyword, garbage collection.	8 Hours L2
Module-2 **Inheritance:** inheritance basics, using super, creating multi-level hierarchy, method overriding, Abstract class **Exception handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions	8 Hours L3
Module-3 **Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces. **Multi-Threaded Programming:** What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, producer consumer problems.	8 Hours L3
Module-4 **Event Handling:** Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes.	8 Hours L3
Module-5 **Swings:** Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable.	8 Hours L2

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Describe** the basic concepts of object-oriented programming language.
CO2	**Develop** java programs to illustrate the concept of inheritance and exception handling.
CO3	**Apply** Multi-threading concepts to create parallel programming.
CO4	**Analyze** Event Handling mechanisms to create interactive programs.
CO5	**Develop** GUI interfaces for a computer program to interact with users using Swings.

Textbooks:

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007

Reference Books:

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806
2. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.
3. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full** questions choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	1	-
Average	3	3	3	-	-	-	-	-	-	-	-	-	1	-

Low-1: Medium-2: High-3

SEMESTER – V
Professional Elective-I

Course: Operating Systems

Course Code	22ECE55B	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites:

Course Learning Objectives: Students will be taught;

CLO1	Concepts of operating system and multi programming.
CLO2	Process management and File structures.
CLO3	Scheme of memory management.
CLO4	Resource allocation policies for deadlock prevention or deadlock avoidance.
CLO5	Security and various attacks.

Content	No. of Hours / RBT levels
Module-1 **Introduction and overview of operating system**: Abstract views of an Operating system, Computing environment and nature of computations Classes of operating systems, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, distributed operating systems, modern operating system, Virtual machine operating systems, kernel-based operating systems, microkernel-based operating systems. (Text-1: 1.1, 3.1, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.5, 4.6 & 4.7)	8 Hours L2, L3
Module-2 **Process Management:** Processes and Program, implementing processes, race conditions, critical sections, control synchronization and indivisible operations, synchronization approaches, semaphores. (Text-1: 5.1, 5.2, 6.2, 6.3, 6.4, 6.5 & 6.9). **File systems**: Files, Directories, File System Implementation. (Text-2: 4.1, 4.2, 4.3.1, 4.3.2, 4.3.3 & 4.3.4).	8 Hours L2, L3
Module-3 **Memory Management:** Static and Dynamic memory allocation, Memory allocation to a process, Reuse of memory, Contiguous memory allocation, Non-contiguous memory allocation, Paging, Segmentation, segmentation with paging.(Text-1: 11.2, 11.4, 11.5.1, 11.6, 11.7, 11.8, 11.9 & 11.10).	8 Hours L2, L3
Module-4 **Deadlocks:** Resources, Introduction to Deadlocks, The ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention. (Text-2: 6.1, 6.2, 6.3, 6.4, 6.5 & 6.6).	8 Hours L2, L3

Module-5	
Security and Protection: overview of security and protection, security attacks, formal aspects of security, Encryption, authentication and password security, protection structures, capabilities, classification of computer security, case studies in security and protection. (Text-1: 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 15.7, 15.8 & 15.9).	8 Hours L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	Explain the various classes, structure of operating system and multi
CO2	Describe the File systems and process requirement in an operating system.
CO3	Analyze the management allocation schemes and segmentation.
CO4	Describes the resource allocation policies to prevent the deadlock.
CO5	Apply the knowledge of operating system for security and protection.

Textbooks:

1. Dhamdhere, Operating Systems – A concept based approach, TMH, 3rd edition.
2. Andrew S Tanenbaum, Herbert Boss, "Modern Operating Systems", 4th edition.

Reference Books:

1. Operating Systems Concepts, Silberschatz and Galvin, John Wiley, 7th Edition, 2001.
2. Operating System – Internals and Design Systems, William Stalling, Pearson Education, 4th Ed, 2006

MOOCs

https://nptel.ac.in/courses/106106144
https://www.coursera.org/specializations/codio-introduction-operating-systems

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	

	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1									2	2	1
CO2	3	2	1									2	2	1
CO3	3	2	1									2	2	1
CO4	3	2	1									2	2	1
CO5	3	2	1									2	2	1
Average	3	2	1									2	2	1

Low -1: Medium -2: High-3

SEMESTER – V

Professional Elective-I

Course: Engineering Electromagnetics

Course Code	22ECE55C	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Vector Algebra

Course Learning Objectives: Students will be taught;

CLO1	Coulomb's Law, Electric Field Intensity and Flux density.
CLO2	Gauss's law and Divergence.
CLO3	Electric and magnetic field parameters using various static Electromagnetic Laws.
CLO4	Maxwell's equations for static and time varying Fields.
CLO5	Concept of Uniform Plane waves.

Content	No.of Hours/ RBT levels
Module-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 of sheet of charge & Electric flux density. (Text-1: 2.1 to 2.5 and 3.1)	8 Hours L3
Module-2 **Gauss's law and Divergence:** Gauss' law, Application of Gauss law: Some Symmetrical Charge Distributions, Applications of Gauss Law: Differential Volume Element, Divergence, Maxwell's First equation, Vector Operator del & Divergence theorem. (Text-1. 3.2 to 3.7) **Energy, Potential and Conductors:** Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential & The potential field of point charge. (Text-1: 4.1 to 4.4)	8 Hours L3
Module-3 **Steady Magnetic Field:** Current and Current density, Continuity of current. Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials. (Text-1: 5.1, 5.2 and 8.1 to 8.5)	8 Hours L3
Module-4 **Magnetic Forces and Maxwell's Equations:** Force on a moving charge, differential current elements, Force between differential current elements - Numerical Problems. Faraday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form for static and time varying fields. (Text-1: 9.1, 9.2, 9.3, 10.1 to 10.4)	8 Hours L3

Module-5	
Uniform Plane Wave: Wave propagation in free space, Wave propagation in Dielectrics, Poynting's Theorem, Propagation in good conductors: Skin effect.(Text-1: 12.1 to 12.4)	8 Hours L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Apply** the concept of Coulomb's law and Electric field Intensity to determine Electrostatic force and Field..
CO2	**Apply** Guass's law, Divergence and potential to solve problems on various charge distributions.
CO3	**Analyze** different laws of Steady magnetic field to solve engineering Problems.
CO4	**Explain** magnetic forces and Maxwells equations.
CO5	**Discuss** wave propagation in various media.

Textbooks:

1. W.H. Hayt and J.A. Buck, Engineering Electromagnetics, 7th Edition, Tata McGraw-Hill, 2009.

Reference Books:

1. Matthew N O Sadiku, Elements of Electromagnetics, 4th edition, Oxford University Press, 2007.
2. Edward C. Jordan and Keith G Balmain, Electromagnetic Waves and Radiating Systems, 2nd edition, Prentice Hall of India, 2002.
3. John Krauss and Daniel A. Fleisch, Electromagnetics with Applications, 5th edition, Tata McGraw Hill, 1999.

MOOCs

https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ee04
https://www.edx.org/course/electricity-and-magnetism-maxwells-equations
https://www.coursera.org/lecture/electrodynamics-introduction/1-1-introduction-to-electromagnetism-qilQb

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	1	-
Average	3	2	2	-	-	-	-	-	-	-	-	-	1	-

Low -1: Medium -2: High-3

SEMESTER – V

Professional Elective-I

Course: Satellite Communication

Course Code	22ECE55D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Satellite Orbits and Trajectories.
CLO2	Satellite subsystem and Earth Station.
CLO3	Multiple Access Techniques and Satellite Link Design Fundamentals.
CLO4	Communication Satellites.
CLO5	Remote Sensing Satellites, Weather Forecasting Satellites and Navigation Satellites.

Content	No. of Hours / RBT levels
Module 1 **Satellite Orbits and Trajectories:** Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization, Orbital effects on satellite's performance, Eclipses, Look angles: Azimuth angle, Elevation angle. (Text 1: 2.1, 2.2, 2.3, 3.3, 3.4, 3.5, 3.6, 3.7.1 & 3.7.2)	8 Hours L2
Module 2 **Satellite subsystem:** Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload. **Earth Station:** Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking. (Text1: 4.1, 4.5, 4.6, 4.7, 4.8, 8.1, 8.2, 8.3, 8.4, 8.5 & 8.6)	8 Hours L2
Module 3 **Multiple Access Techniques:** Introduction, FDMA, SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA. **Satellite Link Design Fundamentals:** Transmission Equation, Satellite Link Parameters, Propagation considerations.(Text1: 6.1, 6.2, 6.3, 6.4, 6.13, 6.14, 7.1, 7.2 &7.4).	8 Hours L3
Module 4 **Communication Satellites:** Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, Regional satellite Systems, National Satellite Systems.(Text1: 9.1, 9.3, 9.5, 9.6, 9.7, 9.8, 9.10.2 & 9.10.3).	8 Hours L2

Module 5	8 Hours L3
Remote Sensing Satellites: Classification of remote sensing systems, orbits, Payloads, Types of images: Image Classification, Interpretation, Applications. **Weather Forecasting Satellites:** Fundamentals, Images, Orbits, Payloads, Applications. **Navigation Satellites:** Development of Satellite Navigation Systems, GPS system, Applications.(Text1: 10.1, 10.2, 10.7, 10.8, 10.9, 10.10, 11.1, 11.3, 12.1, 12.2 & 12.8).	

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Comprehend** the satellite orbits and its trajectories with the definitions of parameters associated with it.
CO2	**Describe** the electronic hardware systems associated with the satellite subsystem and earth station.
CO3	**Compute** the satellite link parameters under various propagation conditions with the illustration of multiple access techniques.
CO4	**Discuss** different types of communication satellites.
CO5	**Explain** the satellites used as remote sensing, weather forecasting and Navigational satellites.

Textbooks:

1.Anil K. Maini, Varsha Agrawal, Satellite Communications, 1st edition, Wiley India Pvt. Ltd., 2015,

Reference Books:

1. Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International,2006.
2. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd , 2017.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	1	1	3	-	-	-	1	2	2
CO2	2	2	2	2	-	1	1	-	-	1	-	1	2	1
CO3	1	2	-	1	-	1	-	1	-	-	-	-	1	1
CO4	1	2	2	1	-	1	-	1	-	1	-	1	2	1
CO5	-	-	-	-	-	2	1	1	-	-	-	-	3	1
Average	2	2	2	1	-	1	1	2	-	1	-	1	2	1

Low-1: Medium-2: High-3

SEMESTER – V

Course: Research Methodology and IPR

Course Code	22RMIK57	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Objectives:

CLO1	To make the student understand the foundations of Research and problem solution
CLO2	Knowledge in Research design, Qualitative and Quantitative Research
CLO3	Knowledge to formulate and derive static and dynamic aero elastic equations of motion.
CLO4	To understand the different types of IPR

Content
Module 1 (08 hours)
RESEARCH METHODOLOGY: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. DEFINING THE RESEARCH PROBLEM: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration
Module 2 (08 hours)
REVIEWING THE LITERATURE: Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. RESEARCH DESIGN: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs
Module 3 (08 hours)
DESIGN OF SAMPLE SURVEYS: Design of Sampling: Introduction, Sample Design, Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. MEASUREMENT AND SCALING: Qualitative and Quantitative Data, DATA COLLECTION: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.
Module 4 (08 hours)
TESTING OF HYPOTHESES: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. INTERPRETATION AND REPORT WRITING: Technique of Interpretation, Precaution in

Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.
Module 5 (08 hours)
INTELLECTUAL PROPERTY: Principles of IPR, Kinds of IPR, Patent- Concepts, Novelty, Utility Inventiveness/Non-obviousness, Procedure for granting and obtaining patents; Copyright- conditions for grant of copyright, Copyright in Literary, Dramatic and Musical ,Works, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers, Trademark Law and Practices - Procedure of registration of trademark; Emerging Issues and Challenges; Few Future Aspects of Intellectual Property Rights;

Textbook:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
4. Lionel Bently., Brad Sherman-Intellectual Property Law, 3rd Edition

Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO 1	Understand the research problem by literature review to solve problems
CO 2	Develop skills in qualitative and quantitative data analysis and presentation.
CO 3	Develop advanced critical thinking skills.
CO 4	Understand to write the report writing and awareness about IPR

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools

(AATs), and three tests. Some possible AATs: seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO PO Mapping			
CO/PO	PO6	PO8	PO12
CO 1	3	3	3
CO 2	3	3	3
CO 3	3	3	3
CO 4	3	3	3
Average	3	3	3

Low-1: Medium-2: High-3

SEMESTER – V

Course: Environmental Studies

Course Code	22CIVK58	CIE Marks	50
Hours/Week (L: T: P)	2:0:0	SEE Marks	50
No. of Credits	2	Examination Hours	3

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To understand ecosystem functions and 17 SDG's for sustainable development
CLO2	To understand advanced energy systems and natural resource management.
CLO3	To understand global environmental issues, related policies and solutions.
CLO4	To understand key environmental legislation related to water, air, waste and environmental protection.
CLO5	To understand e-waste management.

Content	No. of Hours/ RBT levels
Module 1 – Ecosystem and Sustainability Ecosystem: Structure of Ecosystem, Types: Forest, Desert, Wetlands, Riverine, Oceanic ecosystems. Sustainability: 17SDG targets and possible actions. Self-Study **Component (SSC): Components of the environment.**	6 Hours L2
Module 2 - Natural Resource Management Natural Resources: Water resources – Availability & Quality aspects, Energy: Different types of energy, Conventional sources & non-conventional sources of Energy, Solar energy, OTEC Wind Energy, Hydrogen as an alternative energy Self-Study Component (SSC): Alternative Energy sources Disaster Management, Sustainable Mining - case studies and Carbon Trading **Self-Study Component (SSC): Alternative Energy sources.**	6 Hours L2
Module 3 – Environmental Pollution & Waste Management Environmental Pollution: Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Water Pollution, Water borne diseases & water induced diseases, Noise pollution, Soil	6 Hours L2

Pollution, Air pollution (Sources, Impacts, Preventive measures and Public Health Aspects. Waste Management: Bio-medical Wastes; Solid waste; Hazardous wastes; Industrial and Municipal Sludge Solid Waste Management , types and sources, functional elements of SWM, Biomedical Waste Management - Sources, Characteristics **Self-Study Component (SSC): Case studies of air pollution episodes.**	
Module 4 - Global Environmental Issues and Environmental Legislation Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology **Environmental Legislation** Environmental Legislation: Water Act 1974, Air Act 1981, Environmental Protection Act 1984, Solid Waste Management Rules-2016, E- Waste management Rule - 2022, Biomedical Waste management- 2016 **Self-Study Component (SSC): Case studies on waste management options**	6 Hours L2
Module 5 - E - Waste Management E - Waste Management: Introduction of E- waste; composition and generation. Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment, domestic e-waste disposal, Basic principles of E waste management, Component of E waste management. E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2022 - Salient Features and its implications. **Self-Study Component (SSC): E-Waste (Management) Amendment Rules, 2023, 2024**	**6 Hours** L2

COURSE OUTCOMES: Upon completion of this course, student will be able to:

22CIVK58.1	**Analyze** ecosystem dynamics to formulate strategies for addressing sustainability challenges and implementing the SDGs.
22CIVK58.2	**Evaluate** energy technologies to design effective resource management strategies.
22CIVK58.3	**Evaluate** the impacts of pollution to develop effective waste management strategies.
22CIVK58.4	**Evaluate** global environmental issues to design solutions for sustainable management.

22CIVK58.5	Interpret environmental laws and regulations for sustainable management practices.
22CIVK58.6	Understand e-waste management in a global scenario.

Suggested Learning Resources:

Textbooks

1. S M Prakash , "Environmental Studies" 3rd Edition, Elite Publishing House, Mangalore, 2018.
2. Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009.

Reference Books:

1. EarchBarucha, "Environmental Studies for UG students", 2004.
2. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited.
3. R. Rajagopalan, "Environmental Studies- From Crisis to Cure", 2nd Edition, Oxford university press, New Delhi, 2013.
4. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi.
5. Raman Sivakumar, "Principles of Environmental Science and Engineering", 2nd edition, Cengage learning Singapur, 2005.
6. G. Tyler Miller Jr., "Environmental Science – working with the Earth", Eleventh Edition, Thomson Brooks /Cole, 2006
7. Dr. Pratiba Singh, Dr.Anoop Singh and Dr. PiyushMalaviya, "Text Book of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi.

Web Reference:

- https://www.hzu.edu.in/bed/E%20V%20S.pdf
- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://onlinecourses.swayam2.ac.in/cec19_bt03/preview
- https://sdgs.un.org/goals
- https://kspcb.karnataka.gov.in/waste-management/biomedical-waste E Waste (Management) Rules, 2022.
- https://kspcb.karnataka.gov.in/sites/default/files/inlinefiles/E%20Waste%20%28Management%29%20Rules%2C%202022.pdf

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of three test marks will be added to test component. CIE is executed by way of two quizzes/Alternate Assessment Tools(AAT's), some possible AAT's: Seminar/ assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

Understand e-waste management in a global scenario.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PS 02	PS 03
22CIVK58.1	2					1	1	1				2			3
22CIVK58.2	2	2	2			1	3	1				1			3
22CIVK58.3		2	2	2		1	3	1							2
22CIVK58.4		2	2	2		1	3	1				1			2
22CIVK58.5	1	2	2	2		1	2	1						1	2
22CIVK58.6	2	2	1			2	2	1				1			2
Average	1.75	2	1.8	2		1.16	2.3	1				1.25		1	2.33

SEMESTER – VI

Course: Embedded Systems

Course Code	22ECE61	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	The requirements of an Embedded system.
CLO2	ARM7 architecture and branching instructions.
CLO3	Programming using ARM and THUMB instruction set.
CLO4	Programming to handle an exception and interrupts.
CLO5	Creating task and scheduling them in real time operating system.

Content	No. of Hours/ RBT levels
Module 1 **Introduction to Embedded Systems:** Embedded system vs General computing system, characteristics of an embedded system, quality attributes of embedded system, core of embedded system, memory, sensors and actuators, communication interfaces, Embedded firmware design approaches, embedded firmware development languages. (Text 1)	8 Hours L3
Module 2 **ARM7 Processor Fundamentals:** ARM Architecture, Registers, current program status register, pipeline, exceptions, interrupts and vector table, core extensions. Introduction to ARM Instruction Set: Data Processing Instructions, Branch Instructions. (Text 1)	8 Hours L3
Module 3 **Introduction to ARM7 Instruction Set**: Load Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, and Conditional Execution. **Introduction to the THUMB Instruction set:** Thumb register usage, ARM7 – Thumb Interworking, other branch instructions, Data Processing Instructions, Single register Load –Store Instructions, Multiple register Load Store Instructions, Stack Instructions, and Software Interrupt Instruction. (Text 1)	8 Hours L3
Module 4 **Interrupts & Exception Handling in ARM7:** Exception Handling Interrupts, Interrupt handling schemes, Design of system using GPIO's (LCD interface, 4 x 4 Keypad), Timers. (Text 1 and Ref.2)	8 Hours L3
Module 5 **Embedded/Real Time Operating System Concepts:** A Task, process and threads, multiprocessing and Multitasking, Task Scheduling, Task Communication. (Text 2)	8 Hours L3

Practical Component of IPC		
Sl. No.	Experiments	RBT levels
	ARM Assembly programming	
1.	Write an assembly language program to evaluate the following i) Data transfer Instructions ii) Conditional Instructions	L3
2.	Write an assembly language program to evaluate the following i) Arithmetic Instructions ii) Shift and Rotate instructions	L3
	Interfacing Programming Conduct the following experiments on an ARM evaluation board using evaluation version of Embedded 'C' and Keil uVision-4 tool/compiler.	
3.	Write an embedded C program to Display "Hello World" message using Internal UART.	L3
4.	Write an embedded C program to Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.	L3
5.	Write an embedded C program to Interface a DAC and generate Triangular and Square waveforms.	L3
6.	Write an embedded C program to Interface a 4x4 keyboard and display the key code on an LCD.	L2
7.	Write an embedded C program to Demonstrate the use of an external interrupt to toggle an LED On/Off.	L3
8.	Write an embedded C program to Interface a dc motor and control its speed.	L3
9.	Write an embedded C program to Interface a simple Switch and display its status through Relay, Buzzer and LED.	L3
10.	Write an embedded C program to measure Ambient temperature using a sensor and SPI ADC IC	L3

COURSE OUTCOMES: Upon completion of this course, student will be able to:

CO1	**Explain** the Embedded system and its requirements.
CO2	**Describe** the ARM7 architecture, data processing and Branching Instruction.
CO3	**Write** program using ARM and Thumb instruction set.
CO4	**Analyze** the interrupts and write a program for Exception handling in ARM7.
CO5	**Explain** the need of real time operating system for embedded system applications.

Textbooks:

1. Andrew N. Sloss, ARM system Developers Guide, Elsevier, 1st edition, 2008
2. Shibu K V, Introduction to Embedded Systems, 2nd edition, McGraw Hill Education, 2009.

Reference books:

1. K. V. K. K. Prasad, Embedded Real-Time Systems: Concepts, Design & Programming, Dreamtech Press, 2005.
2. https://www.electronicwings.com/sensors-modules

Scheme of Evaluation: (Integrated courses)
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.
Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Typical Evaluation pattern for integrated courses is shown in the Table-1

Table-1: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
		Grand Total	100

CO-PO and PSO mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		2	2	1		2	2				2	2	3	2
CO2	1	1	1	2	2							1	2	2
CO3	1	1	1	2	2							1	2	2
CO4		1	1	2	2							1	2	2
CO5				1								2	2	2
Average	1	1	1	2	2	2	2				2	2	2	2

Low-1: Medium-2: High-3

SEMESTER –VI

Course: CMOS VLSI Design

Course Code	22ECE62	CIE Marks	50
Hours/Week (L: T: P)	3:2:0	SEE Marks	50
No. of Credits	4	Examination Hours	03

Prerequisites: Analog Electronic Circuits and Design and Analysis of Digital Circuits

Course Learning Objectives: Students will be taught;

CLO1	MOS transistor theory and CMOS logic.
CLO2	Fabrication process and MOS circuit design process.
CLO3	Basic circuit concepts and scaling of MOS circuits.
CLO4	Subsystem design process with an illustration.
CLO5	Semiconductor memories, system timings, testing, debugging and verification methods.

Content	No. of Hours / RBT levels
Module-1 **Introduction**: A Brief History, CMOS Logic, MOS Transistor Theory, Long Channel I-V Characteristics, Non- ideal I-V Effects, DC Transfer Characteristics. (Text 2: 1.1, 1.4, 2.1, 2.2, 2.4 & 2.5).	8 Hours L2, L3
Module-2 **Fabrication:** nMOS Fabrication, CMOS Fabrication-P-well process and N-well process. **MOS Design Processes:** MOS Layers, Stick Diagrams: nMOS Design style, CMOS Design style, Design Rules and Layout. (Text 1: 1.7, 1.8.1, 1.8.2, 3.1 to 3.3).	8 Hours L2, L3
Module-3 **Basic Circuit Concepts**: Sheet Resistance, Sheet resistance concept applied to MOS transistors and inverters, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads, Propagation Delays. **Scaling of MOS Circuits**: Scaling Models & Scaling Factors for Device Parameters. (Text 1: 4.1 to 4.9, 5.1, 5.2).	8 Hours L2, L3
Module-4 **Subsystem Design and Layout**: Some Architectural Issues, Switch Logic, Gate (restoring) Logic, A parity generator, Multiplexers (Data selectors), Design of 4-bit shifter. **Illustration of the Design Processes:** Some observations on the design process, Design of an ALU Subsystem, (Text 1: 6.1 to 6.3, 6.4.1, 6.4.3, 7.2.2, 8.1, 8.3)	8 Hours L2, L3
Module-5 **Memory, Registers and Aspects of system Timing:** System Timing Considerations, commonly used Storage/Memory elements (Text 1: 9.1, 9.2). **Testing, Debugging and Verification:** Introduction: Logic Verification, Manufacturing Test Principles, Design for testability, Boundary Scan (Text 2: 15.1.1, 15.5, 15.6, 15.7).	8 Hours L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Demonstrate** the concepts of MOS transistor theory, CMOS fabrication flow.
CO2	**Analyze** MOS Circuit Design Processes, Circuit Characterization and Performance Estimation.
CO3	**Illustrate** the scaling of MOS circuits and know the Subsystem Design Process.
CO4	**Design** of Combinational and Sequential Circuits.
CO5	**Explain** the Memory, registers, system timing and testability adapted in VLSI Design.

Textbooks:

1. Douglas A Pucknell and Kamran Eshaghian, Basic VLSI Design, 3rd Edition, Eastern Economy Edition 2006.
2. Neil H. E. Weste, David Harris and Ayan Banerjee, CMOS VLSI Design- A Circuits and Systems Perspective, 4th Edition, Pearson Education 2011.

Reference Books:

1. Adel Sedra and K. C. Smith, Microelectronics Circuits Theory and Applications, 7th Edition, Oxford University Press, International Version, 2009.
2. Behzad Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill Education (India) Private Limited, 2007.
3. Sung Mo Kang and Yosuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3rd Edition, McGraw Hill Education (India) Private Limited,

MOOCs:

https://www.youtube.com/watch?v=sV2xT-WCSSI
https://www.youtube.com/watch?v=faiEVOOCe-s
https://www.youtube.com/watch?v=arut8G4Ego0
https://www.youtube.com/watch?v=yyliRphXLq4
https://www.youtube.com/watch?v=egfHY-NOt6Y

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	1	-	1	-	-	-	-	2	2	2
CO2	3	3	3	-	1	-	-	-	-	-	2	2	2	2
CO3	3	3	3	-	1	-	-	-	-	-	2	2	2	2
CO4	3	3	3	-	1	-	-	-	-	-	2	2	2	2
CO5	3	3	3	-	1	-	1	-	-	-	2	2	2	2
Average	3	3	3	-	1	-	1	-	-	-	2	2	2	2

Low-1: Medium-2: High-3

SEMESTER – VI

Professional Elective – II

Course: Digital Image Processing

Course Code	22ECE63A	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Fundamentals of digital image Processing.
CLO2	Image transforms used in digital image processing.
CLO3	Image enhancement techniques used in Digital image processing.
CLO4	Image restoration techniques and methods used in digital image processing.
CLO5	Morphological operations used in digital image processing.

Content	No. of Hours/ RBT levels
Module 1 **Introduction:** What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use Digital image processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition. (Text1: 1.1 to 1.5 and 2.1 to 2.3)	8 Hours L3
Module 2 Image Sampling and Quantization, Some Basic Relationships Between Pixels, Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. (Text1: 2.4, 2.5 and 3.2 to 3.6)	8 Hours L3
Module 3 **Filtering in the Frequency Domain:** Basics of Filtering in the Frequency Domain, image smoothing using frequency domain filters, Image Sharpening Using Frequency Domain Filters, Selective Filtering. (Text1: 4.7 to 4.10)	8 Hours L3
Module 4 **Image Restoration and Reconstruction:** A model of image degradation and restoration process, Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. (Text1: 5.1 to 5.9)	8 Hours L3
Module 5 **Color Image Processing:** Color Fundamentals, Color Models, Pseudo color Image Processing. (Text1: 6.1 to 6.3) Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing. (Text1: 9.1 to 9.3)	8 Hours L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Explain** the fundamental processing steps and components of image processing.
CO2	**Illustrate** image digitization, basic relationships between pixels and processing in Spatial domain.
CO3	**Apply** image processing techniques in both the frequency domains.
CO4	**Analyze** image restoration techniques in both spatial and frequency domains.
CO5	**Explain** the concept of colour image processing and morphological image processing.

Text Book:

1. Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

Reference Books:

1. S.Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing Tata McGrawHill 2014.
2. A K. Jain, Fundamentals of Digital Image Processing, Pearson 2004.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	10	
SEE	Semester End Examination	**100**	**50**
		Grand Total	**100**

CO-PO and PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	1	-	-	1	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	1
CO3	3	1	2	-	-	-	-	-	1	-	-	1	1	-
CO4	2	1	1	-	-	-	-	-	-	-	-	-	-	1
CO5	2	-	2	-	-	-	-	-	1	1	-	1	1	-
Average	2	1	2		-	-	-		1	1		1	1	1

Low-1: Medium-2: High-3

SEMESTER –VI

Professional Elective-II

Course: Machine Learning with Python

Course Code	22ECE63B	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites:

Course Objectives: Students will be taught;

CLO1	Machine learning concepts and problems relevant to machine learning.
CLO2	Representation of Decision Tree for the decision learning problem.
CLO3	Neural Networks applications in machine learning.
CLO4	Bayes classifier and K NN algorithm.
CLO5	Statistical analysis of machine learning problems.

Content	No. of Hours / RBT levels
Module 1 **Introduction:** Well posed learning problems, Designing a Learning System, respective and Issues in Machine Learning. **Concept Learning:** Concept Learning Task, Concept Learning as search, Find S algorithm, Vector space, Candidate Elimination algorithm. Python programs using NumPy, and Matplotlib. (Text-1:1.1 to 1.3, 2.2 to 2.5)	8 Hours L1, L2
Module 2 **Decision Tree Learning:** Decision Tree representation, Appropriate problems for decision learning Basic Decision tree algorithm, hypothesis space search in decision tree learning, Issues in decision tree learning. Python programs on Decision tree. (Text-1:3.2 to 3.5 & 3.7)	8 Hours L2, L3
Module 3 **Artificial Neural Networks:** Introduction, Neural Network Representation, Appropriate problems, Perceptrons, Back Propagation algorithm. Numerical. Examples, Python Examples on ANN. (Text-1: 4.1, 4.2, 4.3, 4.4, 4.5 & 4.6)	8 Hours L1, L2
Module 4 **Bayesian Learning:** Introduction, Bayes Theorem, Bayes and Concept Learning, ML and LS error hypothesis, ML for predicting probabilities, ML for predicting probabilities Naïve Bayes classifier, Bayesian belief networks. Numerical examples. Python examples on Naïve Bayes Classifier. (Text-1:6.1 to 6.5, 6.9 & 6.11)	8 Hours L2, L3
Module 5 **Instance Based Learning:** Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, Numerical examples on KNN, Python programs on KNN. (Text 1:8.1 to 8.4) **Reinforcement Learning:** Introduction, Learning Task, Q- Learning: Q learning Algorithm.(Text 1:13.1 to 13.3)	8 Hours L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Understand** the design of Learning System and Python Libraries used in Machine Learning.
CO2	**Interpret** the appropriate problems for Decision Tree Learning and solve with Python programming.
CO3	**Describe** the Artificial Neural Networks, Perceptrons and Back Propagation Algorithm.
CO4	**Apply** theory of probability to concept learning and Bayes Classifier.
CO5	**Analyze** Instance Based Learning and Reinforcement Learning.

TextBook:

1. Tom M. Mitchell, Machine Learning India Edition, McGraw Hill Education,2013

Reference Books:

1. Anuradha Srinivasaraghavan and Vincy Joseph, Machine Learning, 2020, Wiley.
2. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn and Tensor Flow, O'REILLY, 2017 Edition.
3. Fabio Nelli, Python Data Analytics, with Pandas, NumPy and Matplotlib – Second Edition, 2018.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

The Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1		-		-	-	-		-	2	1	1
CO2	2	2	1		-		-	-	-		-	2	1	1
CO3	3	1	1		-		-	-			-	2	1	1
CO4	2	2	1		-		-	-			-	2	1	1
CO5	2	2	1		-		-	-			-	1	1	1
Average	2	2	1		-		-					2	1	1

Low-1: Medium-2: High-3

SEMESTER – VI

Course: Information Theory and Coding

Course Code	22ECE63C	CIE Marks	50
Hours/Week (L:T:P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Communication systems

Course Learning Objectives: Students will be taught;

CLO1	Information content and its measurement of both independent and dependent sources
CLO2	Source encoding algorithms and its properties
CLO3	Communication channel and different Entropies associated with channels
CLO4	Error control coding
CLO5	Convolution encoding algorithm for error detection and correction.

Content	No. of Hours / RBT levels
Module-1 **Information Theory:** Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model for Information Sources, Entropy and Information rate of Markoff Sources, Extension of Discrete memoryless source. (Text 1)	8 Hours L3
Module-2 **Source Coding**: Encoding of the Source Output, Shannon's Encoding algorithm, Shannon Fano algorithm, Huffman coding, Source coding theorem, prefix codes, Kraft McMillan Inequality properties (KMI) ,Arithmetic Coding, Lempel – Ziv Algorithm. (Text 1)	8 Hours L3
Module-3 **Information Channels**: Communication Channels, Discrete Communication channels, Channel Matrix, Joint Probability Matrix (JPM), System Entropies, Mutual information, Channel Capacity, Channel capacity of Binary Symmetric Channel, Binary Erasure Channel, Capacity calculation using Muroga's method, Continuous Channels, Shannon Hartley law and its Implications. (Text 1).	8 Hours L3
Module-4 **Error Control Coding:** Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes. Linear Block Codes- matrix description of Linear Block Codes, Error detection and Correction capabilities of Linear Block Codes, Single error correction Hamming code. Binary Cyclic Codes- Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction (Text- 1).	8 Hours L3
Module-5 **Convolution Codes:** Convolution Encoder, Time and Transform domain approach, code tree, Trellis and state diagram, Viterbi Algorithm, BCH and Golay codes. (Text-2)	8 Hours L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Explain** concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source
CO2	**Obtain** the code words for the information content using Encoding Algorithms
CO3	**Compute** system entropies, mutual information and capacity of a Channels.
CO4	**Analyze** the code words of a k- bit messages using Linear block codes and Cyclic codes.
CO5	**Compute** the output for the given input sequences using time and transform domain approach.

Text Books:

1. K. Sam Shanmugam, Digital and Analog communication systems, John Wiley India Pvt. Ltd, 1996.
2. Bernard Sklar, Digital communication Fundamentals and Applications, Pearson Education Pvt. Ltd, 2003

Reference Books:

1. Simon Haykin, Digital communication, John Wiley India Pvt. Ltd, 2008
2. J. Das, S. K. Mullick and P. K. Chatterjee, Principles of Digital Communication, Wiley, 1986
3. HariBhat and Ganesh Rao, Information Theory and Coding, Cengage, 2017.
4. Todd K Moon, Error Correction Coding, Wiley Std. Edition, 2006

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	-	-	-	-	-	-	-	1	-	1
CO4	3	3	-	-	-	-	-	1	-	-	-	1	2	-
CO5	3	-	-	-	-	-	-	1	-	-	-	1	2	1
Average	3	3	-	-	-	-	-	1	-	-	-	1	2	1

Low-1: Medium-2: High-3

SEMESTER – VI

Professional Electives-II

Course: Microwave and Radar

Course Code	22ECE63D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught.

CLO1	High frequency microwave lines.
CLO2	Microwave diodes and operation.
CLO3	Microwave networks and passive devices.
CLO4	Radar fundamentals and analyze the radar signals.
CLO5	Various technologies involved in the design of radar transmitters and receivers.

Content	No. of Hours/RBT levels
Module 1 **Microwave transmission lines:** Introduction, transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance and line admittance. Smith chart, impedance matching using single stubs, Microwave coaxial connectors. (Text-1: 3.1-3.5 & 3.7)	8 Hours L2
Module 2 **Microwave diodes:** Transfer electron devices: Introduction, GUNN effect diodes – GaAs diode, RWH theory, Modes of operation, Avalanche transit time devices: READ diode, IMPATT diode, BARITT diode, Parametric amplifiers Other diodes: PIN diodes, Schottky barrier diodes(Text-1: 10.1-10.8)	8 Hours L3
Module 3 **Microwave network theory:** Microwave network theory and passive devices. Symmetrical Z and Y parameters, for reciprocal Networks, S matrix representation of multi-port networks. **Microwave passive devices:** Microwave passive devices, Coaxial connectors and adapters, Phase shifters, Attenuators, Waveguide Tees, Magic tees. (Text-1: 6.1-6.4)	8 Hours L3
Module 4 **Basics of Radar:** Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems. Radar Equation: SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets – sphere, cone-sphere (Text-2: 1.1-1.4, 1.6, 2.1-2.3 & 2.5-2.7)	8 Hours L3

Module 5	8 Hours L3
CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems.FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar. (Text-2: 3.1-3.3 & 3.5)	

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Understand** the working principles of high frequency transmission lines.
CO2	**Discuss** the working principles of microwave diodes.
CO3	**Explain** the microwave passive devices and network theory.
CO4	**Discuss** the radar fundamentals and radar signals.
CO5	**Explain** the working principle of pulse Doppler radars, their applications and limitations.

Textbooks:

1. Annapurna Das, Sisir K Das, Microwave Engineering, 2nd Edition, TMH Edition, 2009.
2. Merrill I. Skolnik, Introduction to Radar Systems, 2nd Edition, TMH Special Indian Edition, 2007.

Reference Books:

1. Byron Edde, Radar Principals Technology Applications,3rd Edition, Pearson Education, 2004.
2. Peebles, Jr., Radar Principles, 3rd Edition, P.Z.Wiley, 1998.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least one **full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	2	-	-	-	-	-	-	1	1	2	-
CO2	2	2	-	2	-	-	-	-	-	-	1	1	2	-
CO3	2	2	-	2	-	-	-	-	-	-	1	1	2	-
CO4	2	2	-	2	-	-	-	-	-	-	1	1	2	-
CO5	2	2	-	2	-	-	-	-	-	-	1	1	2	-
Average	2	2	-	2	-	-	-	-	-	-	1	1	2	-

Low-1: Medium-2: High-3

SEMESTER – VI

(Open Electives-I other than ECE students)

Course: Electronic Communication Systems

Course Code	22ECE64A	**CIE Marks**	50
Hours/Week (L: T: P)	3:0:0	**SEE Marks**	50
No. of Credits	3	**Examination Hours**	03

Course Learning Objectives Students will be taught;

CLO1	Essential elements of an electronic communications.
CLO2	Amplitude, Frequency & Phase modulations and Amplitude demodulation.
CLO3	Basics of sampling and quantization.
CLO4	Various digital modulation schemes and Source and Channel Coding techniques.
CLO5	Principles of wireless communications system.

Content	No. of Hours / RBT Level
Module -1 **Introduction to Electronic Communications:** Historical perspective, Electromagnetic frequency spectrum, signal and its representation, Elements of electronic communications system, primary communication resources, signal transmission concepts, Analog and digital transmission, Modulation, Concept of frequency translation, Signal radiation and propagation. (Text 1: 1.1 to1.10)	8 Hours L2
Module 2 **Noise:** Classification and source of noise **(Text1:3.1)** **Amplitude Modulation Techniques**: Types of analog modulation, Principle of amplitude modulation, AM power distribution, Limitations of AM **Analog Transmission and Reception:** AM Radio transmitters, AM Radio Receivers. (Text 1: 3.1, 4.1, 4.2, 4.4, 4.6, 6.1 & 6.2)	8 Hours L2
Module -3 **Sampling Theorem and pulse Modulation Techniques:** Digital Versus Analog Transmissions, Sampling Theorem, Classification of pulse modulation techniques, PAM, PWM, PPM, PCM. (Text 1: 7.2 to 7.6)	8 Hours L2
Module -4 **Digital Modulation Techniques:** Types of digital Modulation, ASK, FSK, PSK, QPSK. **Source and Channel Coding**: Objective of source coding, source coding technique, Shannon's source coding theorem, need of channel coding, Channel coding theorem, error control and coding. ((Text 1: 9.1 to 9.5, 11.1 to 11.3, 11.8, 11.9 &11.12)	8 Hours L2
Module -5 **Evolution of wireless communication systems:** Brief History of wireless communications, Advantages of wireless communication, disadvantages of wireless communications, wireless network generations, Comparison of	8 Hours L2

wireless systems, Evolution of next generation networks, Applications of wireless communication. **Principles of Cellular Communications:** Cellular terminology, Cell structure and Cluster, Frequency reuse concept, Cluster size and system capacity, Method of locating cochannel cells and Frequency reuse distance. (Text 2: 1.1 to 1.7, 4.1 to 4.7)	

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Describe** operation of communication systems.
CO2	**Explain** the techniques of Amplitude and Angle modulation.
CO3	**Describe** the concept of sampling and quantization.
CO4	**Explain** the concepts of different digital modulation techniques.
CO5	**Describe** the principles of wireless communications system.

Text books:

1. T L Singal, Analog and Digital Communications McGraw Hill Education (India) Private Limited, 1st Edition, 2012.

Reference Books:

1. B. P. Lathi, Modern Digital and Analog Communication Systems Oxford University Press, 4th Edition, 2010.
2. R.P. Singh and S. Sapre, Communication Systems: Analog and Digital, TMH, 2nd edition, 2007.
3. Gray J Mullett, Introduction to Wireless Telecommunications systems and Networks Cengage learning, 1st Edition, 2006.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-		2	1
CO2	3	2	1	-	-	-	-	-	-	-	-		2	1
CO3	3	2	1	-	-	-	-	-	-	-	-		2	1
CO4	3	2	1	-	-	-	-	-	-	-	-		2	1
CO5	3	2	1	-	-	-	-	-	-	-	-		2	1
Average	3	2	1	-	-	-	-	-	-	-	-		1	1

Low-1: Medium-2: High-3

SEMESTER –VI

(Open Electives-I other than ECE students)

Course: Micro Electro Mechanical Systems

Course Code	22ECE64B	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Basic Electronics, Elements Mechanical Engineering, Basic concepts of Physics.

Course Learning Objectives: Students will be taught;

CLO1	Microsystems and applications.
CLO2	Working principles of MEMS devices.
CLO3	Microsystem design and fabrication.
CLO4	Scaling in Electrostatic Forces and Electromagnetic Force.
CLO5	Micro manufacturing techniques.

Content	No. of Hours / RBT levels
Module-1 **Overview of MEMS and Microsystems:** MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications of Micro systems in Automotive industry, Applications of Microsystems in other industries. (Text-1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7 & 1.8)	8 Hours L2
Module-2 **Working Principles of Microsystems:** Introduction, Microsensors- Biomedical sensors & Biosensors, Chemical sensors, Optical sensors, Pressure sensor and Thermal sensors. Microactuation- Actuation using thermal force, shape memory alloys, piezoelectric crystals and electrostatic force. MEMS with Microactuators- Microgippers, Micromotors and Micropumps. Microaccelerometers, Microfluidics. (Text-1: 2.1, 2.2, 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.6, 2.3, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.4, 2.4.1, 2.4.2, 2.4.4, 2.5, 2.6)	8 Hours L3
Module-3 **Engineering Science for Microsystems Design and Fabrication:** Introduction, Ions and Ionization, Molecular Theory of Matter and Inter-Molecular Forces, Plasma Physics, Electrochemistry-Electrolysis. (Text 1: 3.1, 3.3, 3.4, 3.7, 3.8, 3.8.1) **Engineering Mechanics for Microsystems Design:** Introduction, Static Bending of Thin Plates, Overview on Finite Element Stress Analysis. (Text-1: 4.1, 4.2 & 4.7)	8 Hours L3
Module-4 **Scaling Laws in Miniaturization:** Introduction, scaling in Geometry, scaling in Rigid-Body Dynamics-scaling in dynamic force, trimmer force scaling vector. Scaling in Electrostatic Forces, scaling in Electromagnetic Force, scaling in Electricity, scaling in Fluid Mechanics, scaling in Heat Transfer-scaling in heat conduction and scaling in heat convection. (Text-1: 6.1, 6.2, 6.3, 6.3.1, 6.3.2, 6.4, 6.5, 6.6, 6.7, 6.8 & 6.8.2)	8 Hours L3

Module-5	8 Hours L3
Overview of Micromanufacturing: Introduction, Bulk Micromanufacturing- over view of Etching, Isotropic and Anisotropic etching, Wet etchants, Etch stop, Dry etching, Comparison of wet versus dry etching. Surface Micromachining- General description, Process in general, Mechanical problems associated with surface micro machining. The LIGA Process- General description of the LIGA process, Material for substrates and photoresists. Electroplating. SLIGA process. Summary of Micromanufacturing. (Text-1: 9.1, 9.2, 9.2.1, 9.2.2,9.2.3, 9.2.4, 9.2.5, 9.2.6, 9.3.1, 9.3.2, 9.3.3, 9.4, 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.5, 9.5.1,9.5.2 & 9.5.3)	

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Explain** Microsystems used in MEMS and their application areas.
CO2	**Describe** the working principles of MEMS devices.
CO3	**Develop** mathematical and analytical models of MEMS devices.
CO4	**Discuss** the scaling in fabrication of MEMS devices..
CO5	**Describe** the different Micromanufacturing techniques used in Mems devices development.

Textbook:

1. Tai-Ran Hsu, MEMS and Micro systems: Design and Manufacture. 2nd Edition, 8th reprint, Tata Mc Graw-Hill Edition, 2002.

Reference Books:

1. Hans H. Gatzen, Volker Saile and JurgLeuthold, Micro and Nano Fabrication: Tools and
2. Processes, Springer, 2015.
3. Dilip Kumar Bhattacharya and Brajesh Kumar Kaushik, Microelectromechanical Systems, Cengage Learning India Private Limited, 2015

MOOCs:

1. https://www.nptelvideos.com/video.php?id=788
2. https://www.youtube.com/watch?v=j9y0gfN9WMg
3. https://www.youtube.com/watch?v=EALXTht-stg
4. https://www.youtube.com/watch?v=unj23A8br0U

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	1	1	1	-	-	-			
CO2	3	2	1	-	-	1	1	1	-	-	-			
CO3	3	2	1	-	-	1	1	1	-	-	-			
CO4	3	2	1	-	-	1	1	1	-	-	-			
CO5	3	2	1	-	-	1	1	1	-	-	-			
Average	3	2	1	-	-	1	1	1	-	-	-			

Low-1: Medium-2: High-3

SEMESTER --VI

Course: Electronic Circuits with Verilog

(Open Electives-I other than ECE students)

Course Code	22ECE64C	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	To impart the concepts of simplifying Boolean expression using K-map techniques.
CLO2	To impart the concepts of designing and analyzing combinational logic circuits.
CLO3	To impart design methods and analysis of sequential logic circuits.
CLO4	To impart the concepts of Verilog HDL-data flow models for the design of digital systems.
CLO5	To impart the concepts of Verilog HDL- models using behavioral and structural description.

Content	No. of Hours/ RBT levels
Module 1 **Boolean Algebra and Logic Gates:** Basic Definitions, Basic Theorems and properties of Boolean algebra. Boolean Functions, Canonical and standard forms, Other logic operations, Digital Logic gates. **Simplification of Boolean Functions:** The map method, Two, three, four and five variable map, sum of product and product of sum simplification. (Text-1)	08 Hours L2
Module 2 **Combinational Logic:** Introduction, Design procedure, Adders, Subtractor, Code conversion, Binary adder, Subtractor, Magnitude comparator Decoder, Encoder, Multiplexer, Demultiplexer. (Text-1)	08 Hours L2
Module 3 **Synchronous Sequential Logic:** Introduction, Flip-Flops, Triggering of flip-flops-RS, D, JK and T flip flops, Ripple counters, Synchronous counters. (Text-1)	08 Hours L3
Module 4 **Introduction to Verilog:** Why HDL, Brief History of HDL, Structure of Verilog module, Operators, Data Types, Styles of Description (only Verilog), Verilog Data flow description: Highlights of Data flow description, Structure of Data flow description. (Text-2)	08 Hours L3
Module 5 **Verilog Behavioral description:** Structure, Sequential Statements, Verilog Behavioral Description of Multiplexers (only Verilog), **Verilog Structural description:** Highlights of Structural description, Organization of structural description, Binding: Structural description of Full Adder and ripple carry adder.(Text-2)	08 Hours L3

COURSE OUTCOMES: Upon completion of this course, student will be able to;

CO1	**Simplify** Boolean functions using K-map technique
CO2	**Analyze** and design for combinational logic circuits.
CO3	**Analyze** the concepts of Flip Flops (SR, D, T and JK) and to design the synchronous counters.
CO4	**Develop** Verilog description using dataflow modeling style.
CO5	**Develop** Verilog description using structural description for digital circuits.

Textbooks:

1. Morris Mano and Michel D Ciletti, Digital Design, 3 rd Edition, Pearson Publication.
2. Nazeih M Botros, HDL Programming VHDL and Verilog 2009 reprint, Dreamtech press.

Reference books:

1. John M Yarbrough, Digital Logic Applications and Design Thomson Learning, 2001.
2. Donald D Givone, Digital Principles and Design McGraw Hill, 2002.
3. Donald P Leach and Albert P Malivno, Digital Principles and Applications, 7th Edition TMC.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/. mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	1	1	1	-	-	-	1	-	-
CO2	3	2	1	-	-	1	1	1	-	-	-	1	2	1
CO3	3	2	1	-	-	1	1	1	-	-	-	1	2	1
CO4	3	2	1	-	-	1	1	1	-	-	-	1	2	1
CO5	3	2	1	-	-	1	1	1	-	-	-	1	2	1
Average	3	2	1	-	-	1	1	1	-	-	-	1	2	1

Low-1: Medium-2: High-3

SEMESTER –VI

COURSE: Introduction Digital Image Processing

(Open Elective-I: other than ECE Students)

Course Code	22ECE64D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Fundamentals of digital image Processing.
CLO2	Transformation techniques used in digital image processing.
CLO3	Image compression techniques used in Digital image processing.
CLO4	Image enhancement techniques used in digital image processing.
CLO5	Morphological operations and color image processing used in digital image processing.

Content	No. of Hours/ RBT levels
Module 1 **Introduction:** What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use Digital image processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition. (Text1)	8 Hours L2
Module 2 **Digital Image Fundamentals:** Image Sampling and Quantization, Some Basic Relationships Between Pixels, Some Basic Intensity Transformation Functions, Histogram Processing. (Text1)	8 Hours L2
Module 3 **Some basic compression methods:** Huffman coding, Arithmetic coding, LZW coding, RUN length coding, Bit plane coding **An introduction to mathematical tool used in digital image processing:** Array verses matrix operation, linear verses nonlinear operation, arithmetic operation, set and logical operation, vector and matrix operation. (Text1)	8 Hours L3
Module 4 **Fundamentals of Spatial Filtering:** Smoothing Spatial Filters, Sharpening Spatial Filters. **Image Segmentation:** Fundamentals, point line and edge detection, Thresholding. (Text1)	8 Hours L3
Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing. (Text1)	8 Hours L3

COURSE OUTCOMES: Upon completion of this course, student will be able to;

CO1	Explain the fundamental principles of Digital image processing
CO2	Illustrate image digitization and basic relationships between pixels.
CO3	Describe the different image compression techniques.
CO4	Apply image processing techniques in both the spatial domains.
CO5	Explain the concept of colour image processing and morphological image processing.

Text Books:

1. Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

Reference Books:

1. S.Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing, Tata McGrawHill 2014.
2. A K. Jain, Fundamentals of Digital Image Processing, Pearson 2004.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least one **full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Quiz 1/AAT	05	
	Quiz 2/AAT	05	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	1	-	-	1	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	1
CO3	3	1	2	-	-	-	-	-	1	-	-	1	1	-
CO4	2	1	1	-	-	-	-	-	-	-	-	-	-	1
CO5	2	-	2	-	-	-	-	-	1	1	-	1	1	-
Average	**2**	**1**	**2**		**-**	**-**	**-**		**1**	**1**		**1**	**1**	**1**

Low-1: Medium-2: High-3

SEMESTER – VI

Course: CMOS VLSI Laboratory

Subject Code	22ECEL66	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Credits	1	Examination Hours	03

Course Learning Objectives: Student will be taught;

CLO1	Designing, modeling, simulating and verifying CMOS digital circuits.
CLO2	Designing layouts and performing physical verification of CMOS digital circuits.
CLO3	Analyzing ASIC design flow and understanding the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level netlist.
CLO4	Performing RTL-GDSII flow and understanding the stages in ASIC design.

Sl. No	PART – A Analog Design (Back end)	RBT levels
1. (a) (b)	Capture the schematic of CMOS inverter with load capacitance of 0.1pF and set the widths of inverter (Wn/Wp) and length at selected technology. Observe the input and output voltage for the designed inverter. Also compute tpHL, tpLH and td. Draw the layout of the inverter. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.	L3
2. (a) (b)	Capture the schematic of 2-input CMOS NAND gate. Verify the functionality of NAND gate and also find out the delay td for all four possible combinations of input vectors. Table the results. Draw layout of NAND gate. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.	L3
3.(a) (b)	Capture the schematic of Common Source Amplifier. Find its Transient response, DC response and AC response. Calculate Gain and Bandwidth. Draw layout of common source amplifier. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.	L3
	Part – B **Digital Design (Front end)**	
1.	Write Verilog code for 4-bit up/down asynchronous reset counter and carry out the followings: a. Verify the functionality using test bench b. Synthesize the design by setting area and timing constraint. Obtain the gate level netlist. Record the area requirement in terms of number of cells required power and area requirement.	L3
2.	Write Verilog code for 4-bit adder and verify its functionality using test bench. Synthesize the design by setting proper constraints and	L3

	obtain the net list. From the report generated identify, total number of cells, power requirement and total area required.	
3.	Write Verilog code for Latch and Flip-flop, Synthesize the design and compare the synthesis report (SR, JK, D, T).	L3
4.	For the synthesized netlist carry out the following for any one of the above experiments: a. Floor planning (automatic), identify the placement of pads b. Placement and Routing, record the parameters such as no. of layers used for routing, flip method for placement of standard cells, placement of standard cells, routes of power and ground, and routing of standard cells. c. Physical verification and record the LVS and DRC reports. d. Perform Back annotation and verify the functionality of the design. e. Generate GDSII and record the number of masks and its color composition.	L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Demonstrate** ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level net list.
CO2	**Design** and simulate basic CMOS circuits like inverter, NAND gate and common source amplifier.
CO3	**Design** and simulate combinational and sequential digital circuits using Verilog HDL.
CO4	**Illustrate** the Synthesis process of digital circuits using EDA tool.
CO5	**Perform** RTL-GDSII flow and understand the stages in ASIC design.

Textbooks:

1. Sung Mo Kang and Yosuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3rd Edition, Tata McGraw-Hill.
2. Neil H. E. Weste and David Money Harris CMOS VLSI Design- A Circuits and Systems Perspective, 4th Edition, Pearson Education, 2011.

Scheme of Examination:

Semester End Examination (SEE):

1. All laboratory experiments are to be included for practical examination.
2. Students can pick one experiment from the questions lot prepared by the examiners.
3. Change of experiment is allowed only once and 20% Marks allotted to the write up part to be made zero.

Semester End Examination Evaluation		
SL.NO	ACTIVITY	MARKS
1	Write-Up	15
2	Conduction	70
3	Viva Voce	15
	TOTAL	100

Note: The marks scored will be proportionately reduced to 50

Continuous Internal Evaluation (CIE):

As part of CIE process, progressive continuous evaluation is done for laboratory work on weekly basis of conduct of experiment by student either individually or in group based on the laboratory. The breakup of the marks allocated is given in the Table-1.

Table-1 WEEKLY EVALUATION OF CONDUCT OF EXPERIMENT		
SL.NO	ACTIVITY	MAX MARKS
1	Conduct of experiment and documentation	10
2	Analysis & interpretation of results	5
3	Viva voce	5
TOTAL		20

Internal exam conducted at the end of the semester or on completion of a predefined set of experiments based on the laboratory. The evaluation detail of laboratory internal exam is given in Table-2

Table-2 LAB INTERNAL EXAM		
SL.NO	ACTIVITY	MAX MARKS
1	Detailed write-up about the experiment with relevant procedure and calculation.	5
2	Conduction of experiment	20
3	Viva voce	5
TOTAL		30

TABLE-3 FINAL CIE CALCULATION		
SL.NO	METRICS USED	MAX MARKS
1	**Average of all weekly evaluation of conduct of experiment**	20
2	**LAB Internal Exam**	30
TOTAL		50

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	3				-	-	-	2	3	3
CO2	3	2	2	1	3				3		-	2	3	3
CO3	3	2	2	1	3				3		-	2	3	3
CO4	3	2	2	1	3				3		-	2	3	3
CO5	3	2	2	1	3				3		-	2	3	3
Average	3	2	2	1	3				3		-	2	3	3

Low-1: Medium-2: High-3

SEMESTER – VI

Ability Enhancement Course / Skill Enhancement Course- III

COURSE: Communication Simulink Toolbox

Course Code	22ECE67A	CIE Marks	50
Hours/Week (L:T:P)	0:0:2	SEE Marks	50
No. of Credits	1	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Simulate discrete time signals.
CLO2	DPSK and QPSK Transmitter and Receiver.
CLO3	Random noise generation histogram plotting.
CLO4	OFDM modulation and demodulation.
CLO5	Filtering operations.

List of Experiments to be conducted using MATLAB Simulink

Sl. No.	Content
1.	Generation of signals such as Sine, Square, Triangular and Ramp.
2.	DPSK Transmitter and Receiver in Simulink.
3.	Generate a multiband signal using the Communications Toolbox.
4.	Random noise generation using Simulink & display histogram plots of Gaussian and Uniform noise.
5.	Perform Equalization, Convolution, and Cyclic Prefix Addition on basic OFDM.
6.	QPSK Transmitter and Receiver in Simulink.
7.	Design and implementation of Low pass and High pass filter.
8.	Design and implementation of Band pass and Band reject filter.
9.	Obtain the scatter plots & eye diagrams of a QPSK signal to visualize the signal behavior in presence of AWGN.
10.	Perform OFDM modulation and demodulation.

COURSE OUTCOMES: Upon completion of this course, student will be able to;

CO1	Generate Sine, Square, Triangular and Ramp signals and display waveforms.
CO2	Perform DPSK and QPSK modulation and demodulation in presence of noise.
CO3	Generate random noise and plot histogram for various types of noise.
CO4	Perform various operations on OFDM.
CO5	Demonstrate different filtering operations on signals.

Scheme of Examination:

Semester End Examination (SEE):

1. All laboratory experiments are to be included for practical examination.
2. Students can pick one experiment from the questions lot prepared by the examiners.
3. Change of experiment is allowed only once and 20% Marks allotted to the conduction part to be made zero.

Semester End Examination Evaluation		
SL.NO	ACTIVITY	MARKS
1	Write-Up	15
2	Conduction	70
3	Viva Voce	15
TOTAL		100

Note: The marks scored will be proportionately reduced to 50

Continuous Internal Evaluation (CIE):

As part of CIE process, progressive continuous evaluation is done for laboratory work on weekly basis of conduct of experiment by student either individually or in group based on the laboratory. The breakup of the marks allocated is given in the TABLE-1

TABLE-1 WEEKLY EVALUATION OF CONDUCT OF EXPERIMENT		
SL.NO	ACTIVITY	MAX MARKS
1	Conduct of experiment and documentation	10
2	Analysis & interpretation of results	5
3	Viva voce	5
TOTAL		20

Internal exam conducted at the end of the semester or on completion of a predefined set of experiments based on the laboratory. The evaluation detail of laboratory internal exam is given in TABLE_2

TABLE-2 LAB INTERNAL EXAM		
SL.NO	ACTIVITY	MAX MARKS
1	Detailed write-up about the experiment with relevant procedure and calculation.	5
2	Conduction of experiment	20
3	Viva voce	5
TOTAL		30

TABLE-3 FINAL CIE CALCULATION		
SL.NO	METRICS USED	MAX MARKS
1	Average of all weekly evaluation of conduct of experiment	20
2	Lab Internal Exam	30
TOTAL		50

CO-PO and PSO mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	1			1		1
CO2	3	2						1	1			1		1
CO3	3	2						1	1			1		1
CO4	3	2						1	1			1		1
CO5	3	2						1	1			1		1
Average	3	2						1	1			1		1

Low-1: Medium-2: High-3

SEMESTER –VI

Course: Digital Image Processing Lab

Course Code	22ECE67B	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
No. of Credits	1	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Fundamentals of spatial and intensity resolution.
CLO2	Application of FFT and intensity transformation.
CLO3	Image enhancement techniques.
CLO4	Edge and line detection
CLO5	Image segmentation and morphological operations.

Sl. No.	Experiments	RBT levels
1	To analyze spatial resolution of images using MATLAB.	L3
2	To analyze intensity resolution of images using MATLAB.	L3
3	To perform intensity transformation of images using MATLAB.	L3
4	To apply Discrete Fourier Transform on image and study its properties using MATLAB.	L3
5	To study the histogram and histogram equalization using MATLAB.	L3
6	To perform image enhancement by spatial filtering using MATLAB.	L3
7	To detect edges in the image using MATLAB.	L3
8	To detect lines in the images using MATLAB.	L3
9	To perform morphological operations on image using MATLAB.	L3
10	To perform region based segmentation of image using MATLAB.	L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	Analyze spatial resolution and intensity resolution.
CO2	Apply DFT and intensity transformation to an image.
CO3	Implement histogram equalization on image.
CO4	Apply algorithms to detect edges and lines in an image.
CO5	Implement morphological operations and image segmentation.

Text Book:

1. Digital Image Processing- Rafel C Gonzalez and Richard E. Woods, PHI 3rd Edition 2010.

Reference Books:

1. S.Jayaraman, S. Esakkirajan and T. Veerakumar, Digital Image Processing Tata McGrawHill 2014.
2. A K. Jain, Fundamentals of Digital Image Processing, Pearson 2004.

Scheme of Examination:

Semester End Examination (SEE):

All laboratory experiments are to be included for practical examination. Students can pick

one experiment from the questions lot prepared by the examiners. Change of experiment is allowed only once and 15% Marks allotted to the write up part to be made zero.

Semester End Examination Evaluation		
SL.NO	ACTIVITY	MARKS
1	Write-Up	15
2	Conduction	70
3	Viva Voce	15
TOTAL		100

Note: The marks scored will be proportionately reduced to 50

Continuous Internal Evaluation (CIE):

As part of CIE process, progressive continuous evaluation is done for laboratory work on weekly basis of conduct of experiment by student either individually or in group based on the laboratory. The breakup of the marks allocated is given in the TABLE-1

TABLE-1 WEEKLY EVALUATION OF CONDUCT OF EXPERIMENT		
SL.NO	ACTIVITY	MAX MARKS
1	Conduct of experiment and documentation	10
2	Analysis & interpretation of results	5
3	Viva voce	5
TOTAL		20

Internal examination is conducted at the end of the semester or on completion of a predefined set of experiments based on the laboratory. The evaluation detail of the laboratory internal exam is given in TABLE-2

TABLE-2 LAB INTERNAL EXAMINATION		
SL.NO	ACTIVITY	MAX MARKS
1	Detailed write-up about the experiment with relevant procedure and calculation.	5
2	Conduction of experiment	20
3	Viva voce	5
TOTAL		30

TABLE-3 FINAL CIE CALCULATION		
SL.NO	METRICS USED	MAX MARKS
1	Average of all weekly evaluations of conduct of an experiment	20
2	Lab Internal Examination	30
TOTAL		50

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	1	-	-	1	-	-	1	-	2
CO2	3	3	2	-	-	1	-	-	1	-	-	1	-	2
CO3	3	3	2	-	-	1	-	-	1	-	-	1	-	2
CO4	3	3	2	-	-	1	-	-	1	-	-	1	-	2
CO5	3	3	2	-	-	1	-	-	1	-	-	1	-	2
Average	3	3	2		-	1	-		1	-	-	1	-	2

Low-1: Medium-2: High-3

SEMESTER – VI

COURSE: Multimedia Communication

Course Code	22ECE67C	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Computer Communication Networks

Course Objectives: Students will be taught;

CLO1	Fundamentals of Multimedia Communication and different multimedia networks and applications.
CLO2	Digitization principle techniques required to analyze different media types.
CLO3	Text and Image Compression techniques and gain knowledge of DMS.
CLO4	Audio and Video compression techniques.
CLO5	Gain fundamental knowledge about multimedia communication across different networks.

Content	No. of Hours/ RBT levels
Module 1 **Multimedia Communications**: Introduction, Multimedia information representation, multimedia networks, multimedia applications and networking terminology. (Text 1)	8 Hours L2
Module 2 **Information Representation**: Introduction, Digitization principles, Text, Images, Audio and Video. (Text 1)	8 Hours L2
Module 3 **Text and image compression:** Introduction, Compression principles, text compression, image Compression. (Text 1) **Distributed multimedia systems:** Introduction, main Features of a DMS, Resource management of DMS, Networking, Multimedia operating systems (Text 2).	8 Hours L2
Module 4 **Audio and video compression:** Introduction, Audio compression, video compression, video compression principles, video compression. (Text 1).	8 Hours L2
Module 5 **Multimedia Communication Across Networks:** Packet audio/video in the network environment, Video transport across generic networks, Multimedia Transport across ATM Networks. (Text 2).	8 Hours L2

COURSE OUTCOMES: Upon completion of this course, student will be able to;

CO1	**Explain** the basic of different multimedia networks &applications.
CO2	**Analyze** different media types to represent them in digital form.
CO3	**Compare** different types of text and images using different compression techniques
CO4	**Explain** the different types of compression techniques to compress audio and video.
CO5	**Describe** multimedia Communication across Networks.

Text books:

1. Fred Halsall, Multimedia Communications: Applications, Networks, Protocols and Standards, 1st Edition, Pearson education, 2001
2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, Multimedia Communication Systems, 1st Edition ,Pearson education, 2004.

Reference book:

1. Raifsteinmetz, Klara Nahrstedt, Multimedia:Computing, Communications and Applications, 1st Edition , Pearson education, 2002.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO4	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO5	3	2	-	-	-	-	-	-	-	1	-	1	-	-
Average	3	2	-	-	-	-	-	-	-	1	-	1	-	-

Low-1: Medium-2: High-3

SEMESTER –VI

Course: Internet of Things and Cloud Computing

Course Code	22ECE67D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	IoT and its deployment
CLO2	M2M and IoT system Management
CLO3	IoT Platforms and design Methodology
CLO4	Cloud computing and Virtualization
CLO5	Role of cloud computing in IoT.

Content	No. of Hours / RBT levels
Module-1 Introduction to Internet of Things: Introduction, Physical Design of IoT, Logic Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Templates. Domain Specific IoTs- Home Automation, Environment (Text-1: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1 & 2.4)	8 Hours L2
Module-2 M2M and IoT System Management: Difference between IoT and M2M , SDN and NFV for IoT IoT System Management with NETCONF-YANG: Need for IoT Systems Management, Simple Network Management Protocol (SNMP), Network Operator Requirements, NETCONF , YANG, IoT Systems Management with NETCONF-YANG (Text-1: 3.2, 3.3, 3.4.1, 4.2, 4.3, 4.4, 4.5 & 4.6)	8 Hours L2
Module-3 IoT Platforms and Design Methodology: IoT Design Methodoiogy, Case Study on IoT System for Weather Monitoring , What is an IoT device, Exemplary device Raspberry Pi, About the board , Interfaces, Programming Raspberry pi with Python (Text1 :5.2, 5.3, 7.1, 7.3, 7.5 & 7.6)	**8 Hours** **L3**
Module-4 Introduction to Cloud and Virtualization: Introduction ,Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft –Hyper V **(Text2: 1.1, chapter 3)**	8 Hours L3
Module-5 **Cloud Computing Architecture:** Cloud Computing Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud	8 Hours L3

Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects (Text2 : chapter 4)	

Course **Outcomes:** Upon completion of this course, student will be able to:

CO1	**Explain** the various concept of the IoT and their technologies.
CO2	**Discuss** IoT system management through SNMP protocol
CO3	**Apply** IoT design methodology to develop simple programs using Raspberry pi board.
CO4	**Explain** cloud computing and Architecture.
CO5	**Describe** the Architectures, services and models of the cloud.

Textbooks:

1. Bahga, Arshdeep., Madisetti, Vijay. Internet of Things: A Hands-on Approach. United Kingdom: Arshdeep Bahga & Vijay Madisetti, 2014.
2. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education,2013

Reference Books:

1. Jayaswal, Kallakurchi, Houde, Shah, KLSI, Cloud Computing Black Book,, Dreamtech Press,2012

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50

CO-PO and PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	1	2	-	-	-	-	-	-	-	-	1	-	2
CO2	-	-	3	2	2	-	-	-	-	-	-	2	1	3
CO3	-	-	-	-	-	-	-	-	-	-	-	1	1	1
CO4	-	-	3	-	-	-	-	-	-	-	-	2	1	1
CO5	-	-	2	2	3	-	-	-	-	-	-	2	1	3
Average	-	1	3	2	3	-	-	-	-	-	-	2	1	2

Low-1: Medium-2: High-3

SEMESTER – VI

Course: Indian Knowledge System

Course Code	22IKSK69	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	0	Examination Hours	01

Course Objectives:

CLO1	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system
CLO2	To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

Content
Module 1 (05 hours)
Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.
Module 2 (05 hours)
Traditional Knowledge in Humanities and Sciences: Lingistics, Number and measurements-Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology
Module 3 (05 hours)
Traditional Knowledge in Professional domain: Town planning and architecture Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.

Reference Books:

1. Introduction to Indian Knowledge System- concepts and applications, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0
2. Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN- 13: 978-8126912230,
3. Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,

COURSE OUTCOMES: Upon completion of this course, student will be able to:

CO 1	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO 2	Appreciate the need and importance of protecting traditional knowledge.
CO 3	Recognize the relevance of Traditional knowledge in different domains.
CO 4	Establish the significance of Indian Knowledge systems in the contemporary world

Scheme of Examination:

Semester End Examination (SEE):

SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question

paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.

Continuous Internal Evaluation (CIE):

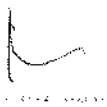
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. Typical Evaluation pattern for regular courses is shown in Table 2.

ble 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
		Grand Total	100

CO/PO	PO6
CO 1	3
CO 2	3
CO 3	3
CO 4	3
Average	3

Low-1: Medium-2: High-3



SEMESTER – VI

Course: Universal Human Values

Course Code	22UHV69	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	0	Examination Hours	01

Course Objectives:

CLO1	To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
CLO2	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
CLO3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
CLO4	To provide a much-needed orientation input in value education to the young enquiring minds.

Content
Module 1 (03 hours)
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations
Module 2 (03 hours)
Harmony in the Human Being : Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health
Module 3 (03 hours)
Harmony in the Family and Society : Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order
Module 4 (03 hours)
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence
Module 5 (03 hours)
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence

in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Reference Books:

1. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1
2. The Teacher"s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

COURSE OUTCOMES:

Upon completion of this course, student would:

CO 1	Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO 2	Have better critical ability
CO 3	Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO 4	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

Scheme of Examination:

Semester End Examination (SEE):
SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests.
Typical Evaluation pattern for regular courses is shown in Table 2.

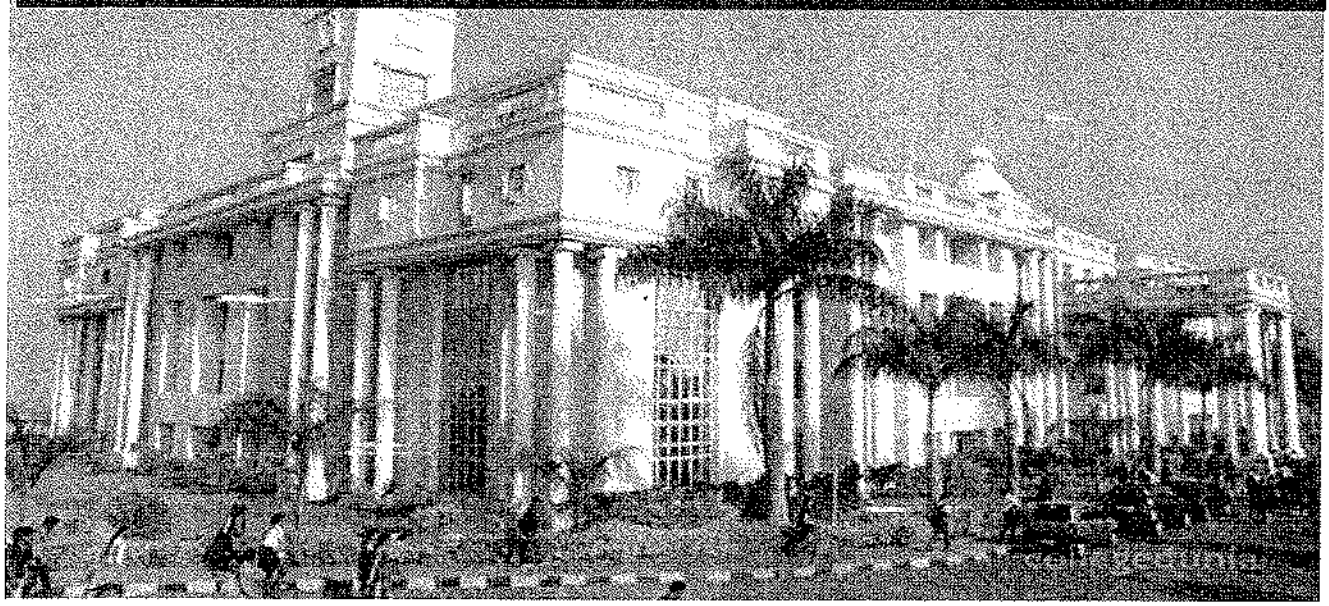
Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO/PO	PO6
CO 1	3
CO 2	3
CO 3	3
CO 4	3
Average	3

Low-1: Medium-2: High-3

IV-YEAR ECE SYLLABUS-2022 SCHEME



Department of Electronics and Communication Engineering

GLOBAL ACADEMY OF TECHNOLOGY

(Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
NBA Accredited CS, E&C, E&E, MECH, CV and IS branches)

Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098.

HEAD OF THE DEPARTMENT
Dept. of Electronics & Communication Engg.
Global Academy of Technology
Rajarajeshwarinagar, Bangalore-98

SEMESTER – VII

Course: Computer Communication Networks (Integrated)

Course Code	22ECE71	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	layering architecture of OSI reference model and TCP/IP protocol suite.
CLO2	Protocols associated with each layer.
CLO3	Different networking architectures and their representations.
CLO4	Functions and services associated with each layer.

Content	No. of Hours / RBT levels
Module-1 **Data Communications:** Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN, Switching and Internet. **Network Models:** Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. (Text1:1.1, 1.2, 1.3, 2.1, 2.2 & 2.3.1)	8 Hours L3
Module-2 **Data-Link Layer: Introduction:** Nodes and Links, Services, Categories of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Piggybacking. **Media Access Control:** Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing, Channelization: FDMA, TDMA & CDMA (Text 1: 9.1, 9.2-9.2.1, 9.2.2, 11.1-11.1.1, 11.1.2, 11.2, 12.1, 12.2 & 12.3)	8 Hours L3
Module-3 **Wired LANs:** Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet: Characteristics, Addressing, Access Method, Efficiency, Implementation, Fast Ethernet: Access Method, Physical Layer, Gigabit Ethernet: MAC Sublayer, Physical Layer, 10 Gigabit Ethernet. **Wireless LANs:** Introduction: Architectural Comparison, Characteristics, IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Layers. (Text 1: 13.1, 13.2-13.2.1 to 13.2.5, 13.3, 13.4, 13.5, 15.1, 15.2 & 15.3)	8 Hours L3
Module-4 **Network Layer:** Introduction, Network Layer services, Packet Switching, Datagram IPV4 Addresses, Forwarding of IP Packets Based on destination Address and Label. **Network Layer Protocols:** Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams, ICMPv4: Messages,	8 Hours L3

Debugging Tools, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP. Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing. **Next Gen IP:** IPV6 Addressing, ICMPv6. (Text 1:18.1, 18.2, 18.4, 18.5-18.5.1, 18.5.2, 19.1.1 to 19.1.3, 19.2.1 to 19.2.2, 19.3, 20.2, 22.1 & 22.2)	
Module-5 **Transport Layer:** Introduction: Transport Layer Services, Connectionless and Connection Oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Selective repeat protocol. **User Datagram Protocol:** User Datagram, UDP Services, UDP Applications. **Transmission Control Protocol:** TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control, TCP Timers. (Text 1: 23.1, 23.2.1 to 23.2.4, 24.2, 24.3.1 to 24.3.10)	8 Hours L3

	Practical Component of IPC
	PART-A: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/QualNet/ Packet Tracer or any other equivalent tool.
1.	Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
2.	Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
3.	Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data-rate.
4.	Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.
5.	Implementation of Link state routing algorithm.
	PART-B: Implement the following in C/C++
6.	Write a program for a HLDC frame to perform Bit stuffing and Character stuffing.
7.	Write a program for distance vector algorithm to find suitable path for transmission.
8.	Implement Dijkstra's algorithm to compute the shortest routing path.
9.	Implementation of Stop and Wait Protocol and Sliding Window Protocol.
10.	Write a program for congestion control using leaky bucket algorithm.

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Explain** the concepts of networking.
CO2	**Describe** the various networking architectures.
CO3	**Explain** the protocols and services of different layers.
CO4	**Describe** the basic network configurations and standards associated with each network.
CO5	**Analyze** a simple network and measure its parameters.

Textbook:

1. Behrouz A Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill,

2013.

Reference Books:

1. James J Kurose and Keith W Ross, "Computer Networks", 7th Edition, Pearson Education,2014.
2. Wayne Tomasi, "Introduction to Data Communication and Networking", 1st Edition. Pearson Education, 2015.
3. Andrew S Tanenbaum, "Computer Networks", 5th Edition, Prentice Hall, 2017.
4. William Stallings, "Data and Computer Communications",8th Edition, Prentice Hall, 2017.

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE **Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50.** There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester. Typical Evaluation pattern for integrated courses is shown in Table-1.

Table-1: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
		Grand Total	100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO4	3	2	-	-		-	-		-	1	-	1	-	-
CO5	3	2	-	-	-	-	-	-	-	1	-	1	-	-
Average	3	2	-	-	-	-	-	-	-	1	-	1	-	-

Low-1: Medium-2: High-3

SEMESTER –VII

Course: Antennas and Wave Propagation(Integrated)

Course Code	22ECE72	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
No. of Credits	4	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Basics of antenna theory.
CLO2	Field pattern of different types of antenna arrays.
CLO3	Short dipole and thin linear antenna.
CLO4	Types of antennas.
CLO5	Radio wave propagation.

Content	No. of Hours / RBT levels
Module-1 **Antenna Basics:** Introduction, Basic antenna parameters, patterns, beam area, radiation intensity, beam efficiency, diversity and gain, directivity and resolution, antenna apertures, effective height, The radio communication link, fields from oscillating dipole, antenna field zones, antenna temperature, antenna impedance, front to back ratio, point sources, power patterns, power theorem. (Text-1: 2.1-2.13 & 4.1 to 4.4)	8 Hours L2
Module-2 **Point Sources and Arrays:** Radiation intensity, Examples of power patterns, field patterns, phase patterns, Array of two isotropic point sources, pattern multiplication, nonisotropic and dissimilar point sources, Linear array of n isotropic point sources of equal amplitude and spacing, null directions for arrays of n isotropic point sources. (Text-1: 4.5 to4.10 & 4.12 to 4.14)	8 Hours L3
Module-3 **Electric Dipoles and Thin Linear Antenna**: Introduction, short electric dipole, fields of a short dipole (no derivation of field components), radiation resistance of short dipole, thin linear antenna, and radiation resistances of lambda/2 Antenna. (Text-1: 5.1-5.6)	8 Hours L3
Module-4 **Antenna Types:** Introduction, small loop, comparison of far fields of small loop and short dipole, loop antenna general case, radiation resistance, patch antennas, Helical Antenna, helical geometry, horn antennas, rectangular horn antennas, Yagi-Uda array, parabolic reflectors, log periodic antenna, lens antenna. (Tex- 1: 6.1-6.4, 6.7, 6.18, 7.3, 7.4, 6.19, 6.20, 7.7, 8.7, 9.7 &14.1)	8 Hours L3
Module-5 **Radio Wave Propagation:** Radio wave propagation: Introduction, Ground wave propagation, free space propagation, ground reflection, surface wave, diffraction. Troposphere propagation, Tropospheric scatter, Ionospheric propagation, electrical properties of the ionosphere, effects of earth's magnetic field. (Text-2: 8.1.1-8.1.4, 8.1.6, 8.1.7, 8.2.1 & 8.2.2)	8 Hours L2

Practical Component of IPC	
List of Experiments	
1	Conduct an experiment to study the Characteristics of Reflex Klystron.
2	Conduct an experiment to study V-I Characteristics of Gunn Diode.
2	Study of characteristics of E-plane Tee/H-plane Tee using microwave test bench
3	Conduct an experiment to obtain the radiation pattern of a diploe antenna using MATLAB
4	Conduct an experiment to obtain the radiation pattern of a Patch antenna using MATLAB
5	Conduct an experiment to obtain the radiation pattern of a Log-Periodic antenna using MATLAB
6	Conduct an experiment to obtain the radiation pattern of a Yagi-Uda antenna using MATLAB.
7	Conduct an experiment to obtain the radiation pattern of E-Plane and H-plane of Horn antenna using MATLAB
8	To Measure the harmonics of Sine and Square waves on Spectrum analyses

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Describe** antennas, their principle of operation, radiation pattern and applications.
CO2	**Analyze** antenna arrays and determine radiation patterns of different types of arrays.
CO3	**Compare** the radiation pattern of electric dipoles and thin linear antennas.
CO4	**Select** various antenna configurations according to the applications.
CO5	**Identify** different forms of radio wave propagation.

Textbooks:

1. John D. Krauss, Ronald J Marhefka and Ahmad S Khan, Antennas and Wave Propagation, 4th Special Indian Edition, McGraw- Hill Education Pvt. Ltd., 2010.
2. Harish and Sachidananda, Antennas and Wave Propagation, 3rd Edition, Oxford University Press, 2007.

Reference Books:

1. C.A. Balanis, Antenna Theory, 3rd Edition, John Wiley & Sons, 2005.
2. K.D. Prasad, Satya Prakashan, Antennas and Wave Propagation, 5th Edition, Tech India Publications, New Delhi, 2001.

Scheme of Evaluation: (Integrated courses)

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**

The laboratory assessment would be restricted to only the CIE evaluation.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. The average of the three tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for

20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester. Typical Evaluation pattern for integrated courses is shown in Table-1.

Table-1: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
Grand Total			100

CO-PO and PSO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	1	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	1	-	-	-	-	2	-
CO3	3	-	-	-	-	-	-	1	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	1	-	-	-	1	2	-
CO5	3	-	-	-	-	-	-	-	-	-	-	1	2	-
Average	3	2	-	-	-	-	-	1	-	-	-	1	2	-

Low-1: Medium-2: High-3

SEMESTER –VII

Course: Cryptography

Course Code	22ECE73	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites:

Course Objectives: Students will be taught;

CLO1	The classical encryption techniques and concepts of number theory.
CLO2	The various symmetric cipher techniques.
CLO3	The various asymmetric cipher techniques.
CLO4	Pseudo random sequence generators and One-Way hash functions.
CLO5	Message authentication codes and Digital signatures.

Content	No. of Hours / RBT levels
Module-1 **Classical Encryption Techniques:** Symmetric cipher model, Substitution techniques, Transposition techniques. **Basic Concepts of Number Theory and Finite Fields**: Euclidean algorithm, Modular arithmetic, Groups, Rings and Fields. (Text 1: Chapter 1- 1, 2 & 3, Chapter 3- 2, 3 & 4)	8 Hours L2, L3
Module-2 **Block Ciphers and Data Encryption Standard (DES)**: Traditional Block Cipher structure, Data encryption standard (DES). **Advanced Encryption Standards:** The AES structure, AES transformation function, AES key expansion. (Text 1: Chapter2- 1&2, Chapter 4-2, 3 & 4)	8 Hours L2, L3
Module-3 **Public Key Cryptography and RSA:** Principles of Public-Key Cryptosystems, The RSA algorithm, Diffie-Hellman Key Exchange, Elgamal cryptographic system, Elliptic Curve Cryptography. (Text 1: Chapter 8- 1 & 2, Chapter 9- 1, 2 & 4)	8 Hours L2, L3
Module-4 **Pseudo-Random-Sequence Generators and Stream Ciphers:** Linear Congruential Generators, Linear Feedback Shift Registers, Design and analysis of stream ciphers, Stream ciphers using LFSRs- Geffe Generator, Generalized Geffe Generator, Beth-Paper stop-and-go generator. **One-Way Hash Functions**: Background- Length of One-Way Hash Functions, Overview of One-Way Hash Functions, MD4, MD5. (Text 2: Chapter 16- 16.1 to 16.4, Chapter 18- 18.1, 18.4 & 18.5)	8 Hours L2, L3
Module-5 **Message Authentication Codes:** Message Authentication requirements, Message Authentication Functions, Security of MACs, MACs Based on Block Ciphers: DAA and CMAC. **Digital Signatures**: Digital Signatures, NIST Digital Signature Algorithm. (Text 1: Chapter 11- Section 1, 2, 4 & 6, Chapter 12- Section 1, 4)	8 Hours L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Apply** classical cryptographic algorithms to encrypt and decrypt the data using number theory concepts.
CO2	**Explore** symmetric cryptographic algorithms to encrypt and decrypt the information.
CO3	**Apply** asymmetric cryptographic algorithms to encrypt and decrypt the information.
CO4	**Explore** pseudo random sequence generators and one-way hash functions.
CO5	**Analyze** message authentication codes and digital signature techniques.

Textbooks:

1. William Stallings, Cryptography and Network Security Principles and Practice, Pearson Education Inc., 6th edition, 2014.
2. Bruce Schneier, Applied Cryptography Protocols, Algorithms, and Source code in C, Wiley Publications, 2nd edition.

Reference Books:

1. Behrouz A. Forouzan , Cryptography and Network Security, TMH, 2007.
2. AtulKahate, Cryptography and Network Security, TMH, 2003.

MOOCs:

https://digimat.in/nptel/courses/video/106105031/L01.html
https://onlinecourses.nptel.ac.in/noc22_cs03/
https://archive.nptel.ac.in/courses/106/107/106107155/

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO4	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO5	3	2	-	-	-	-	-	-	-	1	-	1	-	-
Average	3	2	-	-	-	-	-	-	-	1	-	1	-	-

Low-1: Medium-2: High-3

SEMESTER –VII

Professional Elective - III

Course: Advanced VLSI

Course Code	22ECE74A	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Analog Electronic Circuits, Design and Analysis of Digital Circuit and VLSI Design

Course Learning Objectives: Students will be taught;

CLO1	Delay power calculations for VLSI circuits.
CLO2	Combinational circuit design
CLO3	Sequential circuit design and advanced techniques used in CMOS logic circuits.
CLO4	Various arithmetic circuits in CMOS VLSI design.
CLO5	System level physical design and testing of VLSI circuits.

Content	No. of Hours/ RBT levels
Module-1 **Delay:** Introduction, Transient Response, RC Delay Model, Linear Delay Model, Logical Efforts of Paths (Text 1: Chapter 4:4.1 to 4.5, except sub-sections 4.3.7, 4.4.5, 4.4.6, 4.5.4, 4.5.5 and 4.5.6). **Power:** Introduction, Low power architectures. (Text 1: Chapter 5: 5.1, 5.5)	8 Hours L2, L3
Module-2 **Combinational Circuit Design:** Introduction, Circuit families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Pass-Transistor Circuits, Circuit pitfalls, threshold drops, ratio failures, leakage, charge sharing, power supply noise, hot spots, minority carrier injection. (Text 1: Chapter 9: 9.1, 9.2, 9.2.1, 9.2.2, 9.2.3, 9.2.5, 9.3.1 to 9.3.7)	8 Hours L2, L3
Module-3 **Sequential Circuit Design:** Introduction, sequencing methods, Circuit Design for Latches and Flip Flops. (Text 1: Chapter 10:10.1, 10.2.1, 10.3.1 to 10.3.5) **Advanced Techniques in CMOS Logic Circuits:** Mirror Circuits, Pseudo-nMOS, Tri-state circuits, Dynamic CMOS logic circuits. (Text 2: Chapter 9: 9.1, 9.2, 9.3 & 9.5)	8 Hours L2, L3
Module-4 **Arithmetic Circuits in CMOS VLSI:** Bit adder circuits, Ripple-Carry Adders, Other high speed adders, Carry skip circuits, carry select adders, Multipliers, array multipliers. (Text 2: Chapter 12: 12.1, 12.2, 12.4, 12.4.1, 12.4.2, 12.4.3, 12.5, 12.5.1)	8 Hours L2, L3
Module-5 **System level physical design:** Large scale physical design, Floor planning and routing. (Text 2: Chapter 14: 14.1, 14.5) **Reliability and Testing of VLSI Circuits:** CMOS Testing, Test generation methods. (Text 2: Chapter 16: 16.2 & 16.3)	8 Hours L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Understand** delay power calculations in VLSI circuits.
CO2	**Analyze** combinational circuits.
CO3	**Analyze** Sequential circuit design and advanced techniques used in CMOS logic circuits.
CO4	**Explore** various arithmetic circuits in CMOS VLSI design.
CO5	**Realize** system level physical design and testing of VLSI circuits.

Textbooks:

1. Neil H. E. Weste, David Harris and Ayan Banerjee, CMOS VLSI Design- A Circuits and Systems Perspective, 4th Edition, Pearson Education 2011.
2. John P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & Sons.

Reference Books:

1. Adel Sedra and K. C. Smith, Microelectronics Circuits Theory and Applications, 7th Edition, Oxford University Press, International Version, 2009.
2. Behzad Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill Education (India) Private Limited, 2007.
3. Sung Mo Kang and Yosuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 3rd Edition, McGraw Hill Education (India) Private Limited.
4. Douglas A Pucknell and Kamran Eshaghian, Basic VLSI Design, 3rd Edition, Eastern Economy Edition 2006.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	1	-	1	-	-	-	-	2	2	2
CO2	3	3	3	-	1	-	-	-	-	-	2	2	2	2
CO3	3	3	3	-	1	-	-	-	-	-	2	2	2	2
CO4	3	3	3	-	1	-	-	-	-	-	2	2	2	2
CO5	3	3	3	-	1	-	1	-	-	-	2	2	2	2
Average	3	3	3	-	1	-	1	-	-	-	2	2	2	2

Low-1: Medium-2: High-3

SEMESTER – VII

Professional Elective - III

Course: High-Performance Computer Networks

Course Code	22ECE74B	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Computer Communication Networks

Course Learning Objectives: Students will be taught;

CLO1	Communication Networks, Network Services, and layered Architecture
CLO2	Different Internet protocols
CLO3	Circuit-Switched Networks and Wireless Networks

Content	No. of Hours/ RBT levels
Module 1 **History of Communication Networks:** History of Communication Networks, Networking principles, Future Networks Internet, Pure ATM Network, Cable Network, Wireless. (Text-1,1.1 to 1.3.4)	8 Hours L2
Module 2 **Network Services and Layered Architectures**: Applications, Traffic characterization and quality of service, Network services, High-Performance networks, Network Elements, Basic Network Mechanisms, Layered Architecture, Open data network model, Network architectures, Network bottlenecks. (Text-1,2.1 to 2.10)	8 Hours L2
Module 3 **The Internet and TCP/IP Networks:** The Internet, Overview of Internet Protocols, Internet Protocol, TCP and UDP, Internet success and limitation, Performance of TCP/IP Networks. (Text-1,4.1 to 4.6)	8 Hours L3
Module 4 **Circuit Switched Networks**: Performance of Circuit-Switched Networks, SONET, Dense Wave-Division Multiplexing (DWDM), Fiber to the Home, Digital Subscriber Line (DSL), Intelligent Networks, CATV (Text-1, 5.1 to 5.7)	8 Hours L2
Module 5 **Wireless Networks:** The Wireless Channel, Link Level Design, Channel Access, Network Design, Wireless Networks Today, Future Systems and Standards. (Text-1, 7.2 to 7.7)	8 Hours L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	Understand the communication network principles and future networks.
CO2	Understand the network services and layered architectures.
CO3	Explain the Internet and different protocols.
CO4	Understand the performance of circuit-switched networks
CO5	Explain the design principle and channel access for wireless Networks

Textbooks:

1. Jean Warland, Pravin Varaiya: Morgan "High-Performance Communication Networks", Kauffman/Elsevier 2nd Edition Kaufmann Publishers 2000

Reference Books:

1. William Stallings "High-Speed Networks and Internet: Performance and Quality of Service" Pearson Edu., 2001.
2. James F.Kurose, Keith W.Ross "Computer Networks", ,2nd Edition , Pearson Education 2003

MOOCs:

https://onlinecourses.nptel.ac.in/noc23_cs35/preview
https://www.coursera.org/learn/computer-networking
https://onlinecourses.nptel.ac.in/noc22_cs19/preview

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	1	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	1	2
CO4	3	2	2			-	-	-	-	-	-		1	2
CO5	2	2	2			-	-	-	-	-	-		1	2
Average	2	2	2			-	-	-	-	-	-		1	2

Low-1: Medium-2: High-3

SEMESTER – VII

Professional Elective - III

Course: Optical Fiber Communication

Course Code	22ECE74C	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Basic concepts of optical fiber Communication.
CLO2	Transmission characteristics and losses in optical fiber.
CLO3	Types of optical sources and detectors
CLO4	Optical components and its applications in optical communication networks
CLO5	Network standards in optical fiber and Network architectures along with its functionalities.

Content	No. of Hours / RBT levels
Module 1 **Optical fiber communications**: Historical development, The general system, Advantages of optical fiber communication. **Optical fiber wave guides**: Ray theory transmission, Modes in planar guide, Phase and group velocity. **Cylindrical fiber**: Modes, Step index fibers, Graded index fibers, Single mode fibers. (Text 2: 1.1 to 1.3, 2.2, 2.3.2, 2.3.32.4 & 2.5)	8 Hours L3
Module 2 **Transmission characteristics of optical fibers**: Attenuation, Material absorption losses, Linear scattering losses. Nonlinear scattering losses, Fiber bend loss, Dispersion and intramodal dispersion. **Optical Fiber Connectors**: Fiber alignment and joint loss. **Fiber splices**: Fusion Splices, Mechanical splices, Cylindrical ferrule connectors, Duplex and Multiple fiber connectors. **Fiber couplers**: Three and four port couplers, star couplers and Wavelength division multiplexing couplers. (Text 2: 3.1 to 3.9, 5.2, 5.3 & 5.6)	8 Hours L3
Module 3 **Optical sources**: Light Emitting diodes, LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. (Text 1:4.2.1 to 4.2.4) **Laser Diodes**: Modes and Threshold conditions, Laser diode Rate equation, External Quantum Efficiency and Resonant Frequencies. (Text 1: 4.3.1 to 4.3.4) **Photodetectors**: Physical principles of Photodiodes, Photo detector noise and Detector response time. (Text 1: 6.1 to 6.3)	8 Hours L3
Module 4 **WDM Concepts and Components**: Operational Principles of WDM, Mach-Zehnder Interferometer Multiplexers, Fiber grating filters, Tunable sources. (Text 1: 10.1.1, 10.2.5, 10.4 & 10.9)	8 Hours L3

Optical amplifiers: Basic application and Types, Semiconductor optical amplifiers and Erbium Doped Fiber Amplifiers (Text 1: 11.1 to 11.3)	
Module 5 **Optical Networks:** Network Concepts, Network Topologies, SONET/SDH, High Speed Lightwave Links, Optical Add/Drop Multiplexing and optical switching. (Text 1: 13.1 to 13.6)	8 Hours L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Explain** the concept of optical fiber communication
CO2	**Describe** the transmission characteristics and losses, Couplers and connectors in optical fiber communication
CO3	**Describe** the constructional features and the characteristics of optical sources and detectors.
CO4	**Discuss** the principle of WDM and its Components.
CO5	**Illustrate** Optical network concepts and its switching.

Textbooks:

1. Gerd Keiser, Optical Fiber Communication, 5th edition, McGraw Hill Education(India) Private Limited, 2015.
2. John M Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson Education, 2010.

Reference Book:

1. Joseph C Palais, Fiber Optic Communication, 5th edition, Pearson Education, 2009.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			**100**

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO2	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO3	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO4	3	2	1	-	-	-	-	-	-	-	-	3	2	2
CO5	3	2	1	-	-	-	-	-	-	-	-	3	2	2
Average	3	2	1	-	-	-	-	-	-	-	-	3	2	2

Low-1: Medium-2: High-3

SEMESTER – VII

Professional Elective - III

Course: Biomedical Signal Processing

Course Code	22ECE74D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Different types of biomedical signals.
CLO2	Processing of biomedical signals.
CLO3	Data compression techniques.
CLO4	Methods of analysis of ECG signals.
CLO5	Analysis of EEG signals

Content	No. of Hours / RBT levels
Module-1 **Introduction to Biomedical Signals:** The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis. **Electrocardiography:** Basic electrocardiographies, ECG lead systems, ECG signal characteristics. **Signal Conversion: Simple** signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits (Text 3: chapter 1,Text 1: chapter 2,chapter 3)	8 Hours L2, L3
Module-2 **Signal Averaging:** Basics of signal averaging, signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging. **Adaptive Noise Cancelling:** Principal noise canceller model, 60-Hzadaptive cancelling using a sine wave model, other applications of adaptive filtering. (Text 1: chapter 9 and chapter 8)	8 Hours L2, L3
Module-3 **Data Compression Techniques:** Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding, data reduction algorithms The Fourier transform, Correlation, Convolution, Power spectrum estimation, Frequency domain analysis of the ECG. (Text 1)	8 Hours L2, L3
Module-4 **Cardiological signal processing:** Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG signal characteristics (parameters and their estimation), Analog filters, ECG amplifier, and QRS detector, Power spectrum of the ECG, Bandpass filtering techniques, Differentiation techniques, Template matching techniques, A QRS detection algorithm, Realtime ECG processing algorithm, ECG interpretation, ST segment analyzer, Portable arrhythmia monitor.(Text 1: chapter 12,chapter 11)	8 Hours L2, L3

Module-5	8 Hours
Neurological signal processing: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics (EEG rhythms, waves, and transients), Correlation. **Analysis of EEG channels:** Detection of EEG rhythms, Template matching for EEG, spike and wave detection(Text 2 and 3)	L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Analyze** the various biomedical signals.
CO2	**Apply** signal averaging and adaptive signal processing to extract biomedical signals from noise.
CO3	**Apply** classical and modern filtering and compression techniques for ECG and EEG signals.
CO4	**Explain** the basics of ECG and its parameters.
CO5	**Describe** the detection of EEG signals

Textbooks:

1. Willis J. Tompkins, Biomedical Digital Signal Processing, PHI 2001.
2. D C Reddy, Biomedical Signal Processing Principles and Techniques, McGraw- Hill publications, 2005.
3. Rangaraj M. Rangayyan, Biomedical Signal Analysis, John Wiley & Sons 2002.

MOOCs:

https://www.classcentral.com/course/swayam-biomedical-signal-processing-10069.
https://onlinecourses.nptel.ac.in/noc20_ee41/preview.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses.

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	-	-	-	-	-	-	-	-	-	1	-	1
CO4	3	3	-	-	-	-	-	-	-	-	-	1	2	-
CO5	3	-	-	-	-	-	-	-	-	-	-	1	2	1
Average	3	3	-	-	-	-	-	-	-	-	-	1	2	1

Low-1: Medium-2: High-3

SEMESTER – VII

Open Elective-II (Offered to other than ECE students)

Course: Wireless and Mobile Networks

Course Code	22ECE75A	CIE Marks	50
Hours/Week (L: T: P)	3: 0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Digital Communication, Spread Spectrum Modulation.

Course Learning Objectives: Students will be taught.

CLO1	Fundamental concept of wireless communication.
CLO2	Wireless Body Area Networks and Personal Area networks
CLO3	Standards and Architecture of Wireless Local Area Networks.
CLO4	Architecture, protocols of WMANs and WWANs
CLO5	Types of Adhoc Networks, Protocols and Applications.

Content	No. of Hours / RBT levels
Module-1 **Fundamentals of Wireless Communication:** Wireless Communication System, Wireless Media, Frequency Spectrum, Wireless Communication Channel Specifications, Types of Wireless Communication Systems. Text1: 1.1, 1.2, 1.3, 1.4, 1.6 & 1.7 **Basics of Wireless Networks:** Introduction, Wireless Network, Wireless Switching Technology, Wireless Communication Problems, Wireless Network Reference Model, Wireless Networking Issues, Wireless Networking Standards.Text1: 2.1, 2.2, 2.3, 2.4 & 2.5	8 Hours L2, L3
Module-2 **Wireless Body Area Networks:** Wireless Body Area Network (WBAN), Network Architecture, Network Components, Design Issues, Network Protocols, WBAN Technologies. Text1:3.1, 3.3, 3.4, 3.5, 3.6 & 3.7. **Wireless Personal Area Networks:** Wireless Personal Area Network (WPAN), Network Architecture, WPAN Components, WPAN Technologies and Protocols, WPAN Applications.Text1:4.1, 4.2, 4.3 & 4.5	8 Hours L2, L3
Module-3 **Wireless Local Area Networks:** Network Components, Design Requirements of WLAN, Network Architecture, WLAN Standards, IEEE 802.11p, WLAN Applications.Text1:5.1, 5.2, 5.3, 5.4, 5.6 & 5.7.	8 Hours L2, L3
Module-4 **Wireless Metropolitan Area Networks:** Wireless Metropolitan Area Networks, WMAN Network Architecture, Network Protocols, Broadband Wireless Networks, WMAN Applications. Text1:6.1,6.2,6.3,6.4,6.5 **Wireless Wide Area Networks:** Cellular Networks, WLAN versus WWAN, WWAN Applications. Text1:7.1, 7.3 &7.5	8 Hours L2, L3
Module-5 **Wireless Ad Hoc Networks:** Wireless Ad Hoc Networks, Mobile Ad Hoc Networks, Wireless Sensor Networks, Wireless Mesh Networks, Vehicular Ad Hoc Networks (VANETs) Text1: 8.1, 8.2, 8.3, 8.4 & 8.5	8 Hours L2, L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	Understand Wireless communication, fundamentals, communication systems, and networks.
CO2	Discuss the operation of WPAN components, standards and protocols.
CO3	Describe the various protocols and standards (WiMAX) used in WMAN, broadband wireless networks – LMDS, MMDS.
CO4	Demonstrate the communication protocols and interworking of WLAN, WMAN and WWAN
CO5	Illustrate the concept of wireless ad hoc networks, the architecture and protocols and the applications of wireless ad hoc networks

Textbook:

1. Sunil Kumar S Manvi, Mahabaleshwar S Kakkasageri, Wireless and Mobile Networks, 2nd Edition, Wiley India Pvt. Ltd. 2016.

Reference books:

1. Imrich Chlamtac Yi-Bang Lin, Wireless and Mobile Network Architectures, Wiley Publication, 2008.

Software/Learning Websites:

1. www.philadelphia.edu.jo/newlibrary/./file101fc6e5c77f4675b2958dc10a8c99c9 pdf
2. www.radio Electronics.com/info/wireless/Bluetooth/Bluetooth overview.php
3. www.gsma.com/futurenetworks/wp-content/uploads/2014
4. www.octoscope.com/English/.../octoscope_WirelessTutorial_20090209 pdf.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50

CO-PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1							2	2	2	1	1
CO2	2	1	1							2	2	2	1	1
CO3	2	1	1							2	2	2	1	1
CO4	2	1	1							2	2	2	1	1
CO5	2	1	1							2	2	2	1	1
Average	2	1	1							2	2	2	1	1

Low-1: Medium-2: High-3

SEMESTER – VII

Open Elective-II (Offered to other than ECE students)

Course: Automotive Electronics

Course Code	22ECE75B	**CIE Marks**	50
Hours/Week (L: T: P)	3: 0:0	**SEE Marks**	50
No. of Credits	3	**Examination Hours**	03

Prerequisites: Basic Electronics, Elements Mechanical Engineering, Basic concepts of Physics.

Course Learning Objectives: Students will be taught;

CLO1	Basics of automotive systems and electronic control.
CLO2	Sensors and Actuators
CLO3	Digital Engine control features.
CLO4	Networking of various modules in automotive systems and communication protocols
CLO5	Automotive Diagnostics

Content	No. of Hours / RBT level
Module-1 **Automotive Fundamentals Overview:** Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive Systems, The Engine – Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System - Spark plug, High voltage circuit and distribution, Spark pulse generation, Ignition Timing, Drive Train - Transmission, Drive Shaft, Differential, Suspension, Brakes, Steering System (Text 1) **The Basics of Electronic Engine Control:** Motivation for Electronic Engine Control – Exhaust Emissions, Fuel Economy, Concept of an Electronic Engine control system, Definition of General terms, Definition of Engine performance terms, Engine mapping, Effect of Air/Fuel ratio, spark timing and EGR on performance, Control Strategy, Electronic Fuel control system, Electronic Ignition. (Text 1)	8 Hours L3
Module-2 **Automotive Sensors:** Automotive Control System applications of Sensors and Actuators –Variables to be measured, Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O2/EGO) Lambda Sensors, (Text 1) **Automotive Engine Control Actuators:** Solenoid, Fuel Injector, EGR Actuator, Ignition System (Text 1)	8 Hours L3
Module-3 **Digital Engine Control Systems:** Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control - Closed loop Ignition timing, Integrated Engine Control System -	**8 Hours** L3

Secondary Air Management, Evaporative Emissions Canister Purge, Automatic System Adjustment, System Diagnostics. (Text 1) **Control Units:** Operating conditions, Design, Data processing, Programming, Digital modules in the Control unit, Control unit software. (Text 2)	
Module-4 **Automotive Networking:** Bus Systems, Classification, Applications in the vehicle, Coupling of networks, Examples of networked vehicles **CAN Bus:** Protocol layers, Message format. **LIN Bus:** Overview, Applications. **MOST Bus:** Introduction, Requirements, Type of use. **Bluetooth:** Overview, Applications. **Flex Ray:** Overview, Areas of application. Diagnostic Interfaces. (Text 2) **Vehicle Motion Control:** Typical Cruise Control System, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Digital Cruise Control configuration, Cruise Control Electronics (Digital only), Antilock Brake System (ABS) (Text 1)	8 Hours L3
Module-5 **Automotive Diagnostics:** Timing Light, Engine Analyzer, On-board diagnostics, Off-board diagnostics, Expert Systems, Occupant Protection Systems – Accelerometer based Air Bag systems. (Text 1: Chapter 10) **Future Automotive Electronic Systems:** Collision Avoidance Radar warning Systems, Low tire pressure warning system, Heads Up display, Speech Synthesis, Navigation – Navigation Sensors – Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation, Automatic driving Control.(Text 1)	8 Hours L3

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Acquire** an overview of automotive components, subsystems, and basics of Electronic Engine Control in today's automotive industry.
CO2	**Interfacing** with microcontrollers / microprocessors during automotive system design.
CO3	**Explain** operation of Digital Engine Control Systems & Secondary air management in automobiles.
CO4	**Describe** the networking of various modules in automotive systems, Communication protocols and diagnostics of the sub systems.
CO5	**Explain** the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts

Textbooks:

1. William B. Ribbens, Understanding Automotive Electronics, 6th Edition, Elsevier Publishing, 2003.
2. Robert Bosch Gmbh, Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th Edition, John Wiley, 2007.

Reference Books:

1. Detlef E. Ricken and Wolfgang Gessner, vanced Microsystems for Automotive Applications,Springer Publishing, 1998.
2. Automotive Electronic Diagnostics (Course-2) Kindle Edition

MOOCs:
https://www.youtube.com/watch?v=IVBb6KJM1fk
https://www.youtube.com/watch?v=3E1SXG7VkQk
https://www.youtube.com/watch?v=Sh6qZ-Sh7Jk
https://www.youtube.com/watch?v=LZ82iANWBL0

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50

CO/PO and PSO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			2	1	1				2	2	1
CO2	3	2	1			2	1	1				2	2	1
CO3	3	2	1			1	1	2				2	2	1
CO4	3	2	1			2	1	2				2	2	1
CO5	3	2	1			2	1	2				1	2	1
Average	3	2	1			2	1	2				2	2	1

Low-1: Medium-2: High-3

SEMESTER – VII

Open Elective-II (Offered to other than ECE students)

Course: Smart Sensors and Instrumentation

Course Code	22ECE75C	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Learning Objectives: Students will be taught;

CLO1	Understand various technologies associated in manufacturing of sensors
CLO2	Acquire knowledge about types of sensors used in modern digital systems
CLO3	Understand types of instrument errors and circuits for multirange Ammeters and Voltmeters.
CLO4	Describe principle of operation of digital measuring instruments and Bridges
CLO5	Understand the operations of transducers and Data Acquisition System.

Content	No. of Hours / RBT levels
Module-1 **Introduction to sensor-based measurement systems:** General concepts and terminology, sensor classification, Primary Sensors, material for sensors, microsensor technology. (Text 1:1.1, 1.2, 1.7-1.9)	8 Hours L2
Module-2 **Self-generating Sensors**- Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors. (Text 1: 6.1 to 6.5)	8 Hours L2
Module-3 **Principles of Measurement**: Performance characteristics, Static Characteristics, Error in Measurement, Types of Static Error, Multirange Ammeters, Multirange voltmeter. **Digital Voltmeter:** Ramp Technique, Dual slope, integrating Type DVM, and Successive Approximations type DVM. (Text 2: 1.2 -1.6, 3.2, 4.4, 5.2-5.4, 5.6)	8 Hours L3
Module-4 **Digital Instruments:** Universal counter, Decade counter, Digital tachometer, Digital pH meter, Digital phase meter. **Bridges**: Wheatstone's Bridge, AC Bridges - Capacitance and Inductance Comparison bridge, Wien's bridge.(Text2: 6.5, 6.6, 6.9, 6.10, 6.12, 11.2, 11.8 -11.10 & 11.14)	8 Hours L3
Module-5 **Transducers:** Introduction, Electrical Transducer, Selecting a Transducer Resistive Transducer, Resistive position Transducer, Resistance Wire Strain Gauges, Resistance Thermometer, Thermistor, LVDT. **Data Acquisition System (DAS)**: Introduction, Objectives of DAS, Signal conditioning of inputs, Single channel DAS, Computer based DAS. (Text2: 13.1-13.8, 13.11, 17.1-17.4 & 17.6).	8 Hours L2

Course Outcomes: Upon completion of this course, student will be able to:

CO1	**Understand** the concept of Sensors and its manufacturing.
CO2	**Describe** the operation of various self-generating sensors.
CO3	**Discuss** the operation of measurements and the operation of Digital voltameter.
CO4	**Evaluate** various measurement parameters using digital multimeter and bridges.
CO5	**Elaborate** the working of transducers and Data Acquisition System.

Textbooks:

1. Sensors and Signal Conditioning, Ramon Pallas Areny, John G. Webster,2nd edition, John Wiley, and Sons, 2000.
2. Electronic Instrumentation, H.S.Kalsi, Mc Graw Hill, 3rdEdition, 2012.

Reference Books:

1. Electronic Instrumentation & Measurements, David Bell, Oxford University Press PHI, 2ndEdition, 2006.
2. Modern Electronic Instrumentation and Measuring Techniques, D. Helfrick and W.D. Cooper Pearson, 1stEdition, 2015.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignments	10	
SEE	Semester End Examination	50	50
Grand Total			100

CO-PO and PSO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO2	1	1	1	-	-	-	-	-	-	-	-	-	1	1
CO3	1	2	-	-	-	-	-	-	-	-	-	1	1	-
CO4	3	3	2	-	-	-	-	1	-	-	-	1	2	1
CO5	2	1	-	-	-	-	-	1	-	-	-	1	2	1
Average	2	2	-	-	-	-	-	1	-	-	-	1	2	1

Low-1: Medium-2: High-3

SEMESTER – VI

Open Elective – II (Offered to other than ECE students)

COURSE: Multimedia Communication

Course Code	22ECE75D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Prerequisites: Computer Communication Networks

Course Objectives: Students will be taught;

CLO1	Fundamentals of Multimedia Communication and different multimedia networks and applications.
CLO2	Digitization principle techniques required to analyze different media types.
CLO3	Text and Image Compression techniques and gain knowledge of DMS.
CLO4	Audio and Video compression techniques.
CLO5	Gain fundamental knowledge about multimedia communication across different networks.

Content	No. of Hours/ RBT levels
Module 1 **Multimedia Communications**: Introduction, Multimedia information representation, multimedia networks, multimedia applications and networking terminology. (Text 1)	8 Hours L2
Module 2 **Information Representation**: Introduction, Digitization principles, Text, Images, Audio and Video. (Text 1)	8 Hours L2
Module 3 **Text and image compression:** Introduction, Compression principles, text compression, image Compression. (Text 1) **Distributed multimedia systems:** Introduction, main Features of a DMS, Resource management of DMS, Networking, Multimedia operating systems (Text 2).	8 Hours L2
Module 4 **Audio and video compression:** Introduction, Audio compression, video compression, video compression principles, video compression. (Text 1).	8 Hours L2
Module 5 **Multimedia Communication Across Networks:** Packet audio/video in the network environment, Video transport across generic networks, Multimedia Transport across ATM Networks. (Text 2).	8 Hours L2

COURSE OUTCOMES: Upon completion of this course, student will be able to;

CO1	**Explain** the basic of different multimedia networks &applications.
CO2	**Analyze** different media types to represent them in digital form.

CO3	**Compare** different types of text and images using different compression techniques
CO4	**Explain** the different types of compression techniques to compress audio and video.
CO5	**Describe** multimedia Communication across Networks.

Text books:

1. Fred Halsall, Multimedia Communications: Applications, Networks, Protocols and Standards, 1st Edition, Pearson education, 2001
2. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, Multimedia Communication Systems 1st Edition , Pearson education, 2004.

Reference book:

1. Raifsteinmetz and Klara Nahrstedt, Multimedia: Computing, Communications and Applications, 1st Edition, Pearson education, 2002.

Scheme of Examination:

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question** from each module.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs**: Seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other. Typical Evaluation pattern for regular courses is shown in Table 1

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO4	3	2	-	-	-	-	-	-	-	1	-	1	-	-
CO5	3	2	-	-	-	-	-	-	-	1	-	1	-	-
Average	3	2	-	-	-	-	-	-	-	1	-	1	-	-

Low-1: Medium-2: High-3

Dr. Manjunatha Reddy H.S
M.Tech, Ph.D
Professor and HOD
Department of Electronics and Communication Engg.
Global Academy of Technology