UNIVERSITY OF CALICUT

CURRICULUM

(1 TO 8 SEMESTERS)

&

SYLLABUS

B. Tech. - Electronics & Computer Science Engineering

(2024 SCHEME)

(Applicable to 2024 admission onwards)

CURRICULUM 2024 SCHEME

I to VIII SEMESTERS

Every course of B. Tech. Program shall be placed in one of the ten categories as listed in table below.

Sl. No	Category	Credits
1	Humanities and Social Science including Management courses (HSMC)	8
2	Basic Science Courses (BSC)	27
3	Engineering Science Courses (ESC)	21
4	Professional Core Courses (PCC)	74
5	Professional Elective Courses (PEC)	9
6	Open Elective Courses (OEC)	9
7	Internship, Project work, Seminar and Viva Voce	12
8	Mandatory Non-credit Courses (P/F) with grade	0
9	Mandatory Student Activities (P/F)	1
10	Laboratory sessions and Mini Project	10
	Total Mandatory Credits	**174**
11	Value Added Course (Optional)	12

Semester-wise credit distribution shall be as below:

Semester	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total Credits**
Credits	21	24	21	20	22	22	21	22	173
Activity Points	50				50				**---**
Credits for Activity	1								1
Grand Total									**174**

Humanities and Social Science including Management Courses (HSC)			
Sl. No	**Title**	**Semester**	**Credit**
1	English for Technical Writing	1	2
2	Universal Human Values	2	3
3	Engineering Economics and Principles of Management	5	3
Total Credits			**8**

Basic Science Courses (BSC)			
Sl. No	**Title**	**Semester**	**Credit**
1	Engineering Mathematics I	1	4
2	Engineering Chemistry	1	4
3	Engineering Mathematics II	2	4
4	Engineering Physics	2	4
5	Biology for Engineers	2	3
6	Engineering Mathematics III	3	4
7	Engineering Mathematics IV	4	4
Total Credits			**27**

Engineering Science Courses (ESC)			
Sl. No	**Title**	**Semester**	**Credit**
1	Basics of Electrical & Electronics Engineering	1	4
2	Programming for Problem Solving using C	1	4
3	Electrical & Electronics Engineering Workshop	1	2
4	Idea & Design Thinking Lab	1	1
5	Basics of Mechanical & Civil Engineering	2	4
6	Engineering Graphics	2	4
7	Mechanical & Civil Engineering Workshop	2	2
Total Credits			**21**

Professional Core Courses (PCC)			
Sl. No	**Title**	**Semester**	**Credit**
1	Electronic Circuits	3	4
2	Network Theory	3	4
3	Computer organization & Architecture	3	3
4	Switching theory & Logic Design	3	4
5	Signals & Systems	4	4
6	Data Structures & Algorithms	4	4
7	Foundation of Data Science	4	3
8	Analog Circuits	4	3
9	Digital Signal Processing	5	4
10	Database Management Systems	5	3
11	Software Engineering	5	4
12	Microprocessors & Microcontrollers	5	3
13	Computer Networks	5	3
14	Design & Analysis of Algorithms	6	3
15	Web and Internet Technology	6	3
16	VLSI Design	6	3
17	Operating Systems	6	4
18	Information Theory and Coding	7	4
19	Machine Learning	7	4
20	Cryptography and Network Security	7	3
21	Digital Image Processing	8	4
22	Introduction to Cybersecurity	8	3
Total Credits			**74**

Internship, Project work, Seminar and Viva Voce			
Sl. No	**Title**	**Semester**	**Credit**
1	Internship	6	1
2	Project Phase I	7	2
3	Seminar	8	2
4	Project Phase II	8	4
5	Viva Voce	8	3
Total Credits			**12**

Mandatory Non-credit Courses (P/F) with grade			
Sl. No	**Title**	**Semester**	**Credit**
1	Concepts of National Service	1	0
2	Environmental Science	2	0
3	Life Skills & Professional Ethics	3	0
4	Constitution of India	4	0
Total Credits			**0**

Laboratory sessions and Mini Project			
Sl. No	**Title**	**Semester**	**Credit**
1	Electronic Circuits Lab	3	1
2	Digital Electronics Lab	3	1
3	Data structures Lab	4	1
4	Analog Circuits Lab	4	1
5	Database Management Systems Lab	5	1
6	Microcontrollers Lab	5	1
7	Networks Lab	6	1
8	Mini Project	6	1

9	VLSI Lab	7	1
10	Operating Systems Lab	7	1
Total Credits			**10**

MINORS:

Minor is an additional credential a student may earn if he/she does **11 credits** worth of additional learning in a discipline other than his/her major discipline of B.Tech. degree. The objective is to permit a student to customize their Engineering degree to suit their specific interests. Upon completion of an Engineering Minor, a student will be better equipped to perform interdisciplinary research and will be better employable. The academic units offering minors in their discipline will prescribe the set of courses and/or other activities like projects necessary for earning a minor in that discipline.

A specialist basket of 3-6 courses is identified for each Minor. Each basket may rest on one or more foundation courses. A basket may have sequences within it, i.e.,advanced courses may rest on basic courses in the basket. he/she accumulates credits by registering for the required courses, and if the requirements for a particular minor are met within the time limit for the course, the minor will be awarded. This will be mentioned in the Degree Certificate as **“Bachelor of Technology in xxx with Minor in yyy”**.

1. The individual course credits earned, however, will be reflected in the consolidated grade card.

2. Registration is permitted for Minor at the **beginning of fourth semester**.

3.Total credits required to award B.Tech with Minor is **184** (173 + 11).

4. Out of the 11 Credits, 9 credits shall be earned by undergoing a minimum of three courses, of which one course shall be a mini project based on the chosen area. They can do mini project in S7.

5.The classes for Minor shall be conducted along with regular classes and no extra time shall be required for conducting the courses.

6. **There won’t be any supplementary examination for the courses chosen for Minor**.

HONOURS:

Calicut University is providing this option for academically extra brilliant students to acquire Honours. Students can attend various value added MOOC (Massive Open Online Courses) like NPTEL courses to earn a maximum of **12 additional credits** for getting 'Honours' degree in the discipline with a condition that he/she should have secured an aggregate of **8.0 CGPA** till final semester without any history of backlogs. The selected course can be in the same discipline.

a) The additional value-added MOOC courses can be of **8 – 12-week** duration.
b) **4 credits** will be awarded to a student on successful completion of each MOOC. Successful completion of a MOOC is considered only when a student scores a **minimum score of 60%** in the respective course.

Thus, a student will be eligible to get an undergraduate degree with 'Honours' when he/she successfully earns an additional requirement of 12 credits through the successful completion of **3 MOOCs**. However, the additional credits thus far earned by the student shall be included in the grade card but shall not be considered in calculating the CGPA. Upon completion of Honours, a student will be better equipped to perform research in his/her branch of engineering and allied sectors.

On successful achievement of 12 credits from the honours and 173 credits from their respective B-Tech syllabus, the student will earn a total credit of 185 at the end of the programme which he/she will be eligible to get the Degree Certificate as **"Bachelor of Technology in Electronics and Computer Science Engineering, with Honours"**.

The details of the students eligible for conferring the Honours Degree must be sent to the university by the principal, with the details of his/her marks up to 7th semester and the number of value-added courses and credits earned before the commencement of the 8th semester university examination.

COURSE CODE AND COURSE NUMBER:

Each course is denoted by a unique code consisting of two alphabets followed by two numerals like **EC24 807 (P).** The first two letter code refers to the department offering the course. EC stands for Electronics and Communication Engineering. The second two digits represent the year in which the syllabus is implemented, thus the digit 24 represents the year 2024. Out of the next three digits, the first digit represents the semester in which the subject belongs, Eg. In 807, 8 means 8th semester and 07 is the 7th subject in that semester. The last alphabet represents whether the subject belongs to the Practical or laboratory category. Eg. (P) Means the subject belongs to the Practical category.

L-T-P-C STRUCTURE:

Notations	Description
L	Lecture hours- For theory based courses hours are represented in this form. Eg 3-0-0-0, means 3 hour lecture per week is dedicated for this subject
T	Tutorial hours- These hours may be assigned for solving numerical problems and allied activities. Eg. 3-1-0-0, means 1 hour per week is dedicated for this purpose.
P	Practical/Drawing/Interactive session/Visits etc- These hours may be dedicated for conducting laboratory sessions, practical classes, Engg/machine drawing classes, interactive sessions, group discussions and even industrial visits pertaining to a specific subject for better learning. Eg. 0-0-1-0 means one hour is dedicated for the above mentioned purpose.
C	Credit - These are assigned based on the importance of the subject to the course. Eg. 0-0-1-1 means one credit is dedicated for the above mentioned purpose.

DEPARTMENTS

Each course is offered by a department and their two-letter course prefix is given in the table.

Departments and their codes

Sl. No	Department	Course Prefix
01	Computer Science & Engineering	CS
02	Electronics & Communication Engineering	EC
03	Electronics & Computer Science Engineering	ES
04	Electrical & Electronics Engineering	EE
05	Mechanical Engineering	ME
06	Printing Technology	PT

INDUCTION PROGRAM

A mandatory induction program for first semester students is designed for **one week**. This unique one-week immersion foundation programme designed especially for the fresher's, includes a wide range of activities right from workshops, lectures and seminars by eminent people, visits to local areas, familiarization to branch, department and innovations, physical activity, yoga, literacy, sports tournaments, social work and much more. The programme is designed to mould students into well-rounded individuals, aware and sensitized to local and global conditions and foster their creativity, improve their level of confidence, to involve with the existing environment, inculcate values and ethics, and help students to discover their passion. Foundation Programme also serves as a platform for the fresher's to interact with their batch mates, faculty and seniors and start working as a team with them. The program is structured around the following four themes:

- **Values and Ethics**: Focuses on fostering a strong sense of ethical judgment and moral fortitude.
- **Creativity**: Provide channels to exhibit and develop individual creativity by expressing themselves through art, craft, music, singing, media, dramatics, and other creative designs/activities.
- **Leadership, Communication and Teamwork**: Develop a culture of teamwork and group communication.
- **Social Awareness**: Nurture a deeper understanding of the existing local and global environment and our role in that place as a responsible citizen of the world.

SCHEME OF 1st SEMESTER B.Tech ELECTRONICS & COMPUTER SCIENCE ENGG COURSE								
Subject Code	**Subject Name**	**Hours**			**Marks**		**Duration of Semester End Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
EN24 101	Engineering Mathematics I	3	1	0	50	100	3	4
CH24 103A	Engineering Chemistry	2	1	2	50	100	3	4
BE24 105A	Basics of Electrical & Electronics Engineering	2	2	0	50	100	3	4
PC24 107A	Programming for Problem Solving using C	2	1	2	50	100	3	4
EN24 108	English for Technical Writing	1	0	2	50	100	3	2
EN24 109	Concepts of National Service	3	0	0	100	-	-	0
BE24 111A (P)	Electrical & Electronics Engineering Workshop	0	0	4	50	100	2	2
EN24 112 (P)	IDEA & Design Thinking Lab	0	0	2	100	-	2	1
	TOTAL	**13**	**5**	**12**	**500**	**600**		**21**
		30						

SCHEME OF 2nd SEMESTER B.Tech ELECTRONICS & COMPUTER SCIENCE ENGG COURSE								
Subject Code	**Subject Name**	**Hours**			**Marks**		**Duration of Semester End Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
EN24 201	Engineering Mathematics II	3	1	0	50	100	3	4
PH24 203B	Engineering Physics	2	1	2	50	100	3	4
MC24 205B	Basics of Mechanical & Civil Engineering	2	2	0	50	100	3	4
GS24 207B	Engineering Graphics	2	0	3	50	100	3	4
EN24 209	Biology for Engineers	3	0	0	50	100	3	3
EN24 210	Universal Human Values	3	0	0	50	100	3	3
EN24 211	Environmental Science	2	0	0	100	-	-	0
MC24 213B (P)	Mechanical & Civil Engineering Workshop	0	0	4	50	100	2	2
	TOTAL	**17**	**4**	**9**	**450**	**700**		**24**
		30						

SCHEME OF 3rd SEMESTER B.Tech ELECTRONICS & COMPUTER SCIENCE ENGG COURSE								
Subject Code	**Subject Name**	**Hours**			**Marks**		**Duration of Semester End Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
EN24 301	Engineering Mathematics III	3	1	0	50	100	3	4
ES24 302	Electronic Circuits	3	1	0	50	100	3	4
ES24 303	Network Theory	3	1	0	50	100	3	4
ES24 304	Computer Organization & Architecture	3	1	0	50	100	3	3
ES24 305	Switching Theory & Logic Design	3	1	0	50	100	3	4
EN24 306	Life Skills & Professional Ethics	3	1	0	100	-	-	0
ES24 307(P)	Electronic Circuits Lab	0	0	3	50	100	3	1
ES24 308(P)	Logic Design Lab	0	0	3	50	100	3	1
	TOTAL	**18**	**6**	**6**	**450**	**700**		**21**
		30						

SCHEME OF 4th SEMESTER B.Tech ELECTRONICS & COMPUTER SCIENCE ENGG COURSE								
Subject Code	**Subject Name**	**Hours**			**Marks**		**Duration of Semester End Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
EN24 401	Engineering Mathematics IV	3	1	0	50	100	3	4
ES24 402	Signals & Systems	3	1	0	50	100	3	4
ES24 403	Data Structures & Algorithms	3	1	0	50	100	3	4
ES24 404	Foundation of Data Science	3	1	0	50	100	3	3
ES24 405	Analog Circuits	3	1	0	50	100	3	3
EN24 406	Constitution of India	3	1	0	100	-	-	0
ES24 407	Minor course*	0	0	0	50	100	3	3
ES24 408(P)	Data Structures Lab	0	0	3	50	100	3	1
ES24 409(P)	Analog Circuit Lab	0	0	3	50	100	3	1
	TOTAL	**19**	**5**	**6**	**450**	**700**		**20**
		30						

Special timetable will be allotted for minor course

SCHEME OF 5th SEMESTER B.Tech ELECTRONICS & COMPUTER SCIENCE ENGG COURSE								
Subject Code	**Subject Name**	**Hours**			**Marks**		**Duration of Semester End Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
ES24 501	Engineering Economics & Principles of Management	3	1	0	50	100	3	3
ES24 502	Digital Signal Processing	3	1	0	50	100	3	4
ES24 503	Database Management Systems	3	1	0	50	100	3	3
ES24 504	Software Engineering	3	1	0	50	100	3	4
ES24 505	Microprocessors & Microcontrollers	3	1	0	50	100	3	3
ES24 506	Computer Networks	3	1	0	50	100	3	3
ES24 507	Minor Course*	0	0	0	50	100	3	3
ES24 508 (P)	Database Management Systems Lab	0	0	3	50	100	3	1
ES24 509 (P)	Microcontrollers Lab	0	0	3	50	100	3	1
	TOTAL	18	6	6	**400**	**800**	**24**	**22**
		30						
Special timetable will be allotted for minor course								

SCHEME OF 6th SEMESTER B.Tech ELECTRONICS & COMPUTER SCIENCE ENGG COURSE								
Subject Code	**Subject Name**	**Hours**			**Marks**		**Duration of Semester End Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
ES24 601	Design and Analysis of Algorithms	3	1	0	50	100	3	3
ES24 602	Web and Internet Technology	3	1	0	50	100	3	3
ES24 603	VLSI Design	3	1	0	50	100	3	3
ES24 604	Operating Systems	3	1	0	50	100	3	4
ES24 605	Professional Elective - I	3	1	0	50	100	3	3
ES24 606	Open Elective - I	3	1	0	50	100	3	3
ES24 607	Minor Course*	0	0	0	50	100	3	3
ES24 608 (P)	Networks Lab	0	0	3	50	100	3	1
ES24 609 (P)	Mini Project	0	0	3	100		-	1
ES24 610 (P)	Internship**	0	0	0	100	-	-	1
	TOTAL	**18**	**6**	**6**	**550**	**700**		**22**
		30						
***Special timetable will be allotted for minor course.**								

Professional Elective I		Open Elective I	
Subject Code	**Subject Name**	**Subject Code**	**Subject Name**
ES24 605 (A)	Advanced Data Structures	ES24 606 (A)	IPR and Patenting
ES24 605 (B)	Power Electronics	ES24 606 (B)	E-Farming
ES24 605 (C)	Electronic Instrumentation	ES24 606 (C)	PCB Fabrication
ES24 605 (D)	Cyber Law and Ethics	ES24 606 (D)	Waste Management and Upcycling
ES24 605 (E)	Embedded Systems	ES24 606 (E)	Ethical Hacking
ES24 605 (F)	Network & Linear Control System	ES24 606 (F)	Object Oriented Programming Using JAVA

OPEN ELECTIVE:

These elective subjects are open to all students of various engineering disciplines. Any student can opt an elective subject based on his/her interest. These elective topics are of general in nature and focused on thrust areas. The number of students that can be accommodated in an elective is limited to 50; the allotment can be on a first come first serve basis.

INTERNSHIP:

Students need to undergo a **minimum of 10-15 days internship** in an Industry/Firm associated with rural technology and agriculture/Rural village to observe, identify and give suggestions to the problems related to Electronics and Computer Science Engineering sector in the society. In addition, the student may also work on a specified task or project which may be assigned to him/her. The students will have an opportunity to develop observational skills, develop confidence to identify and understand the issues related with Electronics and communication engineering and come up with solutions to rectify the same. This motive of the programme is ultimately focused on the mutual benefit to the students, industry and society. The outcome of the internship should be presented in the form of a report.

Total marks: 100, minimum marks required to pass the internship is 50, split-up of the marks are as follows

Attendance	**: 10**
Coordinator	**: 20**
Technical Content of the Report	**: 30**
Presentation	**: 40**

SCHEME OF 7th SEMESTER B.Tech ELECTRONICS & COMPUTER SCIENCE ENGG COURSE								
Subject Code	Subject Name	Hours			Marks		Duration of Semester End Examination	Credits
		L	T	P	Internal	End Semester		
ES24 701	Information Theory and Coding	3	1	0	50	100	3	4
ES24 702	Machine Learning	3	1	0	50	100	3	4
ES24 703	Cryptography and Network Security	3	1	0	50	100	3	3
ES24 704	Professional Elective - II	3	1	0	50	100	3	3
ES24 705	Open Elective - II	3	1	0	50	100	3	3
ES24 706 (P)	VLSI Lab	0	0	3	50	100	3	1
ES24 707 (P)	Operating System Lab	0	0	3	50	100	3	1
ES24 708 (P)	Project Phase I	0	0	4	100	-	-	2
ES24 709 (P)	Project in Minor*	0	0	0	100	-	-	2
	TOTAL	**15**	**5**	**10**	**450**	**700**		**21**
		30						
***Special timetable will be allotted for minor course.**								

Professional Elective II		Open Elective II	
Subject Code	**Subject Name**	**Subject Code**	**Subject Name**
ES24 704 (A)	Multirate Signal Processing	ES24 705 (A)	Introduction to R Programming
ES24 704 (B)	Adaptive Signal Processing	ES24 705 (B)	Bioinformatics
ES24 704 (C)	Advanced Database Design	ES24 705 (C)	Consumer Electronics
ES24 704 (D)	Nano Electronics	ES24 705 (D)	Product Life Cycle Management
ES24 704 (E)	Pattern Recognition	ES24 705 (E)	Virtual Reality
ES24 704 (F)	Robotics &Automation	ES24 705 (F)	Internet of Things

PROJECT PHASE I:

A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The guides may encourage socially relevant project which can be interdisciplinary in nature.

Faculty members and students can interact with members of the local body, practicing engineers, industry and research institutions, to identify the issues which are predominant in that area/state and need immediate attention. Such issues may be categorized and converted into a research problem so that they can study the feasibility of doing a research project in that area. This method of addressing the problems of society will enhance the culture and social concern of the students. This initiative can produce engineers with social commitment.

The objective of project work is to enable the student to take up investigative study in the broad field which can be of interdisciplinary nature, either fully theoretical/simulation/practical or involving both theoretical and practical work. The department can assign a group of four students, under the guidance of a faculty to do the project work. Thus the assigned faculty can constantly interact with these students and mentor them properly to gain confidence in taking up research work and supporting them to make it a reality. This initiative is expected to provide a good base for the student(s) in taking up a research & development project.

Faculty themselves or along with students in the Institutions/departments can apply for project grants with research organizations like Kerala State Council for Science Technology and Environment (KSCSTE), Department of Science & Technology (DST) for doing projects. Faculty/students can also approach Agricultural, Veterinary, Fisheries, and Health Sciences Universities for doing projects in a variety of fields where they require technical support from the engineering sector. These types of funded research projects will improve the creativity and outlook of the students which will be beneficial to the society.

The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Preparing an Action Plan for conducting the investigation, including teamwork;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Block level design documentation
- Conducting preliminary Analysis/ Modelling/ Simulation/ Experiment/ Design/ Feasibility;
- Preparing a Written Report on the Study conducted for presentation to the department;
- Final seminar, as oral presentation before the evaluation committee.

Total marks: 100, minimum marks required to get a pass is 50, Mark distribution is as follows

Project Guide	**: 30**
Interim evaluation by the evaluation committee	**: 20**
Final presentation	**: 30**
Report evaluation by the evaluation committee	**: 20**

SCHEME OF 8th SEMESTER B.Tech ELECTRONICS & COMPUTER SCIENCE ENGG COURSE								
Subject Code	**Subject Name**	**Hours**			**Marks**		**Duration of Semester End Examination**	**Credits**
		L	**T**	**P**	**Internal**	**End Semester**		
ES24 801	Digital Image Processing	3	1	0	50	100	3	4
ES24 802	Introduction to Cybersecurity	3	1	0	50	100	3	3
ES24 803	Professional Elective - III	3	1	0	50	100	3	3
ES24 804	Open Elective - III	3	1	0	50	100	3	3
ES24 805 (P)	Seminar	0	0	6	100	-	-	2
ES24 806 (P)	Project Phase II	0	0	8	100	-	-	4
ES24 807 (P)	Viva Voce	0	0	0	-	100	-	3
		12	4	14				
	TOTAL	**30**			**400**	**500**		**22**

Professional Elective III		Open Elective III	
Subject Code	Subject Name	Subject Code	Subject Name
ES24 803 (A)	Wavelets	ES24 804 (A)	Edge Computing
ES24 803 (B)	Wireless Sensor Networks	ES24 804 (B)	Research Methodology
ES24 803 (C)	Text Mining	ES24 804 (C)	Leadership and Corporate Strategy
ES24 803 (D)	Natural Language Processing	ES24 804 (D)	Mobile Application Development
ES24 803 (E)	Bio-Medical Signal Processing	ES24 804 (E)	Blockchain
ES24 803 (F)	Computer Based Control System	ES24 804 (F)	Computer Hardware Engineering

SEMINAR:

To encourage and motivate the students to read and collect recent and reliable information from their area of interest confined to the relevant discipline from technical publications including peer reviewed journals, conference, books, project reports etc., prepare a report based on a central theme and present it before a peer audience. A faculty member can guide a maximum of five students of his/her area of interest to have better interaction and creative support in guiding the seminar. Each student shall present the seminar for about 20 minutes duration on the selected topic. The report and the presentation shall be evaluated by a team of internal members comprising three senior faculty members based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the report.

Total marks: 100, minimum marks required to pass the seminar is 50, split-up of the marks are as follows

Attendance	**: 10**
Seminar Guide	**: 20**
Technical Content of the Report	**: 30**
Presentation	**: 40**

PROJECT PHASE II:

The objective of project phase II & dissertation is to enable the students to extend further the investigative study taken up in Project Phase I. This work can be either fully theoretical/practical or involving both theoretical and practical work, socially relevant initiatives (work from local body/village) funded project from a research organization. The project is under the guidance of a faculty (project Guide) from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This project work is expected to provide a good overall training for the students in research and development, execution of a theory into practical by facing the challenges with confidence by developing technical leadership. The assigned project work is normally evaluated based on the following points:

- Depth of knowledge in the topic assigned/work executed based on the report prepared under Phase I;
- Review and finalization of the approach to the identified problem relating to the assigned topic/work;
- Detailed Analysis/ Modelling/ Simulation/ Design/ Problem Solving/ Experiment as needed;
- Final development of product/process, testing, results, conclusions and future directions;
- Preparation of a paper for Conference presentation/Publication in Journals, if available;
- Preparation of a Dissertation in the standard format for evaluation by the Department;
- Final Presentation before a Committee

Total marks: 100, minimum marks required to pass 50, split-up of the marks are as follows

Project Guide **: 30**

Interim evaluation by the evaluation committee **: 20**

Quality of the report evaluated by the above committee **: 20**

Final evaluation by a three- member faculty committee **: 30**

MINOR:

Students who have registered for **B.Tech Minor in Electronics & Computer Science Engineering** can opt to study the courses listed below:

MINOR BASKET				
SEMESTER	**MINOR BASKET A - DATA SCIENCE**		**MINOR BASKET B - VLSI**	
	Subject Code	**Subject Name**	**Subject Code**	**Subject Name**
S4	ES24 407A	Foundation of Data Science	ES24 407B	Electronic Devices
S5	ES24 507A	Data Science with Python	ES24 507B	Digital System Design
S6	ES24 607A	Big Data Analytical Tools	ES24 607B	VLSI Design
S7	ES24 709A (P)	Project in Minor	ES24 709B (P)	Project in Minor

ACTIVITY POINTS: -

The Tutor, HOD and Principal must ensure that the students' have acquired the required mandatory activity points of 100 points and 75 points for lateral entry students by the end of 8th semester respectively. The accumulated activity points of all students must be consolidated and entered into the university portal by the college officials before the commencement of each semester's university examinations.

Activities that a student can engage in and the maximum quantum of points that can be earned from them are listed below.

Annexure-I

i)	**NATIONAL LEVEL ACTIVITIES**				
CODE	**NAME OF ACTIVITY**	**MAX ACTIVITY POINTS**	**POINTS DISTRIBUTION**	**ACTIVITY**	**MINIMUM DURATION**
NA1	NSO	70			2 SEM.
NA2	NCC	70			2 SEM.
NA3	NSS	70	• For ten days camp - **40 points** • Rest of the points will be allotted according to the decision of NSS Program Officer		2 SEM. (Consider at S2 and S4)
ii)	**COLLEGE LEVEL ACTIVITIES**				
CA1	Active Member /Office bearer of professional Societies (Students Chapter)	30/40	• Executive Member - **40 Points** • Core Coordinator - **30 points** • Sub Coordinator - **30 points** • Active Member - **10 points**	• IEEE • ASME • NASA • SAE etc. • College Association Chapters	4 SEM.

CA2	Elected office bearer of Student forums	30	• General Post - **30 points** • Department Secretary/ Year Representative - **25 points**	**General Post -** • Chairman • Vice Chairman • Secretary • Joint Secretary • UUC • Sports • Magazine Editor • Fine Arts Secretary	2 SEM.
CA3	Member/Captain of College Athletic/Games teams	20/30	• Captain - **20 points** • Member- **15 points** (Additional **10 points** awarded for national level)	• Cricket • Football •Volleyball • Chess etc	2 SEM.
CA4	Executive Member of students clubs	20		• IEDC •TinkerHub • Hackclub • APT(E) etc	2 SEM.
CA5	Volunteer for important college functions	25		•Placement cell coordinators can be considered	2 SEM.
CA6	Participant for important college functions	20			2 SEM.

CA7	Committee member/Organizer of Tech Fest/Cultural Fest/Conference	20/30	Committee member/Organizer - **20 points** (**30 points** will be awarded for national level/international level programs)		2 SEM.
CA8	Placed within top three in Paper presentation/debate/cultural competitions etc	30	• First Prize – **30 points** • Second Prize – **25 points** • Third Prize- **20 points**	Technical Fest can also be considered	
CA9	Placed within three in State/National level Sports/Games	30	• First Prize- **30 points** • Second Prize - **25 points** • Third Prize - **20 points**		
iii)	**ENTREPRENEURSHIP**				
EA1	Any Creative Project execution	40		Concerned dept project coordinator should form a panel with external faculty from other dept. and get approved	
EA2	Awards for Projects	60			
EA3	Initiation of Start-ups	60			
EA4	Attracted Venture Capital	80			

EA5	Filed a Patent	80	• Patent -Filed - **50 points** •Patent-Published - **60 points** •Patent-Approved - **70 points** • Patent-Licensed - **80 points**		
EA6	Completed Prototype Development	80	•Prototype developed and tested- **60 points** •Completed prototype development- **80 points**	Concerned dept project coordinator should form a panel with external faculty from other dept and get approved	
iv)	**SELF INITIATIVES**				
SA1	Attended College/University level conferences	25		•Seminars •Workshopcan also be considered	4 SEM.
SA2	Attended National/International Conference	30		• Seminars • Workshop • STTPs conducted at IITs/NITs/Universities can also be considered	4 SEM.
SA3	Published /got an award for a technical paper	30/40	• Publication - **30 points** • Awards - **40 points**		2 SEM.
SA4	Organizer of student technical Conference/Competition	30			

SA5	Foreign Language skills	50		• TOEFL • IELTS etc	
SA6	Online courses taken & completed	50		10 hours per week or one month course duration can be considered	

SEMESTER I

EN24 101	ENGINEERING MATHEMATICS I	3-1-0-4

COURSE OBJECTIVES:

- To familiarize with functions of several variables that is essential in most branches of Engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To familiarize the student with concept of vector differentiation.
- To familiarize the student with concept of vector integration.
- To develop the essential tool of Matrices and Linear Algebra in a comprehensive manner.

SYLLABUS:

MODULE I: Multivariable Calculus **(10 hours)**

Functions of several variables- Limit, continuity and partial derivatives- Partial derivatives of functions of two variables-Implicit partial differentiation-Partial derivatives of functions of more than two variables-Higher order partial derivatives-total derivative-Maxima, minima and saddle points.

MODULE II: Multiple integrals and their applications **(10 hours)**

Double integrals (Cartesian and polar coordinates)-Change of order of integration of double integrals-change of variables (Cartesian to polar)-triple integrals-volume of solids, change of variables (rectangular to cylindrical).

MODULE III: Vector differential calculus **(10 hours)**

Vector functions of a single variable- Differentiation of vector functions- scalar and vector Fields-gradient of scalar field-divergence and curl of vector fields-relation between the vector differential operators.

MODULE IV: Vector integral calculus **(10 hours)**

Integration of vector functions- scalar line integrals- surface and volume integrals of vector Functions-Gauss divergence theorem- Stokes theorem- Greens theorem (without proof).

MODULE V: Matrices **(12 hours)**

Rank of a matrix- Solution of System of linear equations-Homogeneous and non- Homogeneous Hermitian, Skew –Hermitian and Unitary matrices- Eigen values and Eigen Vectors- Cayley Hamilton theorem- Diagonalisation of matrices.

COURSE OUTCOMES:

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

- Develop skills of using the derivatives to find critical points, inflection points and local extrema
- Acquire the basic concept of partial differentiation and its applications in engineering model physical phenomena involving continuous changes of variables and parameters
- Acquire the knowledge of vector differentiation.
- Develop skills for using integration of vector functions.
- Use matrices and determinants for solving system of linear equations and applying it in engineering problems.

TEXT BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publication Reprint, 2008

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9 th Edition, John Wiley& Sons, 2006.
2. Veerarajan T., Engineering Mathematics for First year, Tata McGraw-Hill, New Delhi, 2008.
3. Ramana B.V. Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi,11th Reprint, 2010.
4. D.Poole, Linear Algebra, A Modern Introduction ,2nd Edition, Brooks/Cole ,2005.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers,36th Edition ,2010.
6. K.B.Dutta, Matrices and Linear Algebra ,PHI Learning Pvt Ltd,New Delhi,2003.
7. M.D.Raisinghania, Vector Analysis, S.Chand and company,India,1997.
8. Jack L Goldbeg, Matrix Theory with applications, Mc Graw Hill, Newyork, 1992.
9. A.K.Hazra, Matrix Algebra,Calculus and generalized inverse, Viva Books, New Delhi.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks: 100**)**

PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks.** Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks** Two questions from each module with choice to answer one question.

CH24 103A	ENGINEERING CHEMISTRY	2-1-2-4

COURSE OBJECTIVES:

- To enable the students to acquire knowledge in the concepts of chemistry for engineering applications.
- To familiarize the students with different application-oriented topics like polymers, metal ions in biological system fuels, lubricants, batteries, energy storage devices, etc.
- To illuminate the students with the chemistry of compounds which are involved in petrol, diesel, lubricants and their functions in the respective areas.
- To develop abilities and skills that are relevant to the study and practice of chemistry.
- To equip the students with the working knowledge of chemical principles, nature and transformation of materials and their applications.

SYLLABUS:

MODULE I: (10 hours)

Conducting Polymers - Classification, Preparation, structure, conduction mechanism and applications of polymers such as polyacetylene and polyaniline.

Fullerenes and Carbon-nanotubes - Preparation, Properties and Applications.

Practical Work: Preparation of (i) Urea-Formaldehyde resin and (ii) Phenol-Formaldehyde resin.

MODULE II: (10 hours)

Water Treatment -Hardness, Boiler feed water (Scale and Sludge Formation) Determination of hardness by EDTA method Softening of hard water (Lime-Soda and Ion Exchange methods) - Numerical based on the above Alkalinity of water, Dissolved Oxygen in water (BOD and COD)

Purification of water for domestic use.

Practical Work: Determination of (i) Total hardness of a given water sample, (ii) Chloride ion in a given water sample, (iii) Dissolved oxygen present in a given water sample, and (iv) Percentage of available chlorine present in a given bleaching powder sample.

MODULE III: (10 hours)

Fuels – Classification, Calorific value and its determination using Bomb Calorimeter Refining of Petroleum, Cracking and Reforming- Petrol Knocking and Octane number, Diesel knocking and Cetane number, Biodiesel and Non-petroleum fuels, CNG and LPG

MODULE IV: **(10 hours)**

Electrochemistry- Electrochemical cells, Salt bridge, Helmholtz double layer Single electrode potential, EMF of an electrochemical cell and its determination Standard Hydrogen Electrode (SHE), Determination of standard reduction potential using SHE, Electrochemical series and its applications Nernst equation and its applications (Numerical problems). Storage Cells- Lead acid accumulator and Nickel-Cadmium battery, H_2-O_2 fuel cell.

Module V: **(12 hours)**

Corrosion- Dry corrosion (Self protecting corrosion products, Pilling-Bed worth rule) Wet corrosion (Corrosion of iron in acidic, neutral and basic conditions) Differential aeration and Stress corrosion, Galvanic corrosion and galvanic series. corrosion control by cathodic protection. Inorganic coatings like Galvanizing, Tinning, Electroplating and Anodising of Aluminium.

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

- Analyse the importance of hardness of water and the basic concept of polymers.
- Rationalize the properties of lubricants and the major fuels used in the daily life.
- Explore the basic idea of metal ions in biological system and their importance.
- Streamline the worth of electrical storage using batteries or fuel cells by learning the electrochemistry.
- List major chemical corrosion reactions and prevention methods that can be utilised in the protection of metal.

TEXT BOOKS:

1. A textbook of Engineering Chemistry by Dr. Sunitha Rattan, S. K. Kataria Publisher
2. Engineering Chemistry, N. Krishnamurthy and D. Madhavan, PHI Learning Pvt Ltd

REFERENCE BOOKS:

1. Seymour R.B, Introduction to Polymer Chemistry, McGraw Hill, New York
2. Billmeyar, F.W, Text book of Polymer Science, Wiley Interscience, New York
3. L.H. Sperling, Introduction to Physical Polymer Science, Wiley Interscience, New York
4. P.K. Goel, Water Pollution, Causes, Effects and Control, New Age International
5. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 3 rd Ed., Wiley Eastern Ltd
6. P. W. Atkins, Physical Chemistry, J.D. Paula, Oxford University Press
7. V. Kumar, Introduction to Green Chemistry, Vishal Publishing House.
8. B. S. Bahl and Arun Bahl S., Advanced Organic Chemistry, Chand & Company.
9. L. S. Brown and Thomas A. Holme, Chemistry for Engineering Students, Cengage Learning
10. Janice Gorzynski Smith, Organic Chemistry, McGraw-Hill publications
11. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publishers
12. Engineering Chemistry, P. Rath, Cengage Learning
13. Engineering Chemistry, M.J. Shultz, Cengage Learning, New Delhi
14. Engineering Chemistry, R. Mukhopadhyay and S. Datta, New Age International Publishers
15. A textbook of Engineering Chemistry, S. S. Dara and S. S. Umare, S. Chand Pvt Ltd

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

10% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

30% - Lab Performance

10% - Regularity in the class

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

BE24 105A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	2-2-0-4

COURSE OBJECTIVES:

- To set a firm and solid foundation in Electrical and Electronics Engineering with strong analytical skills.
- Conceptual understanding of basic laws and analysis methods in electrical and magnetic circuits.
- To understand the working of diodes and transistors.
- To impart knowledge about digital electronics.
- To give basic ideas about various communication systems (no analysis required in this subject).

SYLLABUS:

MODULE I: **(10 hours)**

D. C. Circuits: (Only Independent sources) Kirchhoff's law- ideal and practical voltage and current sources. Mesh and Nodal analysis (Super node and super Mesh excluded)- Star delta transformation (resistive networks only-derivation is not needed). AC Fundamentals: Mathematical and graphical representation of sinusoidal voltage- concept of cycle, period, frequency, instantaneous, peak, average, R.M.S. values- peak factor and form factor- phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors. Study of circuits of pure resistance, inductance and capacitance and corresponding voltage- current phasor diagrams, voltage – current and power waveforms.

MODULE II: **(12 hours)**

Single phase AC Circuits: Study of series and parallel R-L, R-C, R-L-C circuits, concept of impedance and admittance for different combinations, wave form and relevant voltage current phasor diagrams. Concept of active, reactive, apparent power and power factor-band width, quality factor. Polyphase AC circuits: Concept of three phase supply and phase sequence. Balanced and unbalanced loads voltage current and power relations in three phase balanced star and delta loads and their phasor diagrams.

MODULE III: **(10 hours)**

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, PN Junction diode, Principle of operation, V-I characteristics, principle of working of Zener diode, Photo diode, LED and Solar cell. Bipolar Junction Transistors, PNP and NPN structures, Principle of operation, input and output characteristics of common emitter configuration (NPN only).

MODULE IV: **(10 hours)**

Digital Systems: logic expressions, Boolean laws, duality, De-Morgan's law, logic functions and gates, adders and subtractors.Block diagram description of a dc power supply, half wave and full wave (including bridge) rectifiers, capacitor filter, working of simple zener voltage regulator. Amplifiers and Oscillators: principle of electronic amplifiers, circuit diagram and working of common emitter amplifier, working principles of oscillators, concepts of feedback, circuit diagram & working of RC phase shift oscillator.

MODULE V: **(10 hours)**

Radio Communication: modulation, principle of AM and FM, block diagrams of transmitters, waveforms, comparison of AM and FM, Mobile communication: basic principles of cellular communications, concepts of cells, frequency reuse. Optical communication: block diagram of the optical communication system, principle of light transmission through fiber, advantages of optical communication systems.

COURSE OUTCOMES:

At the end of the course the students should be able to:

- Apply fundamental concepts and circuit laws to solve simple DC electric circuits.
- Analyse basic magnetic circuits and apply the fundamental laws of electrical engineering.
- Illustrate the basic concept of different types of diodes and transistors.
- Analyse various digital gates.
- Explain about the basic communication systems.

TEXT BOOKS:

1. Edward Hughes, Electrical and Electronics Technology, 9/e, Pearson.
2. Vincent Del Toro, Electrical Engineering Fundamentals, Pearson Education.
3. SK Bhattacharya, Basic Electrical & Electronics Engineering, Pearson.
4. M.S Sukhija and T.K Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University press, 2012.
5. Neil Storey, Electronics: A system approach, 3/e, Pearson.
6. Wayne Tomasi, Electronic Communication Systems: Fundamentals through advanced, 5/e, Prentice Hall.

REFERENCE BOOKS:

1. Kothari and Nagrath, Theory & problems of Basic Electrical engineering. Tata McGraw Hill.
2. JB Gupta, A course in electrical Engg. SK. Kataria & Sons.
3. BL Theraja, Electrical Technology Vol. 1.
4. K Uma Rao, Basic Electrical Engineering, Pearson.
5. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson.
6. J. B. Gupta, An integrated Course in Electronics and Communication Engineering, Katson books, 3rd Edition.

Internal Continuous Assessment (Maximum Marks-50).

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Marks-100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks** Two questions from each module with choice to answer one question.

PC24 107A	**PROGRAMMING FOR PROBLEM SOLVING USING C**	**2-1-2-4**

COURSE OBJECTIVES:

- To impart the basic concepts of computer and information technology.
- To provide students with fundamental understanding of C programming.
- To develop problem solving skills through c programming, enabling students to translate real problems into code.
- To help students gain proficiency in writing C code, including conditional statements, loops, functions, structure and union.
- To introduce pointers, file handling and I/O operations in C.

SYLLABUS:

MODULE I: (10 hours)

Introduction to Computers: A simple model of a computer - hardware and software, characteristics of computers, Computer generations and classification, Input-Output devices.

Computer memory: Hierarchy of memory, Read Only Memory, RAM, Different types of storage devices, Processor concepts - System Software & Application software.

Operating System: Definition and functions. Computer Languages: Machine language, assembly language and high level language. Translators: Compiler, Interpreter and Assembler.

MODULE II: (10 hours)

Flowchart and Algorithm- Development of algorithms for simple problems. Basic structure of C program: Character set, Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Variable declaration, Input output functions, printf and scanf.

Operators and Expressions: Different types of operators, Evaluation of Expressions, Precedence of Arithmetic operators.

MODULE III: (11 hours)

Decision making and branching: Different if statements, switch statements, The conditional (?:) operator, Goto statements. Decision making and Looping: The While statement, do statement, for statement, Jumps in loops. Arrays: Introduction, Declaration and initialization of One dimensional and Two dimensional arrays. (Do simple example programs for all concepts)

MODULE IV: **(11 hours)**

String: Declaration, Initialization, Reading and writing of strings, String handling functions.

Functions: Elements of user defined functions (Definition, Calls, Declaration), Category of functions, Recursion, Variables Scope visibility and lifetime, storage classes.

Structures: Definition, Declaring structure variables, Accessing structure members, structure initialization, Arrays of structures, Arrays within structures. Unions. (Do simple example programs for all concepts).

MODULE V: **(10 hours)**

Pointers: Understanding pointers, Declaration, Initialization, Accessing a variable through its pointer, differentiate call by value and call by reference.

File: Definition, opening and closing a file, Input and output operations, error handling during I/O operations, Random access to files. (Do simple example programs for all concepts).

Case study: Enabling students to translate real problems into code using C programming.

COURSE OUTCOMES:

At the end of the course the students should be able to:

- Understand functionalities and components of digital computers and different kinds of softwares.
- Describe the fundamentals of C programming languages
- Apply appropriate Control structures to solve problems.
- Describe the concept of Arrays and strings.
- Write user defined functions and apply the concept of recursion to solve problems.
- Understand the concept of string Operations, structure, union, pointers and file operations.

TEXT BOOKS:

1. Goel, A Computer Fundamentals, Pearson Education India, 2010.

2. E. Balaguruswamy, Programming in ANSI C, 8th ed., McGraw Hill Education, New Delhi,2019.

3. V. Rajaraman, Neeharika Adabala, Fundamentals of Computers, 6th ed., Prentice-Hall India, New Delhi, 2015.

REFERENCE BOOKS:

1. V. Rajaraman, Computer Basics and C Programming, Prentice-Hall India, New Delhi,2008

2. B. Gottfried, Programming with C, 2nd ed, Tata McGraw Hill, NewDelhi, 2006

3. Schaum Series, Gottfried B.S.,Tata McGraw Hill,Programming with C

4. Yashavant P, Kanetkar, BPB Publications, Let us C

Internal Continuous Assessment (Maximum Marks-50**)**

40% - Test-1 (For Theory)

40% - Test-2 (For Lab, Internal Examination)

10% - Fair Record

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates must answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks** Two questions from each module with a choice to answer one question.

EN24 108	ENGLISH FOR TECHNICAL WRITING	1-0-2-2

COURSE OBJECTIVES:

- To provide a learning environment to practice listening, speaking, reading, and writing skills.
- To develop vocabulary and language skills relevant to engineering as a profession
- To assist the students in carrying on the tasks and activities through guided instructions and materials.
- To effectively integrate English language learning with employability skills and training.
- To provide hands-on experience through case studies, mini-projects, group and individual presentations.

SYLLABUS:

MODULE I: **(8 hours)**

Basic Writing Skills: Sentence Structures, Use of phrases and clauses in sentences–Importance of proper punctuation–Parts of Speech–Identifying Common Errors in Writing–Subject-verb agreement.

MODULE II: **(12 hours)**

Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages–Technical report writing: Synopsis writing, formats for reports, Introductory report, Progress report, Incident report, Feasibility report, Marketing report, Field report, Laboratory test report, and Project report.

MODULE III: **(12 hours)**

Technical Writing: Definition and Preparation of Manual–Memorandum– Agenda, Minutes of a Meeting–PowerPoint Presentation–Written Communication: Note making and taking, narrating events chronologically–Writing resumes and cover letters.

MODULE IV: **(8 hours)**

Writing Practices: Essay Writing–Formal Letters–Reading Comprehension–Precis Writing – Memos.

MODULE V: **(8 hours)**

Oral Communication (This Module involves interactive practice sessions in Language Lab) – Listening Comprehension–Vocabulary Games–Pronunciation–Intonation, Stress and Rhythm– Common Everyday Situations: Conversations and Dialogues– Group Discussions – Interviews – Oral Presentation –Debates.

COURSE OUTCOMES:

At the end of the course the students should be able to:

- Heighten their awareness of correct usage of English grammar in writing and sounds in speaking.
- Write official correspondence i.e., reports, memos, letters, and e-mails and prepares impressive curriculum vitae and resumes.
- Enhance their verbal communication skills through free speeches, role plays, activities, and interactions.
- Improve their self-esteem and captivate them to be effective in facing interview boards confidently.
- Create effective presentations in front of different clusters.

REFERENCE BOOKS:

1. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and Pushpa Lata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.
7. William Stallings, Data and Computer Communications, 8th Ed, Pearson Education.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

10% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

30% - Lab Performance

10% - Regularity in the class

University Examination Pattern (Maximum Total Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates must answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with a choice to answer one question.

EN24 109	CONCEPTS OF NATIONAL SERVICE	3-0-0-0

COURSE OBJECTIVES:

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

SYLLABUS:

MODULE I: (10 hours)

Basic Concepts of NSS: History, Philosophy, Definition, Aims and Objectives – Emblem, Flag, Motto, Song, Badge, NSS day etc, – Organizational structure (from national to regional level) Roles and responsibilities of various NSS functionaries.

Environmental Issues: Environment conservation, enrichment and sustainability Climate change, global efforts for environment conservation.

Conservation of natural resources (Rain water harnessing) – Renewable energy: Solar, Air, and Water Waste land development, soil conservations and afforestation.

MODULE II: (10 hours)

Understanding Youth: Definition, profile of youth, categories, issues, challenges and opportunities for youth – Youth as an agent of social change - Youth development programmes at University level, college level, National level, State level and voluntary sector (NGO).

Role of Youth Leadership: Meaning, types, importance, role and traits of youth leadership Qualities of good leaders – Role of youth in Peace-building, conflict resolution, and nation-building.

MODULE III: **(7 hours)**

Youth and Health: Healthy lifestyles – Alcohol, Smoking and drug abuse – Stress management

Youth and Crime: Sociological and psychological factors influencing youth crime – Juvenile justice Peer mentoring in preventing crimes – Awareness about anti-ragging – Cyber-crime and its prevention.

MODULE IV: **(10 hours)**

Family and Society: Concept of family, community and society – Dynamics and impacts of growing up in the family – Human values – Decline of value and family system – Gender discrimination issues Regionalism and Caste system in India.

Health and Hygiene: Definition, needs and scope of health education – National health programme Food and nutrition – Reproductive health – Safe drinking water, water borne diseases and sanitation Concept of hygiene and maintenance of hygiene – Health and hygiene awareness programmes for community – Social service programmes for child welfare, physically and mentally challenged.

MODULE V: **(8 hours)**

Awareness Programme in Community: Road safety, Food safety programme, Cyber safety, Substrate abuse safety, and Drugs safety programme – Blood donation, Eye donation, Organs donation, and Body donation awareness programme – AIDS/HIV awareness and Stress management programme.

Disaster Management: Introduction and classification of disasters – Role of youth Disaster Management Pre-disaster: Educating the community – Sensitizing Government servants during the disasters.

COURSE OUTCOMES:

At the end of the course the students should be able to:

- Understand the importance of his / her responsibilities towards society.
- Analyse the environmental and societal problems/issues and to design solutions for the same.
- Evaluate the existing system and to propose practical solutions for the same for sustainable development.
- Implement government or self-driven projects effectively in the field.
- Develop capacity to meet emergencies and natural disasters and practice.

REFERENCE BOOKS:

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry or Youth Affairs and Sports, New Delhi.
2. Rashtriya Seva Yojana Sankalpana – Prof. Dr. Sankay Chakane, Dr. Pramod Prabhakar, Diamond Publication, Pune.
3. National Service Scheme Manual for NSS District Coordinators, National Service Scheme cell, Dept. of Higher and Technical Education, Mantralaya.
4. Annual report of National service Scheme (NSS) published by dept. of Higher and Technical Educational, Mantralaya.
5. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.
6. Case material as a Training Aid for Field Workers, Gurmeet Hans.
7. Social service opportunities in hospital, Kapil K. Krishnan, TISS.
8. New Trends in NSS, Research papers published by University of Pune.

Internal Continuous Assessment (Maximum Marks-100)

50%- Assessment and Evaluation pattern

50%- Activities

BE24 111A(P)	ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP	0-0-4-2

COURSE OBJECTIVES:

- To impart a basic knowledge of electrical circuits, machines and power systems.
- To understand the electrical safety and ability to design relevant protection system
- Identification of active and passive components
- Build electronic circuits on breadboard and solder electronic circuits on PCB.
- Identify various subsystems of electronic systems like PA systems.

SYLLABUS:

List of experiments

(Minimum 10 experiments out of 13)

1. Familiarization of general symbols used in electrical circuits.
2. Precautions against and cure from electric shock.
3. Wiring practice of a circuit to control two lamps by two SPST switches.
4. Wiring practice of a circuit to control one lamp by two SPDT switches.
5. Wiring practice of a circuit to control one fluorescent lamp and one three pin plug socket.
6. Wiring practice of a main switch board consisting of ICDP switch, DB, MCB and ELCB.
7. Methods of earthing: measurement of earth resistance, testing of electrical installations.
8. Familiarization/identification of electronic components.
9. Familiarization/application of instruments and equipment: multimeter, power supply, CRO, function generator.
10. Assembling electronic circuit on general purpose bread board: Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener regulator.
11. Introduction to soldering practice: study of soldering components, solders, tools, heat sink.
12. PCB assembly and testing of full wave rectifier circuit diagram.
13. Familiarization of setting up a PA system with different microphones, loud speakers, mixer etc.

COURSE OUTCOMES:

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

- Familiarize with the important electrical components and their working.
- Make use of various testing instruments and commonly used tools.
- Get an idea of electrical protective devices.
- Practice simple electrical wirings and installations.
- Familiarize with the methods of earthing.
- Make use of various testing instruments and commonly used tools.
- Build electronic circuits on breadboard.
- Solder electronic circuits on PCB.
- Identify various subsystems of electronic systems like PA Systems.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and Viva voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern (Maximum Marks-100).

50% - Procedure, conducting experiments and Performance

40% - Viva Voce

10% - Fair Record

EN24 112(P)	IDEA & DESIGN THINKING LAB	0-0-2-1

COURSE OBJECTIVES:

- To cultivate creativity and innovation among students.
- To develop problem-solving skills using design thinking methodologies.
- To foster collaborative teamwork and effective communication.
- To provide practical experience in idea generation and prototyping.
- To prepare students for real-world problem-solving scenarios.

SYLLABUS*:*

List of experiments

(Minimum 9 experiments out of 12)

1. Introduction to Idea and Design Thinking, Overview of innovation and design thinking, Historical context and case studies and Understanding the design thinking process.
2. Empathize and Define, Conducting user interviews, identifying problems and needs, Defining problem statements
3. Ideation, Techniques for brainstorming, Idea selection and prioritization, Prototyping and testing ideas
4. Teamwork and Collaboration, Building effective teams, Communication and collaboration skills, Group dynamics and conflict resolution
5. Prototyping and User Testing, Rapid prototyping techniques, Conducting user testing, Iterative design
6. Design Thinking in Real-World Context, Applying design thinking to various industries, Ethical considerations in design
7. Refining prototypes
8. Testing-Documentation and the Pitching.
9. Software Development using Scrum Framework –Scrum tools - Case Studies.
10. DevOPs the advanced process of software engineering for faster problem resolution and team collaboration.
11. Agile software methodology for faster development of quality software
12. Unresolve different transformations of a product or a service through brainstorming and incremental approach, etc.

COURSE OUTCOMES:

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

1. Foster a mindset for innovation by providing insights into how innovative ideas have been generated and implemented through the study of design thinking and historical case studies
2. Enhance problem-solving skills by equipping students with the ability to conduct user interviews, identify problems, and define problem statements effectively, enabling them to empathize with users.
3. Help students to generate a wide range of creative solutions to address the identified problems, fostering creativity and divergent thinking.
4. Develop essential interpersonal skills necessary for successful collaboration in diverse team settings.
5. Create prototypes quickly, gather feedback from users, and refine their solutions based on user needs, ensuring that the final product or service is user-centric and meets the desire outcomes.

TEXT BOOKS:

1. Christian Muller-Roterberg, Design Thinking for Dummies, John Wiley & sons

Internal Continuous Assessment (Maximum Marks-100)

30% - Individual assignments

40% - Group projects

15% - Final presentation

15% - Attendance and participation

SEMESTER – 2

EN24 201	ENGINEERING MATHEMATICS II	3-1-0-4

COURSE OBJECTIVES:

- To introduce effective mathematical tools for the solutions of differential equations of first order that model physical process.
- To introduce effective mathematical tools for the solutions of differential equations of higher order.
- To develop the tool of Power series for learning advanced Engineering Mathematics.
- To introduce Laplace transforms of elementary functions and solution of differential equations using Laplace transforms.
- To develop the tool of Fourier transforms for learning Advanced Engineering Mathematics.

SYLLABUS:

Module I: First order ordinary differential equations **(10 hours)**

Homogeneous differential equations, differential equations reducible to homogeneous, Exact, linear and Bernoulli's equations. Applications of differential equations of first order - orthogonal trajectories.

Module II: **Ordinary differential equations of higher order** **(10 hours)**

Second order linear differential equations with constant coefficients, method of variation of parameters, second order linear differential equations with variable coefficients-Cauchy's linear differential equations.

Module III: Power series **(10 hours)**

Taylor's and Maclaurin's theorems with remainders, Power series, Taylor's Series, Maclaurin's series, series for exponential, trigonometric, hyperbolic and logarithmic functions, Leibnitz formula for n^{th} derivative of product of two functions.

Module IV: Laplace Transforms **(10 hours)**

Laplace transform-Elementary properties -Inverse Laplace transform- Solution of ordinary differential Equations using Laplace transform.

Module V: Fourier Transforms **(12 hours)**

Fourier Integral theorem (Proof not required) – Fourier Sine and Cosine integral representations– Fourier transforms – transforms of some elementary functions – Elementary properties of Fourier transforms – Convolution theorem (No proof) – Fourier Sine and Cosine transforms –transforms of some elementary functions – Properties of Fourier Sine and Cosine transforms.

COURSE OUTCOMES:

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

- Acquire basic knowledge of differential equations and methods of solving them.
- Model and analyze differential equations in a wide range of physical phenomena Acquire the knowledge of power series expansions of different.
- Use tools for Laplace transforms and apply it in solution of differential equations.
- Use tools for Fourier Transforms.

TEXT BOOKS:

1. G.B Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition Pearson, Reprint,2002
2. Erwin Kreyszig Advanced engineering mathematics, 9th Edition, John Wiley & sons 2006
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications Reprint, 2008.

REFERENCE BOOKS:

1. E. A. Coddington, An introduction to ordinary differential equations, Prentice Hall 1995.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers,36th Edition, 2010.
3. Veerarajan T, Engineering Mathematics for First year, Tata McGraw-Hill, New Delhi,2008.
4. Ramana B.V. Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi,11th Reprint ,2010.
5. George.F.Simmons, Differential Equations, Tata Mc Graw Hill ,2001
6. George.F.Simmons , Differential Equations with Applications and Historical notes, Tata Mc Graw Hill, 2005
7. Ronald.N.Bracewell, Fourier Transforms and its Applications, Tata Mc Graw Hill,2005
8. J.Billingham.A.C.King and S.R.Otto,Differential Equations,Linear,Non-Linear,Ordinary,Partial,Cambridge University press,2005

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% -Assignments (minimum 2) such as homework, problem solving,

Group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks: 100**)**

PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question

COURSE OBJECTIVES:

- To impart the basic concepts and ideas in physics.
- To develop scientific attitudes and enable the students to correlate the concepts of physics with the core programmes.
- To explain the dual nature of radiation and matter.
- To apply Schrödinger's equation to solve finite and infinite potential problems and apply quantum ideas at the nanoscale.
- To understand the Maxwell's equations for electromagnetic waves.

SYLLABUS:

MODULE I: **(10 hours)**

Periodic motion- simple harmonic motion- characteristics of simple harmonic motion- vibration of simple spring mass system. Damped harmonic oscillator – heavy, critical and light damping- energy decay in a damped harmonic oscillator, quality factor-forced mechanical and electrical oscillators- Resonance. Transverse and Longitudinal waves - Transverse waves on a stretched string- the wave equation on a string, derivation for the velocity and frequency of transverse vibrations on a stretched string.

Practical Work: 1**.** Melde's string apparatus. Measurement of frequency in the transverse mode.

MODULE II: **(10 hours)**

Interference of reflected light in thin films-Interference in thin films (Cosine law), Derivation of the conditions of constructive and destructive Interference - Air Wedge, Determination of thickness of a thin wire- Antireflection coatings. Fresnel and Fraunhofer classes of diffraction- Diffraction grating, Gratin equation- Rayleigh's criterion for limit of resolution, Resolving power of a grating with expression (no derivation)- Comparison of interference and diffraction.

Practical Work:

1. Wavelength of sodium light by Newtons Ring method.
2. Diameter of a thin wire or thickness of a thin wire by Air-wedge method.
3. Wavelength of mercury spectral lines using diffraction grating and spectrometer

MODULE III: (12 hours)

Wave-Particle dualism- de Broglie hypothesis, de-Broglie wavelength – Wave function; Admissibility conditions, Physical significance, Probability density, Normalization condition - Time dependent Schrödinger wave equation - Time independent Schrödinger wave equation Applying the Schrodinger equation- Particle in a one-dimensional box- Energy Eigen values and normalized wave function.

Optic fibres- principle of propagation-numerical aperture, optic fibre communication system (block diagram), industrial, medical and technological applications of optical fibre, fibre optic sensors, basics of intensity modulated and phase modulated sensors.

MODULE IV: (10 hours)

Physics of gradient, divergence and curl – Gauss's divergence theorem and Stoke's theorem- Equation of continuity, Deduction of Maxwell's equations in vacuum - Electromagnetic waves- Electromagnetic wave equation in free space, velocity of Electromagnetic waves in free space, Poynting's theorem (Qualitative).

MODULE V: (10 hours)

Pauli's exclusion principle - Particle in a three-dimensional box; expression for Energy Eigen value and normalized wave function - Concept of quantum state and degeneracy - The density of states- Expression for density of states for a spinless particle, density of states for an electron. Effective mass concept (qualitative). Numerical problems.

COURSE OUTCOMES:

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

- Familiarize with the principles of Physics and its significance in engineering systems and technological advances.
- Categorize oscillations by computing the characteristics of mechanical and electrical oscillators
- Apply the concept of interference and diffraction for Determination of wavelength of unknown sources.
- Apply the basic principles of Quantum Mechanics by determining the energy Eigen values and Eigen functions of a particle in a box.
- Apply Maxwell's equations in estimating the speed of light.

TEXT BOOKS:

1. Physics for Engineers- M.R. Seenivasan- New Age Publishers 1996 Edition.
2. Beiser A, Concepts of Modern Physics, McGraw Hill India Ltd.
3. Brijlal and Subramanyam, A Text Book of Optics, S. Chand & Co.
4. Mehta V K, Principles of Electronics, S. Chand & Co.
5. Rajendran V and Marikani A, Physics I, Tata McGraw Hill Co Ltd.
6. T. Pradeep, "Nano: The Essentials'', McGraw Hill India Ltd, 2007.
7. Griffiths "Introduction to Electrodynamics" 4th Edition, Pearson.

REFERENCE BOOKS:

1. Aruldhas G, Engineering Physics, PHI Ltd.
2. Bhattacharya and Tandon, Engineering Physics, Oxford India.
3. Dominic and Nahari, A Text Book of Engineering Physics, Owl Books Publishers
4. Hecht E, Optics, Pearson Education.
5. Mehta N, Applied Physics for Engineers, PHI Ltd.
6. Palais J. C, Fiber Optic Communications, Pearson Education.
7. Pandey B. K and Chathurvedi S, Engineering Physics, Cengage Learning.
8. Philip J, A Text Book of Engineering Physics, Educational Publishers.
9. Premlet B, Engineering Physics, McGraw Hill India Ltd.
10. Sarin A and Rewal A, Engineering Physics, Wiley India Pvt Ltd
11. Sears and Zemansky, University Physics, Pearson.
12. Vasudeva A. S, A Text Book of Engineering Physics, S. Chand &Co.
13. Kakani A. S, A Text Book of Electronics, New Age International (p) publishers 2000 Edition.
14. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016.

Internal Continuous Assessment (Maximum Marks-50).

50% - Tests (minimum 2).

10% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

30% - Lab Performance including Test.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks.**

Two questions from each module with choice to answer one question.

MC24 205B	BASICS OF MECHANICAL & CIVIL ENGINEERING	2-2-0-4

COURSE OBJECTIVES:

- To satisfy the technical requirement of understanding various principles associated with civil Engineering.
- To make the students persuade the civil engineering works that is an integral part of Engineering professional's life irrespective of the discipline.
- To acquire knowledge about information technology in Civil Engineering.
- To understand the basic thermodynamic principles and laws to analyze and design thermodynamic systems.
- To familiarize various theories behind the working of hydraulic machines.

SYLLABUS:

MODULE I: **(10 hours)**

Scope of civil engineering

Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub-disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering- Introduction to types of buildings as per NBC - Structural Components of a residential building and their functions.

Building planning

Introduction to planning of residential buildings-Principles of building planning - Selection of site for buildings, Orientation of a building, Open space requirements, Position of doors and windows, Size of rooms.

MODULE II: **(10 hours)**

Introduction to surveying

Surveying: Objects – classification – principles -Modern Tools of Surveying and Mapping - Total Station, Global Positioning System, Remote Sensing and Geographic Information System.

Building construction

Building construction – Foundations: Types of foundations (sketches only) - Bearing capacity and Settlement (definition only) –Functions of foundations - Requirement of good foundations. Geometric, structural, and functional features of Roads and Bridges.

MODULE III: **(12 hours)**

Modern trends in civil engineering

Robotics and Automation in construction industry - Artificial Intelligence and Machine Learning techniques- Applications of AI in Civil Engineering – 3D Printing in Prefabricated Construction – (BIM) Building Information Modelling (Only brief description is expected)-civil engineering aspects only.

Civil engineering materials

Brief description of Engineering properties and applications of the following construction materials- Cement – concrete – steel - Reinforced Cement Concrete Fundamentals (Only brief description is expected) - modern materials (Study on laboratory tests not expected, detailed manufacturing processes of materials not expected)

MODULE IV: **(10 hours)**

Analysis of thermodynamic cycles: Carnot, Otto, Diesel cycles, Derivation of efficiency of these cycles,Problems to calculate heat added, heat rejected, net work and efficiency. IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines. Efficiencies of IC Engines (Definitions only), Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI.Concept of hybrid engines.

MODULE V: **(10 hours)**

Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners. Description about working with sketches of: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines (No velocity triangles) Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches.

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

- Get an overview of surveying, building planning and modern trends in civil engineering.
- Provide an essential tool to understand the basics of civil engineering works that an engineer come across in professional as well as personal life.
- Prepare the layouts of buildings and other infrastructures, obtain understanding of the basic elements of the transportation system, modern techniques for construction industry.
- Analyse thermodynamic cycles and calculate its efficiency.
- Describe the working of hydraulic machines.

TEXT BOOKS:

1. Dr. B.C. Punamia, Surveying Vol. I, II, Laxmi Publications.
2. Gurcharan Singh, Building planning, designing and scheduling, Standard Publishers.
3. Rangwala, S. C. and Dalal, K. B , Building Construction, Charotar Publishing house.
4. S.S Bhavikatti., Basic Civil Engineering., New Age International Pvt.Ltd,Publishers
5. Plevris,Vagelis,Ahmad,Lagaros , Artificial intelligence and machine learning techniques for civil engineering.,IGI Global publishers.
6. Benjamin,J.,Basic Mechanical Engineering,Pentex Books,9th Edition,2018
7. Balachandran, P.Basic Mechanical Engineering,Owl Books

REFERENCE BOOKS:

1. T.P Kanetkar and S.V Kulkarni , Surveying and Levelling Vol. I and II.
2. James M. Anderson, Edward M. Mikhail, Surveying Theory and Practice (Seventh Edition).
3. T.M Lillesand, R.W Kiefer. And J.W Chipman , Remote sensing and Image interpretation 5th edition
4. S.V.Deodhar , Building Science and Planning.
5. Keeble Lewis, Principles of Town planning.
6. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
7. Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I -CRC Press
8. Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters &Publishers Pvt. Ltd., Mumbai.
9. Sawhney, G. S., Fundamentals of Mechanical Engineering, PHI
10. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018

Internal Continuous Assessment (Maximum Marks-50).

60% - Tests (minimum 2).
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Marks-100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

GS24 207B	ENGINEERING GRAPHICS	2-0-3- 4

COURSE OBJECTIVES:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing.
- To impart knowledge on the projection of points, lines and plane surfaces.
- To improve the visualization skills for better understanding of projection of solids.
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To enable the students to draw the different machine elements / mechanical parts.

SYLLABUS:

MODULE I: **(10 hours)**

Engineering Graphics – introduction - Drawing instruments and their use – lines, Lettering and dimensioning – Scales- Familiarization with Standard Code of practice for general engineering drawing. - Projections of points in different quadrants. Projections of straight lines - True length and inclinations of a line with reference planes. Traces of lines – Line parallel to both reference planes - Perpendicular to one of the reference planes - Inclined to one and parallel to other reference plane - Inclined to both the reference planes – Rotating line method – Rotating plane method.

MODULE II: **(12 hours)**

a) Projections of planes - lamina of geometrical shapes - Plane lamina parallel, inclined and perpendicular to the reference planes - Inclined to one and perpendicular to the other reference plane - Inclined to both the reference planes - Inclined to the two reference planes but perpendicular to the profile plane.

b) Projections of Solids of revolution and Frustums - Projections of solids with axis parallel to one and inclined to the other reference plane - Axis inclined to both the reference planes - Projections of solids on auxiliary planes (Solids to be drawn: Cube, Prisms, Pyramids, Cone and Cylinder).

MODULE III: **(13 hours)**

a) Sections of solids - Sections by cutting planes parallel to the reference planes - Cutting plane inclined to one and perpendicular to other reference plane - True shape of the section by projecting on auxiliary plane (Solids to be drawn: Cube, Prisms, Pyramids, Cone and Cylinder).

b) Development of surfaces of solids - Development of Polyhedra, Cylinder, Cone, Sphere and sectioned solids - Development of solids having hole or cut.

MODULE IV: **(13 hours)**

a) Introduction to isometric projection - Isometric scale - Isometric views - Isometric projections of Prisms, Pyramids, Cylinder, Cone, Spheres, sectioned solids.

b) Introduction to perspective projections – Visual ray method of drawing perspective projection - Perspective views of plane figures such as polygons and circles - Perspective views of solids like Prisms and Cube.

MODULE V: **(12 hours)**

Conventional representation of threaded fasteners - Drawing of nuts, bolts (Square & Hexagonal) Washers - locking arrangements of nuts - Foundation bolts.

COURSE OUTCOMES:

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

- Familiarise with the Fundamentals of Engineering Drawing standards.
- Interpret 3D shapes from orthographic projections of objects and they will be able to make orthographic projections of any object.
- Draw the sectional view of the solids.
- Make developments of surfaces & solids.
- Create drawings using Visual ray method & also able to draw conventional representation of threaded fasters.

TEXT BOOKS:

1. P.I Varghese, Engineering Graphics, VIP Publications, Thrissur.

2. N D Bhatt, "Engineering Drawing", Charotar Publications.

REFERENCE BOOKS:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

2. John.K.C, Engineering graphics, PHI Learning Pvt, Ltd. 2009.

Internal Continuous Assessment (Maximum Marks-50)

60% - Assignments (minimum 10 Drawing sheets, 2 from each module) plus two assignments on CAD.

30% - Tests (minimum 2)

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-100)

Q 1. Two questions (a) and (b) of 20 marks each from module I, with a choice to answer any one.

Q 2. Two questions (a) and (b) of 20 marks each from module II, one from module II(a) and one from module II(b)with a choice to answer any one.

Q 3. Two questions (a) and (b) of 20 marks each from module III, one from module III(a) and one from module III(b), with a choice to answer any one.

Q 4. Two questions (a) and (b) of 20 marks each from module IV, one from module IV(a) and one from module IV(b), with a choice to answer any one.

Q 5. Two questions (a) and (b) of 20 marks each from module V, with a choice to answer any one.

EN24 209	BIOLOGY FOR ENGINEERS	3-0-0-3

PRE-REQUISITES: Basic knowledge in the biological aspects of the human body.

COURSE OBJECTIVES:

- Analysis of physiological systems, enzyme classification and genetic principles.
- Understand various instrumentation systems for measurement and analysis of physiological parameters.
- Understand the foundational principles of proficiency in respiratory measurements and pulmonary function assessments.
- Apply knowledge of diagnostic imaging techniques.
- Evaluate the physiological impacts of electric currents and implement prevents measure to mitigate electrical hazards in healthcare.

SYLLABUS:

MODULE I: (10 hours)

Introduction to biomedical engineering - Role of biomedical engineers. Physiological systems of the body. Circulatory systems-Pulmonary circulation. Blood group. Protiens - structure and function. RNA, DNA, Mendel's laws (principle only)

MODULE II: (10 hours)

Cardiovascular system heart- structure of heart and major blood vessels, cardiac cycle, ECG – Einthoven triangle. Electroencephalogram (EEG): structure of brain. Wave form, stroke. Electrodes and leads. Bio electric potentials: EMG, EGG, ERG, EOG. (basic principle and waveform only)

MODULE III: (10 hours)

Respiratory measurements: Spirometry – Basic system and applications- Pulmonary function measurements: Respiratory volumes, lung capacity, tidal volume. Blood Pressure, Ventilator, cardiac pacemaker. Dialysis. Infant incubator. Diathermy. Lithotripsy (concepts only).

MODULE IV: (10 hours)

Ultrasound scanning (application level) 3D and 4D. Angiography, Endoscopy, X-Ray, CT, MRI, Oximeter (application level). A- scan, B-scan and M -scan.

MODULE V: (9 hours)

Physiological effects of electric currents, Macro shock and Microshock. Leakage current. Sources of electrical hazards. Different methods of electric accident prevention. Safety Codes.

COURSE OUTCOMES:

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

- Serve as a foundation course for engineers in the healthcare field.
- Introduce the basic anatomy of the major systems of engineering importance in the human Body.
- Study the basic physiological concepts of the systems.
- Explore the basic engineering principles related to human physiology.
- Understand the electrical safety and ability to design relevant protection systems.

TEXT BOOKS:

1. Laura lee Sherwood, Human Physiology: From Cells to Systems, Brooks/Cole, Cengage Learning.

2. Arthur C. Guyton, Textbook of Medical Physiology, Prism Books (Pvt) Ltd & W.B. Saunders Company.

3.John G. Webster, Medical Instrumentation Application and Design, 5/e, Wiley

REFERENCE BOOKS:

1. Samson Wright, Cyril A. Keele (editor), Eric Neil (editor): Applied Physiology, Oxford University Press.
2. J.B.West.: Best and Taylor's Physiological Basis of Medical Practice, Williams and Wilkins, Baltimore.
3. Valerie C. Scanlon, Tina sanders: Essentials of anatomy and physiology
4. W.F.Ganong: Review of Medical Physiology, Prentice-Hall, Connecticut. Kathleen
5. J.W. Wilson, Ross and Wilson, Anatomy and Physiology in Health and Illness, ELBS/Churchill Livingstone.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks** Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks** Two questions from each module with choice to answer one question.

EN24 210	UNIVERSAL HUMAN VALUES	3-0-0-3

COURSE OBJECTIVES:

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
- 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.
- 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.
- Able to know the Holistic technologies, management models and production systems.

SYLLABUS:

MODULE I: (10 hours)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Understanding the need, basic guidelines, content and process for Value Education. Self-Exploration– Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

MODULE II: (10 hours)

Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’. Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer). Understanding the characteristics and activities of ‘I’ and harmony in ‘I’. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

MODULE III: (10 hours)

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding Harmony in the family – the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfilment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family.

MODULE IV: (10 hours)

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

MODULE V: (12 hours)

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

a) Ability to utilize the professional competence for augmenting universal human order

b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,

c) Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers

b) At the level of society: as mutually enriching institutions and organizations.

COURSE OUTCOMES:

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

- Find that technical education without study of human values can generate more problems than solutions.
- See that they can enlist their desires and the desires are not vague.
- See that all physical facilities they use are required for a limited time in a limited quantity.
- Differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them.
- Present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.

TEXT BOOKS:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
5. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
6. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

REFERENCE BOOKS:

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010.
2. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

EN24 211	ENVIRONMENTAL SCIENCE	2-0-0-0

COURSE OBJECTIVES:

- To impart basic knowledge about the environment and its allied problems.
- To understand the problems of pollution, deforestation, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues at local and global levels.
- To create awareness among the students to address these issues and conserve the environment in a better way.
- To make students aware of the basic structure and functions of ecosystem.
- To explain and discuss the distribution of different natural resources and their sustainable management.

SYLLABUS:

MODULE I: **(7 hours)**

Environment and Environmental Science- Definition, concept, components, and importance- Ecosystem and Ecology- Structure and Function of Ecosystem, Food chain, food web and ecological pyramids.

MODULE II: **(7 hours)**

Environmental Pollution - Definition, causes, effects and control measures- a. Air pollution b. Water pollution (thermal and marine pollution) c. Land pollution d. Radiation pollution and Nuclear hazard. e. Noise pollution. Solid waste management- Causes, effects and control measures- Global warming and climate change Ozone depletion- Acid rain- Causes, effects and control measures.

MODULE III: ***(*7 hours)**

Biodiversity - Definition, concept, levels, and biodiversity values- Biodiversity of India, India as a diversity nation and Hotspot of biodiversity- Threats to Biodiversity (Habitat loss, poaching of wildlife and man-wildlife conflict).

MODULE IV: ***(*7 hours)**

Natural Resources and their Conservation- Forest Resources- Uses and overexploitation of forests and consequences of deforestation- Water Resources- Use and consequences of over-utilization, concept of rainwater harvesting and watershed management, water conflicts. Food Resources- Sources of food, food problems, Impacts of modern agriculture on the environment.

MODULE V: ***(*7 hours)**

Environmental Technology- cleantech, STEM, BAT, green technologies, environmental sustainability, Environmental projects.

COURSE OUTCOMES:

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

- Develop concepts and methods from surroundings and their application in environmental problem-solving.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
- Identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
- Analyse an industrial activity and identify the environmental problems

TEXT BOOKS:

1. Daniels and Krishnaswamy, Environmental studies, Wiley India Pvt Ltd, 2009.
2. Raman Sivakumar, Introduction to environmental science and engineering, 2nd edn, . Tata McGraw Hill, 2010.
3. Anindita Basak, Environmental Studies, Pearson Education, 2009.
4. Suresh K.D, Environmental Engineering and Management, Katson Books, 2007.
5. Benny Joseph, Environmental studies, 2nd edn, McGraw Hill, 2009.

REFERENCE BOOKS:

1. Raghavan Nambiar, K Textbook of Environmental Studies, Scitech Publishers(India) Pvt. Ltd.
2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009.
3. P N Palanisamy, P Manikandan, A Geetha, Manjula Rani, Environmental Science, Pearson Education, 2012.
4. D.L. Manjunath, Environmental Studies, Pearson Education, 2011.

Internal Continuous Assessment (Maximum Marks-100)

60% - Tests (minimum 2).
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Regularity in the class.

MC24 213B(P)	MECHANICAL & CIVIL ENGINEERING WORKSHOP	0-0-4-2

COURSE OBJECTIVES:

- To provide experience on plotting, measuring/determining horizontal distances, level differences between stations and horizontal angles.
- To provide experience on setting out for small buildings, masonry construction and necessary skills for planning, preparing and executing an engineering project.
- To inculcate engineering aptitude, confidence and experience towards technical skills.
- To train the students mentally and physically for industries.
- To impart knowledge and technical skills on basic manufacturing methods.

SYLLABUS:

List of experiments

(Minimum 10 experiments out of 14)

1. Chain and Cross staff Surveying - Study of chain and accessories,

Calculate the area of Built-up Space and a small parcel of land using chain and cross-staff

2. Levelling - Study of levelling instruments, Determination of reduced levels of five or six points in the field.
3. Theodolite - Study of Theodolite, Measuring horizontal and vertical angles
4. Brick Masonry - Elevation and plan (Construct a one and half thick brick wall of 50cm height and 60cm length using English bond). Use spirit level to assess the tilt of walls.
5. Total Station Survey - Site plan preparation (Determination of area and traversing)
6. Setting out of a building: Computation of plinth area / built up area, Floor area / carpet area - for a simple single storeyed building (single room only); The student should set out a building as per the given building plan using tape only.
7. Collection and study of various civil engineering drawings like plan, elevation, structural drawing, plumbing drawing etc.
8. Site visit and preparation of visit report.
9. Carpentry: Introduction to workshop safety and personal protective equipment (PPE).Study of carpentry tools and their uses. Practice in marking, sawing, chiselling, and planning. Introduction to different types of joints and their applications. Hands-on project: Building a simple wooden structure or piece of furniture. Introduction to power tools used in carpentry.

10. Fitting: Workshop safety and tool usage guidelines. Study of fitting tools, including chisels, files, saws, and drills. Techniques for chipping, filing, cutting, drilling, and tapping. Practice in creating male and female joints and stepped joints. Introduction to precision measuring techniques. Use of micro meters and callipers for accurate measurements.

11. Smithy: Safety procedures for the smithy workshop. Study of smithy tools and equipment. Forging of square prisms and hexagonal bolts. Heat treatment and tempering of metals. Hands-on project: Forging a basic tool or decorative item.

12. Foundry: Workshop safety and sand preparation techniques. Study of foundry tools and equipment. Practice in sand moulding and casting. Introduction to different casting methods (e.g., sand casting, investment casting). Hands-on project: Creating a casting mould and pouring molten metal.

13. Sheet Metal Work: Safety guidelines for sheet metal work. Study of sheet metal tools and equipment. Selection of different gauge sheets. Types of joints, trays, and containers in sheet metal work. Hands-on project: Design and build a sheet metal enclosure or housing.

14. Welding: Introduction to welding safety and precautions. Study of welding tools and equipment. Different types of welding joints. Practice in welding various joints. Introduction to welding processes (e.g., MIG, TIG, stick welding) Hands-on project: Welding a small assembly.

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

- Name different devices and tools used for civil engineering measurements
- Demonstrate the steps involved in basic civil engineering activities like plot measurements, setting out operation, evaluating the natural profile of land and undertaking simple construction works.
- Explain the use of various tools and devices used in civil engineering measurements
- Carpentry: Basic use of carpentry tools, execution of precision tasks (e.g., marking, sawing, chiseling), creation of diverse joints, and safe operation of power tools.
- Fitting: Mastery of fitting operations (e.g., chipping, filing, and cutting), accurate construction of male/female joints, and application of precision measurement techniques.
- Smithy: Competence in using smithy tools, forging square prisms and hexagonal bolts, and understanding heat treatment of metals.
- Sheet Metal Work: Selection of suitable gauge sheets, skillful joining techniques, and effective fabrication of trays and containers.

- Welding and Metal Properties: Knowledge of welding safety, proficiency in various welding joints, and comprehension of metal properties in fabrication.
- Fitting Tools and Operations: Recognition and explanation of fitting tool functions, precise execution of operations (e.g., marking, sawing, drilling), and understanding the applications of male and female joints.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and Viva Voce

30% - Tests

10% - Regularity in the lab

University Examination Pattern (Maximum Marks-100)

70% - Procedure, conducting experiments, result, tabulation and interference

20% - Viva Voce

10% - Fair Record

SEMESTER – 3

EN24 301	ENGINEERING MATHEMATICS III	3-1-0-4

COURSE OBJECTIVES:

- To provide a quick overview of the concepts and results in complex functtion that may be useful in engineering.
- To introduce the concepts and results in complex differentiation and integration that may be useful in engineering.
- To introduce the concepts of linear algebra.
- To introduce the concept of partial differential equations.
- To formulate physical problems using partial differential equations.

SYLLABUS:

MODULE I: Functions of a Complex Variable I (10 hours)

Functions of a Complex Variable- Limit- Continuity- Derivative of a Complex function- Analytic functions- Cauchy-Riemann Equations- Laplace equation-, Harmonic Functions- Conformal Mapping- Examples:e^{z}, sin z, cosh z, (z+$\frac{1}{z}$) -Mobius Transformation.

MODULE II: Functions of a Complex Variable II (10 hours)

Definition of Line integral in the complex plane- Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted)- Independence of path- Cauchy's integral formula- Derivatives of analytic functions (No proof)- Taylor series (No proof)- Laurent series (No proof)- Singularities- Zeros- Poles- Residues- Evaluation of residues- Cauchy's residue theorem.

MODULE III: Linear Algebra (12 hours)

Vector spaces- Definition- Examples- Subspaces- Linear Span- Linear Independence- Linear Dependence. Basis- Dimension. Orthogonal and Orthonormal Sets- Orthogonal Basis- Orthonormal Basis Gram-Schmidt orthogonalization process. Inner product spaces- Definition- Examples- Inequalities- Schwartz- Triangle (No proof).

MODULE IV: Partial Differential Equations (10 hours)

Introduction- Solutions of equations of the form F(p,q) = 0, F(x,p,q) = 0 , F(z,p,q) = 0 , F1(x,p) = F2(y,q), Clairaut's form- z = px + qy + F(p,q) , Lagrange's form- Pp + Qq =R . Classification of Linear PDE's.

MODULE V: Applications of Partial Differential Equations **(10 hours)**

Derivation of one dimensional wave equation- solution of one dimensional wave equation- Derivation of one dimensional heat equation- solution of one dimensional heat equation.

COURSE OUTCOMES:

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

- Analyze given complex function is analytic and to find its series development.
- Describe the basic properties of complex integration.
- Develop the essential tool of linear algebra in a comprehensive manner.
- Use mathematical tools for the solution of Partial differential equations that models physical processes**.**
- Model and analyze partial differential equations in a wide range of physical phenomena and has got applications across all branches of engineering.

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers,36th Edition ,2010.

2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics,Laxmi Publications Reprint ,2008.

REFERENCE BOOKS:

1.G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson Reprint,2002

2.Erwin Kreyszig, Advanced engineering mathematics, 9th Edition, John Wiley & sons 2006.

3.Theory and Problems of Linear Algebra,R.D.Sharma,Rittu Jain

Continuous Assessment (Maximum Marks-50).

60% - Tests (minimum 2).

30% -Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks-100).

PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks** Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks** Two qestins from each module with choice to answer one question.

ES24 302	ELECTRONIC CIRCUITS	3-1-0-4

PRE-REQUISITES: BE24 105A BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING

COURSE OBJECTIVES:

- To understand BJT biasing circuits and BJT amplifiers.
- To impart the basic idea of FET amplifiers and its design.
- To study different wave generating circuits.
- To introduce the concept of both negative and positive feedback in electronic circuits.
- To study various types of power amplifiers.

SYLLABUS:

MODULE I: (10 hours)

BJT biasing circuits: Types, Q point, Bias stability, Stability factors, RC coupled amplifier and effect of various components, Concept of DC and AC load lines, Fixing of operating point. BJT amplifiers- analysis and design of CC, CE and CB configurations Transistor model: h parameter model.

MODULE II: (11 hours)

FET amplifiers: Biasing of JFET-small signal equivalent circuit models-Analysis and design of common source, common drain and common gate amplifier configurations. Regulators - Zener diode regulator - emitter follower output regulator - series pass transistor feedback voltage regulator - short circuit protection and fold back limiting - load and line regulation curves.

MODULE III: (11 hours)

RC differentiator and integrators Multivibrators – principles & analysis of Astable, Monostable and Bistable multivibrators - triggering methods-Schmitt trigger analysis of emitter coupled circuit- principles of miller and bootstrap circuits.

MODULE IV: (10 hours)

Feedback amplifiers- the general feedback structure - effects of negative feedback-Analysis of negative feedback amplifiers – Stability - Positive feedback and oscillators - analysis and design of RC phase shift, Wein bridge, LC and crystal oscillators - stabilization of oscillations.

MODULE V: **(10 hours)**

Power amplifier- class A, B, AB, C, D & S power amplifier- harmonic distortion- efficiency- Wide band amplifier- broad banding techniques- low frequency and high frequency compensation-cascade amplifier- broad banding using inductive loads -Darlington pairs.

COURSE OUTCOMES:

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

- Understand the analysis of different regulator circuits and the design of circuits using transistors
- Design and analyse FET amplifiers and their frequency response
- Understand and design various wave generating circuits
- Understand the concept of feedback amplifiers and hence design different oscillators
- Design and analyse various power amplifiers

TEXT BOOKS:

1. Sedra A.S & Smith K.C., Microelectronic Circuits, Oxford University Press
2. Millman & Halkias :Integrated Electronics, MGH. 1996.

REFERENCE BOOKS:

1. Horenstein M. N: MicroelectroniccircuitsandDevices PHI
2. Gray & Meyer: Analysis and Design of Analog Integrated Circuits; John Wiley
3. Schilling D.L. & Belove C.: Electronic Circuits, McGraw Hill
4. Spencer &Ghausi, Introduction to Electronic Circuit Design; Pearson Education
5. Thomas L.Floyd and David Buchla: Fundamentals of Analog Circuits, Pearson
6. Robert L Boylestad and Louis Nashelsky: Electronic Devices and Circuittheory, Pearson

Internal Continuous Assessment (Maximum Marks-50).

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks- 100).

PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with a choice to answer one question.

ES24 303	NETWORK THEORY	3-1-0-4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To expose the students to the basic concepts of electric circuits and their analysis in time and frequency domain.
- To expose the application of laplace transform in network analysis
- To introduce the concept of network function and two port parameters.
- To introduce the concept of filter circuits and design of passive filters.
- To introduce the techniques of network synthesis.

SYLLABUS

MODULE I: **(11 hours)**

Introduction to circuit variables and circuit elements, Review of Kirchhoff's Laws, Independent and dependent Sources, Source transformations, Mesh and node analysis of network containing independent and dependent sources, Network theorems: Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity theorem, Millman's theorem, Maximum power transfer theorem.

MODULE II: **(9 hours)**

Laplace transforms and properties: Partial Fraction expansions for inverse Laplace transforms, Solution of differential equations using Laplace transforms. Transformation of basic signals and circuits into s-domain Transient analysis of RL, RC, and RLC networks with impulse, step, pulse and exponential inputs.

MODULE III: **(11 hours)**

Network functions: The concept of complex frequency- driving point and transfer functions- Impulse response-Poles and Zeros of network functions-Restriction of poles and zeros in the driving point and transfer function, Time domain behavior from the pole-zero plot, Two-port network parameters: Impedance, admittance, transmission and hybrid-Conversion formulae. Analysis of interconnected two port networks-parallel, series, and cascade connections of two port networks.

MODULE IV: **(10 hours)**

Introduction to filters- low pass, high pass, band pass and band reject filters, RC, RL filters- constant K and m derived filters. Frequency transformations: Transformation to high pass, band pass and band elimination filters. Attenuators: Types of attenuators, T and Bridged T attenuators.

Module V: **(11 hours)**

Elements of realizability Theory: Causality and stability-Hurwitz Polynomials-Positive Real Functions-Properties of LC Admittance Functions, Synthesis of L-C Driving point Admittances- Properties of R-C Driving point Impedances- Properties of R-L Impedances and R-C admittances.

COURSE OUTCOMES:

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

- Understand the basic concepts of electric circuits and the theorems.
- Analyse the electric circuits in time and frequency domain
- Understand the network functions and analysis not interconnected networks
- Understand the concept of filter circuits and design of passive filters
- Study the techniques of network synthesis

TEXT BOOKS:

1. Van Valkenberg, Network Analysis, Prentice-Hall of India
2. Franklin F. Kuo, Network Analysis and Synthesis, Wiley India, Second Edition.
3. Edminister, Electric Circuits – Schaum's Outline Series, McGraw-Hill.
4. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education

REFERENCE BOOKS:

1. DeCarlo/Lin, Linear Circuit Analysis, Oxford University Press, Second edition
2. D. Roy Choudhary, Networks and Systems, New Age International Publishers, Second Edition
3. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994

Internal Continuous Assessment (Maximum Marks-50).

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Marks- 100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with a choice to answer one question.

ES24 304	COMPUTER ORGANIZATION AND ARCHITECTURE	3-1-0-3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Gain knowledge about the fundamental hardware components of a computer system.
- To understand basic processing units, input/ output organization and pipelining concept
- Explore the memory hierarchy, including cache memory, main memory, virtual memory and secondary storage.
- Study the logic design of processors.
- Learn about binary arithmetic, and how arithmetic operations are performed in computer systems.

SYLLABUS:

MODULE I: **(10 hours)**

Basic structure of computers: functional units - basic operational concepts - bus structures. memory locations and addresses - memory operations - instructions and instruction sequencing - addressing modes.

Basic processing unit: fundamental concepts – instruction cycle – execution of a complete instruction single bus and multiple bus organization

MODULE II: **(11 hours)**

Numbers, Arithmetic Operation and Characters. **Arithmetic:** Addition and subtraction of signed numbers - Design of fast adders - Multiplication of positive numbers - Signed operand multiplication Integer division.

MODULE III: **(11 hours)**

The Memory system: Basic concepts – Memory Hierarchy - Semiconductor RAM memories, Internal organization of memory chips, Static memories, Asynchronous DRAM, Synchronous DRAM - Read Only Memories - Cache memories, mapping functions - Virtual memory - Secondary storage

MODULE IV: **(11 hours)**

Processor logic design: Processor organization - Arithmetic logic unit - Design of arithmetic circuit design of logic circuit - Design of arithmetic logic unit - Status register - Design of shifter - processor unit - Design of accumulator.

MODULE V: **(10 hours)**

Input / Output organization: Accessing of I/O devices - Interrupts, Interrupt hardware -Direct memory access. **Pipelining:** Basic concepts - Data hazards - Instruction hazards – Control hazards

COURSE OUTCOMES:

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

- Recognize and express the relevance of basic components, I/O organization and pipelining schemes in a digital computer
- Explain the types of memory systems and mapping functions used in memory systems.
- Illustrate the design of the Arithmetic Logic Unit and explain the usage of registers in it.
- Explain the implementation aspects of arithmetic algorithms in a digital computer.

TEXT BOOKS:

1. Hamacher C. V., Computer Organization – International Edition -5th Edition, McGraw Hill, New York, 2011
2. Mano M. M., Digital Logic & Computer Design, PHI, 2004.

REFERENCE BOOKS:

1. Patterson D.A. and J. L. Hennessy, Computer Organization and Design, 5/e, Morgan Kaufmann Publishers, 2013.
2. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson, 9/e, 2013.
3. Rajaraman V. and T. Radhakrishnan, Computer Organization and Architecture, Prentice Hall, 2011

Internal Continuous Assessment (Maximum
Marks-50) 60% - Tests (minimum 2).

30% -Assignments (minimum 2) such as homework, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks- 100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with a choice to answer one question.

ES24 305	**SWITCHING THEORY & LOGIC DESIGN**	**3-1-0-4**

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart an understanding of the basic concepts of Boolean algebra and digital systems.
- To impart familiarity with the design and implementation of different types of practically used sequential circuits.
- To get a brief idea about combinational logic circuits.
- To get a brief idea about sequential logic circuits.
- To familiarize with shift registers.

SYLLABUS:

MODULE I: (12 hours)

Number systems:- Decimal, Binary, Octal and Hexadecimal – conversion from one system to another – representation of negative numbers – representation of BCD numbers -character representation – character coding schemes – ASCII – EBCDIC.

Addition, subtraction, multiplication and division of binary numbers - Addition and subtraction of BCD, Octal and Hexadecimal numbers - Introduction to floating point numbers.

MODULE II: (9 hours)

Boolean Algebra:- Postulates of Boolean algebra - Basic theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and standard forms - Simplification of Boolean Functions- Using Karnaugh-Map Method (upto five variables), Don't care conditions, Product of sums using basic and universal gates.

MODULE III: (10 hours)

Combinational Logic: Design Procedure & Implementation of combinational logic circuits - Binary adders and subtractors, Binary Parallel adder, Carry look ahead adder, BCD adder, Code converter, Magnitude comparator, Decoder, Demultiplexer, Encoder, Multiplexer, Parity generator/ Checker.

MODULE IV: **(11 hours)**

Sequential logic circuits: Flip-flops – SR, JK, T and D - Triggering of flip-flops- Master slave flip- flops - Excitation table and characteristic equation.

Registers: Registers with parallel load.

Counters: Asynchronous counters- Binary and BCD counters, timing sequences and state diagrams. Synchronous counters- Binary Up- down counter, BCD counter.

MODULE V: **(10 hours)**

Shift registers – Serial In Serial Out, Serial In Parallel Out, Bidirectional Shift Register with Parallel load - Ring counter - Johnson counter- Timing sequences and state diagrams.

Programmable logic devices: Memory decoding - Error detection and correction – RAM – ROM - Programmable Logic Array (PLA) - Implementation of simple circuits using PLA.

COURSE OUTCOMES:

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

- Apply concepts of various number systems and logic circuits
- Analyze and minimize Boolean expressions using Karnaugh maps
- Analyze and use multiplexers and de-multiplexers in designing logic circuits.
- Compare and contrast different types of flip flops and its applications.
- Design various logic circuits using complex programmable logic devices.

TEXT BOOKS:

1. Mano M. M., *Digital Logic & Computer Design*, 4/e, Pearson Education, 2013.
2. Floyd T. L., *Digital Fundamentals*, 10/e, Pearson Education, 2009.
3. M. Morris Mano, *Computer System Architecture*, 3/e, Pearson Education, 2007.
4. Harris D. M. and, S. L. Harris, Digital *Design and Computer Architecture*, 2/e, Morgan Kaufmann Publishers, 2013.

REFERENCE BOOKS:

1. Tokheim R. L., *Digital Electronics Principles and Applications*, 7/e, Tata McGraw Hill, 2007.
2. Mano M. M. and M. D Ciletti, *Digital Design*, 4/e, Pearson Education, 2008.
3. Rajaraman V. and T. Radhakrishnan, An Introduction to Digital Computer Design, 5/e, Prentice Hall India Private Limited, 2012.
4. Leach D, Malvino A P, Saha G, Digital Principles and Applications, 8/e, McGraw Hill Education, 2015.
5. Charles H Roth,Jr, Lizy Kurian John, Digital System Design using VHDL,2/e, Cengage Learning.

Internal Continuous Assessment (Maximum Marks-100).

60% - Tests (minimum 2).

30% -Assignments (minimum 2) such as homework, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

EN24 306	LIFE SKILLS & ETHICS FOR ENGINEERS	3-1-0-0

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- To develop communication competence in prospective engineers.
- To enable them to convey thoughts and ideas with clarity and focus.
- To equip them to face Group Discussion and to inculcate critical thinking process.
- To prepare them on problem solving skills and to understand team dynamics and effectiveness.
- To learn leadership qualities and practice them.

SYLLABUS:

MODULE I: **(14 hours)**

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

Life skills for professionals: positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ and SQ

***Group discussion*:** Differences between group discussion and debate; Ensuring success in group discussions.

Presentation skills: Oral presentation and public speaking skills; business presentations, Technology-based Communication: Netiquettes: effective e-mail messages; power-point presentation; enhancing editing skills using computer software.

MODULE II: **(8 hours)**

***Need for Creativity in the 21st century**:* Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity

***Critical thinking Vs Creative thinking**:* Functions of Left Brain and Right brain, Convergent and Divergent Thinking, Critical reading and Multiple intelligence.

***Steps in problem solving, Problem Solving Techniques**:* Problem Solving through Six Thinking Hats, Mind Mapping, Forced Connections. Problem Solving strategies, Analytical Thinking and quantitative reasoning expressed in written form, Numeric, symbolic, and graphic reasoning, Solving application problems.

MODULE III: **(10 hours)**

***Introduction to Groups and Teams**:* Team Composition, Managing Team Performance, Importance of Group, Stages of Group, Group Cycle, Group Problem Solving, Achieving Group Consensus, Group dynamics techniques, Group Vs team, Team dynamics, Managing Team Performance & Managing Conflict in Teams. Working Together in Teams, Team Decision-Making, Team culture and power, Team leader development.

MODULE IV: **(10 hours)**

Morals, Values and Ethics, Integrity: Work Ethics, Service learning, Civic virtue, Respect for others, Living Peacefully. Senses of 'Engineering Ethics’, variety of moral issues, Types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, Consensus and controversy, Models of professional roles, Theories about right action, Self-interest, customs and religion, application of ethical theories. Engineering as experimentation, engineers as responsible experimenters, Codes of ethics. Environmental ethics, computer ethics, Weapons development, engineers as managers, consulting engineers, engineers as expert witnesses and advisors, moral leadership, sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

MODULE V: **(10 hours)**

Introduction, a framework for considering leadership: Entrepreneurial and moral leadership, vision, people selection and development, cultural dimensions of leadership, Growing as a leader, turn around leadership, gaining control, trust, managing diverse stakeholders, crisis management, Implications of national culture and multicultural leadership, Types of leadership, Leadership traits. Leadership styles, VUCA leadership, DART Leadership, Transactional Vs Transformational leaders, Leadership grid, Effective leaders, making of a leader, Formulate leadership

COURSE OUTCOMES:

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

- Define and identify different life skills required in personal and professional life.
- Make effective presentations, face group discussions and debate.
- Critically think about a particular problem and solve them.
- Work in group and teams.
- Become an effective leader.

TEXT BOOKS:

1. Life Skills for Engineers, Compiled by ICT Academy of Kerala, McGraw Hill Education (India) Private Ltd., 2016.

REFERENCE BOOKS:

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2. Barun K. Mitra, “Personality Development & Soft Skills”, First Edition; Oxford Publishers, 2011
3. Kalyana, “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd, 2015
4. Larry James, “The First Book of Life Skills”; First Edition; Embassy Books, 2016
5. ShaliniVerma, “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand (G/L) & Company, 2014
6. John C. Maxwell, “The 5 Levels of Leadership”, Centre Street, A division of Hachette Book Group Inc., 2014
7. Remesh S., Vishnu R.G., "Life Skills for Engineers", Ridhima Publications, First Edition, 2016

Internal Continuous Assessment (Maximum Marks-100).

50% - Group Discussion

50% - Presentation skills

ES24 307(P)	**ELECTRONIC CIRCUITS LAB**	**0-0-3-1**

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To Implement of Basic Electronic circuits and analyse their characteristics.
- To understand the working of different transistor configurations and plot their characteristics.
- To understand the functioning of voltage regulator circuits.
- To design and setup different amplifier circuits and understand their frequency response.
- To simulate the various electronic circuits using tools such as SPICE.

List of Experiments

(A minimum of 10 experiments must be conducted)

1. Diode and Zener diode characteristics -DC and dynamic resistance
2. First order LPF/HPF with R & C for a given cut off frequency.
3. Clipping and clamping circuits with diodes
4. Half wave rectifier and Full wave rectifier with C, LC filters
5. CE and CB configuration determination of h-parameters
6. Voltage Regulator with Zener diode and pass transistor.
7. Single / Two Stage RC coupled amplifier- design for gain - frequency response
8. Emitter Follower with and without complementary transistors frequency response
9. JFET amplifier - Design for gain - frequency response
10. RC Phase shift oscillator using BJT/FET
11. Crystal / LC Oscillators
12. Power amplifier - Class A / Class AB

13. Cascode amplifier - frequency response
14. UJT relaxation oscillator
15. SPICE - Analysis, Device Models, Netlists, Schematic Capture and plotting.

COURSE OUTCOMES:

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

- Understand the working of basic electronic circuits and analyse their characteristics.
- Understand the working of different transistor configurations and plot their characteristics.
- Understand the functioning of voltage regulator circuits.
- Design and setup different amplifier circuits and understand their frequency response.
- Simulate the various electronic circuits using tools such as SPICE.

Internal Continuous Assessment (Maximum Marks-50).

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

End Semester Practical Examination (Maximum Marks-100).

70% - Procedure and tabulation form, Conducting experiment, results, and inference

20% - Viva voce

10% - Record

ES24 308(P)	**Logic Design LAB**	**0-0-3-1**

PRE-REQUISITES: SWITCHING THEORY & LOGIC DESIGN

COURSE OBJECTIVES:

- Familiarize and experience on digital electronics components and systems, which are fundamental building blocks of the computer systems.
- To apply Boolean laws to simplify digital circuits
- To understand the operation of various logic gates and digital ICs
- To understand the operation of digital displays, flip flops and counters
- To design and understand different combinational logic circuits.

List of Exercises / Experiments

(Minimum 8 experiments are mandatory)

1. Familiarization of logic gates and digital trainer kit
2. Implement various gates using universal gates
3. Combinational circuits: Adder, Subtractor
4. Code converters: binary to gray, gray to binary
5. Multiplexer and Demultiplexer using gates
6. Study of Flip Flops using gates and Flip Flop.
7. Asynchronous counters.
8. Ring and Johnson counter.
9. Synchronous counters – Design.
10. Shift Registers – Right, Left, Serial, Parallel.

COURSE OUTCOMES:

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

- Understand the operation of various logic gates and digital ICs.
- Understand the operation of digital displays, flip flops and counters.
- Design and understand different combinational logic circuits.
- Design and understand different sequential logic circuits.
- Design and setup different circuits using IC 741 and IC 555.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

End Semester Practical Examination (Maximum Marks-100)

70% - Procedure and tabulation form, Conducting experiment, results and inference

20% - Viva voce

10% - Fair record

SEMESTER - 4

EN24 401	ENGINEERING MATHEMATICS IV	3-1-0-4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To deal with the methods for collection, classification and analysis of numerical data.
- To describe the characteristics and compute probabilities using discrete probability distributions.
- To describe the characteristics and compute continuous probability distributions.
- To develop hypothesis testing methodology using test statistics.
- To develop the tool of Z transforms for learning Advanced Engineering Mathematics.

SYLLABUS:

MODULE I: Bivariate Probability Distributions **(10 hours)**

Two random variables, Joint probability mass function, Joint probability density function, Marginal probability distributions, Conditional probability distributions, Independence of random variables, Joint distribution function, Bivariate moments, Conditional expectation, Conditional variance.

MODULE II: Discrete Probability Distributions **(10 hours)**

Random variables, Mean and Variance of probability distributions, Binomial Distribution Poisson Distribution, Poisson approximation to Binomial distribution, Hypergeometric Distribution, Geometric Distribution.

MODULE III: Continuous Probability Distributions **(10 hours)**

Probability densities, Normal Distribution, Uniform Distribution, Gamma Distribution.

MODULE IV: Theory of Distributions **(12 hours)**

Population and Samples, Sampling Distribution, Sampling distribution of Mean (s known), Sampling Mean (s known), Sampling distribution of Mean (σ unknown), Sampling distribution of Variance, Interval Distribution, Confidence interval for Mean, Null Hypothesis and Test of Hypothesis, Hypothesis concerning one mean, Hypothesis concerning two means, Estimation of Variances, Hypothesis concerning one variance, Hypothesis concerning Two variances, Test of Goodness of fit.

MODULE V: Z -Transforms **(10 hours)**

Definition of Z transform, Properties of Z transform, Z transform of basic sequences, Z transform standard discrete functions, First shifting theorem, Second shifting theorem, Initial value theorem, Final value theorem, Shift property, Convolution theorem (No proof).

COURSE OUTCOMES:

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

- Acquire the knowledge of basic ideas of joint probability distributions.
- Acquire the knowledge to describe the characteristics and compute probabilities using discrete probability distributions.
- Acquire the knowledge to describe the characteristics and compute continuous probability distributions.
- Develops the skills of hypothesis testing methodology using test statistics.
- Use tools for Z Transforms.

TEXT BOOKS:

1. Richard A Johnson, CB Gupta, Miller and Freund's Probability and statistics for Engineers,
2. Wylie C.R and L.C. Barret, Advanced Engineering Mathematics, McGraw Hill.
3. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers,35th Edition

REFERENCE BOOKS:

1.ErwinKreszig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.

2.N Bali, M Goyal, C Watkins, Advanced Engineering Mathematics, A Computer Approach, 7e, Infinity Science Press, Fire Wall Media.

3.William Hines, Douglas Montgomery, avid Goldman, Connie Borror, Probability and Statistics in Engineering, 4e, John Wiley and Sons, Inc.

4.Sheldon M Ross, Introduction to Probability and Statistics for Engineers and Scientists, 3e, Elsevier, Academic Press.

5.H Parthasarathy, Engineering Mathematics, A Project & Problem based approach, Anne Books India.

6.B V Ramana, Higher Engineering Mathematics, McGraw Hill.

7.J K Sharma, Business Mathematics, Theory and Applications, Anne Books India.

8. Sastry S.S., Advanced Engineering Mathematics-Vol. I and II., Prentice Hall of India.

9.Veerarajan.T, Probability,Statistics and Random Processes,Tata McGraw-Hill,2nd edition.

10.P. Ramesh Babu, R. Anandanatarajan, Signals and Systems,4e, Scitech publications INDIA) pvt.ltd

Internal Continuous Assessment (Maximum Marks-50).
60% - Tests (minimum 2).
30% -Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Regularity in the class.

University Examination Pattern (Maximum Marks-100).

PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks** Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks** Two questions from each module with choice to answer one question.

ES24 402	SIGNALS & SYSTEMS	3-1-0-4

PRE-REQUISITES: ENGINEERING MATHEMATICS III

COURSE OBJECTIVES:

- To introduce the student to the idea of signals, system analysis and its characterization.
- To study and analyse continuous and discrete-time signals and systems and the properties.
- To study and analyze concepts using Fourier analysis tools.
- To study and analyse Laplace Transform and Z- transform.
- To study concepts of the sampling process, reconstruction of signals and interpolation.

SYLLABUS:

MODULE I: (12 hours)

Introduction to signals and systems- Classification of signals- Basic operations on signals- Elementary signals- Concept of system- Properties of systems-stability, invertibility, time invariance, linearity, causality, memory- Time domain representation for Linear Time Invariant Systems - Continuous time LTI systems and convolution integral - Discrete time LTI systems and linear convolution. - Differential equation and difference equation representation for LTI systems.

MODULE II: (11 hours)

Fourier representation of continuous time signals- Fourier series-Properties-Convergence-Fourier transform- Existence of the Fourier integral- Properties of Fourier representation- Energy spectral density and power spectral density- Frequency response of LTI systems- Sampling and Reconstruction.

MODULE III: (11 hours)

Laplace transform analysis of systems- Unilateral and Bilateral Laplace Transforms, Properties relation between transfer function and differential equation- Causality and Stability- Inverse system- Determining the frequency response from poles and zeros.

MODULE IV: (8 hours)

Fourier representation of discrete time signals- Discrete time Fourier series and its properties- linearity, time shift, frequency shift, convolution, multiplication, duality, symmetry Parseval"s theorem. Discrete time Fourier transform and its properties-linearity, time shift, frequency shift, scaling, frequency differentiation, Summation, Time domain convolution, multiplication, Conjugation property, Parseval"s theorem.

MODULE V: (10 hours)

Z transform-properties of the region of convergence- Properties of the Z- transform - Relating transfer function and difference equation- Stability and Causality- Inverse Z-transform - Determining the frequency response from poles and zeros- Unilateral Z-transform- Solving difference Equations- Relationship between Z-transform and Fourier transform.

COURSE OUTCOMES:

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

- Define and represent basic properties of continuous and discrete time signals and systems.
- Represent the continuous time signals in Fourier series and explain the properties of Fourier transform and Laplace transform.
- Represent continuous and discrete systems in time and frequency domain using different transforms.
- Investigate the stability of LTI systems using transforms.
- Describe sampling theorem techniques for sampling and reconstruction.

TEXT BOOKS:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall.
2. Simon Haykin, Signals & Systems, John Wiley, 2/e, 2003
3. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous andDiscrete", 4th edition, Prentice Hall, 1998.
4. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
5. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
6. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c 1999.

REFERENCE BOOKS:

1. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia)Private Limited, c1998.
2. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley andSons, 1995.
3. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
4. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
5. Ashok Ambardar, "Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.
6. D Ganesh Rao, Satish Tunga, "Signals and Systems", Sanguine Technical Publishers.

Internal Continuous Assessment (Maximum Marks-50).

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Marks- 100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with a choice to answer one question.

ES24 403	DATA STRUCTURES AND ALGORITHMS	3-1-0-4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To learn efficient data storage mechanisms for easy access.
- Familiarize with various linked list operations
- To get a clear understanding of linear data structures.
- To get a clear understanding of non-linear data structures.
- To study various searching and sorting techniques.

SYLLABUS:

MODULE I: Introduction **(9 hours)**

Introduction and overview of data structures- Linear data structures – Non-linear data structures – Algorithms - Complexity of algorithms – Time complexity - Space complexity - Asymptotic notations

-Complexity calculation of simple algorithms - Recursion: Recursive algorithms – Analysis of recursive algorithms

MODULE II: Arrays and searching **(12 hours)**

Arrays – Representation - Sparse matrix, Stacks, Queues - Circular Queues, Priority Queues, Double Ended Queues, Evaluation of expressions - Linear Search and Binary Search

MODULE III: Linked List **(12 hours)**

Singly Linked List - Operations on Linked List - Insertion and the deletion at the beginning, at the end and at the specific location - Doubly Linked List - Insertion and the deletion at the beginning, at the end and after a given node - Circular Linked List - Insertion and the deletion at the beginning and at the end - Stacks and Queues using Linked List - Conversion of infix to postfix, Evaluation of postfix expression

MODULE IV: Tree and Graphs **(9 hours)**

Trees – Basic terminologies- Definition and concepts- Representation of binary tree –- Binary tree traversals – pre-order, inorder and postorder – Types of binary trees – Binary search tree.

Graphs – Graph terminologies -Representation of graph - Graph traversals – DFS, BFS – Dijkstra's and Floyd's algorithm, Minimum spanning tree – Kruskal's algorithm, Prim's algorithm.

MODULE V: Sorting and Hashing **(10 hours)**

Sorting- Basic terminologies- Sorting techniques – Bubble sort – Insertion sort – Selection sort – Quick sort – Heap sort – Merge sort

Hashing - Hashing techniques, Collision resolution, Overflow handling, Hashing functions – Mid square, Division, Folding, Digit analysis

COURSE OUTCOMES:

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

- Identify and apply suitable data structures like arrays, linked list, stacks and queues to solve real world problems.
- Represent and manipulate data using nonlinear data structures like trees and graphs and use them to design algorithms for various applications.
- Illustrate and compare various techniques for searching and sorting.
- To choose appropriate data structure as applied to specified problem definition.

TEXT BOOKS:

1. Samanta D, Classic Data Structures, 2nd Edition , Prentice Hall.

REFERENCE BOOKS:

1. A. M. Tanenbaum, Y. Langsam, M. J. Augenstein, “Data Structures Using C”, Pearson Education, 2^{nd} Edition.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Universities Press, Fundamentals of Data Structures in C,2^{nd} Editon.
3. Aho A. V., J. E. Hopcroft and J. D. Ullman, Data Structures and Algorithms, Pearson Publication.
4. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson,3^{rd} edition.
5. E. Balagurusamy, “Data Structures Using C”, Tata McGraw Hill, 2013.
6. Adam Drozdek, Thomson, Data structures and algorithms in C++, 3rd Edition.
7. R.L. Kruse, “Data Structure and Program Design”, Prentice Hall, Second Edition.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quizzes, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 404	FOUNDATION OF DATA SCIENCE	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Building the fundamentals of data science
- To introduce fundamental ideas to process data.
- To introduce and discuss techniques for applying hypotheses and data into actionable predictions.
- Gaining practical experience in programming tools for data science.
- Empowering students with tools and techniques used in data science.

SYLLABUS:

MODULE I: Introduction **(10 hours)**

Data Science: Benefits and uses – Facets of data – Data science process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory data analysis – Build the model– Presenting findings and building applications – Data Mining – Data Warehousing – Basic statistical descriptions of data

MODULE II: Data Describing **(10 hours)**

Types of data – Types of variables - Describing data with tables and graphs –Describing data with averages – Describing variability – Normal distributions and Standard (z) Scores

MODULE III: Describing Relationship **(11 hours)**

Correlation –Scatter plots – Correlation coefficient for quantitative data – Computational formula for correlation coefficient – Regression –Regression line – Least Squares Regression Line – Standard error of estimate – Interpretation of r2 –Multiple regression equations –Regression towards the mean.

MODULE IV: Python Libraries for data wrangling **(10 hours)**

Basics of Numpy arrays –Aggregations –Computations on arrays –Comparisons, Masks, Boolean logic – Fancy indexing – Structured arrays – Data manipulation with Pandas – Data indexing and selection – Operating on data – Missing data – Hierarchical indexing – Combining datasets – Aggregation and grouping – Pivot tables.

MODULE V: Data Visualization **(11 hours)**

Importing Matplotlib – Line plots – Scatter plots – Visualizing errors – Density and contour plots – Histograms – Legends – Colors – Subplots – Text and annotation – Customization – Three dimensional plotting – Geographic data with Basemap – Visualization with Seaborn.

COURSE OUTCOMES:

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

- Explain and discuss the significance of data science and its key functionalities
- Discuss and demonstrate various models suitable for data science.
- Demonstrate knowledge and understanding of topics in data processing.
- Key concepts in data science including tools and approaches.
- Discuss topics in statistical analysis.

TEXT BOOKS:

1. Jojo Moolayil, "Smarter Decisions: The Intersection of IoT and Data Science", PACKT, 2016.
2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.

REFERENCE BOOKS:

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
2. Jeffrey S. Saltz, Jeffrey M. Stanton,An Introduction to Data Science,2017, Sage Publications.
3. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.
4. EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and presenting data 2015 published by Wiley.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quizzes, literature survey, seminar, term-project etc.

10% - Regularity in the class

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 405	ANALOG CIRCUITS	3-1-0-3

PRE-REQUISITES: ELECTRONIC CIRCUITS

COURSE OBJECTIVES:

- To understand the working of differential amplifiers.
- To understand the concept of integrated circuits and OP- AMP.
- To understand the functioning and design of wave shaping circuits using OP-AMP.
- To know the various data converters and voltage regulator ICs.
- To analyze the working and applications of PLL and 555 timer IC.

SYLLABUS:

MODULE I: (9 hours)

Differential Amplifiers -The BJT differential pair- Large and small signal operation- MOS differential amplifier- Large and small signal operation– Non ideal characteristics of the differential amplifier - Differential amplifier with active load- Concept of CMRR - Methods to improve CMRR - Frequency response analysis.

MODULE II: (10 hours)

Introduction to integrated circuits- Op Amp-block diagram. Op-amp 741-typical op-amp parameters-DC analysis –small signal analysis – Gain, frequency response. Linear op amp circuits–summing and difference amplifiers- Differentiator and integrator– I-V and V-I converters- Instrumentation amplifier, Log and antilog amplifiers analog multipliers –Voltage Comparators-Schmitt trigger.

MODULE III: (12 hours)

Signal generators (analysis required)- Phase shift and Wien Bridge Oscillators- Astable and Monostable Circuits-Linear sweep circuits. Active filters (analysis required)- filter transfer function- Butterworth and Chebyshev filters-First order and second order function (Sallen-key) for low-pass, high-pass, band –pass, band-stop and all –pass filters-twin tee notch filter-Second order LC LCR Resonator and switched capacitor filters.

MODULE IV: (11 hours)

Data converters-definitions and specifications – DAC - Weighted resistor and R-2R DAC. ADC - flash, integrating type, Counter Ramp, pipeline, tracking and Successive approximation, dual slope & oversampling ADCs - sigma - delta ADC. Linear voltage regulators- protection mechanisms-LM 723 Functional-diagram-Design of voltage regulator using 723-Three terminal Voltage regulators-functional operation of 78xx series IC and design of fixed and adjustable regulators.

MODULE V: **(10 hours)**

Phase locked loops- operation of first and second order PLLs-Lock and Capture range-LM565PLL-Application of PLL as AM/FM/FSK/ detectors, frequency translators, phase shifter, tracking filter, signal synchronizer and frequency synthesizer. Voltage controlled oscillator. Timer IC 555 – internal diagram – working – Astable multivibrators and Monostable multivibrator with timer IC 555.

COURSE OUTCOMES:

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

- Understand the working of differential amplifiers.
- Understand the concept of integrated circuits and OP- AMP.
- Understand the functioning and design of different OP-AMP based circuits.
- Know the various data converters and voltage regulator ICs.
- Analyze the working and applications of PLL and 555 timer IC.

TEXT BOOKS:

1. Sedra A.S & Smith K.C., Microelectronic Circuits, Oxford University Press.
2. Millman J. &Taub H., Pulse, Digital & Switching Waveforms, Tata McGraw Hill.
3. Horenstein M.N: Microelectronic circuits and Devices PHI.
4. Gray Meyer:Analysis and Design of Analog Integrated Circuits; John Wiley.
5. Schilling D.L. &Belove C.: Electronic Circuits, McGraw Hill.
6. Ramakant A. Gayakwad, Op-amps and Linear Integrated Circuits, Prentice Hall.
7. D. Roy Choudhury, Shail Jain.‘Linear Integrated Circuits‘, New Age International
8. S. Salivahanan, V. S. Kanchana Bhaaskaran, “Linear Integrated Circuits”, McGraw-Hill Education

REFERENCE BOOKS:

1. Milman & Halkias, Integrated Electronics, McGraw Hill.
2. Robert L Boylestad and Louis Nashelsky: Electronic Devices and Circuit theory, Pearson.
3. Thomas L.Floyd and David Buchla: Fundamentals of Analog Circuits,Pearson.
4. Spencer &Ghausi, Introduction to Electronic Circuit Design; Pearson Education.
5. VenkataRao K, Rama Sudha K, ManmadhaRao G., Pulse and Digital Circuits:Pearson Education.
6. Coughlin R.F. & Driscoll F.F., Operational Amplifiers and Linear Integrated Circuits,Pearson Education.
7. A.V.Bakshi A.P.Godse U.A.Bakshi, “Linear Integrated Circuits”, Technical Publications.

Internal Continuous Assessment (Maximum Marks-50).

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Marks- 100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with a choice to answer one question.

EN24 406	CONSTITUTION OF INDIA	3-1-0-0

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To help the students to concentrate on their day-to-day discipline
- To give the knowledge and strength to face the society and people
- Describe the principles of Federalism, Secularism, and Democracy.
- Develop critical thinking and analytical skills in understanding Constitutional law.
- The role of the Constitution in promoting national integration and unity.

SYLLABUS

MODULE I **(8 hours)**

Definition of constitution, historical background, salient features of the constitution - Preamble of the constitution, union and its territory - Meaning of citizenship, types, termination of citizenship.

MODULE II **(12 hours)**

Definition of state, fundamental rights, general nature, classification, right to equality, right to freedom, right against exploitation - Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences - Directive principles of state policy, classification of directives, fundamental duties.

MODULE III **(10 hours)**

The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions - The parliament, composition, Rajyasabha, Loksabha, qualification and disqualification of membership, functions of parliament - Union judiciary, the supreme court, jurisdiction, appeal by special leave.

MODULE IV **(9 hours)**

The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories - The State Legislature, composition, qualification and disqualification of membership, functions - The state judiciary, the high court, jurisdiction, writ in jurisdiction.

MODULE V **(9 hours)**

Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission - Emergency provision, freedom of trade commerce and intercourse, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals - Official language, elections, special provisions relating to certain classes, amendment of the Constitution.

COURSE OUTCOMES:

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

- Explain the background of the present constitution of India and features.
- Utilize the fundamental rights and duties.
- Understand the working of the union executive, parliament and judiciary.
- Understand the working of the state executive, legislature and judiciary.
- Utilize the special provisions and statutory institutions.

TEXTBOOKS

1. DD Basu, Introduction to the constitution of India, LexisNexis, New Delhi, 24e,2019
2. PM Bhakshi, The constitution of India, Universal Law, 14e, 2017

REFERENCE BOOKS

1. Ministry of law and justice, the constitution of India, Govt of India, New Delhi, 2019.
2. JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e, 2019
3. MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

Internal Continuous Assessment *(Maximum Marks-100)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

MINOR

MINOR BASKET				
SEMESTER	MINOR BASKET A - DATA SCIENCE		MINOR BASKET B - VLSI	
	Subject Code	**Subject Name**	**Subject Code**	**Subject Name**
S4	ES24 407A	Foundation of Data Science	ES24 407B	Electronic Devices
S5	ES24 507A	Data Science with Python	ES24 507B	Digital System Design
S6	ES24 607A	Big Data Analytical Tools	ES24 607B	VLSI Design
S7	ES24 709A (P)	Project in Minor	ES24 709B (P)	Project in Minor

ES24 407A	Foundation of Data Science	0-0-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To understand basic concepts of data sciences.
- To introduce fundamental ideas to process data.
- To study the techniques for applying hypotheses and data into actionable predictions.
- Apply data science techniques to real-world problems.
- Use data visualization tools to communicate insights effectively.

SYLLABUS:

MODULE I: **(11 hours)**

Data Science: Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications – Data Mining – Data Warehousing – Basic Statistical descriptions of Data

MODULE II: **(10 hours)**

Types of Data – Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores

MODULE III: **(11 hours)**

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean

MODULE IV: **(10 hours)**

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

MODULE V **(10 hours)**

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting – Geographic Data with Basemap – Visualization with Seaborn.

COURSE OUTCOMES:

The student will be able to:

- Explain and discuss the significance of data science and its key functionalities
- Discuss and demonstrate various models suitable for data science.
- Demonstrate knowledge and understanding of topics in data processing.
- Key concepts in data science including tools and approaches.
- Discuss topics in statistical analysis.

TEXT BOOKS:

1. Dr.A Selva Reegan,Dr.S Shanmugham,"Foundation of DataScience",The charulatha Publications,Regulation 2021
2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.

REFERENCE BOOKS:

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
2. Jeffrey S. Saltz, Jeffrey M. Stanton,An Introduction to Data Science,2017,sage publications.
3. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.
4.EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and presenting data 2015 published by Wiley.

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with a choice to answer one question. Maximum Total Marks: 100

ES24 407B	Electronic Devices	0-0-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To provide an insight into the basic semiconductor concepts.
- To identify various diodes.
- To understand concepts of various FETs.
- To implement diodes in day to day life applications.
- To understand current semiconductor devices and technology to appreciate its applications to electronics circuits and systems

SYLLABUS:

MODULE I: **(12 hours)**

Energy bands in semiconductors - direct and indirect band gap semiconductors -effective mass - intrinsic and extrinsic semiconductors - Fermi and quasi-Fermi level - electron and hole concentrations at equilibrium - temperature dependence of carrier concentration - carrier transport-conductivity and mobility - diffusion and drift of carriers - Einstein relation - continuity equation

MODULE II: **(11 hours)**

PN junctions - abrupt and graded junctions-contact potential - space charge at a junction - current flow at a junction - carrier injection - diode equation - minority and majority carrier currents - capacitance of pn junctions - reverse bias breakdown - Zener and avalanche breakdown- tunnel diode - varactor diode - Zener diode - Metal semiconductor junctions

MODULE III: **(10 hours)**

Bipolar junction transistors-Minority carrier distribution and terminal currents- coupled diode model-switching –Drift in the base region-Base narrowing -Avalanche breakdown-Kirk effect, Frequency limitations of transistor –capacitance and charging times- Hybrid-pi model

MODULE IV: **(10 hours)**

Junction FET - VI characteristics- MOS capacitor -C V characteristics- MOSFET – p channel and n channel MOSFETs - depletion and enhancement mode MOSFETs – small signal model.

MODULE V: (9 hours)

Power Electronics-Power Diodes - Insulated Gate Bipolar Transistor – Power MOSFETs, LED: working principle, characteristics – Photodiode: working principle, characteristics.

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

- Compute the carrier concentration at equilibrium and to describe the generation and recombination of charge carriers in semiconductors and transport mechanism
- Explain the formation, analysis and operation of PN junction
- Analyse the operation of bipolar junction transistors and compute the terminal currents
- Describe the structure and operation of JFET and MOSFET
- Understand the working of power electronic devices, working principle and characteristics of LED and photodiode

TEXT BOOKS:

1. Ben G Streetman and Sanjay Banerjee: Solid State Electronic Devices, (Fifth Edition) Pearson Education
2. Neamen, Semiconductor Physics &Devices, Pearson Education
3. Sze S M, Physics of Semiconductor Devices, John Willey
4. Pierret R F, Semiconductor Device Fundamentals, Pearson Education
5. Tyagi M S, Introduction to Semiconductor Materials &Devices, John Willey
6. SimaDimitrije, Physics of Semiconductor Devices, Oxford University Press

REFERENCE BOOKS:

1. Sah C T, Solid State Electronics, World Scientific
2. Muller &Camins, Device Electronics for Integrated Circuits, John Willey
3. Dipankar Nagchoudhuri: Microelectronic Devices, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions,

quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 408(P)	DATA STRUCTURES LAB	0-0-3-1

PRE-REQUISITES: DATA STRUCTURES AND ALGORITHMS

COURSE OBJECTIVES:

- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To understand the minimal spanning tree algorithms.
- To implement graph traversal algorithms
- To get familiarized with various sorting and searching algorithms

List of Exercises / Experiments

(Minimum of 8 mandatory)

1. Linked list operations: Insertion and Deletion operation at the beginning, at the end and after a given node and traversal
2. Stack and Queue: Implementation using arrays and Linked lists
3. Searching Methods: Binary search and Hashing
4. Binary Search Tree. Implementation with insertion, deletion and traversal
5. Sorting: Recursive implementation of Quick Sort and Merge Sort
6. Graph Search Algorithms: DFS and BFS on a connected directed graph
7. Minimal Spanning Tree. Implementation of Kruskal's and Prim's Algorithms
8. Shortest Path Algorithm. Dijkstra and Floyd Warshall Algorithsm
9. Conversion of infix to postfix
10. Infix Expression Evaluation: Using expression tree
11. Applications of Heap: Priority Queue and Heap Sort.

COURSE OUTCOMES:

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

- Implement basic data structures such as arrays, linked lists, stacks and queues.
- Apply programming techniques using pointers, dynamic memory allocation and structures to implement data structures: stack, queue, tree and graph
- Develop programs for implementing trees and their traversal operations.
- Implement graph traversal algorithms.
- Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and viva voce.

30% - Tests

10% - Regularity in the lab.

End Semester Practical Examination (Maximum Marks-100)

70% - Algorithm, coding, compiling and executing, result and inference

20% - Viva voce

10% - Fair record

ES24 409 (P)	ANALOG CIRCUITS LAB	0-0-3-1

PRE-REQUISITES: ANALOG CIRCUITS

COURSE OBJECTIVES:

- To understand the functioning of OP-AMP IC 741 and measure its various parameters.
- To design and setup different operational circuits using IC 741.
- To understand the working of voltage regulator IC 723.
- To design and setup circuits using 555 timer IC.
- To design and setup data converters and PLL.

List of Experiments

(A minimum of 10 experiments must be conducted)

1. Measurement of op-amp parameters-CMRR, slew rate.
2. Inverting and non-inverting amplifiers, integrators and differentiators Frequency response, Comparators-Zero crossing detector using op amp IC741 (simulation required – simulate using appropriate software).
3. Schmitt trigger using op amp IC741 -precision limiter
4. Instrumentation amplifier using op amp IC741 -gain, CMRR & input impedance.
5. RC Phase shift oscillator using op amp IC741(simulation required – simulate using appropriate software)
6. Single op-amp second order LFF and HPF using op amp IC741 (frequency response required)
7. Square, triangular and ramp generation using op amp IC741.
8. Voltage regulation using IC 723- line and load regulations.
9. Astable and monostable multivibrators using op amp IC741
10. Astable and monostable multivibrators using IC 555
11. Realization of ADCs.
12. Realization of DACs.

COURSE OUTCOMES: At the end of the course the student should able to:

- Understand the functioning of OP-AMP IC 741 and measure its various parameters.
- Design and setup different operational circuits using IC 741.
- Understand the working of voltage regulator IC 723.
- Design and setup circuits using 555 timer IC.
- Design and setup data converters and PLL.

Internal Continuous Assessment (Maximum Marks-50).

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

Semester-end Practical Examinations(Maximum Marks-100).

70% - Procedure and tabulation form, Conducting experiment, results and inference

20% - Vivavoce

10% - Record of works done

SEMESTER - 5

ES24 501	Engineering Economics & Principles of Management	3-1-0-3

PRE-REQUISITES:NIL

SECTION 1: ENGINEERING ECONOMICS

COURSE OBJECTIVES:

- To make fundamentally strong base for decision making skills by applying the concepts of economics.
- Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
- Prepare engineering students to analyse profit/revenue data and carry out make economic analysis in the decision-making process to justify or reject alternatives/projects.

SYLLABUS:

MODULE I: (11 hours)

Introduction to Engineering Economics – Technical efficiency, Economic efficiency.

Supply and Demand: Determinants of demand, Law of demand, Determinants of supply, Law of supply, Market equilibrium. Elasticity of demand – Types of elasticity, Factors affecting the price elasticity of demand - Utility analysis, indifference curves, Law of equi-marginal utility, marginal utility theory, Law of diminishing marginal utility -production possibility curve. Production concepts-average product-marginal product-law of variable proportions, Isoquant.

MODULE II: (10 hours)

Value Analysis - Time value of money - Interest formulae and their applications: Single-payment compound amount factor, Single-payment present worth factor, Equal-payment series compound amount factor, Equal-payment series sinking fund factor, Equal-payment series present worth factor, Equal-payment series capital recovery factor, Effective interest rate. Investment criteria: Pay Back Period, Net Present Value, Internal Rate of Return, Benefit-cost ratio.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Understand major principles of economic analysis for decision making among alternative courses of action in engineering.
- Apply economic principles to prices and quantities in competitive supply and demand for goods and for money.
- Solve economic problems involving comparison and selection of alternatives by using analytical techniques including interest rate formulas and investment criteria.

TEXT BOOKS:

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
2. Dwivedi, D.N., "Managerial Economics, 7/E", Vikas Publishing House, 2009
3. Salvatore D, "Managerial Economics: Principles and Worldwide Application:(adapted version)", OUP Catalogue. 2012.

REFERENCE BOOKS:

1. Sullivan, W.G, Wicks, M.W., and Koelling. C.P, "Engineering Economy 15/E", Prentice Hall, New York, 2011.
2. Chan S. Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
3. Prasanna Chandra, "Financial Management: Theory & Practice, 8/E", Tata-McGraw Hill, 2011.
4. Rangarajan C. Indian economy: essays on money and finance. UBS Publishers' Distributors; 1999.

Internal Continuous Assessment (Maximum Marks-20)

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-40)

PART A: Analytical/problem solving SHORT questions **4 x 5 marks= 20 marks**
Candidates have to answer FOUR questions out of SIX. There shall be THREE questions from each module with total SIX questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions **2 x 10 marks= 20 marks**
Two questions from each module with choice to answer one question.

SECTION 2: PRINCIPLES OF MANAGEMENT

COURSE OBJECTIVES:

- To develop ability to analyse and evaluate a management processes and variety of management practices in the contemporary context.
- To understand and apply the basic concepts of functional areas of management like human resources, Marketing and Finance.
- To be able to evaluate managerial decision-making process, project management techniques, developing innovative products and social responsibility ideologies to create sustainable organization.
- To be able to understand existing managerial practices to create their own innovative management competencies required for complex global workplace.

SYLLABUS:

MODULE I: (10 hours)

The management process: managerial skills and roles, evolution of management theory; principles of planning: types of plans, steps in planning; principles of organizing: organizational structures; directing; motivation; controlling; sustainability in management.

MODULE II: (11 hours)

Human resource management: human resource planning, performance metrics. Marketing management: fundamentals of marketing, market segmentation, consumer and industrial markets. Financial management: Basic principles of: double entry book keeping, financial statements, sources of finance, classification of costs, break-even analysis (Basic concepts only).

MODULE III: **(10 hours)**

Managerial decision-making process: Decision-making under certainty, risk and uncertainty, network techniques for project management: critical path method, Programme Evaluation and Review Technique (PERT): time/cost trade-off in critical path networks (simple problems only).

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Manage people with a focus on improving the effectiveness of organisations.
- Critically analyse and evaluate management theories and functions for proper implementation.
- Plan and make effective decisions with a farsighted approach for organisations.
- Lead an organization with an innovative and entrepreneurial perspective

TEXT BOOKS:

1. H. Koontz, and H. Weihrich, Essentials of Management: An International Perspective, 10th Edition. McGraw-Hill, 2015.
2. Ramesh Unnikrishnan, Principles of Management, Educational Publishers and Distributers, 2021.
3. O. P. Khanna, Industrial Engineering and Management, 17th Edition, Dhanpat Rai Publications, 2018.

REFERENCE BOOKS:

1. R. W. Griffin, Management: Principles and Applications. 10th Edition, Cengage Learning, 2008.
2. P. Kotler, K. L. Keller, A. Koshy, and M. Jha, Marketing Management: A South Asian Perspective, 15th ed. Pearson, 2014.
3. M. Y. Khan, and P. K. Jain, Financial Management. 8th Edition Tata-McGraw Hill, 2018.
4. Heinz Weirich, Mark V Cannice and Harold Koontz, Management: a Global, Innovative and Entrepreneurial Perspective, 14th Edition, McGraw Hill Education, 2013.

Internal Continuous Assessment (Maximum Marks-30)

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern (Maximum Marks-60)

PART A: Analytical/problem solving SHORT questions **6 x 5 marks= 30 marks**

Candidates have to answer SIX questions out of NINE. There shall be THREE questions from each module with total NINE questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **3 x 10 marks= 30 marks**

Two questions from each module with choice to answer one question.

Note: Section 1 and Section 2 are to be answered in separate answer books.

Maximum 40 marks and 60 marks for Section 1 and Section 2 respectively.

ES24 502	Digital Signal Processing	3-1-0-4

PRE-REQUISITES: SIGNALS AND SYSTEMS

COURSE OBJECTIVES:

- To understand the basic concepts of discrete Fourier transforms
- To study the design techniques for digital filters
- To understand the structure realization of FIR and IIR filters
- To introduce the architecture of DSP processors

SYLLABUS

MODULE I **(11 Hours)**

Review of Discrete Time Fourier series and Discrete Time Fourier Transform - Frequency domain sampling - Discrete Fourier Transform-Properties - Circular convolution – Linear convolution using DFT - Linear filtering of long data sequences - Overlap add and overlap save methods.

Computation of DFT: Radix-2 Decimation in Time FFT Algorithms, Radix-2 Decimation in Frequency FFT Algorithms, IDFT computation using Radix-2 FFT Algorithms

MODULE II **(11 Hours)**

Block diagram and signal flow graph representations of filters - FIR Filter Structures: (Linear structures), Direct Form, Cascade Form and Lattice Structure - IIR Filter Structures: Direct Form, Transposed Form, Cascade Form and Parallel Form - Computational Complexity of Digital filter structures- Representation of numbers & errors due to rounding and truncation - Quantization of filter coefficients - round off effects in digital filters - Limit cycle oscillations, scaling to prevent overflow

MODULE III **(10 Hours)**

Design of FIR Filters- Symmetric and Anti-symmetric FIR Filters - Design of linear phase FIR Filters using Window methods (rectangular, Hamming and Hanning) and frequency sampling Method - Comparison of Design Methods for Linear Phase FIR Filters

MODULE IV **(9 Hours)**

Design of IIR Digital Filters from Analog Filters (Butterworth) - IIR Filter Design by Impulse Invariance, and Bilinear Transformation - Frequency Transformations in the Analog and Digital Domain

MODULE V **(11 Hours)**

Computer architecture for signal processing: Introduction to TMS320C67xx digital signal processor - Multi-rate Digital Signal Processing: Decimation and Interpolation (Time domain and Frequency Domain Interpretation without proof) - Finite word length effects in DSP systems: Introduction (analysis not required), fixed-point and floating-point DSP arithmetic, ADC quantization noise

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

- Interpret and represent digital signals and systems
- Illustrate the frequency domain analysis of discrete time signals
- Design & analyze DSP systems like FIR and IIR Filter etc.
- Summarize computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors
- Describe the DSP processor architectures

TEXT BOOKS:

1. Oppenheim A. V., Schafer R. W., Discrete-Time Signal Processing, Prentice Hall/Pearson.
2. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall of India Pvt. Ltd., 1997.
3. Emmanuel C. Ifeacher, Barry W. Jervis, Digital Signal Processing: A Practical Approach, Pearson Education 2004
4. Li Tan, DSP-Fundamentals & Applications, Elsevier, New Delhi, 2008
5. Roberto Cristi, Modern Digital Signal Processing, Cengage learning India pvt. Ltd.,2004,4th Indian reprint 2009, New Delhi

REFERENCE BOOKS:

1. Mitra S. K., Digital Signal Processing: A Computer Based Approach, Tata McGraw-Hill
2. B Venkataramani & M. Bhaskar, Digital Signal Processors-Architecture,3. Programming and Applications, Tata Mcgraw Hill
3. Dag Strannbby & William Walker, DSP & Applications. Elsevier, New Delhi, 2nd Ed. 2004
4. Vinay K Ingle, John G Proakis, DSP- A MATLAB based approach, Cengage learning India
5. Sen M. Kuo and Woon-Seng Gem, Digital Signal Processors, Pearson

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 503	DATABASE MANAGEMENT SYSTEMS	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To learn the modelling
- To design databases.
- To emphasis how to organize and maintain.
- To retrieve efficiently, and effectively -information from DBMS.
- To understand different modelling.

SYLLABUS:

MODULE I: **(9 hours)**

Introduction: - Characteristics of database approaches – Database Users- Advantages of using DBMS - Categories of Data Models-Schemas instance and Database Models-Three Schema architecture and Data Independence-Database languages and interfaces. Database modelling using Entity Relationship (ER) – Entity type, Entity Sets, Attributes and Keys. Relationship types, Relationship sets, roles and Structural constraints - Weak Entity Types.

MODULE II: **(10 hours)**

Enhanced Entity Relationship (EER)– Subclasses - Superclass and Inheritance - Specialization and Generalization. Relational data model - Relational model constraints and relational database schemas - Relational Algebra - Tuple relational calculus-Domain relational calculus - Relational database design using ER - ER-to-Relational mapping - Queries in SQL - DDL and DML- SQL views

MODULE III: **(11 hours)**

Relational Database Design: Different anomalies in designing a database, Normalization, Functional Dependency (FD), Armstrong's Axioms, Equivalence of FDs, minimal Cover. Normalization using functional dependencies, INF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions.

MODULE IV: **(11 hours)**

Multivalued dependencies and 4NF (general definitions) - Join dependencies and 5NF (general definitions). Physical Data Organization: Index structures - Single level ordered indexes, Multi-level indexes, Dynamic multilevel indexes using B tree and B+- Trees.

MODULE V: **(11 hours)**

Transaction processing: Desirable properties of transactions - Characterizing schedules based on Recoverability and Serializability - Concurrency control techniques-Twophase locking-Timestamp ordering - Granularity of data items and multiple granularity locking -Database recovery techniques - based on deferred update and immediate update - Shadow paging -ARIES recovery algorithm.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Explain the differences between database design and conventional programming.
- Develop in-depth understanding of databases.
- Optimize database performance in practice.
- Design ER-models to represent simple database application scenarios.
- Apply normalization to improve the database design.

TEXT BOOKS:

1. Elmasri & Navathe, Fundamentals Of Database Systems, Pearson Education, 2016, 7th Edition.
2. Avi Silberschatz ,Henry F. Korth ,S. Sudarshan, Database System Concepts,2016, 6th Edition.

REFERENCE BOOKS:

1. Christopher J. Date, An Introduction to Database Systems 8th Ed.
2. Héctor García-Molina, Jeffrey Ullman, and Jennifer Widom, Database Systems: The Complete Book 2nd Ed.
3. An Introduction to Database Systems – Bibin C. Desai, Galgotia Publications

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 504	SOFTWARE ENGINEERING	3-1-0-4

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the fundamental concepts of software engineering.
- To build an understanding on various phases of software development.
- To introduce various software process models.
- To understand different models.
- To implement software quality task.

SYLLABUS

MODULE I: Introduction **(12 hours)**

Introduction to Software Engineering - Software engineering ethics. **Software process models** - The waterfall model, Incremental development. Process activities - Software specification, Software design and implementation, Software validation, Software evolution. Boehm's Spiral Model - Case studies : An insulin pump control system. Mentcare - a patient information system for mental health care **.**

MODULE II: Requirement Analysis and Design **(11 hours)**

Functional and non-functional requirements, Software Requirements Specification Template, Feature identification. Design concepts - Design within the context of software engineering, Design Process, Design concepts, Design Model. Component level design - What is a component?, Designing Class-Based Components, Conducting Component level design, Component level design for web-apps.

MODULE III: Implementation and testing **(10 hours)**

Object-oriented design using the UML, Design patterns, Implementation issues - Cost impact of Software Defects, Code review and statistical analysis. Informal Review, Formal Technical Reviews, Software testing strategies - Unit Testing, Integration Testing, Validation testing, System testing, Debugging, White box testing, Path testing, Control Structure testing, Black box testing. Overview of DevOps and Code Management - Code management, DevOps automation -Software maintenance.

MODULE IV: Software Project Management **(10 hours)**

Software Project Management - Risk management, Managing people, Teamwork. Project Planning, Software pricing, Plan-driven development, Project scheduling, Agile planning - Estimation techniques, COCOMO cost modelling. Configuration management, Version management.

MODULE V: Software Quality **(10 hours)**

Software Quality, Software Quality Dilemma, Achieving Software Quality Elements of Software Quality Assurance, SQA Tasks, Software measurement and metrics. Software Process Improvement(SPI), SPI Process CMMI process improvement framework, ISO 9001:2000 for Software.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Identify suitable life cycle models to be used.
- Analyse a problem and identify and define the computing requirements to the problem.
- Translate a requirement specification to a design using an appropriate software engineering methodology.
- Formulate appropriate testing strategy for the given software system.
- Develop software projects based on current technology, by managing resources economically and keeping ethical values.

TEXT BOOKS:

1. Ian Sommerville, Software Engineering, University of Lancaster, Pearson Education, Tenth edition, 2015.
2. Roger S. Pressman, Software Engineering : A practitioner's approach, McGraw Hill publication, Eighth edition, 2014.

REFERENCE BOOKS:

1. K. K.Aggarwal and Yogesh Singh, Software Engineering, New age International Publishers, 2nd edition, 2005.
2. S.A. Kelkar, Software Project Management: A concise study, PHI, 3rd edition, 2012.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**.
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

ES24 505	Microprocessors & Microcontrollers	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To introduce knowledge about architecture, interfacing and programming with 8086 microprocessor and 8051 microcontroller.
- To design microprocessor-based system for relevant applications using peripheral ICs.
- To program the microcontroller.
- To design a system to perform an application.
- To understand concepts of various microcontrollers.

SYLLABUS:

MODULE I: (9 hours)

Brief history of Microprocessors, Von Neumann and Harvard architecture- Distinction between CISC and RISC computers Intel 8086 processor- Internal Architecture of 8086/8088microprocessors-Bus Interface Unit (BIU) and Execution Unit (EU) - Address space, Data organization, Registers, Memory segmentation and Addressing, Stack, I/O space.

MODULE II: (10 hours)

Hardware structure of 8086 microprocessor -Minimum and Maximum mode- Basic read and write machine cycle timing- Coprocessor and Multiprocessor configuration- Hardware organization of address space- Control signals and I/O interfaces- Memory devices, circuits and sub system design- Various types of memories, Memory address decoding – Interrupts Programming concepts- Assembly programming using instructions for data transfer, arithmetic, logical, shift and rotate operations and string manipulations - Procedures- Macros.

MODULE III: (12 hours)

I/O interfacing circuits - Hand shaking, Serial and Parallel interfacing- Address decoding Interfacing chips- Programmable peripheral interfacing (8255)- Internal block diagram-Modes of operation Programmable communication interface (8251)- Basics of serial communication. Internal block diagram of 8251- Programmable timer (8253)- Internal block diagram of 8253- Different Modes DMA controller (8237/8257)- Internal block diagram- Interrupt sequence for an 8086 based system Keyboard display interface (8279)- Keyboard Interface-Display interface

MODULE IV: **(10 hours)**

Microcontrollers: Introduction, Comparison between microprocessors and microcontrollers, Microcontroller families, 8051-features, architecture, memory organization, registers, I/O ports, pin configuration and functions Timer/counter concept, operating modes, Addressing modes, Instruction set, Interrupts in 8051: types, Serial communication: RS 232 interface, registers in UART, Modes of operation

MODULE V: **(10 hours)**

Assembly language programming examples for 8051 Interfacing: Interfacing (block schematic and assembly language programming) of DIP switch, stepper motor, ADC, DAC, LEDs and 7 segment displays, alphanumeric LCD module with 8051, Interrupt handling and programming, Programming examples for serial data transmission and reception

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

- Differentiate various processor architectures
- Describe hardware architecture and memory organization of 8086 and 8051.
- Write assembly language programs for 8086 and 8051.
- Design and develop 8086 systems using peripheral ICs.
- Develop systems using 8051 microcontroller.

TEXT BOOKS:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996

2. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.

3. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

4. Lyla B Das, “Microprocessors and microcontrollers”, Pearson education, India 2011

REFERENCE BOOKS:

1. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 506	COMPUTER NETWORKS	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To familiarize with the basic taxonomy.
- To understand terminology of computer networking.
- To introduce the major concepts involved in WAN, LAN and Wireless LAN
- Understand layers and its network functionalities.
- Familiarization with the protocols used in the layered architecture.

SYLLABUS:

MODULE I: (10 hours)

Introduction - Uses of computer networks, **Network hardware –** LAN, MAN, WAN, Wireless LAN, **Network software** - Protocol hierarchies – Design issues for layers, Connection oriented and connectionless services - **Reference models** – The OSI reference model, The TCP/IP reference model, Comparison of OSI and TCP/IP reference models.

MODULE II: (10 hours)

Medium Access Control (MAC) sublayer –Channel allocation problem – Static allocation, Dynamic allocation, **Ethernet** – Standard Ethernet, Fast Ethernet, Gigabit Ethernet, **Wireless LANs** - 802.11 architecture, MAC sublayer, Addressing Mechanisms, Physical layer, **Bluetooth** – Architecture, Layers in the Bluetooth: Radio layer, baseband layer, L2CAP

MODULE III: (11 hours)

IPv4 - Addresses - Classless and Classfull Addressing, Subnetting, Supernetting, **IPV6-** Address space - **Routing protocols** - Distance Vector Routing - RIP, Link State Routing - OSPF – Path vector routing – BGP, **Address Mapping** – ARP, RARP, DHCP - **ICMP** – Message types.

MODULE IV: (11 hours)

User Datagram Protocol – User Datagram, UDP Operation. **Transmission Control Protocol** – TCP services, TCP segment, TCP connection, Flow and Error control. **Congestion Control** – Open loop, Closed loop. **Quality-of-Service** - Flow characteristics, Techniques to improve QoS.

MODULE V: **(10 hours)**

Domain Name System: Domain Name Space, Distribution of name space, Types of records.

E Mail: Architecture, User agent: SMTP, Message transfer agent, Message access agent: POP, IMAP, File Transfer Protocol.

World Wide Web: Architecture, web documents, **Hypertext Transfer Protocol** – HTTP transaction

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Conceptualize all the OSI Layers
- Familiar with wireless networking concepts
- Understand different routing algorithms
- Differentiate between connection oriented and connection less services of transport layer.
- Understand the protocols and devices used in different layers

TEXT BOOK:

1. A. S. Tanenbaum , Computer Networks, 4th Edition, PHI (Prentice Hall India).

REFERENCE BOOKS:

1. Kevin R. Fall, W. Richard Stevens, TCP/IP Illustrated, Volume 1, 2011
2. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, UNIX Network Programming: The Sockets Networking API, Volume 1
3. William Stallings, Data and Computer Communications, Prentice Hall, Sixth Edition, 2007
4. Douglas Comer, Internetworking with TCP/IP: Principles, protocols, and architecture, Prentice Hall,Vol. I, 2006
5. Martin W. Murhammer, TCP/IP Tutorial and Technical Overview, 6th Edition, Prentice Hall PTR, 1998

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

MINOR

ES24 507 A	DATA SCIENCE WITH PYTHON	0-0-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python.

SYLLABUS:

MODULE I: INTRODUCTION (10 hours)

Data Science: Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications – Data Mining – Data Warehousing – Basic Statistical descriptions of Data

MODULE II :DESCRIBING DATA (10 hours)

Types of Data – Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores

MODULE III :DESCRIBING RELATIONSHIPS (11 hours)

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean.

MODULE IV :PYTHON LIBRARIES FOR DATA WRANGLING (11 hours)

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables.

MODULE V DATA VISUALIZATION **(10 hours)**

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting – Geographic Data with Basemap – Visualization with Seaborn

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

- Define the data science process
- Understand different types of data description for data science process
- Gain knowledge on relationships between data
- Use the Python Libraries for Data Wrangling
- Apply visualization Libraries in Python to interpret and explore data

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications,2016.
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

REFERENCE BOOKS

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press,2014.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 507B	Digital System Design	0-0-0-3

PRE-REQUISITES: DIGITAL ELECTRONICS

COURSE OBJECTIVES:

- Able to simulate.
- Understand various Laws and theorems.
- Implement typical digital circuits.
- Implement Universal gates.
- Define various hazards.

SYLLABUS:

MODULE I: **(11 hours)**

Introduction to VHDL - Behavioural, Data flow and structural description -Identifiers, Data objects, Data types, Delay models -Transport vs Inertial Delay – Sequential Processing - Process Statement - Signal Assignment vs Variable Assignment - Assert and report statements - Subprograms and functions- Packages - Predefined Attributes - Configurations- Subprogram Overloading - VHDL synthesis - Design Examples.

MODULE II: **(10 hours)**

Combinational logic design-analysis procedure-design procedure-documentation-block diagram-gate symbols-signal names and active levels-bubble to bubble logic design-schematic structures. Circuit timing-timing diagrams- propagation delay- timing specifications. Impediments to Synchronous design: Clock Skew, Gating the clock, Asynchronous inputs Synchronizer Failure and Metastability Timing hazards: Static Hazards, Dynamic Hazards, Designing hazard free circuit

MODULE III: **(12 hours)**

Synchronous sequential circuit-synthesis- mealy and moore models-state diagram-state table- state assignment-serial adder example-state minimisation procedure, partitioning and merging procedure -design of counter, arbiter. Asynchronous sequential circuit – Asynchronous Behaviour-Analysis of asynchronous circuits-examples.

MODULE IV: **(10 hours)**

Designing with Programmable devices: Programmable Logic Arrays- Programmable Array Logic sequential-combinational PLDs (Eg: PAL14L4 &PAL12H6), Sequential PLDs (Eg: PAL16R4)- Simple PLDs (Eg: 22V10)- Complex Programmable Logic Devices (Eg: XC9500)- Field Programmable Gate Arrays (Eg: XC 4000 & FLEX 10K.

MODULE V: **(9 hours)**

Introduction to Testing and Diagnosis Digital System Testing: Fault models – fault equivalence – fault location- fault dominance - single and multiple stuck faults -Design for Testability: Design for Testability: Ad-hoc design for testability techniques - Classical scan designs - Boundary scan standards - Built-in-self-test.

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

- Design any circuit using VHDL
- Describe the procedure for designing combinational circuits
- Design any type of state machines.
- Explain FPGA and its relevance in modern circuit implementation.
- Find the faults, errors and the importance of testing digital circuits

TEXT BOOKS:

1. J. Bhasker, A VHDL Primer, Pearson Education, 2000.
2. Stephen Brown & Zvonko Vranesic, Fundamentals of Digital Logic with VHDL design, Tata McGraw Hill.

REFERENCE BOOKS:

1. John F Wakerly, Digital Design Principles and Practices, Pearson Education, Fourth Edition.
2. Douglas L Perry, VHDL: Programming by example, Mc Graw Hill, Fourth Edition.
3. Charles H Roth, Jr, Lizy Kurien John, Digital Design using VHDL Cengage Publishers, India Second Edition

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 508(P)	DATABASE MANAGEMENT SYSTEMS LAB	0-0-3-1

PRE-REQUISITES: DATABASE MANAGEMENT SYSTEMS

COURSE OBJECTIVES:

- To familiarize issues related to database design through hands-on practice
- To understand data definitions.
- To define data manipulation commands.
- To learn the use of database stored procedures.
- To be familiar with the use of a frontend tool.

SYLLABUS:

List of Exercises / Experiments

(Minimum of 8 mandatory)

1. Implementation of **DDL commands** of SQL with suitable examples
   a) Create table
   b) Alter table
   c) Drop Table
2. Implementation of **DML commands** of SQL with suitable examples
   a) Insert
   b) Update
   c) Delete
3. Implementation of **different types of function** with suitable examples
   a) Number function
   b) Aggregate Function
   c) Character Function
   d) Conversion Function
   e) Date Function
4. Implementation of **different types of operators** in SQL
   a) Arithmetic Operators
   b) Logical Operators
   c) Comparison Operator
   d) Special Operator
   e) Set Operation

5. Implementation of **different types of Joins**
    a) Inner Join
    b) Outer Join
    c) Natural Join
6. Study and implementation of
    a) Group By & having clause
    b) Order by clause
    c) Indexing
7. Study and implementation of
    a) Sub queries
    b) Views
8. Study & implementation of **different types of constraints**.
9. Study and Implementation of database
    a) Backup & Recovery Commands.
    b) Rollback, Commit, Save point.
10. Implement
    a) Creating Database/ Table Space
    b) Managing Users: - Create User, Delete User
    c) Managing Passwords
    d) Managing roles: - Grant , Revoke

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Understand the use of data definitions and manipulation commands.
- Implement Views and indexes
- Design database applications using stored procedures
- Design database applications using stored procedures
- Understand Database Connectivity with front end tools
- Implement case study using real life database applications.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

End Semester Practical Examination (Maximum Marks-100)

70% - Algorithm, coding, compiling and executing, result and inference

20% - Viva voce

10% - Fair record

ES24 509(P)	MICROCONTROLLERS LAB	0-0-3-1

PRE-REQUISITES: MICROPROCESSOR & MICROCONTROLLER

COURSE OBJECTIVES:

- To understand Assembly Language programming of Microcontroller.
- To interface simple peripheral devices to a Microcontroller.
- To equip student groups to design.
- To understand various programmes.
- To implement simple embedded systems.

List of experiments
(A minimum of 10 experiments must be conducted)

1. 8086 kit familiarization and basic experiments.
2. Programming exercise using BCD and Hexadecimal numbers
3. Programming exercise: sorting, searching and string
4. Interfacing with A/D and D/A converters
5. Interfacing with stepper motors
6. IBM PC programming: Basic programs using DOS and BIOS interrupts
7. Interfacing with PC: Serial communication and Parallel printer interfacing
8. Interfacing with 8255 - Programmable Peripheral Interface.
9. Interfacing with 8279 - keyboard and display.

8051 Experiments

1. Familiarization of 8051.
2. Basic experiments of 8051 - addition of two 8-bit numbers, subtraction of two 8 bit numbers, multiplication and division.
3. Parallel interfacing I/O ports (Matrix keyboards)
4. Serial communication with PC
5. Parallel interfacing –LCD
6. Interfacing with serial EEPROM

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

- Perform arithmetic operations using 8086/8051 assembly language programming.
- Implement logical operations using 8086/8051 assembly language programming
- Implement string instructions using 8086/8051 assembly language programming
- Demonstrate sorting operations and using assembly language
- Interface 8086/8051 with peripheral devices.

Internal Continuous Assessment (Maximum Marks-50).
60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

Semester-end Practical Examinations (Maximum Marks-100).
10% - Record of works done

20% - Viva voce

70% - Procedure and tabulation form, Conducting experiment, results and inference

SEMESTER - 6

ES24 601	DESIGN AND ANALYSIS OF ALGORITHMS	3-1-0-3

PRE-REQUISITES: DATA STRUCTURES AND ALGORITHMS

COURSE OBJECTIVES:

- To analyse given algorithm and express its time and space complexities in asymptotic notations
- To derive recurrence equations and solve it using Recurrence Tree, Substitution and Master's method to compute time complexity of algorithms
- Illustrate graph traversal algorithms and applications and advanced data structures like AVL trees and Disjoint set operations.
- To demonstrate Divide-and-conquer, Greedy Strategy, dynamic programming, branch-and bound and backtracking algorithm design techniques.
- To familiarize about different complexity classes.

SYLLABUS:

MODULE I: Introduction **(10 hours)**

Characteristics of Algorithms:Criteria for Analysing Algorithms, Time and Space Complexity - Best, Worst and Average Case Complexities, Asymptotic Notations - Big-Oh (O), Big- Omega (Ω), Big-Theta (Θ), Little-oh (o) and Little- Omega (ω) and their properties. Time and Space complexity calculation of simple algorithms.

Analysis of Recursive Algorithms: Recurrence Equations, Solving Recurrence Equations – Recursion Tree Method, Substitution method and Master's Theorem (Proof not required)

MODULE II: Advanced Data Structures **(12 hours)**

Self-Balancing Tree - AVL Trees (Insertion and deletion operations with all rotations in detail, algorithms not expected); Disjoint Sets- Disjoint set operations, Union and find algorithms.DFS and BFS traversals - Analysis, Strongly Connected Components of a Directed graph, Topological Sorting.

MODULE III: Divide & Conquer and Greedy Strategy **(10 hours)**

Divide and conquer – Strassen's algorithm, Merge sort – Analysis of merge sort.

Greedy Strategy- Fractional Knapsack Problem, Minimum cost spanning tree computation-Kruskal's algorithm - analysis, Single source shortest path algorithm - Dijkstra's algorithm-analysis.

MODULE IV: Dynamic Programming, Back Tracking and Branch & Bound (10 hours)

Matrix Chain Multiplication - analysis, All pairs shortest path algorithm - Floyd-Warshall algorithm-analysis. Back Tracking – The N Queen's Problem Branch and Bound Algorithm – Method - Travelling Salesman Problem.

MODULE V: Complexity Theory (10 hours)

Complexity Classes – P, NP, NP- Hard and NP-Complete classes- NP Completeness proof of Clique Problem and Vertex Cover Problem- Approximation algorithms- Bin Packing, Graph Coloring, vertex cover, TSP, Set covering problem.

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

- Analyse the worst-case and average case running times of algorithms using asymptotic analysis.
- Understand the concept of divide and conquer technique , advanced data structures.
- Understand the dynamic-programming paradigm and its algorithmic design situations.
- Familiarize the greedy design technique and the concepts backtracking and branch and bound
- Familiarize with different complexity classes, approximation algorithms and the benefit of using them.

TEXT BOOK:

1. Corman T.H, Lieserson C.E & Rivest R.L, Introduction to Algorithms, Third Edition, Prentice Hall India.

REFERENCE BOOKS:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd Edition, Pearson
2. Alan Van Gelder, Sara Baase," Computer Algorithms- Introduction to design and analysis", 3rd Edition, 2004.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 602	WEB AND INTERNET TECHNOLOGY	3-1-0-3

PREREQUISITE: Nil

COURSE OBJECTIVES:

- To empower students with a comprehensive grasp of web development fundamentals, integrating HTML, XML and CSS.
- To impart the design, development and implementation of dynamic web pages.
- To develop programs for the Web using Scripting Languages.
- To introduce the algorithms and protocols implemented to have human interaction with the internet.
- To provide students with a thorough understanding of multimedia networking applications and network security.

SYLLABUS:

MODULE I: **(11 hours)**

Introduction to Web programming: Origins and Evolution of HTML and XHTML, Basic Syntax of HTML, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, HTML Vs XHTML – XML – HTML Vs XML – Creating XML documents– Introduction to CSS Frameworks.

MODULE II: **(11 hours)**

Introduction to JavaScript: Overview of JavaScript, Object Orientation and JavaScript, Introduction to scripting, General Syntactic Characteristics, Primitives, Operations and Expressions, Screen Output and Keyboard input, Control Statements, Object Creation and Modification, Arrays, Functions.

MODULE III: **(10 hours)**

PHP: PHP - Defining PHP variables, variable types, operators, arrays, strings, and control flow constructs in PHP, Function, creating a Function, Function Libraries, GET and POST methods - Establishing connection with MySQL database

MODULE IV: **(10 hours)**

Network Applications - Client-Server interaction - Socket Interface - Connection Oriented Service - Simple Client and Server example - Domain Name System - Electronic Mail Representation and Transfer - VoIP - File Transfer and Remote File Access - RPC and Middleware - Initialization.

MODULE V: (10 hours)

Multimedia networking - applications - streaming stored audio and video – internet telephony – RTP – scheduling and policing mechanisms – integrated services – RSVP –differentiated services – network management – the internet network management framework – network security – integrity, Access control attacks & control measures.

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

- Develop interactive web pages using HTML/XHTML.
- Present a professional document using Cascaded Style Sheets.
- Construct websites for user interactions using JavaScript.
- Develop web applications using PHP.
- Get a basic idea of multimedia networking.

TEXT BOOKS:

1. P. J. Deitel, H.M. Deitel, Internet & World Wide Web How to Program, 4/e, Pearson International Edition 2010.
2. Robert W. Sebesta, Programming with World Wide Web, 4th edition, Pearson Education, 2009.
3. Douglas E. Comer, Computer Networks and Internets with Internet Applications – Pearson Education.

REFERENCE BOOKS:

1. Greenlaw R. &HeppE. In-line / On-line: Fundamentals of the Internet and the World Wide WebTata McGraw Hill.
2. Kurose J.F. & Ross K.W, Computer Networking: A Top -Down Approach Featuring the Internet Pearson Education.
3. Nalin K. Sharda, Multimedia Information Networking – Prentice Hall of India.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

ES24 603	VLSI DESIGN	3-1-0-3

PRE-REQUISITES: ELECTRONIC DEVICES & ANALOG CIRCUITS

COURSE OBJECTIVES:

- To learn basic CMOS Circuits
- To learn CMOS process technology
- To understand various memory elements.
- To implement various MOS circuits
- To apply various circuits in our day today life.

SYLLABUS:

MODULE I **(12 HOURS)**

Short and narrow channel effects in MOS transistor– subthreshold conduction–body effect channel length modulation- drain induced barrier lowering-hot carrier effects-velocity saturation of charge carriers. Scaling of MOS Transistor-constant voltage and constant field scaling. MOS inverters-resistive load, Saturated NMOS load, Depletion NMOS load, pseudo-MOS-CMOS inverters-robustness and performance–capacitance components-charge sharing– power dissipation.

MODULE II **(9 HOURS)**

Combinational circuits using static CMOS logic style -Design & implementation of Adder–Full adder, Dynamic adder, Carry bypass adder, Carry select adder, Square root carry select adder, Carry look ahead adder-Multipliers, array multipliers-Multiplexers-Memory elements- SRAM, DRAM, ROM, Sense amplifiers–Differential, Single ended

MODULE III **(11 HOURS)**

Wafer processing–diffusion- Fick's Law–analytic solutions for pre-deposition and drive-diffusion–Oxidation–Deal-Grove model–Ion implantation-vertical and lateral projected ranges-channelling-stopping power–Optical lithography-optical exposures-modulation transfer function-proximity and projection printing. Photoresists-types-contrast curves- Etching-wet, plasma and ion etching Epitaxial growth–Physical vapor deposition, chemical vapor deposition, molecular beam epitaxy

MODULE IV **(11 HOURS)**

Device isolation - junction and oxide isolation–LOCOS-SILO-SWAMI process-trench isolation–silicon on insulator isolation- contacts and metallization Schottky contacts implanted ohmic contacts-alloyed contacts-refractory metal contact technology-multilevel metallization

MODULE V **(9 HOURS)**

Fabrication of nMOS transistor, pMOS transistor. CMOS- p well process, n well process, twin tub process-Stick diagram-layout of inverter, NOR and NAND gates-Introduction to PLDs and FPGAs, Design of PLAs.

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

- Summarize the secondary effects of MOS transistor and its impact
- Outline different MOS inverters and its performance parameters
- Elaborate static CMOS logic style in implementing logic circuits.
- Identify the various steps in IC fabrication.
- Express the layout of simple MOS circuit using Lambda based design rules

TEXT BOOKS:

1. Weste & Harris, CMOS VLSI Design, Pearson Education

2. Plummer, Deal & Griffin, Silicon VLSI Technology, Pearson Education

3. Rabaey J.M., Digital Integrated Circuits-A Design Perspective, Pearson Education

4. Weste & Eshraghian, Principles of CMOS VLSI Design, Addison Wesley

5. S K Gandhi, VLSI Fabrication Principles., John Wiley

6. Sung-MoKang & YusufLeblebici, CMOS Digital Integrated Circuits-Analysis & Design, McGraw Hill

7. Nagchoudari, Principles of Microelectronic Technology, Wheeler Publishing

REFERENCE BOOKS:

1. Yuan Taur & Ning T.H., Fundamentals of Modern VLSI Devices, Cambridge Univ. Press

2. Baker Li & Boyce, CMOS-Circuit Design, Layout &Simulation, PHI

3. Sze SM, VLSI Technology, McGraw Hill

4. Ken Martin, Digital Integrated Circuit Design, Oxford Univ. Press

5. Eshraghian & Pucknell, Essentials of VLSI Circuits & Systems, PHI

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A: *Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 604	OPERATING SYSTEMS	3-1-0-4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Gain a solid understanding of the fundamental concepts underlying operating systems, including process management, memory management, file systems, and I/O management.
- Learn about process creation, scheduling, synchronization, and communication.
- Learn about deadlock detection, prevention, and recovery strategies to ensure system stability and resource availability.
- Explore memory allocation techniques, including segmentation, paging, and virtual memory.
- Understand security threats, access control mechanisms, authentication, and encryption techniques.

SYLLABUS:

MODULE I: **(10 hours)**

Introduction- Definition– Operating System Structure - Operating System Operations - Process management- Memory Management- Storage Management- Protection and Security - OpenSource Operating Systems- Operating-System Services- User Operating-System Interface- System Calls- Types of System Calls-System Boot- System Debugging

MODULE II: **(10 hours)**

Processes - Process states, Process control block, threads, scheduling, Operations on processes Process creation and termination – Inter-process communication - shared memory systems, message passing systems, pipes. Threads - Overview - Multithreading Models - Threading issues.

Process Scheduling – Basic concepts - Scheduling criteria – CPU scheduling algorithms: First come First Served, Shortest Job First, Priority scheduling, round robin scheduling.

MODULE III: **(10 hours)**

Process synchronization- Race conditions – Critical section problem – Peterson’s solution, Synchronization hardware, Mutex Locks, Semaphores, Monitors – Synchronization problems - Producer Consumer, Dining Philosophers and Readers-Writer’s problem.

Deadlocks: Necessary conditions, Resource allocation graphs, Deadlock prevention, Deadlock Avoidance – Banker’s algorithm, Deadlock detection, Recovery from deadlock.

MODULE IV: **(12 hours)**

Memory Management: Concept of address spaces, Swapping, Contiguous memory allocation: Worst fit, Best fit, First fit - Fixed and variable partitions: MFT and MVT, Segmentation, Paging. Virtual memory, Demand paging, Page replacement algorithms: FIFO, LRU, Optimal.

MODULE IV: **(10 hours)**

File System: File concept - attributes, operations, types, structure – access methods. File-system implementation, Directory implementation. Allocation methods.

Storage Management: Magnetic disks, Disk structure, Disk scheduling: FCFS, SSTF, SCAN, C SCAN, C LOOK, Disk formatting.

Protection and Security- Protection - Goals of protection- Principles of protection- domain of Protection - access matrix-implementation of access matrix.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Demonstrate a solid understanding of the fundamental concepts, principles, and components of operating systems.
- Explain process creation, scheduling algorithms, synchronization mechanisms, and communication techniques.
- Understand memory allocation strategies, virtual memory concepts, and memory management techniques.
- Identify, analyse, and apply deadlock detection, prevention, and recovery techniques.
- Describe file system organization, file operations, directory structures, and various file access methods.

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, ' Operating System Concepts', 9th Edition, Wiley India 2015.

REFERENCE BOOKS:

1. Andrew S Tanenbaum, “Modern Operating Systems”, 4th Edition, Prentice Hall, 2015.
2. William Stallings, “Operating systems”, 6th Edition, Pearson, Global Edition, 2015.
3. Garry Nutt, Nabendu Chaki, Sarmistha Neogy, “Operating Systems”, 3rd Edition, Pearson Education.
4. D.M.Dhamdhere, “Operating Systems”, 2nd Edition, Tata McGraw Hill, 2011.
5. Sibsankar Haldar, Alex A Aravind, “Operating Systems”, Pearson Education.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 605(A)	ADVANCED DATA STRUCTURE	3-1-0-3

PRE-REQUISITES: DATA STRUCTURES AND ALGORITHMS

COURSE OBJECTIVES:

- To learn advanced concepts in data structures.
- Be exposed to searching, sorting and hashing algorithms.
- To understand various tree structures.
- To understand different graphs structures
- To implement various theorems.

SYLLABUS

MODULE I **(8 hours)**

Review of Basic Concepts: Abstract data types –List ADT- Doubly Linked Lists – Circularly Linked List - Application of linked lists - Debugging pointers - dangling pointers- memory leaks Recursion-Algorithm Analysis-Big Oh, Omega and Theta notations- Solving recurrence equations- Masters Theorem.

MODULE II **(13 hours)**

Trees: Binary Search Trees - Threaded binary trees -Splay trees - Amortized analysis - 2-3 trees- 2-3-4 trees - Red-black trees - B Tree - B+ Tree- AVL Trees - Randomized structures - Skip lists – Treaps.

MODULE III **(8 hours)**

Hashing: Collision Resolution: Separate Chaining: Open Addressing- Linear Probing- Quadratic Probing- Double Hashing- Rehashing- Universal Hash Functions. Pattern matching: Pattern matching algorithms- the Boyer –Moore algorithm, the Knuth-Morris Pratt algorithm.

MODULE IV **(10 hours)**

Graph Algorithms: DFS- BFS- Topological Sort- Bi-connected components- Cut verticesMatching- Network flow- Advanced Structures for Priority Queues and Their Extensions Binomial heaps- Leftist heaps -Skewed heaps- Fibonacci heaps and its application on dijkstra's algorithm.

MODULE V **(11 hours)**

External and internal sorting algorithms - Insertion Sort-Shell sort- Heap Sort-Merge Sort- Quick Sort- Radix Sort- Algorithm Analysis-Sorting Large Structures – Decision Trees- Memory Management - Managing Equal Sized Blocks – Garbage Collection Algorithms for Equal Sized Blocks – Storage Allocation for Objects with Mixed Sizes – Buddy Systems – Storage Compaction

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

- Extend the students knowledge of algorithms and data structures.
- Learn a variety of useful algorithms and techniques.
- Understand the differences types of tree structures.
- Analyse data structure impact on algorithms, program design and program performance.
- Select appropriate design techniques to solve real world problems.

TEXT BOOK:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, 2nd edition

REFERENCE BOOKS

1. Robert Kruse, C L Tondo, Bruce Leung, Shashi Mogalla, Data Structures And Program Design In C, Pearson Education.
2. Debasis Samanta, Classic Data Structures,2nd Edition, Prentice Hall.
3. Yedidyah Lansam, Moshe J. Augenstein, Aaron M. Tenenbaum, Data Structures Using C and C++, PHI.
4. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures.

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz,

literature survey, seminar, term-project etc.

10% - Attendance in the class.

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with choice to answer one question.

ES24 605(B)	POWER ELECTRONICS	3-1-0-3

PRE-REQUISITES: ELECTRONIC CIRCUITS and ELECTRONIC DEVICES

COURSE OBJECTIVES:

- To provide an insight on the concepts of Power Electronics.
- To compare between linear power supply and switched mode power supply.
- To study the applications of Power electronics
- To learn Switched mode regulators
- To define principles of inverters.

SYLLABUS:

MODULE I (11 HOURS)

Linear electronics Vs power electronics. Power diodes -basic structure and static and dynamic characteristics -various types -power transistors -BJT, MOSFET and IGBT –steady state and switching characteristics -Thyristors -basic structure -static and dynamic characteristics -device specifications and ratings -methods of turning on -gate triggering circuit using UJT -methods of turning off-commutation circuits -TRIAC, Power Integrated Circuits (PIC).

MODULE II (10 HOURS)

Line frequency phase-controlled rectifiers using SCR -single phase rectifier with R and RL loads -half controlled and fully controlled converters with continuous and constant currents -SCR inverters -circuits for single phase inverters -series, parallel and bridge

MODULE III (11 HOURS)

AC regulators -single phase ac regulator with R and RL loads -sequence control of ac regulators -cycloconverter - basic principle of operation. Isolated converters - Flyback, Forward and Push Pull-Waveforms and governing equations (Analysis not required).

Uninterruptible power supply- basic circuit operation -different configurations - characteristics and applications. Online and offline UPS

MODULE IV **(10 HOURS)**

Introduction to Switched mode regulators -buck regulators -boost regulators -buck-boost regulators, cuk regulators Waveforms and expression for output voltage, voltage and current ripple under continuous conduction mode-switched mode power supply -principle of operation and analysis -comparison with linear power supply.

MODULE V **(10 HOURS)**

Switched mode inverters- principle of PWM switching schemes. Single phase inverter- Half bridge, Full Bridge and Push pull (Analysis not required). Three phase inverter-Space vector modulation. Choppers -principle of operation -step-up and step-down choppers -speed control of DC motors and induction motors.

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

- Explain basic operation and compare performance of various power semiconductor devices, passive components and switching circuits
- Describe the operation of power diodes and transistors.
- Illustrate the working of rectifiers, inverters and power supplies.
- Summarize the basic circuit operation of regulators and choppers.
- Analyse power converter circuits and learn to select suitable power electronic devices by assessing the requirements of application fields.

TEXT BOOKS

1. Mohan N and T.M Undeland, Power Electronics: Converters, Applications and

Design, John Wiliey.

2. Umanand L., Power Electronics Essentials and Applications, Wiley India 2015

3. Rashid M.H.,Power Electronic Circuits, Devices and Applications, Prentice Hall

India, Third edition, New Delhi

4. Mandal, Power Electronics 1e, McGraw Hill Education, India,2014

REFERENCE BOOKS

1. Sen PC, Power Electronics., Tata McGraw Hill

2. Dubey et. al. G.K., Thyristorised Power Controllers. Wiley Eastern Ltd.

3. Dewan & Straughen, Power Semiconductor Circuits, John Wiley

4. Singh M.D. & Khanchandani K.B., Power Electronics, Tata McGraw Hill

5. Lander C.W., Power Electronics, McGraw Hill

6. Sen P.C., Modern Power Electronics, Wheeler Publishers

Internal Continuous Assessment *(Maximum Marks-50).*

60% - Tests (minimum 2).

30% -Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern *(Maximum Marks-100).*

PART A: Analytical/problem solving SHORT questions **10 x 5 marks= 50 marks** Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks** Two questions from each module with choice to answer one question.

ES24 605(C)	ELECTRONIC INSTRUMENTATION	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To provide an insight on configuration of instruments
- To understand the characteristics of instruments.
- To impart knowledge in the area of measurement principles and standards
- To learn operation, performance.
- To implement the applications of measuring instruments used in electronics laboratories.

SYLLABUS:

MODULE I: **(10 hours)**

Generalized configurations of Instruments- Functional element, Analog and Digital modes, Null and deflection methods, Methods of correction. Classification of instruments. Static and Dynamic characteristics of instruments- Calibration, accuracy, precision, bias, sensitivity, linearity, threshold, resolution, hysterisis and dead space. Measurement errors- various types. Measurement standards and calibration.

MODULE II: **(10 hours)**

Potentiometers: General Principle- Direct Current Potentiometer- AC potentiometer-Application of DC and AC potentiometers. Bridges: Wheatstone "s bridge – Kelvin's Double Bridge - Carry Foster Slide Wire Bridge - Bridge Current Limitations – Maxwell's bridge- Schering bridge- Anderson's bridge and Wein's bridge (Analysis included for all bridges).

MODULE III: **(12 hours)**

Analog to digital converters-Tracking, successive approximation, charge distribution, flash, sub ranging, and integrating type ADCs. Digital to analog converters-weighted resistor, weighted capacitor, potentiometric, and R-2R ladder type DACs. Bipolar DACs, Master slave DACs. Performance specifications of ADCs and DACs. Transducers: Resistance Transducer-Principle of operation-Strain Gauge. Inductive transducer-LVDT. Capacitive Transducers-Capacitor microphone, Hall effect transducer, Proximity transducer

MODULE IV: (10 hours)

Cathode ray oscilloscope (review), Special purpose oscilloscopes- delayed time- base, analog storage, sampling oscilloscopes. Digital storage oscilloscopes- working principle and applications. Graphic Recording Instruments: strip chart recorder, X-Y recorder, Plotter. Signal generators – low frequency signal generators, function generator, pulse, RF signals, sweep generators, Frequency synthesizer

MODULE V: (10 hours)

Liquid crystal display (LCD). Waveform analysing instruments: Distortion meter, Spectrum analyser, Digital spectrum analyser, Q meter, Watthour meter, Power-factor meter, Instrument transformers, Thermocouple instruments, Peak response voltmeter, True RMS meter, Electronic multimeter, Digital voltmeter, Spectrum analyser

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

- Impart knowledge in the area of measurement principles
- Explain the basic principle of potentiometer and various bridge circuits.
- Introduce the fundamental concepts of transducers and analog to digital converters.
- Describe the basic working principle of signal recording devices and signal generators.
- Summarize the operation of frequency analyzing device.

TEXT BOOKS:

1. D A Bell, Electronics Instrumentation and Measurements, Prentice Hall of India, Delhi.
2. S. Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata Mc-Graw Hill, New Delhi, 2003 (for ADCs and DACs only)
3. J. J. Carr, Elements of Electronic Instrumentation and Measurements, 3rd ed., Pearson Education, Delhi, 2003
4. Sawhney AK, A course in Electrical and Electronic Measurements & instrumentation, Dhanpat Rai

REFERENCE BOOKS:

1. E. O. Doebelin, Measurement Systems: Application and Design, 4th ed., McGraw-Hill, New York, 1990
2. A.D. Helfrick and W. D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Pearson Education, Delhi, 1992
3. J. P. Bentley, Measurement Systems, Pearson Education, Delhi, 2003

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

ES24 605(D)	CYBER LAW & ETHICS	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To provide the concepts of cyber law and ethics.
- To gain knowledge about computer contracts, crime and data protection.
- To understand about intellectual property rights.
- To learn various corporate policies.
- To outline Professional and social issues of information and communications.

SYLLABUS:

MODULE I: (10 hours)

Computers and intellectual property– Introduction to Computer Security– Definition– Threats to security–Government requirements– Information Protection and Access Controls–Computer security efforts–Standards–Computer Security mandates and legislation– Privacy considerations–International security activity.

MODULE II: (11 hours)

Computer contracts– Contracts for writing software-–License agreements for "off-the-shelf" software–Contract between software author and publisher–Hardware contracts–Information security policies and procedures–Corporate policies–Tier 1–Tier 2 and Tier3 policies.

MODULE III: (11 hours)

Computers and crime– Introduction- Computer fraud- Hacking - Unauthorized access to computer material-Unauthorized modification of computer programs or data- Miscellaneous offences-information security: fundamentals - Employee Responsibilities-information classification- Information handling Tools of information security

MODULE IV: (10 hours)

Data Protection- Outline of the Data Protection Act 1984- Exemptions from and enforcement of the Data Protection Act 1984- Summary of Data Protection Law - Overview of intellectual property rights-Copyright basics- Computer-generated works- The law of confidence-Patent law.

MODULE V: **(10 hours)**

Professional and social issues of information and communications technology- Information Processing-secure program administration. Information and communication technology crime-The computer professional- Privacy, freedom and the impact of ICT on the society.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Get a clear insight into the different cyber laws and ethics.
- Understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.
- Learn the rights and responsibilities as an employee and a team member.
- Develop in-depth understanding data protection, professional and social issues of information and communications technology.
- Get in depth knowledge about Computers and crime & contracts.

TEXT BOOKS:

1. D. Bainbridge, Introduction to Computer Law, 5/e, Pearson Education, 2004.
2. Debby Russell and Sr. G. T Gangemi, Computer Security Basics (Paperback), 2nd Edition, O Reilly Media, 2006.
3. Thomas R. Peltier, Information Security policies and procedures: A practitioner’s reference, 2nd edition Prentice Hall, 2004.

REFERENCE BOOKS:

1. Harish Chander, Cyber Laws and IT Protection, PHI Learning Private Limited, 2012.
2. P. Duggal, Cyber law: The Indian Perspective, Saakshar Law Publications, Delhi, 2005.
3. C. P. Fleeger and S. L. Fleeger, Security in Computing, 3/e, Pearson Education.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 605(E)	EMBEDDED SYSTEM	3-1-0-3

PRE-REQUISITES: MICROPROCESSOR & MICROCONTROLLER

COURSE OBJECTIVES:

- Outline the basic structure and design of an Embedded System
- Classify the different ways of communicating with I/O devices and standard I/O interfaces
- Demonstrate the programming concepts of Embedded Systems
- To study the basics of RTOS for Embedded systems.
- To understand the architecture of ARM processor and PIC microcontroller

SYLLABUS:

MODULE I: (12 hours)

Introduction to Embedded Systems: Characteristics of Embedded systems, Categories of Embedded System- Requirements of Embedded Systems, Challenges and Issues in Embedded Software Development, Role of processor selection in Embedded System (Microprocessor V/s Microcontroller), Software embedded into a system - Applications of Embedded Systems in Consumer Electronics, Control System, Biomedical Systems, Handheld computers, Communication devices.

MODULE II: (10 hours)

Real time operating systems: Services- Goals – Structures - Kernel - Process Management – Memory Management – Device Management – File System Organization. Task and Task States, tasks and data, Message queues-Timer Function- Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS. OS services. I/O subsystems. Network operating system. Real time embedded system OS. OS security- Real-Time Embedded Software Development.

MODULE III: (12 hours)

Microcontroller: PIC microcontroller- architecture- Internal registers and timer/Clock initialization, Interrupts, Basic programs. ARM processor- architecture – applications

MODULE IV: (8 hours)

Introduction to: assembler, compiler, cross compilers and Integrated Development Environment (IDE). Programming concepts of embedded programming- Features of Embedded C++ and Embedded Java (basics only). Software implementation, Testing, Validation and debugging, system-on-chip. Design Examples: Mobile phones, ATM machine, Set top box

MODULE V: (10 hours)

Embedded system development: Interfacing of external Memory. Interfacing Analog and digital blocks, interfacing of different peripheral devices such as LED, LCD, Graphical LCD, Switches, Relay, stepper motors, ADC, DAC and various sensors.

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

- Illustrate the concepts of embedded system, components and its applications.
- Describe the basics of RTOS.
- Categorize PIC microcontroller and ARM processor.
- Familiarize with the programming environment to develop embedded solutions.
- Summarize the requirements in embedded system development.

TEXT BOOKS:

1. Rajkamal ―Embedded Systems Architecture; Programming and Design‖; Tata McGraw Hill Publications., New Delhi, 3rd Wd. 200.

2. Sreve Heath Embedded system design,,, Elsevier, 2nd Ed. New Delhi, 2003

3. Steve Farber, ARM System –on-chip, Second Edition,2000 Pearson Education

4. K.J. Ayala, The 8051 Microcontroller, Penram International

5. J B Peatman, Design with PIC Microcontrollers, Prentice Hall

6. Dhananjay Gadre, Programming and Customizing the AVR Microcontroller, MGH

7. S. Furbur, ARM system Architecture, Addition wesley, 1996.

REFERENCE BOOKS:

1. Raj Kamal, Microcontrollers Architecture, programming, Interfacing and System Design, Pearson Education.

2. Dr K.V.K.K..Prasad, Embedded /Real-Time systems: Concepts, Design & Programming., DreamTech Publishers.,2004

3. Jonathan.W. Valvano, Embedded Microcomputer Systems, Real Time Interfacing, Published by Thomson Brooks/Col, 2002.

4. G.H. Miller, Microcomputer Engineering, 3d edition, Pearson Education.

5. Louis L. Odette, Intelligent Embedded Systems Addison-Wesley, 1991

6. Microchip Manual for PIC 18F 452

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 605(F)	Network & Linear Control System	3-1-0-3

PRE-REQUISITES: Network Theory & Linear Control System

COURSE OBJECTIVES:

- To study Automate processes to reduce manual intervention and increase efficiency.
- To identify system performance, efficiency, and productivity.
- To ensure reliable operation and detect faults or errors.
- To modify and expand system.
- To provide user-friendly interfaces for monitoring and controlling systems or processes.

SYLLABUS:

MODULE I **(8 Hours)**

Introduction to Electrical Circuits Circuit concept – Types of elements - source transformation-voltage - current relationship for passive elements. Network reduction techniques: series, parallel, series parallel, examples, time and frequency domain analysis of RLC circuits.

MODULE II **(10Hours)**

Introduction to control systems Basic components of a control system, types of control systems, examples of control systems, effect of feedback systems, Laplace Transforms, transfer function, modelling of electrical networks, block diagram reduction, signal flow graphs.

MODULE III **(12 Hours)**

Modelling of mechanical systems Translational and rotational systems, transfer function for typical mechanical systems, analogous systems–force voltage & force-current analogy, impulse response and its relation with transfer function.

MODULE IV **(10 Hours)**

Transient and steady-state response, standard test signals, type and order of systems, concept of poles and zeros, time response of first and second order systems to unit impulse and step input, time domain specifications, Steady-state response, steady state error, static and dynamic error coefficients.

MODULE V **(10 Hours)**

Stability of linear control systems Concept of stability, methods of determining stability, Routh's Hurwitz criterion, Root locus - construction of root locus, effect of addition of poles and zeros on root locus. Frequency response analysis: Frequency domain specifications, stability from Bode plots, relative stability, gain margin and phase margin, introduction to lead, lag and lead-lag compensating networks (excluding design).

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

- Understanding and application of the fundamentals of electrical circuits, their elements and network reduction techniques.
- Analysis and modelling of mechanical systems using translational and rotational systems, along with the understanding of force voltage & force-current analogy.
- Implementing techniques to ensure the stability of linear control systems; using the Routh's Hurwitz criterion, Root locus method and frequency response analysis.
- Understand and model control systems using Laplace Transforms and transfer functions to analyze electrical networks and control systems structures.
- Apply poles and zeros concept, analyze first and second order systems, and compute static and dynamic error coefficients within time domain analysis of feedback control systems.

TEXT BOOKS:

1. Ravish R. Singh: Network Analysis and Synthesis, 2/e, McGraw Hill Education, 2019
2. Farid Golnaraghi, Benjamin C. Kuo, Automatic Control Systems, 9/e, Wiley India.
3. M. Gopal, Control Systems, 4/e, McGraw Hill Education India Education,

REFERENCE BOOKS:

1. Norman S. Nise, Control System Engineering, 5/e, Wiley India
2. Richard C Dorf and Robert H. Bishop, Modern Control Systems, 9/e, Pearson Education,2001.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A**: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B**: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks

Two questions from each module with choice to answer one question.

ES24 606 (A)	IPR and Patenting	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To introduce fundamental aspects of Intellectual property Rights.
- To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
- To understand knowledge on trademarks and registration aspects
- To Design, Geographical Indication (GI), Plant Variety and Layout
- To aware about current trends in IPR and Govt. steps in fostering IPR

SYLLABUS:

MODULE I **(10 Hours)**

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge

MODULE II **(9 Hours)**

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

MODULE III **(10 Hours)**

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

MODULE IV **(10 Hours)**

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non-Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

MODULE V **(10 Hours)**

Design- meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection, Geographical Indication (GI)-meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

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

- Complete their academic projects
- Get an adequate knowledge on patent
- Develop their idea or innovations
- Catch up Intellectual Property (IP) as a career option
- Guide Government Jobs & Patent Examiner

TEXT BOOKS:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.

2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

REFERENCE BOOK:

1.Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions,
quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A**: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE
questions from each module with total FIFTEEN questions.

PART B**: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks

Two questions from each module with choice to answer one question.

ES24 606 (B)	E-Farming	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To introduce students to the holistic concept organic farming as a system
- To identify living ecosystems
- To acquaint students with cultural production practices
- To analyse organic farming
- To understand E farming

SYLLABUS

MODULE I **(10hours)**

Scope of horticultural. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties, Judging maturity time for harvesting of crop; Study of seed viability and germination test.

MODULE II **(10 hours)**

Criteria for site selection, layout and planting methods, nursery raising, commercial varieties/hybrids. sowing and planting times and methods, seed rate and seed treatment for vegetable crops; Identification and description of important fruits, flowers and vegetable crops.

MODULE III **(10 hours)**

Macro and micro propagation methods, plant growing structures, pruning and training, crop coefficients, water requirements and critical stages, Preparation of nursery bed; Practices of pruning and training in some important fruit crops.

MODULE IV **(10 hours)**

Fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, postharvest practices, Garden tools,Study of different garden tools; cultural operations for vegetable crops (sowing, fertilizer application, mulching, irrigation and weed control).

MODULE V **(8hours)**

Management of orchard, Extraction and storage of vegetables seeds. Major pests and diseases and their management in horticulture crops.seed extraction techniques; identification of important pests and diseases and their control, visit to commercial greenhouse/ polyhouse

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

- Maximize yields, minimize inputs, reduce environmental impact.
- Improve overall farm management.
- Identify a transformative shift in agriculture, enabling farmers to embrace data-driven strategies
- Understand technology to enhance their productivity
- Understand technology to enhance their profitability.

TEXT BOOKS

1. Bansal. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi.
2. Saraswathy, S., T.L.Preethi, S.Balasubramanyan, J. Suresh, N.Revathy and S.Natarajan. 2007.

REFERENCE BOOKS:

1.Postharvest management of Horticultural Crops. Agrobios Publishers, Jodhpur.

2.Arjunan, G., Karthikeyan, G, Dinakaran , D. and Raguchander, T. 1999. Diseases of Horticultural Crops. AE Publications, Coimbatore.

3.Sharma Neeta and Mashkoor Alam. 1997. Postharvest diseases of Horticultural crops. International Book publishing Co. UP.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 606(C)	PCB Fabrication	3-1-0-3

PRE-REQUISITES: Knowledge of analog and digital circuits.

COURSE OBJECTIVES:

- Understand the need for PCB Design and
- Understand the steps involved in PCB Design
- Fabrication process.
- Familiarize Schematic and layout
- Design flow using Electronic Design Automation (EDA) tools.

SYLLABUS:

MODULE I **(9 Hours)**

Introduction to PCB -Definition and Need/Relevance of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design

MODULE II **(8 Hours)**

Different Electronic design automation (EDA) tools and comparison. **PCB Design Process** -PCB Design Flow, Placement and routing, Steps involved in layout design. Transmission Line: Transmission lines and its effects Significance of Transmission line in Board design Types of Transmission lines.

MODULE III **(9 Hours)**

Artwork generation Methods - manual and CAD General design factor for digital and analog circuits, Layout and Artwork making for Single-side, double-side and Multilayer Boards, Design for manufacturability, Design-specification standards

MODULE IV **(9 Hours)**

Introduction to PCB Fabrication & Assembly- Steps involved in fabrication of PCB. PCB Fabrication techniques-single, double sided and multilayer, Etching: chemical principles and mechanisms, Post operations- stripping, black oxide coating and solder masking, PCB component assembly processes

MODULE V **(7 Hours)**

Schematic Design, Layout Design, Create new schematic components, Create new component footprints

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

- Appreciate the necessity and evolution of PCB, types and classes of PCB.
- Understand the steps involved in schematic, layout, fabrication and assembly process of PCB design.
- Understand basic concepts of transmission line.
- Design (schematic and layout) PCB for analog circuits, digital circuits and mixed circuits.
- Design (schematic and layout) and fabricate PCB for simple circuits.
- At the end of the course, the students will be able to attain the following COs

TEXT BOOKS:

1. R. S. Khandpur Printed Circuit Boards: Design, Fabrication, and Assembly (McGraw-Hill Electronic Engineering)

REFERENCE BOOKS:

1. Printed Circuit Board by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi

2. Electronic Product Design Volume-I by S D Mehta, S Chand Publications

3. Open-source EDA Tool

4. PCB Fabrication user guide page: http://www.wikihow.com/Create-Printed-Circuit-Boards , http://www.siongboon.com/projects/2005-09-07_home_pcb_fabrication/ , http://reprap.org/wiki/MakePCBInstructions#Making_PCBs

Internal Continuous Assessment *(Maximum Marks-50).*
70% - Tests (minimum 2)
20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.
10% - Attendance and Regularity in the class.
University Examination Pattern (*Maximum Total Marks- 100*).
PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***
Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.
PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***
Two questions from each module with choice to answer one question.

ES24 606 (D)	**Waste Management and Upcycling**	**3-1-0-3**

PRE-REQUISITES: Environmental Science

COURSE OBJECTIVES:

- To study about waste treatment
- To use research-based knowledge and research methods
- Learn broader understandings on various aspects of solid waste management practiced in industries
- Learn recovery of products from solid waste
- To Create, select, and apply appropriate techniques, resources, modern engineering and IT tools

SYLLABUS:

MODULE I – INTRODUCTION TO SOLID WASTE MANAGEMENT **(**10 hours)

Classification of solid wastes (source and type based), solid waste management (SWM), elements of SWM, ESSWM (environmentally sound solid waste management) and EST (environmentally sound technologies), factors affecting SWM, Indian scenario, progress in MSW (municipal solid waste) management in India. Indian and global scenario of e-waste

MODULE II – WASTE GENERATION ASPECTS (10 hours)

Waste stream assessment (WSA), waste generation and composition, waste characteristics (physical and chemical), health and environmental effects (public health and environmental), comparative assessment of waste generation and composition of developing and developed nations, a case study results from an Indian city, handouts on solid waste compositions. E-waste generation.

MODULE III - COLLECTION, STORAGE, TRANSPORT AND DISPOSAL (10 hours)

Waste Collection, Storage and Transport: Collection components, storage-containers/collection vehicles, collection operation, transfer station, waste collection system design, record keeping, control, inventory and monitoring, implementing collection and transfer system, a case study. Waste Disposal: key issues in waste disposal, disposal options and selection criteria, sanitary landfill, landfill gas emission, leachate formation, environmental effects of landfill, landfill operation issues, a case study

MODULE IV – WASTE PROCESSING TECHNIQUES (12 hours)

Purpose of processing, mechanical volume and size reduction, component separation, drying and dewatering. Source Reduction, Product Recovery and Recycling: basics, purpose, implementation monitoring and evaluation of source reduction, significance of recycling, planning of a recycling program, recycling program elements, commonly recycled materials and processes, a case study.

MODULE V – HAZARDOUS WASTE MANAGEMENT (10 hours)

Identification and classification of hazardous waste, hazardous waste treatment, pollution prevention and waste minimization, hazardous wastes management in India. E-waste recycling

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

- Apply the basics of solid waste management towards sustainable development
- Apply technologies to process waste and dispose the same
- Design working models to convert waste to energy
- Manage the waste hazards
- Identify and classify hazardous waste and

TEXT BOOKS:

1. Tchobaanoglous, G., Theisen, H., and Samuel A Vigil, Integrated Solid Waste Management, McGraw-Hill Publishers, 1993.

2. Bilitewski B., Hard He G., Marek K., Weissbach A., and Boeddicker H., Waste Management, Springer, 1994.

REFERENCE BOOKS:

1. White, F. R., Franke P. R & Hindle M., Integrated solid waste management: a life cycle inventory. McDougall, P. John Wiley & Sons. 2001
2. Nicholas, P., & Cheremisinoff, P. D., Handbook of solid waste management and waste minimization technologies, Imprint of Elsevier Science. 2005
3. Solid Waste Engineering by WA. Worrell, P.A Vesilind Cengage Learning 2012.
   Solid and Hazardous waste Management M.N Rao and R. Sulthana. B.S Publications 2012

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A**: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B**: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks

Two questions from each module with choice to answer one question.

ES24 606(E)	ETHICAL HACKING	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.

SYLLABUS:

Module I: (11 hours)

Ethical hacking Overview - Role of security and penetration testers–Penetration-testing Methodologies- Laws of the land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security.

Module II: (10 hours)

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall .

Module III: (10 hours)

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss.

Module IV: **(11 hours)**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade.

Module V: **(10 hours)**

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems – Network Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

COURSE OUTCOMES:

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

- To express knowledge on basics of computer based vulnerabilities.
- To gain understanding on different foot printing, reconnaissance and scanning methods.
- To demonstrate the enumeration and vulnerability analysis methods.
- To gain knowledge on hacking options available in Web and wireless applications.
- To acquire knowledge on the options for network protection.

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCE BOOK:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 606(F)	Object Oriented Programming using JAVA	3-1-0-3

Prerequisite: PROGRAMMING IN C

OBJECTIVES:

- To find meaningful object names and relationships to make code more self-explanatory.
- To built objects and libraries to speed up the development process.
- To create systems that can adapt to changing requirements and grow as needed.
- To model real-world entities and relationships, making code more organized and structured.
- To reduce errors and improve error handling.

SYLLABUS:

Module I **(12Hours)**

Basic Object-Oriented concepts -Object Modelling Using Unified Modelling Language (UML) – UML diagrams, Use case model, Class diagram, Activity diagram. Introduction to Java - Java programming and Runtime Environment, Development Platforms- Java Virtual Machine (JVM), Java compiler, Bytecode, Java Buzzwords, Java program structure, Comments. Primitive Data types - Integers, Floating Point Types, Characters, Boolean. Literals, Type Conversion and Casting, Variables, Arrays, Strings, Vector class. Operators - Arithmetic Operators, Bitwise Operators, Relational Operators, Boolean Logical Operators.

MODULE II **(10Hours)**

Object Oriented Programming in Java - Class Fundamentals, Declaring Objects, Introduction to Methods, Constructors, this Keyword, Method Overloading, Access Control, Static Members, Final Variables. Inheritance - Super Class, Sub Class, The Keyword super, protected Members, Method Overriding, the Object class, Abstract Classes and Methods.

MODULE III **(12 Hours)**

Packages and Interfaces - Defining Package, importing Packages, Interfaces. Exception Handling - Checked Exceptions, Unchecked Exceptions, try Block and catch Clause, Multiple catch Clauses, Nested try Statements, throw, throws and finally. Input/output - I/O Basics, Reading Console Input, Writing Console Output, Print Writer Class, Object Streams and Serialization, Working with Files.

MODULE IV **(12 Hours)**

Java Library - String Handling – String Constructors, String Length, Special String Operations - Character Extraction, String Comparison, Searching Strings, Modifying Strings, using value of(). Multithreaded Programming - The Java Thread Model, The Main Thread, Creating Thread, Creating Multiple Threads, Synchronization, Suspending, Resuming and Stopping Threads.

MODULE V **(12 Hours)**

Swings fundamentals-Swing Controls, Components and Containers, Swing Packages, EventHandling in Swings, Swing Layout Managers, Exploring Swings –JFrame, JLabel, Swing Buttons,JText Field. Java Database Connectivity (JDBC) - JDBC overview, Creating and Executing Queries .

COURSE OUTCOMES: At the end of the course, the student should be able to

- Write Java programs using the object-oriented concepts - classes, objects, constructors, inheritance and polymorphism.
- Utilize datatypes, operators, control statements, built in packages & interfaces, Input/ Output Streams and Files in Java to develop programs.
- Illustrate how robust programs can be written in Java using exception handling mechanism.
- Write application programs in Java using multithreading and database connectivity.
- Write Graphical User Interface based application programs by utilizing event handling features and Swing in Java.

TEXT BOOKS:

1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011. Rajib Mall, Fundamentals of Software Engineering, 4th edition, PHI, 2014.
2. Paul Deitel, Harvey Deitel, Java How to Program, Early Objects 11th Edition, Pearson,2018.

REFERENCES BOOKS:

1. Y. Daniel Liang, Introduction to Java Programming, 7/e, Pearson, 2013.
2. Nageswararao R., Core Java: An Integrated Approach, Dreamtech Press, 2008.
3. Flanagan D.,Java in A Nutshell, 5/e, O'Reilly, 2005.
4. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.
5. Sierra K., Head First Java, 2/e, O'Reilly, 2005.
6. Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

MINOR

ES24 607A	BIG DATA ANALYTICAL TOOLS	0-0-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data.
- Provide HDFS Concepts.
- Understand Map Reduce Jobs.
- Exposure to Data Analytics with Hive and Pig.

SYLLABUS:

MODULE I: **(11 hours)**

Introduction To Big Data And Analytics

Classification of Digital Data, Structured and Unstructured Data - Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Why Big Data - Hadoop Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments - Basically Available Soft State Eventual Consistency - Top Analytics Tools: R, Apache Spark, Plotly, Lumify, Mongo DB

MODULE II: **(10 hours)**

Hadoop

NoSQL: Types of Databases – Advantages – NewSQL - SQL vs. NOSQL vs NewSQL. Distributed Computing Challenges- Introduction to Hadoop: Features – Advantages – Versions - Overview of Hadoop Eco systems - Hadoop distributions - Hadoop vs. SQL – RDBMS vs. Hadoop - Hadoop Components – Architecture – HDFS.

MODULE III: **(11 hours)**

Introduction To Mongodb And Mapreduce Programming

MongoDB: Why Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression.

MODULE IV **(10 hours)**

Introduction To Hive

Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having – RC File Implementation - Hive User Defined Function - Serialization and Deserialization.

MODULE V **(10 hours)**

Introduction To Pig

Pig: Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution - Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo - Pig Versus Hive.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Identify Big Data and its Business Implications.
- Learn NoSQL databases.
- List the components of Hadoop and Hadoop Eco-System.
- Obtain fair knowledge on hive.
- Understand the basics of Pig.

TEXT BOOKS:

1. Seema Acharya, SubhashiniChellappan, "Big Data and Analytics", Wiley Publications, First Edition,2015 .

REFERENCE BOOKS:

1. Tom White, "Hadoop The Definitive Guide", O'Reilly Publications, Fourth Edition, 2015
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013).
3. Hurwitz JS, Nugent A, Halper F, Kaufman M. Big data for dummies. John Wiley & Sons; 2013.
4. Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012 Chuck Lam, "Hadoop In Action", Dreamtech Publications, 2010.
5. Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 607B	VLSI Design	0-0-0-3

PRE-REQUISITES: ELECTRONIC DEVICES & ANALOG CIRCUITS

COURSE OBJECTIVES:

- To learn CMOS Circuits
- To understand basic logic circuits
- To learn CMOS process technology
- To study different types of memories
- To implement various circuits in daily life

SYLLABUS:

MODULE I **(12 HOURS)**

Short and narrow channel effects in MOS transistor– subthreshold conduction–body effect-channel length modulation- drain induced barrier lowering-hot carrier effects-velocity saturation of charge carriers. Scaling of MOS Transistor-constant voltage and constant field scaling. MOS inverters-resistive load, Saturated NMOS load, Depletion NMOS load, pseudo-MOS-CMOS inverters-robustness and performance–capacitance components-charge sharing–power dissipation.

MODULE II **(9 HOURS)**

Combinational circuits using static CMOS logic style -Design & implementation of Adder–Full adder, Dynamic adder, carry bypass adder, Carry select adder, square root carry select adder, Carry look ahead adder-Multipliers, array multipliers-Multiplexers-Memory elements-SRAM, DRAM, ROM, Sense amplifiers–Differential, Single ended

MODULE III **(11 HOURS)**

Wafer processing–diffusion- Fick‘s Law–analytic solutions for predeposition and drive-in diffusion–Oxidation–Deal-Grove model–Ion implantation-vertical and lateral projected ranges-channeling-stopping power–Optical lithography-optical exposures-modulation transfer function-proximity and projection printing–Photoresists-types-contrast curves-Etching-wet, plasma and ion etching- Epitaxial growth–Physical vapor deposition, chemical vapor deposition, molecular beam epitaxy.

MODULE IV **(11 HOURS)**

Device isolation - junction and oxide isolation–LOCOS-SILO-SWAMI process-trench isolation–silicon on insulator isolation- contacts and metallization Schottky contacts-implanted ohmic contacts-alloyed contacts-refractory metal contact technology-multilevel metallization

MODULE V **(9 HOURS)**

Fabrication of nMOS transistor, pMOS transistor. CMOS- p well process, n well process, twin tub process. Layout and design rules (lambda based)-layout using cell hierarchy-layout of MOSFET–stick diagram-layout of inverter, NOR and NAND gates.

COURSE OUTCOMES:

The student will be able to

- Summarize the secondary effects of MOS transistor and its impact in scaling the device.
- Outline different MOS inverters and its performance parameters
- Elaborate static CMOS logic style in implementing logic circuits.
- Identify the various steps in IC fabrication.
- Express the layout of simple MOS circuit using Lambda based design rules

Text Books:

1. Weste & Harris, CMOS VLSI Design, Pearson Education
2. Plummer, Deal&Griffin, Silicon VLSI Technology, Pearson Education
3. Rabaey J.M., Digital Integrated Circuits-A Design Perspective, Pearson Education
4. Weste & Eshraghian, Principles of CMOS VLSI Design, Addison Wesley
5. S KGandhi, VLSI Fabrication Principles., John Wiley
6. Sung-MoKang&YusufLeblebici, CMOSDigitalIntegratedCircuits-Analysis & Design, McGraw Hill
7. Nagchoudari. Principles of Microelectronic Technology, Wheeler Publishing

Reference Books:

1. Yuan Taur & NingT.H., Fundamentals of Modern VLSI Devices, Cambridge Univ. Press
2. Baker.Li & Boyce, CMOS-Circuit Design, Layout&Simulation, PHI
3. Sze SM, VLSI Technology, McGraw Hill
4. Ken Martin, Digital Integrated Circuit Design, Oxford Univ. Press
5. Eshraghian &Pucknell, Essentials of VLSI Circuits & Systems, PHI

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 608(P)	NETWORKS LAB	0-0-3-1

PRE-REQUISITES: Computer Networks, C programming

COURSE OBJECTIVES:

- To introduce the knowledge of data link layer computer networking technology.
- To introduce about network applications and protocols.
- To familiarize with TCP
- To familiarize UDP communications.
- To understand various protocols in network technology

List of Exercises / Experiments

(Minimum 8 Mandatory)

1. Study of basic **Network configuration commands: -**
   a) ping
   b) traceroute
   c) nslookup
   d) pathping
   e) netstat
   f) ifconfig
   g) tcpdump

   Also connect the computers in Local Area Network.
2. To learn **handling and configuration of networking hardware** like RJ-45 connector, Network cables, crimping tool, etc and practically implement the cross-wired cable and straight through cable using crimping tool.
3. To implement **Bit Stuffing** in C language.
4. Implementation of **stop & wait protocol** and **sliding window protocol.**
5. Write a program to generate **Cyclic Redundancy Check** code for a given data frame.
6. Write a program to implement **Dijkstra's algorithm** to compute the shortest path through a graph.
7. Implement client server communication using **TCP.**
8. Using TCP/IP sockets, write a client server program to make client sending the file name and the server to send back the contents of the requested file if present.
9. Implement Inter process communication using **pipes.**
10. Implementation of **Simple Mail Transfer Protocol** using UDP.

COURSE OUTCOMES:

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

- Identify and use various networking components Understand different transmission media and design cables for establishing a network
- Compare routing algorithms
- Understand the TCP/IP configuration for Linux
- Develop simulation of fundamental network concepts using a network simulator.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and viva voce.

30% - Tests.

10% - Regularity in the lab.

End Semester Practical Examination (Maximum Marks-100)

70% - Algorithm, coding, compiling and executing, result and inference

20% - Viva voce

10% - Fair record

ES24 609(P)	MINI PROJECT	0-0-3-1

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model of an electronic system.
- For enabling the students to gain experience in organisation and implementation of a small project and thus acquire the necessary confidence to carry out main project in the final year.

In this practical course, each group consisting of three/four members is expected to design and develop a moderately complex electronic system for practical applications; this should be a working model. The basic concepts of product design may be taken into consideration while designing the project.

A committee consisting of minimum three faculty members specialized in Electronics and Communication engineering will perform assessment of the mini project. Students have to submit a report on the mini project and demonstrate the working model before the evaluation committee.

Internal Continuous Assessment *(Maximum Marks-100)*

30% - Design

30% - Implementation and Result Analysis

10% - Report

20% - Viva voce

10% - Regularity

Course Outcome:

The student will be able to:

- Design and analyze a practical electronic circuit.
- Build an electronic product.
- Demonstrate the product and its applications.
- Inculcate group management and leadership skills.
- Develop documentation skills

ES24 610(P)	INTERNSHIP	0-0-0-1

PRE-REQUISITE: NIL

COURSE OBJECTIVES:

- To become acquainted with the future field of the electronics and communication engineering student
- To apply the acquired knowledge and skills in a practical situation
- To become acquainted with real life problem solving

SYLLABUS:

Students need to undergo a minimum of 10-15 days internship in an Industry/Firm associated with rural technology and agriculture/Rural village to observe, identify and give suggestions to the problems related to Electronics & Communication Engineering or allied engineering sector in the society. The Internship should give exposure to the practical aspects of the relevant course/branch and allied engineering discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The students will have an opportunity to develop observational skills, develop confidence to identify and understand the issues related with machines/systems and come up with solutions to rectify the same. This motive of the programme is ultimately focused on the mutual benefit to the students, industry and society. The outcome of the internship should be presented in the form of a report.

COURSE OUTCOMES:

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

- Identify how the internship relates to their academic courses and preferred career path.
- Communicate in a workplace environment in a clear and confident manner.
- Evaluate performance and accept feedback, in order to make changes as necessary.
- Articulate their experience and skills to potential employers.
- Identify and articulate next steps in their career trajectory.

Internal Continuous Assessment *(Maximum Marks-100, Minimum required to pass-50)*

10% - Attendance

20% - Coordinator

30% - Technical content of the report

40% - Presentation

SEMESTER - 7

ES24 701	Information theory and coding	3-1-0-4

PRE-REQUISITES: DIGITAL COMMUNICATION

COURSE OBJECTIVES:

- To introduce the mathematical concept of information.
- To design analyse source and channel encoder/ decoders.
- To familiarize different coding techniques for error free data transmission.
- To understand the fundamental concepts of information theory, including entropy, mutual information, and channel capacity.
- Develop problem-solving skills using information theory and coding techniques.

SYLLABUS:

MODULE I: **(12 hours)**

Information theory self-information and entropy-properties of entropy entropy of a binary memoryless source-extension of a memoryless source source coding theorem Shannon Fano coding- Huffman coding-Lempel-Ziv coding prefix codes, Kraft's inequality, discrete memoryless channel- Binary Symmetric Channel (BSC)-Channel transition matrix mutual information properties with proof channel capacity-channel coding theorem. Shannon Hartley theorem

MODULE II: **(9 hours)**

Binary erasure channel (BEC) – Convolutional Codes – encoding – time and frequency domain approaches, transfer function and minimum free distance – Maximum likelihood decoding of convolutional codes – The Viterbi Algorithm and coding, Sequential decoding(Application level).

MODULE III: **(12 hours)**

Continuous Sources and Channels: Differential Entropy, Mutual information, Waveform channels, Gaussian channels, Shannon – Hartley theorem, bandwidth, SNR trade off, capacity of a channel of infinite bandwidth, Shannon‘s limit

MODULE IV **(9 hours)**

Binary Primitive BCH codes Encoder generator polynomial parity check matrix decoding of BCH codes, Nonbinary BCH Codes Reed Solomon codes basic concepts of coding and decoding.

MODULE V **(10 hours)**

Convolutional codes binary non-systematic feed forward encoder generator polynomial generator matrix- time domain and transform domain representation tree diagram, state diagram and Trellis diagram representation of convolutional codes distance properties of convolutional codes Maximum likelihood decoding- Sequential decoding- Fano algorithm Interleaved convolutional codes.

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

- Apply the concepts of information, entropy, and Shannon's theorems.
- Apply Concepts of Fields and Coding algebra to construct Galois Fields and its extensions.
- To design encoder and decoder of block codes and cyclic codes and to analyse its error detection and correction capabilities.
- To familiarize BCH and Reed Solomon codes
- To design and sketch Convolution encoders and to understand different decoding methods.

TEXT BOOKS:

1. Norman Abramson Information Theory and Coding Mc Graw Hill
2. Shu Lin & Daniel J. Costello. Jr., Error Control Coding: Fundamentals and Applications 2/e, Prentice Hall Inc., Englewood Cliffs, NJ,2004
3. Simon Haykin, Communication Systems, John Wiley 2. ShuLin, Daniel J Costello.Jr, Error Control Coding, 2nd edition., Pearson

REFERENCE BOOKS:

1. J S Chitode, Information Theory and Coding, Technical Publications, Pune, 2009
2. P S Sathya Narayana, Concepts of Information Theory & Coding, Dynaram Publications.
3. Kelbert & Suhov, Information theory and coding by examples, Cambridge University Press,2013

Internal Continuous Assessment (Maximum Marks-50).

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks- 100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with a choice to answer one question.

ES24 702	Machine Learning	3-1-0-4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.
- To evaluate the algorithms based on corresponding metrics identified.
- To study different hypothesis

SYLLABUS:

MODULE I: (12 hours)

Introduction To Machine Learning: Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

MODULE II: (10 hours)

Supervised Learning: Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model – Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests.

MODULE III: (10 hours)

Ensemble Techniques and Unsupervised Learning: Combining multiple learners: Model combination schemes, Voting, Ensemble Learning – bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

MODULE IV: (10 hours)

Neural Networks: Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

MODULE V: (10 hours)

Design And Analysis Of Machine Learning Experiments: Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Explain the basic course of Machine Learning.
- Construct Supervised Learning Models.
- Construct Unsupervised Learning Models.
- Understand the basic concepts of neural network.
- Evaluate and compare different models.

TEXT BOOKS:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

REFERENCE BOOKS:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016
5. Sebastain Raschka, Vahid Mirjalili, "Python Machine Learning", Packt publishing, 3rd Edition, 2019.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES 24 703	CRYPTOGRAPHY AND NETWORK SECURITY	3-1-0-3

PREREQUISITES: Data communication and networking

COURSE OBJECTIVES:

- To introduce the concept of network security attacks, service and mechanisms.
- To understand symmetric Cipher models.
- To study asymmetric Cipher models.
- To study various protocols for email and network security
- To implement various algorithms.

SYLLABUS

MODULE I **(11 hours)**

OSI security architecture- Security attacks, Security services, Security mechanisms. Number theory- Divisibility, Greatest Common Divisor, Modular arithmetic Operations, Extended Euclidean algorithm, Prime Numbers, Fermat's theorem, Euler's theorem, Miller- Rabin Algorithm.

MODULE II **(10 hours)**

Introduction to cryptography, Symmetric Cipher model, Substitution techniques - Ceasar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One time pad. Transposition techniques. Stream and block Ciphers, Diffusion and Confusion.

MODULE III **(10 hours)**

Data encryption standard - DES encryption and decryption, Details of single round, strength of DES. Advanced Encryption Standard- General structure, Detailed structure, AES transformation functions, AES key expansion.

MODULE IV **(11 hours)**

Asymmetric ciphers- Public key cryptosystem, RSA Algorithm. Diffie Hellman key exchange - Algorithm, Man in the middle attack. Elgan’ll cryptographic system. Cryptographic hash functions. Secure hash algorithm -SHA 512 Logic. Message authentication functions, message authentication code, Digital signature

MODULE V **(10 hours)**

Symmetric key distribution using symmetric and asymmetric encryption, Distribution of public keys, Electronic mail security - pretty good privacy. IP security overview, IP security policy, Encapsulating security payload.

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

- Explain various network security aspects, cryptanalytic attacks and apply the concept of number theory in designing crypto systems.
- Describe various symmetric key cryptosystems.
- Discuss about DES and AES.
- Apply the principles of asymmetric cryptosystems and digital signature.
- Discuss various protocols to ensure Email security and network security.

TEXT BOOKS:

1. Stallings W., Cryptography and Network security: Principles and Practice, 7/e, Pearson Education Asia, 2017.
2. Stallings W., Cryptography and Network security: Principles and Practice, 4/e, Pearson Education Asia, 2006.

REFERENCE BOOKS:

1. AtulKahate, “Cryptography and Network Security, 4e”, Tata McGraw Hill,2019.
2. Bernard Menezes, Network Security and Cryptography-Cengage Learning India, 2011
3. Thomas Mowbray, “Cybersecurity: Managing Systems Conducting Testing, and Investigating Intrusions”, John Wiley, 2014
4. Charles P. Pleeger, Shari Lawrence Pfleeger, “Security in Computing”, Pearson Education Asia, 5thEdition, 2018.
5. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Pearson Education India, 2016.

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz,

literature survey, seminar, term-project etc.

10% - Attendance in the class.

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks

Two questions from each module with choice to answer one question.

ES 24 704(A)	Multirate Signal Processing	3-1-0-3

PRE-REQUISITES: DIGITAL SIGNAL PROCESSING
COURSE OBJECTIVES:

- To impart knowledge on Fundamentals of multirate theory.
- To impart knowledge on M-channel perfect reconstruction filter banks.
- To develop understanding on Perfect reconstruction (PR) filter banks.
- To understand different multi rate operations.
- To design various circuits using adaptive signal processing.

SYLLABUS

MODULE I **(11 HOURS)**

Fundamentals of Multirate Theory The sampling theorem: sampling at subNyquist rate - Basic Formulations and schemes. Basic multirate operations: Up sampling, Down sampling, Decimation and Interpolation -Resampling with rational factor, Polyphase decomposition, Multi-stage Interpolation and Decimation systems. Digital Filter Banks- DFT Filter Bank- Identities- Polyphase representation

MODULE II **(11 HOURS)**

Maximally decimated filter banks: Polyphase representation - Errors in the QMF bank- Perfect reconstruction (PR) QMF Bank - Design of an alias free QMF Bank. M-channel perfect reconstruction filter banks, Uniform band and non-uniform filter bank - tree structured filter bank- Errors created by filter bank system- Polyphase representation perfect reconstruction systems

MODULE III **(11 HOURS)**

Perfect reconstruction (PR) filter banks Para unitary PR Filter Banks- Filter Bank Properties induced by Para unitarity- Two channel FIR Para unitary QMF Bank- Linear phase PR Filter banks- Necessary conditions for Linear phase property. Quantization Effects: -Types of quantization effects in filter banks. -coefficient sensitivity effects, dynamic range and scaling

MODULE IV **(9 HOURS)**

Cosine Modulated filter banks- Cosine Modulated pseudo QMF Bank- Alias cancellation phase- Phase distortion- Closed form expression - Polyphase structure- PR Systems, Lchannel QMF banks, Multilevel filter banks.

MODULE V **(10 HOURS)**

Applications of filter banks in Signal Processing and Communication such as hearing aids, cognitive radio, Software design radio channelizers. Oversampling A/D and D/A converters, introduction to wavelets, Discrete-wavelet transform.

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

- Explain the Fundamentals of Multirate Theory
- Identify perfect reconstruction of filter bank systems.
- Apply efficient realizations for upsampling and downsampling of signals using the polyphase decomposition
- Analyse the quantization effects in filter banks
- Summarize the use of filter banks in application such as signal processing and communication

Text Books:

1. P.P. Vaidyanathan. Multirate systems and filter banks, Prentice Hall. PTR. 1993.
2. N.J. Fliege. Multirate digital signal processing, John Wiley 1994.

Reference Books:

1. Oppenheim, R. Schafer, and J. Buck, "Discrete-time signal processing," Prentice-Hall, 1999
2. Sanjit K. Mitra, Digital Signal Processing: A computer-based approach, McGraw Hill. 1998.
3. R.E. Crochiere. L. R., Multirate Digital Signal Processing, Prentice Hall. Inc.1983.
4. J.G. Proakis. D.G. Manolakis, Digital Signal Processing: Principles. Algorithms and Applications, 3rd Edn. Prentice Hall India, 1999.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*:* Analytical/problem solving SHORT questions ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*:* Analytical/Problem solving DESCRIPTIVE questions ***5 x 10 marks= 50 marks.***

Two questions from each module with choice to answer one question.

ES 24 704(B)	Adaptive Signal Processing	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To introduce adaptive systems
- To understand the filter design
- To understand functions of adaptive signal processing systems.
- To introduce different algorithms to implement adaptive signal processing
- To realize practical applications.

SYLLABUS

MODULE 1 **(9 Hours)**

General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

MODULE II **(11 Hours)**

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment

MODULE III **(10 Hours)**

Variants of the LMS algorithm: The sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

MODULE 1V **(10 Hours)**

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modelling, joint process estimator, gradient adaptive lattice.

MODULE V **(11 Hours)**

Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

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

- Describe the basic concept of adaptive signal processing.
- Explain different type of adaptive algorithms.
- Describe the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation.
- Analyse the mathematical representation of the adaptability requirement.
- Illustrate the mathematical treatment for the modelling and design of the signal processing systems.

TEXT BOOKS:

1. Simon Haykin, “Adaptive Filter Theory”, Pearson Education, 2003.
2. Bernard Widrow and Samuel D. Stearns, “Adaptive Signal Processing”, Person Education, 2005.

REFERENCE BOOKS:

1. John R. Treichler, C. Richard Johnson, Michael G. Larimore, “Theory and Design of Adaptive Filters”, Prentice-Hall of India, 2002
2. S. Thomas Alexander, “Adaptive Signal Processing - Theory and Application”, Springer-Verlag.
3. D. G. Manolokis, V. K. Ingle and S. M. Kogar, “Statistical and Adaptive Signal Processing”, Mc Graw Hill International Edition, 2000.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 704(C)	ADVANCED DATABASE DESIGN	3-1-0-3

PRE-REQUISITES: DATABASE MANAGEMENT SYSTEMS

COURSE OBJECTIVES:

- To enable design of high-quality relational databases and database applications.
- To develop skills in advanced visual & conceptual modelling and database design.
- To make aware of emerging database trends as they apply to semi-structured data, the internet,
- To understand various object-oriented databases.
- To study various emerging technologies.

SYLLABUS:

MODULE I: (11 hours)

Database Design Issues

ER Model - Normalization - Security - Integrity - Consistency - Database Tuning- Optimization and Research Issues – Design of Temporal Databases – Spatial Databases.

MODULE II: (11 hours)

Distributed Databases

Distributed Databases Vs Conventional Databases –Architecture – Fragmentation– Query Processing – Transaction Processing – Concurrency Control – Recovery.

MODULE III: (13 hours)

Object Oriented Databases

Introduction to Object Oriented Data Bases - Approaches - Modelling and Design- Persistence – Query Languages -Transaction - Concurrency – Multi Version Locks - Recovery.

MODULE IV: (11 hours)

Big data storage

Enhanced Data Models - Client/Server Model-Introduction to Big data and it's storage systems- NOSQL data stores- Data Warehousing-introduction-warehouse operations-simple queries -architecture-characteristics- modelling and building data warehouse.

MODULE V: (6 hours)

Emerging Technologies

Rules - Knowledge Bases - Active And Deductive Databases -Parallel Databases– Multimedia Databases – Image Databases– Text Database - Web Databases – Mobile Databases.

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

- To develop skills in advanced visual & conceptual modelling and database design.
- To develop an appreciation of emerging database trends as they apply to semi-structured data, the internet, and object-oriented databases
- To understand Database design issues and current issues.
- To get in depth knowledge about data mining and data warehousing.
- To get a clear insight about emerging systems.

TEXT BOOKS:

1. R. Elmasri, S.B. Navathe, "Fundamentals Of Database Systems", Pearson Education, 2004
2. Sliberschatz A, Henry F. Korth, S. Sudarshan, Database System Concepts, 6th Ed

REFERENCE BOOKS:

1. Abdullah Uz Tansel Et Al, "Temporal Databases: Theory, Design and Principles", Benjamin Cummings Publishers, 1993.
2. C.S.R Prabhu, "Object-Oriented Database Systems", Prentice Hall Of India, 1998.
3. Carlo Zaniolo, Stefano Ceri, Christos Faloustsos, R.T.Snodgrass, V.S.Subrahmanian, "Advanced Database Systems", Morgan Kaufman, 1997.
4. Elisa Bertino, Barbara Catania, Gian Piero Zarri, "Intelligent Database Systems", Addison-Wesley, 2001.
5. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Fourth Edition, McGraw Hill, 2002.
6. N. Tamer Ozsu, Patrick Valduriez, "Principles Of Distributed Database Systems", Prentice Hall International Inc., 1999.
7. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition 2004

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES 24 704(D)	Nano Electronics	3-1-0-3

PRE-REQUISITES: ELECTRONIC DEVICES & VLSI DESIGN

COURSE OBJECTIVES:

- To understand various aspects of nano-technology
- To describe the processes involved in making nano components
- To realize nano materials.
- To learn methods of fabrication.
- To understand various heterojunction transistors.

SYLLABUS:

MODULE I **(12 hours)**

Introduction to nanotechnology, Impacts, Limitations of conventional microelectronics, Trends in microelectronics and optoelectronics Mesoscopic physics, trends in microelectronics and optoelectronics, characteristic lengths in mesoscopic systems. Quantum mechanical coherence. Classification of Nano structures, Low dimensional structures Quantum wells, wires and dots, Basic properties of two-dimensional semiconductor nanostructures, square quantum wells of finite depth, parabolic and triangular quantum wells, Quantum wires and quantum dots, carbon nano tube, graphene

MODULE II **(9 hours)**

Introduction to methods of fabrication of nano-layers, different approaches, physical vapour deposition, chemical vapour deposition Molecular Beam Epitaxy, lon Implantation, Formation of Silicon Dioxide-dry and wet oxidation methods. Fabrication of nano particle-grinding with iron balls, laser ablation, reduction methods, sol gel, self-assembly, precipitation of quantum dots

MODULE III **(19 hours)**

Two-dimensional electronic system, two-dimensional behaviour, MOSFET structures, Heterojunctions Quantum wells, modulation doped quantum wells, multiple quantum wells. The concept of super lattices Kronig-Penney model of super lattice.

MODULE IV **(11 hours)**

Transport of charge in Nanostructures under Electric field parallel transport, hot electrons, perpendicular transport. Quantum transport in nanostructures, Coulomb blockade Transport of charge in magnetic field Effect of magnetic field on a crystal. Aharonov-Bohm effect, the Shubnikov-de Hass effect, the quantum Hall effect.

MODULE V **(11 hours)**

Nanoelectronics devices-MODFETS, heterojunction bipolar transistors Resonant tunnel effect, RTD, RTT, Hot electron transistors Coulomb blockade effect and single electron transistor, CNT transistors Heterostructure semiconductor laser Quantum well laser, quantum dot LED, quantum dot laser Quantum well optical modulator, quantum well sub band photo detectors, principle of NEMS.

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

- Summarize recent trends and classifications of nanostructures in nano-technology.
- Explain the processes involved in making nano components and material.
- Describe structural dynamics of nanomaterials.
- Interpret the behaviour of nanostructures during charge transfer.
- Get an idea about the working of different nano electronic devices.

Text Books:

1. J.M. Martinez-Duart, R.J. Martin Palma, F. Agulle Rueda Nanotechnology for Microelectronics and optoelectronics. Elsevier, 2006

2. W.R. Fahrner, Nanotechnology and Nanocletronics, Springer, 2005

3. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003

4. K.E. Drexler, Nanosystems, Wiley, 1992.

Reference Books:

1. Chattopadhyay, Banerjee, Introduction to Nanoscience & Technology, PHI, 2012

2. George W. Hanson, Fundamentals of Nanoelectronics, Pearson Education, 2009.

3. K. Gaser, P. Glosekotter, J. Dienstahl, Nanoelectronics and Nanosystems, Springer 2004

4. Murty, Shankar, Text book of Nanoscience and Nanotechnology, Universities Press, 2012

5. Poole, Introduction to Nanotechnology, Jolin Wiley, 2006,

6. Supriyo Dutta, Quantum Transport-Atom to transistor, Cambridge, 2013.

Internal Continuous Assessment (Maximum Marks-50)

70%-Tests (minimum 2)

20%-Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10%-Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks-100)

PART A: Analytical/problem solving SHORT questions 10x5marks= 50 marks Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks Two questions from each module with choice to answer one question.

ES 24 704(E)	PATTERN RECOGNITION	3-1-0-3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To introduce the fundamental algorithms for pattern recognition.
- To learn about various risk criteria while finding optimal solutions for error.
- To study dimension reduction methods.
- To implement statistical pattern recognition.
- To instigate the various classification and clustering techniques

SYLLABUS

MODULE 1 **(12 hours)**

Introduction: Basics of pattern recognition system, various applications, Machine Perception, classification of pattern recognition system. Design of Pattern recognition system, Pattern recognition Life Cycle. Statistical Pattern Recognition: Review of probability theory, Gaussian distribution, Bayes decision theory and Classifiers, Optimal solutions for minimum error and minimum risk criteria, Normal density and discriminant functions, Decision surfaces

MODULE 2 **(11 hours)**

Parameter estimation methods: Maximum-Likelihood estimation, Expectation-maximization method, Bayesian parameter estimation Concept of feature extraction and dimensionality, Curse of dimensionality, Dimension reduction methods - Fisher discriminant analysis, Principal component analysis, Hidden Markov Models (HMM) basic concepts, Gaussian mixture models.

MODULE 3 **(10 hours)**

Non-Parameter methods: Non-parametric techniques for density estimation - Parzen-window method, K-Nearest Neighbour method. Non-metric methods for pattern classification: Non-numeric data or nominal data. Decision trees: Concept of construction, splitting of nodes, choosing of attributes, overfitting, pruning.

MODULE 4 **(10 hours)**

Linear Discriminant based algorithm: Perceptron, Support Vector Machines. Multilayer perceptrons, Back Propagation algorithm, Artificial Neural networks. Classifier Ensembles: Bagging, Boosting / AdaBoost.

MODULE 5 **(9 hours)**

Unsupervised learning: Clustering - Criterion functions for clustering, Algorithms for clustering: K-means and Hierarchical methods, Cluster validation

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

- Know the fundamental algorithms for pattern recognition
- Design and construct a pattern recognition system
- Know the major approaches in statistical and syntactic pattern recognition.
- Become aware of the theoretical issues involved in pattern recognition system design such as the curse of dimensionality.
- Implement pattern recognition techniques

TEXT BOOKS

1. C M Bishop, Pattern Recognition and Machine Learning, Springer
2. R O Duda, P.E. Hart and D.G. Stork, Pattern Classification and scene analysis, John Wiley

REFERENCE BOOKS

1. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.
2. Robert J. Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 2007.
3. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4/e, Academic Press, 2009.
4. Tom Mitchell, Machine Learning, McGraw-Hill
5. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance in the class.

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks Two questions from each module with choice to answer one question.

ES 24 704(F)	ROBOTICS &AUTOMATION	3-1-0-3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- To design and develop new products that meet customer needs.
- To create efficient, cost-effective solutions.
- To contribute innovative ideas towards development projects.
- To understand different network technologies.
- To understand skills in programming, electronics, and mechanical engineering.

SYLLABUS

MODULE I **(12 Hours)**

Introduction to Robotics Definition and Origin of Robotics. Robot Anatomy. Robot Specifications. Robot Characteristics – Accuracy, Precision, and Repeatability. Classification of Robots. Advantages and Disadvantages of Robots. Robot Structure - Types of Joints and End Effectors, Mechanisms and Manipulators. Common Kinematic Arrangements. Degree of Freedom. Robot Coordinates. Areas of Application for Robots.

MODULE II **(10 Hours)**

Introduction to Sensors and Actuation Systems for Robots Actuators: Types of Robotic Drive Systems and Actuators: Hydraulic, Pneumatic and Electric drives. Transmission: Gears, Timing Belts and Bearings. Parameters for selection of actuators. Specification. Areas of Application for: Stepper Motor & Servo Motor. Sensors: Types and Applications of Sensors in Robotics: Position, Displacement and Velocity Sensors. Tactile Sensors for Contact and Proximity Assessment.

MODULE III **(12 Hours)**

Introduction to Robot Kinematics and Dynamics Introduction to Kinematics: Position and Orientation of Objects. Rotation. Euler Angles. Rigid Motion Representation using Homogenous Transformation Matrix. Kinematic Modelling: Translation and Rotation Representation, Coordinate Transformation, Forward and Inverse Kinematics. Forward Kinematics-Link Coordinates, Denavit-Hartenberg Representation, Application of DH Convention to Different Serial Kinematic Arrangements

MODULE IV **(12 Hours)**

Introduction to Robot Control. Basics of Control: Open Loop- Closed Loop, Transfer Functions, Control Laws: P, PD, PID, Linear and Non-linear Controls; Control Hardware and Interfacing; Embedded Systems: Microcontroller Architecture and Integration with Sensors, Actuators, Components.

MODULE V **(12 Hours)**

Recent Developments in Robotics Mobile Robots: Mobile Robot Kinematics. Humanoid Robotics: Biped Locomotion, Imitation Learning. Collaborative Robots: Collaborative Robot, Collaborative Operation, Applications. Artificial Intelligence in Robotics: Applications in Unmanned Systems, Defense, Medical, Industries, etc. Industrial Applications of Robots in Material Handling and Assembly. Robotics and Automation for industry 4.0

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

- Attain a thorough understanding of different types of Robots and their applications.
- Select appropriate sensors and actuators based on the robotic applications.
- Perform kinematic and dynamic analyses for robots.
- Carry out the design and control of a simple robot.
- Integrate mechanical and electrical hardware for making a robotic device.

TEXT BOOKS:

1. S.K. Saha, Introduction to Robotics, Tata McGraw Hill, 2nd Edition, 2014

2. Saeed B. Niku, Introduction to Robotics: Analysis, Systems, Applications, JohnWiley & Sons, 2nd Edition, 2011.

3. Spong and Vidyasagar, Robot Dynamics and Control, John Wiley & Sons, 1990.

4. Mikell P. Groover, et al., Industrial Robotics – Technology, Programming and Applications, McGraw Hill, 2nd Edition, 2012

REFERENCE BOOKS

1. John. J. Craig, Introduction to Robotics: Mechanics and Control, PHI, 2005.

2. Ashitava Ghosal, Robotics, Fundamental concepts and analysis, OXFORD University Press, 2006

3. Fu, K. S, Gonzalez, R. C, Lee, C. S. G., Robotics, Control, Sensing, Vision and Intelligence, McGraw-Hill, 1987.

4. Asada, H., and J. J. Slotine. Robot Analysis and Control. New York, NY: Wiley, 1986.

5. Robert J. Schilling, Fundamentals of Robotics: Analysis & Control, Pearson Education, 2000

6. Klafter, R.D., Chmielewski, T.A, Negin, M, Robotic Engineering An Integrated Approach, PHI, 2007

7. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill, New

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz,

literature survey, seminar, term-project etc.

10% - Attendance in the class.

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks Two questions from each module with choice to answer one question.

ES24 705(A)	INTRODUCTION TO R PROGRAMMING	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Adapt basic knowledge on R Programming
- To Write functions and use R in an efficient way.
- To introduce Control statements in R Programming
- To introduce Math functions.
- To become familiar with Graphics.

SYLLABUS:

MODULE I: (12 hours)

Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

MODULE II: (10 hours)

R Programming Structures, Control Statements, Loops, - Looping Over Non-vector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion,

MODULE III: (10 hours)

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions for Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation.

MODULE IV (10 hours)

Input /output, Accessing the Keyboard and Monitor, Reading and writer Files, Accessing the internet: Overview of TCP/IP, Sockets in R, String Manipulation: String Manipulation functions, Regular Expressions.

MODULE V **(10 hours)**

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Explain critical R programming concepts.
- Demonstration and implement of basic R programming framework and data structures
- Explain critical R programming language concepts such as control structures and recursion
- Apply various concepts to write programs in R
- Understand String Manipulation functions

TEXT BOOK:

1. The Art of R Programming, Norman Matloff

REFERENCE BOOKS

1. The Art of R Programming, A K Verma, CengageLearning.
2. R for Everyone, Lander,Pearson
3. R Cookbook, Paul Teetor,Oreilly.
4. R in Action, Rob Kabacoff, Manning.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24705(B)	BIOINFORMATICS	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Adapt basic knowledge on various techniques and areas of applications in bioinformatics.
- Analyse common problem in bioinformatics, alignment techniques, ethical issues, public data sources, and evolutionary modelling.
- Discover the practical use of tools for specific bioinformatic areas.
- To introduce neural networks.
- To become familiar with Hidden Markov Models

SYLLABUS:

MODULE I: (10 hours)

Introduction to bioinformatics and Pairwise sequence alignment

Scope and applications of bioinformatics, Alignment of pairs of sequences; Introduction- Definition of sequence alignment, Methods - Dot matrix sequence comparison. Dynamic programming algorithm for sequence alignment – Global Alignment: Needleman-Wunsch, Local Alignment: Smith-Waterman, Gap penalty, Assessing the significance of an alignment.

MODULE II: (10 hours)

Multiple sequence alignment and Scoring matrices

Dynamic programming, progressive methods, Iterative methods, MSA using CLUSTAL W, PILEUP and CLUSTAL X, purpose and applications of multiple sequence alignment Similarity searches - PAM and BlOSUM matrix, Dayhoff mutation matrix, construction of PAM and BLOSUM matrix. Differences between PAM & BLOSUM.

MODULE III: (11 hours)

Database search methods

Database searching for similar sequences. Sequence similarity search, FASTA sequence database similarity search, BLAST sequence database similarity search, other methods of comparing database of sequences and patterns.

MODULE IV **(11 hours)**

Neural Networks

Theory -Introduction – Priors & likelihoods - Learning algorithms: backpropagation - Neural Networks: Applications - Sequence encoding & output interpretation- Sequence correlations & neural networks

MODULE V **(10 hours)**

Hidden Markov Models

The Theory - Introduction -Prior information & initialization -Likelihood & basic algorithms - Learning algorithms -Applications of HMMs: general aspects -Protein applications

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Apply knowledge of bioinformatics in a practical project.
- Develop the ability for critical assessment of scientific research publications in bioinformatics.
- Build an understanding of the research process in general, such as research methods, scientific writing, and research ethics.
- Evaluate the main databases at the NCBI and EBI resources
- Compare the databases, tools, repositories and be able to use each one to extract specific information

TEXT BOOKS:

1. Bioinformatics: Sequence and Genome Analysis David W. Mount, David Mount
2. Bioinformatics: The Machine Learning Approach – Pierre Baldi and Soren Brunak Publisher: MIT Press.

REFERENCE BOOKS:

1.Bioinformatics Methods and Protocols: Methods and Protocols. edited by Stephen Misener, Stephen A Krawetz - Science – 1999.

2.Hooman H Rashidi, Lukas K Buehler. Bioinformatics Basics -2000.

3.Per Jambeck, Cynthia Gibas. Developing Bioinformatics Computer Skills. Computers 2001.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24705(C)	Consumer Electronics	3-1-0-3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- Understand the fundamental principles and concepts of consumer electronics.
- Analyse various consumer electronic devices
- Identify and describe the components and circuits used in consumer electronic devices.
- Design simple consumer electronic projects.
- Troubleshoot and repair common faults in consumer electronic devices.

SYLLABUS:

MODULE I **(9Hours)**

Mono and Stereo amplifier quality of sound and application. Various microphones (application based). Working principle of types of speakers. Troubleshooting. Microtone: working principle and characteristics, Types-carbon-condenser-crystal.

MODULE II **(8Hours)**

Principles & Sketches of CD player, Mechanism of types of CD player with justification, Block diagram and operation of CD player, types of CD player, Component used for CD mechanism CD pick-up assembly, gear system, drive motors. Block diagram of Hi Fi amplifier and its working

MODULE III **(9Hours)**

Public Address (PA) System: Block diagram, scanning process, Features of composite video signal Modulation used in TV signal transmission, home theatre system, Block diagram and working of MP3 interlaces scanning, horizontal and vertical.

MODULE IV **(10Hours)** Single side band, double sideband &Vestigial sideband transmission, bandwidth for Colour signal. characteristics of colour signal. Additive and subtractive colour mixing. Block diagram of colour TV

MODULE V **(10Hours)**

Composite Video Signal Pedestal bright, Blanking pulse, colour burst, Horizontal sync pulse details, Vertical sync pulse details, equalizing pulses, PAL-D decoder, HDTV, LCD/LED Technology, DTH receiver.

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

- Identify troubleshoot different types of microphones and speakers.
- Maintain audio systems.
- Analyse the composite video signal used in TV signal transmission.
- Understand colour TV processing.
- Maintain various consumer electronic appliances.

Text Books:

1. Bali S.P, Pearson Education India, Delhi, 2007; ISBN: 9788131717592
2. Gulati R.R, New Age International. New Delhi Year 2015, ISBN: 978-81-224-3784-3

Reference Books:

1. Gupta, R.G, Me graw Hill, New Delhi, India 2010, ISBN: 9780070699762
2. Dhake, A.M, McGraw-Hill, New Delhi, lndia 2006, ISBN: 0-07-460105-9-

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance in the class.

University Examination Pattern (Maximum Marks-100)

PART A: Analytical/problem solving SHORT questions 10x 5 marks= 50 marks

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks Two questions from each module with choice to answer one question.

ES24 705(D)	Product Life Cycle Management	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES

- Discuss product lifecycle with customer perception of value.
- Discuss design and manufacture.
- Analyze the cultures of the responsible organizations.
- Realize systems thinking, digitalization, disruptive innovation, and organizational behavior.
- Investigate innovation lapses and product failure

SYLLABUS

MODULEI **(10hours)**

Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM – Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (cPDm), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM). PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications

MODULEII **(10hours)**

User Functions – Data Vault and Document Management, Workflow and Process Management, Product Structure Management, Product Classification and Programme Management.

MODULE III **(10hours)**

Utility Functions -Communication and Notification, data transport, data translation, image services, system administration and application integration Case studies on PLM selection and implementation (like auto, aero, electronic) – other possible sectors, PLM visioning, PLM strategy, PLM feasibility study

MODULE IV **(10hours)**

Change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for-business, organisation, users, product or service, process performance- process compliance and process automation

MODULE V

CUSTOMISATION/INTEGRATION OF PDM/PLM SOFTWARE:

PLM Customization, use of EAI technology (Middleware), Integration with legacy data base, CAD, SLM and ERP.

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

- Summarize the history, concepts and terminology of PLM
- Develop the functions and features of PLM/PDM
- Discuss different modules offered in commercial PLM/PDM tools.
- Interpret the implement PLM/PDM approaches for industrial applications.
- Integrate PLM/PDM with legacy data bases, CAx& ERP systems

TEXT BOOKS:

1. AnttiSaaksvuori and Anselmilmmonen, “Product Lifecycle Management”, Springer Publisher, 2008 (3rd Edition)
2. vicaCrnkovic, Ulf Asklund and AnnitaPerssonDahlqvist, “Implementing and Integrating Product Data Management and Software Configuration Management”, Artech House Publishers, 2003

REFERENCE BOOKS:

1. John Stark, “Global Product: Strategy, Product Lifecycle Management and the Billion Customer Question”, Springer Publisher, 2007
2. John Stark, “Product Lifecycle Management: 21st Century Paradigm for Product Realisation”, Springer Publisher, 2011 (2nd Edition).
3. Michael Grieves, “Product Life Cycle Management”, Tata McGraw Hill, 2006.

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 5 x 10 marks= 50 marks Two questions from each module with choice to answer one question.

ES24 705(E)	VIRTUAL REALITY	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart the fundamental aspects and principles of VR technologies.
- To know the internals of the hardware and software components involved in the development of VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about VR application development.
- To know the technologies involved in the development of VR based applications.

SYLLABUS:

MODULE I: (10 hours)

Introduction: Introduction to Virtual Reality and Augmented Reality, Definition ,Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality ,Virtual Reality Vs 3D Computer Graphics , Benefits of Virtual Reality , Components of VR System .

MODULE II: (11 hours)

VR Modelling: Modelling Geometric Modelling Virtual Object Shape, Object Visual Appearance, Kinematics Modelling, Transformation Matrices, Object Position ,Transformation Invariants ,Object Hierarchies, Viewing the 3D World, Physical Modelling, Collision Detection, Surface Deformation, Force Computation, Force Smoothing and Mapping ,Behaviour Modelling ,Model Management.

MODULE III: (10 hours)

VR Programming, Toolkits and Scene Graphs, World Tool Kit, Java 3D, Comparison of World Tool Kit and Java 3D.

MODULE IV (11 hours)

Human Factors in VR, Methodology and Terminology, VR Health and Safety Issue , VR and Society, Medical Applications of VR , Education, Arts and Entertainment , Military VR Applications , Emerging Applications of VR , VR Applications in Manufacturing ,Applications of VR in Robotics , Information Visualization ,VR in Business , VR in Entertainment , VR in Education.

MODULE V: (10 hours)

Introduction to Augmented Reality, Computer vision for AR, Interaction, Modelling and Annotation, Navigation, Wearable devices.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Understand the basic concepts of VR
- Understand the tools and technologies related to VR
- Know the working principle of VR related Sensor devices
- Design of various models using modelling techniques
- Develop VR applications in different domains

TEXT BOOKS:

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018.
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016.
3. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design", Morgan Kaufmann, 2003

REFERENCE BOOKS:

1. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010.
2. Paul E. Proctor, "The Practical Intrusion Detection Handbook", Prentice Hall , 2001.
3. Ankit Fadia and Mnu Zacharia, "Intrusion Alert", Vikas Publishing house Pvt., Ltd, 2007.
4. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 705 (F)	Internet of Things	3-1-0-3

PRE-REQUISITES: Data Communication, Computer Networks and programming in python

COURSE OBJECTIVES:

- To understand the fundamentals of IoT, its architecture, and components.
- To understand communication protocols and networking in IoT.
- Learn about IoT devices, sensors, and actuators.
- Explore IoT applications, use cases, and industries.
- Develop skills in designing, developing, and deploying IoT systems.

SYLLABUS:

MODULE I **(12 Hours)**

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT challenges, IoT Network Architecture and design, Drivers behind New Network Architectures, Comparing IoT Architectures, A simplified IoT Architecture, The core IoT Functional Stack, IoT data management and Compute Stack

MODULE II **(10 Hours)**

Smart Objects:The "Things" in IoT sensors, Actuators and Smart Objects, Sensor Networks, Connecting Smart Objects, Communication Criteria, IoT Access Technologies

MODULE III **(10 Hours)**

IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods

MODULE IV **(12 Hours)**

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, Differences between IT and OT Security Practices and Systems, Formal Risk Analysis Structures: OCTAVE and FAIR.

MODULE V **(12 Hours)**

IoT Logical Design using Python, IoT Physical Devices and Endpoints - Raspberry Pi interfaces, Programming Raspberry Pi using Python, Other IoT devices, IoT Physical devices and Cloud offerings, Cloud Storage Models, WAMP - Autobahn for IoT, Django, Designing RESTful Web API, Cloud Web Services for IoT.

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

- Outline the fundamentals of IoT and its underlying physical and logical architecture
- Explain the hardware architectures for IoT
- Understand the Network architectures for IoT
- Implement data analytics on the IoT platforms
- Identify IoT applications using the available hardware and software

TEXTBOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint)

2. Arshadeep Bahga, Vijay Madisetti, "Internet of Things: A hands-on approach", University Press, 2015 (First edition)

REFERENCES:

1. Rajkamal, "Internet of Things: Architecture and Design Principles", McGraw Hill (India) Private Limited

2. Dieter Uckelmann, Mark Harrison, Michahelles Florian (Ed.), Architecting the internet of things, Springer, 2011

3. Dr. Ovidiu Vermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, 2013

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24706(P)	VLSI LAB	0-0-3-1

PRE-REQUISITES: VLSI DESIGN

COURSE OBJECTIVES:

- To understand the simulation process of digital circuits
- To familiarize FPGA implementation using VHDL
- To understand circuit simulation using SPICE
- To learn different adders.
- To familiarize various memories

SYLLABUS:

List of Experiments

(A minimum of 10 experiments must be conducted)

PART A

1. Full Adders & Subtractors

2. Comparators using different models.

3. Multiplexers & Demultiplexers

4.Shift Registers

5.Ripple adder & Carry look ahead adder

6.Sequence generator & Detector

7. Implementation of a RAM

PART B

8. PMOS and N MOS transistors, ID-VGS Characteristics and ID-VDS Characteristics.

9. DC and transient response of a CMOS inverter transfer.

10. Buffer & Ring Oscillator

11. Combinational circuits using CMOS logic styles

12. Single stage CS amplifier- transient and frequency response.

13. Single stage source follower- transient and frequency response.

14. Implementation of Current minor circuits.

COURSE OUTCOMES: At the end of the course t he student should able to:

- Write HDL code for basic as well as advanced digital integrated circuits.
- Design any digital VLSI combinatorial and sequential circuits.
- Perform computer aided simulation and synthesis tool for hardware design.
- Simulation of NMOS and CMOS circuits using SPICE
- Efficiently use SPICE tool for circuit analysis

Internal Continuous Assessment (Maximum Marks-50).

60%-Laboratory practical, record and Viva voce.

30%-Tests.

10%-Regularity in the lab.

Semester-end Practical Examinations (Maximum Marks-100).

20% - Viva voce

70%- Procedure and tabulation form, Conducting experiment, results and inference

10%-Record of works done

ES24707(P)	OPERATING SYSTEMS LAB	0-0-3-1

PRE-REQUISITES: BASIC KNOWLEDGE ABOUT OPERATING SYSTEM

COURSE OBJECTIVES:

- Gain a solid understanding of fundamental operating system concepts .
- Study processes, memory management, file systems, and I/O systems.
- Learn to use system calls to interact with the operating system.
- Develop skills in creating, managing, and scheduling processes.
- Implement and compare different CPU scheduling algorithms

SYLLABUS:

List of Exercises / Experiments

(Minimum of 5 mandatory)

1. Simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time.
    a) First Come First Serve (FCFS)
    b) Shortest Job First (SJF)
    c) Priority
2. Write a C program to simulate the following contiguous memory allocation techniques
    a) Worst fit
    b) Best fit
    c) First fit
3. Simulate the following page replacement algorithms
    a) First In First Out(FIFO)
    b) Least Recently Used(LRU)
    c) Optimal
4. Simulate the following classical problems of synchronization using semaphores:
    a) Producer-Consumer Problem
    b) Dining philosopher’s problem
    c) Readers writer’s problem
5. Simulate Bankers Algorithm for Dead Lock Avoidance

6. Simulate the following disk scheduling algorithms
    a) FCFS
    b) SCAN
    c) C-SCAN

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Implement and compare various CPU scheduling algorithms such as FCFS, SJF, Round Robin, and priority scheduling.
- Gain practical experience with core operating system concepts such as process management, memory management etc
- Implement and manage processes, including creating, scheduling, and terminating processes.
- Understand synchronization techniques such as semaphores
- Apply Various scheduling algorithms.

Internal Continuous Assessment (Maximum Marks-50)

60% - Laboratory practical, record and Viva voce.

30% - Tests.

10% - Regularity in the lab.

End Semester Practical Examination (Maximum Marks-100)

70% - Algorithm, coding, compiling and executing, result and inference

20% - Viva voce

10% - Fair record

ES24 708(P)	PROJECT PHASE I	0-0-4-2

PRE-REQUISITE: Nil

COURSE OBJECTIVES*:*

- To enable the students to apply the engineering knowledge in practical problem solving.
- To foster innovation in design of products.
- To design processes systems.
- To develop creative thinking.
- To create viable solutions to engineering problems.

SYLLABUS:

Project work is for duration of two semesters and is expected to be completed in the eighth semester. A project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The guides may encourage socially relevant project which can be interdisciplinary in nature. Each student group consisting of not more than four members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. Project evaluation committee consisting of the HOD or a senior faculty member, guide and three/four faculty members specialized in the above field shall perform the screening and evaluation of the projects.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent. Literature survey and 40% of the work has to be completed in the seventh semester.

Students should execute the project work using the facilities of the institute. However, external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

Each student has to submit an interim report of the project at the end of the 7th semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7th semester.

COURSE OUTCOMES*:* At the end of the course the students will be able to:

- Identify a topic of interest and use acquired knowledge within the selected area of technology for project development.
- Discuss and justify the technical aspects and design aspects of the project with a systematic approach.
- Analyze the technical aspects and design aspects of the project and propose a work plan
- Practice team dynamics to work effectively in a team for the development of technical projects.
- Develop skills in technical presentation and report preparation.

Assessment Pattern

The Evaluation will be conducted as an internal evaluation based on the work done, the report and a viva-voce examination, conducted by a Project evaluation committee appointed by Head of the Department. The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systems under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest or problem domain or conduct open brain storming sessions for developing innovative ideas. Zeroth review will not be a part of the evaluation process.

Internal Continuous Assessment *(Maximum Marks-100, Minimum required to pass-50)*

30% - Project Guide

20% - Interim evaluation by the evaluation committee

30% - Final presentation

20% - Report evaluation by the evaluation committee

MINOR

ES24 709A(P)	PROJECT IN MINOR	0-0-0-2

PRE-REQUISITES:NIL

COURSE OBJECTIVES:

- To estimate the ability of the student in transforming the theoretical knowledge studies so far into a working model of a computer / information system.
- For enabling the students to gain experience in organization and implementation of a project and thus acquire the necessary confidence to implement any system.
- In this practical course, each group consisting of three / four members is expected to design and develop a moderately complex computer / information system with practical applications; this should be a working model. The basic concepts of product design may be taken into consideration while designing the project.
- A committee consisting of minimum three faculty members specialized in Information Technology or computer science and engineering will perform assessment of the project.
- Students have to submit a report on the project and demonstrate the project before the evaluation committee.

Internal Continuous Assessment (Maximum Marks-100)

25% - Design and development

25% - Final result and Demonstration

20% - Final Report

20% - Viva voce

10% - Regularity

SEMESTER - 8

ES24 801	Digital Image Processing	3-1-0-4

PRE-REQUISITES: DIGITAL SIGNAL PROCESSING

COURSE OBJECTIVES:

- To give ideas & techniques of image & video processing
- To impart knowledge about image filtering.
- To understand restoration & reconstruction
- To design different types of filters.
- To learn various transforms.

SYLLABUS:

MODULE I: (11 hours)

Fundamental steps in digital image processing, Components of digital image processing, elements of visual perception, Image sensing and acquisition, image formation model- Image Transforms- 2D orthogonal & unitary transforms, Properties of unitary transforms, DFT, DCT, DST, Hadamard, Haar, Slant, KLT, SVD transform, optical and modulation transfer function, Spectral density function. Sampling and quantization of images, Two dimensional sampling theory, representation of digital image, Spatial and gray level resolution, zooming and shrinking, some basic relationships between pixels- neighbourhood, adjacency, connectivity, distance measures.

MODULE II: (10 hours)

Image enhancement techniques: Some basic gray level transformations, Histogram processing, Smoothing and Sharpening spatial filters, Image enhancement in frequency domain- Smoothing, and Sharpening frequency domain filters, Homomorphic filtering, Image restoration: Noise models, Restoration in the presence of noise only-spatial filtering, Estimating the degradation functions, Inverse filtering.

MODULE III: (10 hours)

Colour image processing: colour models, pseudo-colour processing, Image Compression-Redundancy–inter-pixel and psycho-visual; Lossless compression – predictive, entropy; Lossy compression- predictive and transform coding; Still image compression standards – JPEG and JPEG-2000- morphological image processing: dilation and erosion, opening and closing, some basic morphological algorithms.

MODULE IV: **(10 hours)**

Image segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation, applications of digital image processing in medical, recent developments, Image fusion, pseudo colouring.

MODULE V: (11 hours)

Fundamentals of Video Coding- Inter-frame redundancy, motion estimation techniques – full- search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X. Video Segmentation - Temporal segmentation – shot boundary detection, hard-cuts and soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

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

- Explain different types of image transforms and their properties.
- Describe different techniques employed for the enhancement and restoration of images.
- Interpret image compression standards.
- Summarize the methodologies for image segmentation.
- Describe algorithms for image processing and video processing

TEXT BOOKS:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
3. Murat Tekalp , Digital Video Processing Prentice Hall, 2nd edition 2015
4. S Jayaraman, S Esakkirajan T Veerakumar, digital image processing, Mc Graw Hill India.

REFERENCE BOOKS:

1. Z. Li and M.S. Drew, ―Fundamentals of Multimedia‖, Pearson Education (Asia) Pte. Ltd., 2004.
2. S. Sridhar, Digital Image Processing, Oxford University Press.
3. Al Bovik (ed.), Handbook of Image and Video Processing, Academic Press, 2000.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with a choice to answer one question.

ES24 802	INTRODUCTION TO CYBERSECURITY	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To learn cybercrime and cyber law.
- To understand the cyber-attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber-attack.
- To learn how to prevent a cyber-attack.

SYLLABUS:

MODULE I: (12 hours)

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

MODULE II: (10 hours)

Attacks and Countermeasures: OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

MODULE III: (10 hours)

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

MODULE IV: **(10 hours)**

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

MODULE V: **(10 hours)**

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

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Explain the basics of cyber security, cybercrime and cyber law.
- Classify various types of attacks and learn the tools to launch the attacks
- Apply various tools to perform information gathering
- Apply intrusion techniques to detect intrusion
- Apply intrusion prevention techniques to prevent intrusion

TEXT BOOKS:

1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cyber Security”, Notion Press, 2021
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publishers, 2011
3. https://owasp.org/www-project-top-ten/

REFERENCE BOOKS:

1. David Kim, Michael G. Solomon, “Fundamentals of Information Systems Security”, Jones & Bartlett Learning Publishers, 2013
2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2011
3. Kimberly Graves, “CEH Official Certified Ethical hacker Review Guide”, Wiley Publishers, 2007
4. William Stallings, Lawrie Brown, “Computer Security Principles and Practice”, Third Edition, Pearson Education, 2015
5. Georgia Weidman, “Penetration Testing: A Hands-On Introduction to Hacking”, No Starch Press, 2014

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 803(A)	Wavelets	3-1-0-3

PRE-REQUISITES: MULTIRATE SIGNAL PROCESSING

COURSE OBJECTIVES:

- To impart the importance of wavelets.
- To understand the fundamentals of wavelet theory.
- To familiarize with the most commonly used wavelets.
- To familiarize with the construction of different types of wavelets.
- To learn various compression techniques.

SYLLABUS

MODULE I: (10 hours)

Wavelets- brief overview of Fourier transform and short time Fourier transform, Time frequency analysis, Continuous time frequency representation of signals, Windowed Fourier Transform, Uncertainty principle and time frequency tiling, Wavelets, specifications, admissibility conditions, Continuous wavelet transform, CWT as a correlation, CWT as an operator, Inverse CWT, Redundancy of CWT.

MODULE II: (12 hours)

Discrete Wavelet Transform- Approximations of vectors in nested linear vector spaces, Example of an MRA, Formal definition of MRA, Construction of general orthonormal MRA, a wavelet basis for MRA, Haar Scaling function - Haar wavelet - Haar wavelet decomposition - Haar wavelet packets and application-Digital filtering interpretations- Decomposition and Reconstruction filters, examples of orthogonal basis generating wavelets, interpreting orthonormal MRA for Discrete time signals, Mallat algorithm, Filter bank implementation of DWT.

MODULE III: (10 hours)

Alternative wavelet representations- Biorthogonal wavelets- Biorthogonality in vector space, biorthogonal wavelet bases, signal representation using biorthogonal wavelet system, advantages of biorthogonal wavelets, biorthogonal analysis and synthesis, Frequency domain approach for designing wavelets- derivation of Daubechies wavelets, Franklin and spline wavelets, Hilbert space frames, Frame representation, Representation of signals by frames, Iterative reconstruction, Frame algorithm.

MODULE IV: **(10hours)**

Filter bank implementation, two dimensional Wavelets, filter bank implementation of 2D wavelet transform, lifting scheme: Wavelet transform using polyphase matrix factorization, Geometrical foundations of the lifting scheme, lifting scheme in the z-domain, mathematical preliminaries for polyphase factorization, Dealing with signal boundary.

MODULE V: **(10 hours)**

Applications: Image Compression: EZW Coding, SPIHT, Wavelet Difference Reduction Compression Algorithm, Denoising, speckle removal, edge detection and object isolation, audio compression, communication applications- scaling functions as signalling pulses, Discrete Wavelet Multi-tone Modulation.

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

- Describe time-frequency nature of the signals, windowed Fourier transform and continuous wavelet transform.
- Explain the concept of multiresolution analysis with discrete wavelet transform.
- Illustrate different wavelet representations.
- Design filter bank of two-dimensional wavelet transform.
- Apply the concept of wavelets to practical problems.

TEXT BOOKS:

1. Y.T. Chan, Wavelet Basics, Kluwer Publishers, Boston, 1993.
2. Daubechies, Ten Lectures on Wavelets, Society for Industrial and Applied Mathematics, Philadelphia, PA, 1992.
3. C. K. Chui, An Introduction to Wavelets, Academic Press Inc., New York, 1992.
4. Stephen G. Mallat, A wavelet tour of signal processing 2nd Edition Academic Press, 2000.
5. M. Vetterli, J. Kovacevic, Wavelets and subband coding Prentice Hall Inc, 1995
6. R. M. Rao and A. Bopardikar, Wavelet transforms: Introduction to theory and applications Addison Wesley, 1998.

REFERENCE BOOKS:

1. Gerald Kaiser, A Friendly Guide to Wavelets, Birkhauser, New York, 1995.
2. P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey, 1993.
3. A.N. Akansu and R.A. Haddad, Multiresolution signal Decomposition: Transforms, Subbands and Wavelets, Academic Press, Oranld, Florida, 1992.
4. B. Boashash, Time-Frequency signal analysis, In S.Haykin, (editor), Advanced Spectral Analysis, pages 418--517. Prentice Hall, New Jersey, 1991.
5. J. C. Goswami and A. K. Chan, Fundamentals of wavelets: Theory, Algorithms and Applications Wiley Interscience Publication, John Wiley & Sons Inc., 1999.
6. Michel Misiti, Yves Misiti, Georges Oppenheim, Jean Michel Poggi, Wavelets and their Applications, John Wiley & Sons, 2010.

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions,

quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks- 100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE

questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 803 (B)	Wireless Sensor Networks	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To design wireless sensor networks for a given application.
- To understand emerging research areas in the field of sensor networks.
- To understand MAC protocols used for different communication standards used in WSN.
- To explore new protocols for WSN.
- To define different IEEE standards.

SYLLABUS

MODULE I: **(10 hours)**

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.

MODULE II: **(10 hours)**

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

MODULE III: **(11 hours)**

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee, Dissemination protocol for large sensor networks. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

MODULE IV: **(10 hours)**

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

MODULE V: **(11 hours)**

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

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

- Describe wireless sensor networks for a given application.
- Illustrate emerging research areas in the field of sensor networks.
- Explain MAC protocols used for different communication standards used in WSN.
- Explore new protocols for WSN.
- Summarize operating systems for wireless networks.

TEXT BOOKS:

1. Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009

REFERENCE BOOKS:

1. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
2. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
3. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

Internal Continuous Assessment *(Maximum Marks-50).*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions,

quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (*Maximum Total Marks- 100*).

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE

questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with choice to answer one question.

ES24 803(C)	TEXT MINING	3-1-0-3

PRE-REQUISITES: DATA MINING

COURSE OBJECTIVES:

- To understand general architecture of text mining.
- To learn how to preprocess text, text categorization and clustering of text.
- To study various mining techniques.
- To design Probabilistic Models.
- To implement Clustering Algorithms.

SYLLABUS:

MODULE I: **(10 hours)**

Text Mining-Definition, General architecture. Core text mining operations-Distributions, frequent and near frequent sets, associations, isolating interesting patterns, analysing document collections over time.

MODULE II: **(11 hours)**

Text mining preprocessing techniques-task oriented approaches. Categorisation-applications of text categorisation-definition of the problem, Document Representation, Knowledge Engineering Approach to TC, Machine Learning Approach to TC, Using Unlabelled Data to Improve Classification, Evaluation of Text Classifiers.

MODULE III: **(11 hours)**

Clustering- Clustering Tasks in Text Analysis, The General Clustering Problem, Clustering Algorithms, Clustering of Textual Data. Information Extraction - Introduction, Architecture of IE Systems, Anaphora Resolution, Inductive Algorithms for IE, Structural IE

MODULE IV: **(10 hours)**

Probabilistic Models for Information Extraction- Hidden Markov Models, Stochastic Context-Free Grammars, Maximal Entropy Modelling, Maximal Entropy Markov Models, Conditional Random Fields.

MODULE V: **(10 hours)**

Visualization Approaches - Introduction, Architectural Considerations, Common Visualization Approaches for Text Mining, Visualization Techniques in Link Analysis, Real-World Example: The Document Explorer System.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Understand text mining concept and general architecture of text mining.
- To learn how to preprocessing the text.
- Understand clustering algorithms in text mining.
- To learn different models for information extraction.
- Understand visualization approaches for text mining.

TEXT BOOKS:

1.Ronen Feldman; James Sanger. (2007). The text mining handbook: advanced approaches in analysing unstructured data, Cambridge University Press. New York

REFERENCE BOOKS:

1. Mining Text Data. Charu C. Aggarwal and ChengXiang Zhai, Springer, 2012.
2. Speech & Language Processing. Dan Jurafsky and James H Martin, Pearson Education India, 2000.
3. Introduction to Information Retrieval. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, Cambridge University Press, 2007.
4. Sholom M. Weiss, Nitin Indurkhya, and Tong Zhang, Fundamentals of Predictive Text Mining, Springer, 2010.

Internal Continuous Assessment (Maximum Marks-50)

70% - Tests (minimum 2).

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 803(D)	NATURAL LANGUAGE PROCESSING	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Provide theoretical concepts of language processing that shows how to explore interesting bodies of text.
- Familiarize with fundamental topics in language processing that include tagging, classification, and information extraction using tiny Python programs.
- Facilitate understanding of formal grammar to describe the structure of an unlimited set of sentences.
- Acquaint with methods to parse a sentence, recognize its syntactic structure and construct - representations of meaning.
- Familiarize with design of existing corpora, the typical workflow for creating a corpus and the life cycle of a corpus

SYLLABUS:

MODULE I: **(10 hours)**

Overview And Language Modeling: Overview: Origins and challenges of NLP Language and Grammar-Processing Indian Languages - NLP Applications-Information Retrieval. Language Modeling: Introduction-Various Grammar-based Language Models-Statistical Language Model.

MODULE II: **(12 hours)**

Word Level and Syntactic Analysis- Word Level Analysis: Introduction Morphological Parsing-Spelling Error Detection and correction - Words and Word Classes-Part-of Speech Tagging. Parsing: Constituency Parsing - Probabilistic Parsing.

MODULE III: **(10 hours)**

Semantic Analysis and Discourse Processing- Semantic Analysis: Introduction- Meaning Representation-Lexical Semantics Ambiguity-Word Sense Disambiguation. Discourse Processing: Introduction- cohesion-Reference Resolution Discourse Coherence and Structure.

MODULE IV **(10 hours)**

Natural Language Generation and Machine Translation- Natural Language Generation: Introduction-Architecture of NLG Systems Generation Tasks and Representations-Application of NLG. Problems in Machine Translation

MODULE V **(12 hours)**

Applications and Lexical Resouces - Information Extraction, Automatic Text Categorization and Text Summarization, Question Answering System. LEXICAL RESOURCES: Introduction - WordNet- Frame Net – Stemmers - POS Tagger, Research Corpora, NLTK.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Discuss basic concepts and applications of Natural Language processing
- Analyse words using prefix, suffix, grammar, PoS.
- Analyse structures of Semantic and Discourse to determine what words and phrases mean in relationship
- Analyse Natural Language Generation and apply machine translation
- Implement levels of NLP system using the Components or lexical resources to demonstrate Morphology syntax of a language

TEXT BOOK:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

REFERENCE BOOKS:

1. Christopher Manning “Foundations of Statistical Natural Language Processing,” MIT Press, July 1999.
2. Dan Jurafsky, James H Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Pearson Education India,2nd edition (2013).
3. NitinIndurkhya, Fred J. Damerau “Handbook of Natural Language Processing”, Second Edition, CRC Press, 2010.
4. James Allen “Natural Language Understanding”, Pearson Publication 8th Edition. 2012.
5. Chris Manning and Hinrich Schütze, “Foundations of Statistical Natural Language Processing”, 2nd edition, MITPress Cambridge, MA, 2003.
6. Hobson lane, Cole Howard, Hannes Hapke, “Natural language processing in action” MANNING Publications, 2019.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 803 (E)	Biomedical Signal Processing	3-1-0-3

PRE-REQUISITES: DIGITAL SIGNAL PROCESSING & BIOMEDICAL INSTRUMENTATION

COURSE OBJECTIVES:

- To understand biomedical signals.
- To understand how to apply specific mathematical techniques to solve problem in the area of biomedical signals.
- To identify basic parameters in human body.
- To learn various scanning techniques.
- To define data compression techniques.

SYLLABUS:

MODULE I: **(11 hours)**

Introduction to biomedical signals: the nature of biomedical signals, examples of biomedical signals, objectives and difficulties in biomedical analysis Electrocardiography: Basics electrocardiography, ECG lead systems, ECG signal characteristics. Signal conversion: simple signal conversion systems, conversion requirements for biomedical signals, signal conversion circuits

MODULE II: **(10 hours)**

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 Hz adaptive cancelling using a sine wave model other, applications of adaptive filtering.

MODULE III: **(10 hours)**

Data compression techniques: turning point algorithm, AZTEC algorithm, function algorithm, Huffman Coding, data, reduction algorithm, the Fourier transform, correlation, convolution, power spectrum estimation, frequency domain analysis of the ECG.

MODULE IV: **(11 hours)**

Cardiological signal processing: basic electrocardiography, ECG data acquisition, ECG lead system, EEG signal characteristics (parameters and their estimation), Analog filers, EEG amplifier and QRS detector, power spectrum of the ECG, Bandpass filters techniques, differentiation techniques, template matching techniques, A QRS detection algorithm, real time ECG Processing algorithm, ECG interpretation, ST segment analyzer, portable arrhythmia monitor.

MODULE V: **(9 hours)**

Neurological signal processing: the brain & it's potentials, the electro physiological origin of brain waves. Neurological Applications: The electroencephalogram - EEG rhythms & waveform - categorization of EEG activity - recording techniques - EEG applications- Epilepsy, sleep disorders, brain computer interface**.** Artifacts in EEG & their characteristics and processing - EEG segmentation.

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

- Describe the basic biomedical signals, electrocardiography and signal conversion
- Illustrate different methods of Signal averaging and adaptive noise cancelling techniques
- Analyse the data compression techniques
- Summarize working of Cardiological signal processing, types of EEG processing algorithm.
- Explain the operation of Neurological signal processing and their applications

TEXT BOOKS:

1. Malmivuo, J. and Plonsey, R. Bio electromagnetism: Principles and Applications of Bioelectric and Bio magnetic Fields, Oxford University Press, New York, 1995.
2. D. C Reddy, "Biomedical Signal Processing, Principles and Techniques", Tata McGraw Hill Publishing Company Limited, First Edition, 2005
3. Willis J Tompkins, "Biomedical Digital Signal Processing", Prentice Hall India Private Limited, First Edition, 2006.
4. Rangaraj M Rangayyan "Biomedical Signal Analysis – A case study approach" IEEE press series in biomedical engineering, First Edition, 2002.
5. John G Proakis, Dimitris and G. Manolakis, "Digital Signal Processing Principles algorithms, applications" PHI Third Edition. 2006
6. Sörnmo, Laguna "Bioelectrical Signal Processing in Cardiac & Neurological Applications", Elsevier

REFERENCE BOOKS

1. Metin Akay, "Biomedical signal processing", academic press.
2. Rabiner and Gold, "Theory and application of digital signal processing", EEE pub.

Internal Continuous Assessment (Maximum Marks-50).

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks- 100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 803 (F)	Computer Based Control System	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Understand the fundamental concepts and components of computer-based control systems.
- Design algorithms and programs using various programming languages.
- Analyze dynamic systems using mathematical and computational methods.
- Implement control strategies using microcontrollers, PLCs, and other digital devices.
- Develop problem-solving skills using computer-based control systems.

SYLLABUS:

MODULE I: (10 Hours)

Introduction- open loop and closed loop control, Two position and multi-position control- PID control- controller operation- control system response- control loop tuning- Multivariable control -feedforward control with example.

MODULE II: (10 Hours)

Programmable logic controllers: Introduction – principles of operation – AND, OR, AND-OR – Architecture – Programming languages – ladder diagram instructions – functional Blocks-Applications of PLC. Microcomputers- Block diagram- Analog and digital I/O modules.

MODULE III: (12 Hours)

Direct digital control -DDC structure-DDC software: position algorithm-velocity algorithm-position vs velocity algorithm-cascade control-ratio control-multivariable control- computer instrumentation-feed forward control. Distributed digital control - Advantages of distributed control systems—functional requirements of process control system-system architecture-Distributed control systems-hierarchical levels.

MODULE IV: **(12 Hours)**

Supervisory control and data acquisition systems- block diagram- channel scanning- conversion into engineering units- data processing- distributed SCADA system. Remote Terminal Unit- Analog & Digital I/O Modules – Communication Module – Special software Facilities. Intelligent controllers-Artificial intelligent based systems-Fuzzy logic system-fuzzy controller-Introduction to Artificial neural networks-Neural Controllers-Neuro fuzzy control system.

MODULE V: **(10 Hours)**

Real time programming- Introduction- Input subsystem, processing subsystem, output subsystem, Interrupts, Information Processing. Multitasking-Task Management-Inter task communication-example-real time Linux. Interfacing PC to outside world-PC in real time environment-PC based distributed control systems.

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

- Understand the fundamentals of automatic process control
- Understand the basic concepts of PLCs and microcomputers
- Know about direct digital control and distributed digital control
- Build knowledge on SCADA, RTU and intelligent controllers
- Familiarize real time systems

TEXT BOOK:

1. Krishna Kant, Computer-Based Industrial Control, PHI learning Private ltd., Second edition,2013

REFERENCE BOOKS:

1. Davis W. Pessen, Industrial Automation: Circuit Design and Components, Wiley, 2011

2. Pierre Belanger, Control Engineering: A Modern Approach, Saunders College Publishing, USA, 2005.

3. Laplante P.A., Real Time Systems: An Engineer.s Handbook, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.

4. Stuart A. Boyer: SCADA-Supervisory Control and Data Acquisition, ISA-Instrumentation, Systems, and Automation Society, 2016

5. Gordon Clarke, Deon Reynders: Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Newnes Publications, Oxford, UK,2004

6. Efim Rosenwasser, Bernhard P. Lampe, Multivariable computer-controlled systems: a transfer function approach, Springer, 2006

Internal Continuous Assessment (Maximum Marks-50).

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions,

quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks- 100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE

questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 804 (A)	EDGE COMPUTING	3-1-0-3

PRE-REQUISITES:NETWORKING,IOT AND CLOUD COMPUTING

COURSE OBJECTIVES:

- To understand the Edge computing architecture
- Familiarize IOT basics
- To understand Raspberry Pi Programming
- To learn the implementation of Raspberry Pi microcomputer
- To understand Industrial and Commercial IoT and Edge,

SYLLABUS:

MODULE I: (10 hours)

Introduction to Edge Computing Scenarios and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

MODULE II: (11 hours)

IoT Architecture and Core IoT Modules-A connected ecosystem,IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

MODULE III: (11 hours)

RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

MODULE IV: (10 hours)

Implementation of Microcomputer RaspberryPi and device Interfacing. Edge to Cloud Protocols: Protocols,MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

MODULE V: **(10 hours)**

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

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

- Understand Edge computing concepts and general architecture.
- To learn IOT architecture and modules.
- Understand RaspberryPi configuration.
- To learn MQTT protocols.
- Understand Edge computing with Raspberry Pi.

TEXT BOOKS:

1.IoT and Edge Computing for Architects - Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020,

2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019,

REFERENCE BOOKS:

1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.

2. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE.

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 804 (B)	Research Methodology	3-1-0-3

PREREQUISITE: Nil

COURSE OBJECTIVES

- Discuss the role and importance of research in the social sciences
- Understand the concepts and procedures of sampling, data collection, analysis and reporting
- Identify the complex issues in selecting a research problem
- Understanding and applying the basics in research methodology
- Familiarize ethical issues in research

SYLLABUS:

MODULE I **(8 Hours)**

Science and Research: Definition – History – Evolution of Scientific Inquiry, Scientific Research: Definition, Characteristics, types, need of research. Identification of the problem, assessing the status of the problem, formulating the objectives, preparing design (experimental or otherwise), Actual investigation.

MODULE II **(10 Hours)**

Introduction to Research Methodology: Meaning and importance of Research – Types of Research – Selection and formulation of Research Problem. Research Design – Need – Features – Inductive, Deductive and Development of models Developing a Research Plan – Exploration, Description, Diagnosis, Experimentation, Determining Experimental and Sample Designs. Analysis of Literature Review – Primary and Secondary Sources, Web sources –critical Literature Review.

MODULE III **(10 Hours)**

Data Collection and Analysis

Sources of Data – Primary, Secondary and Teritary – Types of Data – Categorical, nominal & Ordinal. Methods of Collecting Data: Observation, field investigations, Direct studies, Reports, Records or Experimental observations. Sampling methods – Data Processing and Analysis strategies- Graphical representation.

MODULE IV **(10 Hours)**

Scientific Writing

Structure and components of Scientific Reports – types of Report – Technical Reports and Thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports - Illustrations and tables – Bibliography, Referencing and foot notes –Importance of Effective Communication. Preparing Research papers for journals, Seminars and Conferences – Design of paper using TEMPLATE, Calculations of Impact factor of a journal, citation Index, ISBN & ISSN.

MODULE V **(10 Hours)**

Ethics

Ethical Issues – Ethical Committees – Commercialization – copy right – royalty – Intellectual Property rights and patent law – Track Related aspects of intellectual property Rights – Reproduction of published material – Plagiarism – Citation and Acknowledgement –Reproducibility and accountability.

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

- Formulate research problems
- Identify the need of ethics in research
- Explain key research concepts and issues
- Choose methods appropriate to research aims
- Develop skills in qualitative and quantitative data analysis and presentation

TEXT BOOKS:

1. Garg.B.L., Karadia, R., Agarwal,F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.

2. Kothari, C.R.(2008). Research Methodology: Methods and Techniques. Second Edition. New Age International Publishers, New Delhi.

REFERENCE BOOKS:

1. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.

2.Gupta S.P. (2008). Statistical Methods. 37thed. (Rev)Sultan Chand and Sons. New Delhi. 1470 p.

3. Leon & Leon (2202). Internet for everyone, Vikas Publishing House.

4. Wadehra, B.L.2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

5. Research Methodology Dr P M Bulakh,Dr P. S. Patki and Dr A S Chodhary 2010 Published by Expert Trading Corporation Dahisar West, Mumbai 400068

Internal Continuous Assessment (Maximum Marks-50).

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern (Maximum Total Marks- 100).

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 804 (C)	Leadership and Corporate Strategy	3-1-0-3

PREREQUISITE: Nil

COURSE OBJECTIVES

- Develop proficiency in business strategy concepts, tools, and frameworks.
- Develop data-gathering and analytical skills to identify strategic problems and opportunities.
- Develop leadership.
- Develop integrative thinking about the concepts.
- Develop interpersonal skills as a team member.

SYLLABUS

MODULE I **(10 Hours)**

Course Logistics: Value Creation, Value Appropriation, leader-engineer roles, the concept and learning process of strategic leadership, review of key business concepts and terms, use of financial statements and calculating key metrics.

MODULE II **(12 Hours)**

The concept of competitive advantage and industry analyses, pricing approaches, price-cost-demand relationships, business models, plans. The concept of design thinking and the design thinking process. The process of creating uncontested new market space, concept of value curves and Blue Ocean Strategy.

MODULE III **(10 Hours)**

Structuring and building organizations, organizing around value-added processes, strategic leadership and decision-making. Risk management, strategic leadership in a global business world. crisis management.

MODULE IV **(12 Hours)**

Introduction to Informational listening, Intentional Reading, Short Narratives and Passages. Deep listening to Talk Shows and Debates. Note Making, Note Taking ,Paragraph Writing, Continuous Tenses, Prepositions, Articles, Listening to Lectures and Taking Notes, Interpretation of Tables, Charts and Graphs.

MODULE V **(10 Hours)**

Listening to eminent voices of one's interest (Martin Luther King, APJ Abdul Kalam, etc.). "Wh" Questions / Yes or No Questions, Imperatives. Ice breaker, Case study.

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

- Identify and distinguish between different leadership topologies.
- Apply the requisite skills to become effective leaders and agents of change in engineering organizations.
- Distinguish between the technical and adaptive challenges of engineering leadership.
- Analyze real-world leadership challenges in engineering organizations (business cases)
- Create effective virtual and global engineering teams.

TEXT BOOKS

1. Leading Change (2012) – John P. Kotter, Harvard Business School Press, ISBN 978-1-4221-8643-5.
2. Essentials of Engineering Leadership and Innovation (2017) – Pamela McCauley, Routledge, ISBN 978-1-4398-2011-7

REFERENCE BOOK:

1.StrengthsFinder 2.0 (2007) – Tom Rath, Gallup, ISBN 978-1595620156.

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Total Marks-100)*

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with a choice to answer one question.

ES24 804(D)	MOBILE APPLICATION DEVELOPMENT	3-1-0-3

PREREQUISITE: Nil

COURSE OBJECTIVES*:*

- To help students to gain a basic understanding of Android application development.
- To facilitate students to understand android SDK.
- To inculcate working knowledge of Android Studio development tool.
- To understand the design aspects of mobile application.
- To develop new software.

SYLLABUS:

MODULE I: **(11 Hours)**

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

MODULE II: **(11 Hours)**

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

MODULE III*:* **(10 Hours)**

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

MODULE IV: **(10 Hours)**

Testing Android applications: Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

MODULE V: **(10 Hours)**

Using Common Android APIs: Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

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

- Identify various concepts of mobile programming that make it unique from programming for other platforms
- Critique mobile applications on their design pros and cons
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
- Program mobile applications for the Android operating system that use basic and advanced phone features.
- Deploy applications to the Android marketplace for distribution.

TEXT BOOKS*:*

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

REFERENCE BOOKS*:*

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

Internal Continuous Assessment *(Maximum Marks-50)*

70% - Tests (minimum 2)

20% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class.

University Examination Pattern *(Maximum Total Marks-100)*

PART A*: Analytical/problem solving SHORT questions* ***10x 5 marks= 50 marks***

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B*: Analytical/Problem solving DESCRIPTIVE questions* ***5 x 10 marks= 50 marks***

Two questions from each module with a choice to answer one question.

ES24 804(E)	BLOCK CHAIN	3-1-0-3

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Understand the fundamentals of blockchain technology and its components.
- Understand the basics of cryptography
- Familiarization with consensus mechanism used in blockchain.
- Understand tiers of block chain.
- Familiarization with the Components of the Ethereum ecosystem.

SYLLABUS:

MODULE I: (10 hours)

Basics: The Double-Spend Problem, Byzantine Generals' Computing Problems, Public-Key Cryptography, Hashing, Distributed Systems, Distributed Consensus.

MODULE II: (10 hours)

Technology Stack: Block chain, Protocol, Currency. Bitcoin Block chain: Structure, Operations, Features, Consensus Model, Incentive Model

MODULE III: (11 hours)

Ethereum Block chain: Smart Contracts, Ethereum Structure, Operations, Consensus Model, Incentive Model.

MODULE IV (11 hours)

Tiers of Block chain Technology: Block chain 1.0, Block chain 2.0, Block chain 3.0, Types of Block chain: Public Block chain, Private Block chain, Semi-Private Block chain, Sidechains.

MODULE V (10 hours)

Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Block chain.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Describe the basic concepts and technology used for blockchain.
- Distinguish between Symmetric cryptography and asymmetric cryptography.
- understand the smart contract.
- To explain the basic notion of distributed systems
- understand the types of consensus algorithms**.**

TEXT BOOKS:

1. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing.
2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.
3. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
4. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017).

REFERENCE BOOKS:

1. Josh Thompson, „Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming‟, Create Space Independent Publishing Platform, First Edition - 2017.
2. Andreas M. Antonopoulos, Dr.Gavin wood "Mastering Ethereum" O‟Reilly Media Inc, 2019
3. Ritesh Modi, "Solidity Programming Essentials: A Beginner‟s Guide to Build Smart Contracts for Ethereum and BlockChain", Packt Publishing.
4. Kumar Saurabh, Ashutosh Saxena, Blockchain Technology: Concepts and Applications, First Edition, Wiley Publications, First edition, 2020.
5. Chandramouli Subramanian, Asha A George, et al, Blockchain Technology, Universities Press (India) Pvt. Ltd, First edition, August 2020.
6. Daniel Cawrey, Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications, O'Reilly Media, First edition, 2020.
7. Imran Bashir, Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, Packt Publishing, Third edition, 2020

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**

Two questions from each module with choice to answer one question.

ES24 804(F)	Computer Hardware Engineering	3-1-0-3

PRE-REQUISITES: Nil

COURSE OBJECTIVES:

- Understand the fundamental concepts and components of computer hardware.
- Design digital circuits and systems using various logic families and technologies.
- Analyze and troubleshoot digital circuits and systems using various tools and techniques.
- Implement microprocessor-based systems and embedded systems.
- Understand memory and storage technologies, including RAM, ROM, and mass storage devices.

SYLLABUS:

MODULE I **(12 Hours)**

Introduction to computer hardware Processors, Mother Boards and buses: Evolution, classification of computers, modern computers and history of PC, system types and system components. PC Processors and architecture, processor specifications, features. Motherboards and Buses: Mother board form Factors, obsolete form factor, ATX and other modern form factors. Processor sockets/slots. Chipsets, evolution, Intel chipsets and models, Traditional north/south bridge architecture, hub architecture, Intel Integrated Graphics, Motherboard connectors and system Bus types, the Processor Bus, Memory bus, I/O Buses, System Resources, Motherboard selection criteria.

MODULE II **(12 Hours)**

BIOS: Basics, ROM BIOS, the BIOS upgrading, plug and play BIOS and BIOS Error Messages, Memory: ROM, DRAM, SRAM, types of RAM and upgrades memory. Magnetic storage: How magnetic fields are used to store data, read/write head design. Hard Disk storage: Hard drive advancements and form factors: Hard disk drives components and operation, Hard Disk features; capacity and performance. Optical storage: CD - DVD construction technology, DVD tracks and sectors, handling errors. Optical disk format; CD and DVD formats and copy protection, optical dive performance and trouble shooting. Removable storage: Role of removable Flash media drives; flash memory media, types of flash memory drives.

MODULE III **(12 Hours)**

Video hard ware: Display adapters and monitors, integrated video/motherboard chipsets, video RAM and DAC. Video display interface, digital display interface, Monitors display specifications, LCD, CRT, OLED display technologies. Homogeneous and heterogeneous adapters, video capture devices, bad pixels, Audio hardware: Audio adapter concepts, evaluating the quality, sampling, installation sound cards, Microphone, Speakers and their selection criteria.

MODULE IV **(12 Hours)**

I/O interfaces: I/O ports, differences between serial and parallel ports, universal serial bus (USB), IEEE 1394, Hot-plugging and low speed external connections. Input devices: Keyboards (101,104), Keyboard/mouse interface connectors, USB keyboards, VGA, DV, HDMI ports.

MODULE V: **(10 Hours)**

Power Functions: Switch Mode Power Supply (SMPS), Voltages and current ratings, Power switches; ATX, PC/XT/AT and LPX, Motherboard power connectors (ATX and ATX 12V), compatibility and ATX design, Additional power connectors and specifications. Power use calculations, power cycling, power management and power-protections.

COURSE OUTCOMES: At the end of the course, the student should be able to:

- Understand the components in the motherboard and buses
- Explain memory and different storage media
- Identify different types of video and audio hardware
- Design the different types of I/O interfaces
- Understand power supply system

TEXT BOOK:

1.Scott Mueller - Upgrading and Repairing PCs-Que Publishing

REFERENCE BOOK:

1.(McGraw Hill professional) Michael Meyers - Mike Meyers' CompTIA A+ guide to managing and troubleshooting PCs-McGraw-Hill (2007)

Internal Continuous Assessment (Maximum Marks-50)

60% - Tests (minimum 2).

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Regularity in the class.

University Examination Pattern (Maximum Marks: 100)

PART A: Analytical/problem solving SHORT questions **10x 5 marks= 50 marks**

Candidates have to answer TEN questions out of FIFTEEN. There shall be THREE questions from each module with total FIFTEEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions **5 x 10 marks= 50 marks**
Two questions from each module with choice to answer one question.

ES24 805(P)	Seminar	0-0-6-2

PRE-REQUISITE: NIL

COURSE OBJECTIVES:

- To assess the ability of the student to study
- To present a seminar on a topic of current relevance in the field of Electronics and Communication Engineering or allied areas.
- To develop skills in doing literature survey,
- To present technical based presentation.
- To prepare and submit report.

SYLLABUS:

Seminar is intended to encourage and motivate the students to explore the latest trends in technology related to their area of interest confined to the relevant discipline. They need to identify a topic from latest technical publications including peer reviewed journals, conference proceedings, technical reports, books etc. The student need to prepare a report based on a topic and present it before a team of faculty and students. A faculty member can guide maximum of five students of his area of interest to have better interaction and creative support in guiding the seminar. Each student shall present the seminar for about 20 minutes duration on the selected topic. A committee consisting of three faculty members can evaluate the seminar presentation and report. The evaluation can be based on various factors like, depth of knowledge in the topic, presentation skills, confidence level of the candidate, ability in answering questions etc. Due consideration will be given to the technical content, adequacy of references, and overall presentation and quality of the candidate's seminar report during the evaluation process.

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

- Analyze a current topic of professional interest and present it before an audience.
- Review literature on a given advance topic related to the specific stream.
- Prepare a summary of various concepts systematically after considerable study of the content from primary as well as secondary sources.
- Present and discuss the concept & conclusion in an open seminar.
- Present technical report as per specified norms.

Internal Continuous Assessment *(Maximum Marks-100, Minimum required to pass-50)*

10% - Attendance

20% - Seminar Guide

30% - Technical content of the report

40% - Presentation

ES24 806 (P)	Project Phase II	0-0-8-4

PRE-REQUISITE: PROJECT PHASE I

COURSE OBJECTIVES:

- To enable the students to apply the engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.
- To design and develop a software/hardware project to innovatively solve a real-world problem.
- To develop a product and hand over to the society.

SYLLABUS:

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least two Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation. Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the HOD or a senior faculty member, guide and three/four faculty members specialized in different streams in Electronics & Communication Engineering.

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

- Apply engineering knowledge in practical problem solving.
- Develop creative thinking in finding viable solutions to engineering problems.
- Design innovative products, processes or systems.
- Practice team dynamics to work effectively in a team for the development of technical projects.
- Develop skills in technical presentation and report preparation.

Assessment Pattern

The Continuous Internal Evaluation (CIE) will be conducted as 2 Interim evaluations and a final evaluation.

The Interim evaluation, 2 times in the semester will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a project evaluation committee appointed by Head of the Department. First evaluation is to assess the progress of the work, presentation and discussion. Second Evaluation would be a pre-submission presentation before the evaluation committee to assess the quality and quantum of the work done. It is advised to invite the project guide of the concerned batch for the final evaluation.

The final evaluation committee comprises Project coordinator, two faculty members/ expert from Industry/research Institute/ senior faculty from another department (for interdisciplinary projects-(if any)).

Internal Continuous Assessment *(Maximum Marks-100, Minimum required to pass-50)*

30% - Project Guide

20% - Interim evaluation by the evaluation committee

20% - Quality of the report evaluated by the above committee

30% - Final evaluation by a three- member faculty committee

ES24 807 (P)	Viva Voce	0-0-0-3

PRE-REQUISITE: NIL

COURSE OBJECTIVES:

- To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination

SYLLABUS:

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. course, seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level.

For final viva-voce, candidates should produce certified reports of Internship, Seminar, Mini Project and Main Project. If he/she has undergone industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce.

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

- Demonstrate knowledge in the program domain.
- Present his views cogently and precisely.
- Exhibit professional etiquette suitable for career progression.
- Develop project management skills, including planning, organizing, and controlling.
- Ability to identify and manage project risks and issues.

Assessment in Viva Voce *(Maximum Marks-100, Minimum required to pass-50)*

10% - Industrial training/industrial visit/educational tour or Paper presented at National-level

20% - Seminar

30% - Project

40% - Subjects