

Mahatma Education Society's

Pillai College of Engineering

(Autonomous)

Affiliated to University of Mumbai

Dr. K. M. Vasudevan Pillai's Campus, Sector 16, New Panvel – 410 206.



Department of Computer Engineering

Syllabus

of

B.Tech. in Computer Engineering

for

The Admission Batch of AY 2023-24

First Year - Effective from Academic Year 2023-24

Second Year - Effective from Academic Year 2024-25

Third Year - Effective from Academic Year 2025-26

Fourth Year - Effective from Academic Year 2026-27

as per

Choice Based Credit and Grading System

Mahatma Education Society's

Pillai College of Engineering

Vision

Pillai College of Engineering (PCE) will admit, educate and train a diverse population of students who are academically prepared to benefit from the Institute's infrastructure and faculty experience, to become responsible professionals or entrepreneurs in a technical arena. It will further attract, develop and retain, dedicated, excellent teachers, scholars and professionals from diverse backgrounds whose work gives them knowledge beyond the classroom and who are committed to making a significant difference in the lives of their students and the community.

Mission

To develop professional engineers with respect for the environment and make them responsible citizens in technological development both from an Indian and global perspective. This objective is fulfilled through quality education, practical training and interaction with industries and social organizations.



Dr. K. M. Vasudevan Pillai's Campus , Sector - 16, New Panvel – 410 206

Department of Computer Engineering

Vision

To evolve as a centre of academic excellence and to adapt itself to the rapid advancements in the Computer Engineering field.

Mission

To produce highly qualified, well rounded and motivated graduates who can meet new technical challenges, contribute effectively as team members and be innovators in computer hardware, software, design and application. To pursue creative research and new technologies in computer engineering and across disciplines in order to serve the needs of industry, government, society and the scientific community. To inculcate strong ethical values and responsibility towards society.

Program Educational Objectives (PEOs):

- I. Our graduates will have knowledge, skills and attitude that will allow them to contribute significantly to the research and the discovery of new knowledge and methods in computing and enable them to communicate effectively and work in a team.
- II. Our graduates will function ethically and responsibly, and will remain informed and involved as full participants in our profession and our society. Our graduates will successfully function in multi-disciplinary teams.
- III. Our graduates will apply the basic principles and practices of engineering in the computing domain to the benefit of society and to pursue lifelong learning and professional developments.
- IV. Our graduates will use theoretical and technical computer science knowledge to specify requirements, develop a design, and implement and verify a solution for computing systems of different levels of complexity.

Program Outcomes:

Engineering Graduates will be able to:

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

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

Program Specific Outcomes (PSOs):

1. To analyze, design and develop computer programs using appropriate hardware, software and mathematical models in the areas related to algorithms, system software, multimedia, mobile and web technology, data storage and computing, and networking for efficient and secure systems.
2. To use professional engineering practices, logic and strategies for creating innovative career paths to be an entrepreneur, and an urge to pursue higher studies.
3. To Formulate and solve real life engineering problems for the public health and safety with social and environmental awareness along with ethical responsibility.

The Autonomous status of the institute has given an opportunity to design and frame the curriculum in such a way that it incorporates all the needs and requirements of recent developments in all fields within the scope of the technical education. This curriculum will help graduates to attain excellence in their respective field. The curriculum has a blend of basic and advanced courses along with provision of imparting practical knowledge to students through minor and major projects. The syllabus has been approved and passed by the Board of Studies.

Outcome based education is implemented in the academics and very necessary step is undertaken to attain the requirements. Every course has its objectives and outcomes defined in the syllabus which are met through continuous assessment and end semester examinations. Evaluation is done on the basis of Choice Based Credit and Grading System (CBCGS). Optional courses are offered at department and institute level. Selection of electives from the same specialization makes the student eligible to attain a B. Tech. degree with respective specialization.

Every learner/student will be assessed for each course through (i) an Internal/Continuous assessment during the semester in the form of either Practical Performance, Presentation, Demonstration or written examination and (ii) End Semester Examination (ESE), in the form of either theory or viva voce or practical, as prescribed by the respective Board Studies and mentioned in the assessment scheme of the course content/syllabus. This system involves the Continuous Evaluation of students' progress Semester wise. The number of credits assigned with a course is based on the number of contact hours of instruction per week for the course. The credit allocation is available in the syllabus scheme of each semester.

The performance of a learner in a semester is indicated by a number called Semester Grade Performance Index (SGPI). The SGPI is the weighted average of the grade points obtained in all the courses by the learner during the semester. For example, if a learner passes five courses (Theory/labs./Projects/ Seminar etc.) in a semester with credits C_1 , C_2 , C_3 , C_4 and C_5 and learners grade points in these courses are G_1 , G_2 , G_3 , G_4 and G_5 respectively, then learners SGPI is equal to:

$$SGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The learner's up to date assessment of the overall performance from the time s/he entered for the programme is obtained by calculating a number called the Cumulative Grade Performance Index (CGPI), in a manner similar to the calculation of SGPI. The CGPI therefore considers all the courses mentioned in the scheme of instructions and examinations, towards the minimum requirement of the degree learners have enrolled for. The CGPI at the end of this semester is calculated as,

$$CGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + \dots + C_i * G_i + \dots + C_nG_n}{C_1 + C_2 + C_3 + \dots + C_i + \dots + C_n}$$

The Department of Computer Engineering offers a B. Tech. programme in Computer Engineering. This is an eight-semester course. The complete course is a **171 credit** course which comprises core courses and elective courses. The **department level elective courses/Program Elective courses** are distributed over 4 specializations. The specializations are:

1. Artificial Intelligence and Data Science
2. Cloud and Cyber Security
3. Computational Intelligence and Automation.
4. Human Computer Interaction.

The students also have a choice of opting for **Institute level specializations/Open electives** . These are

- 1 Entrepreneurship Development and Management
- 2 Business Management
- 3 IP Management
- 4 Bioengineering
- 5 Bio Instrumentation
- 6 Engineering Design
- 7 Sustainable Technologies
- 8 Contemporary Studies
- 9 Art and Journalism
- 10 Applied Science
- 11 Green Technologies
- 12 Maintenance Engineering
- 13 Life Skills
- 14 Environment & Safety

The credit requirement for the B.Tech. in Computer Engineering course is tabulated in Table 1.

Table 1. Credit Requirement for B.Tech in Computer Engineering

Course Type		Total Credits
BSC/ESC	Basic Science Course	18
	Engineering Science Course	18
Program Courses	Program Core Course (PCC)	54
	Program Elective Course (PEC)	20
Multidisciplinary Courses	Multidisciplinary Minor (MDM)	10
	Open Electives (OE) Other than a particular program	6
Skill Courses	Vocational and Skill Enhancement Course (VSEC)	8
Humanities Social Science and Management (HSSM)	Ability Enhancement Course (AEC-01, AEC-02)	4
	Entrepreneurship/Economics/Management Courses	4
	Indian Knowledge System (IKS)	2
	Value Education Course (VEC)	2
Experiential Learning Courses	Research Methodology	3
	Communication Engineering Project (CEP)/Field Project (FP)	3
	Project	8
	Internship/ On Job Training (OJT)	8
Liberal Learning Courses	Co-curricular Courses (CC)	4
Suggested Total Credits		171

Preface by Board of Studies in Computer Engineering

Dear Students and Teachers, we, the members of Board of Studies Computer Engineering, are very happy to present the B.Tech Computer Engineering syllabus effective from the Academic Year 2021-22 . We are sure you will find this syllabus interesting, challenging, and fulfill certain needs and expectations.

Computer Engineering is one of the most sought-after courses amongst engineering students. The syllabus needs revision in terms of preparing the student for the professional scenario relevant and suitable to cater the needs of industry in the present-day context. The syllabus focuses on providing a sound theoretical background as well as good practical exposure to students in the relevant areas. It is intended to provide a modern, industry-oriented education in Computer Engineering. It aims at producing trained professionals who can successfully become acquainted with the demands of the industry worldwide. They obtain skills and experience in up-to-date knowledge to analysis design, implementation, validation, and documentation of computer software and systems.

This syllabus is finalized through a brainstorming session attended by Heads of Department and senior faculty members of Department of Computer Engineering. The syllabus falls in line with the vision and mission of the Computer Engineering Department and various accreditation agencies by keeping an eye on the technological developments, innovations, and industry requirements.

We would like to place on record our gratitude to the faculty, students, industry experts and stakeholders for having helped us in the formulation of this syllabus.

Board of Studies in Computer Engineering

1. Dr. Sharvari S. Govilkar	Coordinator (Chairman)
2. Dr. Prashant P Nitnaware	Member
3. Prof. Varunakshi Bhojane	Member
4. Prof. Payel Thakur	Member
5. Dr. Neeta Deshpande	Member
6. Dr.Jyoti Malhotra	Member
7. Dr.Kavita Sonawane	Member
8. Prof.Pranita Mahajan	Member
9. Mr. Samir Mahindre	Member
10. Prof. Deepti Lawand	Member

Program Structure for First Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2023-24
Semester I

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned				
			Theory	Pract.	Theory	Pract.	Total		
FY101	Engineering Mathematics I	BSC	3	2	3	1	4		
FY102	Engineering Physics I	BSC	2	1	2	0.5	2.5		
FY103	Engineering Chemistry I	BSC	2	1	2	0.5	2.5		
FY104	C Programming	ESC	3	2	3	1	4		
FY105	Basic Electrical Engineering*	ESC	3	-	3	-	3		
FY109	Basic Electrical Engineering Lab*	VSEC	-	2	-	1	1		
FY111	Basic Workshop -I	VSEC	-	2	-	1	1		
FY113	Indian Knowledge System	HSSM	-	2+2#	-	2	2		
FY114	Co-curricular Course-I	Liberal Learning	-	4	-	2	2		
Total			13	18	13	9	22		
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Oral/ Pract.	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Average					
FY101	Engineering Mathematics I	40	40	40	60	2	25	-	125
FY102	Engineering Physics I	30	30	30	45	2	25	-	100
FY103	Engineering Chemistry I	30	30	30	45	2	25	-	100
FY104	C Programming	40	40	40	60	2	25	25	150
FY105	Basic Electrical Engineering*	40	40	40	60	2	-	-	100
FY109	Basic Electrical Engineering Lab*	-	-	-	-	-	25	25	50
FY111	Basic Workshop -I	-	-	-	-	-	50	-	50
FY113	Indian Knowledge System	-	-	-	-	-	50	-	50
FY114	Co-curricular Course-I	-	-	-	-	-	50	-	50
Total									775

*- The course can be offered in either SEM I or SEM

Program Structure for First Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2023-24
Semester II

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned				
			Theory	Pract.	Theory	Pract.	Total		
FY115	Engineering Mathematics II	BSC	3	2	3	1	4		
FY116	Engineering Physics II	BSC	2	1	2	0.5	2.5		
FY117	Engineering Chemistry II	BSC	2	1	2	0.5	2.5		
FY107	Engineering Mechanics and Graphics*	ESC	3	-	3	-	3		
FY118	Java Programming	PCC	3	2	3	1	4		
FY121	Professional Communication and Ethics-I	AEC	1	2	1	1	2		
FY110	Engineering Mechanics and Graphics Lab*	VSEC	-	2	-	1	1		
FY123	Basic Workshop -II	VSEC	-	2	-	1	1		
FY125	Co-curricular Course-II	Liberal Learning	-	4	-	2	2		
Total			14	16	12	10	22		
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Oral/ Pract.	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Average					
FY115	Engineering Mathematics II	40	40	40	60	2	25	-	125
FY116	Engineering Physics II	30	30	30	45	2	25	-	100
FY117	Engineering Chemistry II	30	30	30	45	2	25	-	100
FY107	Engineering Mechanics and Graphics*	40	40	40	60	2	-	-	100
FY118	Java Programming	40	40	40	60	2	25	25	150
FY121	Professional Communication Ethics	20	20	20	30	1	25	-	75
FY110	Engineering Mechanics and Graphics Lab*	-	-	-	-	-	25	25	50
FY123	Basic Workshop -II	-	-	-	-	-	-	50	50
FY125	Co-curricular Course-II	-		-	-	-	50	-	50
Total									800

*- The course can be offered in either SEM I or SEM II

Program Structure for Second Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2024-25
Semester III

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned				
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total	
CE 201	Engineering Mathematics III	ESC	3	-	1*	3	-	1	4	
CE 202	Data structure	PCC	3	2	-	3	1	-	4	
CE 203	Database Management Systems	PCC	3	2	-	3	1	-	4	
CE 204	Digital Logic and Computer Architecture	MDM	3	-	-	3	-	-	3	
CE 205	Human Values and Social Ethics	VEC	2	-	-	2	-	-	2	
CE 206	Python Programming Lab	VSE C	-	2+2#	-	-	2	-	2	
Total									19	
Course Code	Course Name	Examination Scheme								
		Theory					Term Work	Oral/ Pract.	Total	
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)					
		1	2			Average				
CE 201	Engineering Mathematics III	40	40	40	60	2	25	-	125	
CE 202	Data structure	40	40	40	60	2	25	25	150	
CE 203	Database Management Systems	40	40	40	60	2	25	25	150	
CE 204	Digital Logic and Computer Architecture	40	40	40	60	2	-	-	100	
CE 205	Human Values and Social Ethic	-		-	-	-	50	-	50	
CE 206	Python Programming Lab	-		-	-	-	50	25	75	
Total				-	160	240	-	175	75	650

* Batchwise tutorial of One hour to be conducted.

Theory class to be conducted for full class .

Program Structure for Second Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2024-25

Semester IV

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
CE 208	Engineering Mathematics IV	ESC	3	-	1*	3	-	1	4
CE 209	Design and Analysis of Algorithms	PCC	3	2	-	3	1	-	4
CE 210	Operating Systems	PCC	3	2	-	3	1	-	4
CE 211	Computer Graphics and virtual reality	PCC	3	-	-	3	-	-	3
CE 212	Entrepreneurship	HSSM	2	-	-	2	-	-	2
CE 213	Web Programming	VSEC	-	2+2#	-	-	2	-	2
CE 214	Personal Finance Management	HSSM	2	-	-	2	-	-	2
Total									21
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Oral/ Pract.	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Average					
CE 208	Engineering Mathematics IV	40	40	40	60	2	25	-	125
CE 209	Design and Analysis of Algorithms	40	40	40	60	2	25	25	150
CE 210	Operating Systems	40	40	40	60	2	25	25	150
CE 211	Computer Graphics and virtual reality	40	40	40	60	2	-	-	100
CE 212	Entrepreneurship	20	20	20	40	2	-	-	60
CE 213	Web Programming	-	-	-	-	-	50	25	75
CE 214	Personal Finance Management	20	20	20	40	2	-	-	60
Total				200	320	-	125	75	720

* Batchwise tutorial of One hour to be conducted.

Theory class to be conducted for full class .

Program Structure for Third Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2025-26
Semester V

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
CE 301	Theory of Computation	PCC	3	–	–	3	–	–	3
CE 302	Machine Learning	PCC	3	2	–	3	1	–	4
CE 303	Microprocessor	MDM	3	–	–	3	–	–	3
CE 304	Computer Network	PCC	3	2	–	3	1	–	4
CE 305	Professional Communication and Ethics II	AEC	1	-	2		-	2	2
CE 3xx	Department Level Optional Course I	PEC	3	2	–	3	1	–	4
IL 3XX	ILOC-I	OE	3	–	–	3	–	–	3
Total									23
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Oral/ Pract.	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Average					
CE 301	Theory of Computation	40	40	40	60	2	–	–	100
CE 302	Machine Learning	40	40	40	60	2	25	25	150
CE 303	Microprocessor	40	40	40	60	2	–	–	100
CE 304	Computer Network	40	40	40	60	2	25	25	150
CE 305	Professional Communication and Ethics II	-	-	-	-	-	50	-	50
CE 3xx	Department Level Optional Course I	40	40	40	60	2	25	25	150
IL 3XX	ILOC-I	40	40	40	60	2	–	–	100
Total				240	360		125	75	800

* Batchwise tutorial of One hour to be conducted.

Theory class to be conducted for full class .

Specializations→	Artificial Intelligence and Data Science	Cloud and Cyber Security	Robotics and Automation	Human Computer Interaction
Course Code	CE 306	CE 307	CE 308	CE 309
Department Level Optional Course I (DLOC I)	Data Warehouse and Data Mining	Cryptography and System Security	IoT and Embedded System for Automation	Augmented Reality and Virtual Reality

SEM V - ILOC I

SN	Specialization	Course 1 (Semester V)	
1	IP Management and Digital Business	IL 360	IPR and Patenting
2	Business Management	IL 361	E- Commerce and E-Business
3	Bio Engineering	IL 362	Introduction to Bioengineering
4	Bio Instrumentation	IL 363	Biomedical Instrumentation
5	Engineering Design	IL 364	Design of Experiments
6	Sustainable Technologies	IL 365	Design for Sustainability
7	Contemporary Studies	IL 366	Political Science
8	Art and Journalism	IL 367	Visual Arts
9	Applied Science	IL 368	Modern Day Sensor Physics
10	Green Technologies	IL 369	Energy Audit and Management
11	Maintenance Engineering	IL 370	Maintenance of Electronics Equipment
12	Life Skills	IL 371	Cooking and Nutrition
13	Environment	IL 372	Environmental Management
14	Safety	IL 373	Vehicle Safety

Program Structure for Third Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2025-26
Semester VI

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned					
			Theory	Pract.	Theory	Pract.	Total			
CE 310	System Programming Compiler Construction	PCC	3	2	3	1	4			
CE 311	Artificial Intelligence	PCC	3	2	3	1	4			
CE 3xx	Department Level Optional Course- II	PEC	3	2	3	1	4			
CE 3xx	Department Level Optional Course- III	PEC	3	2	3	1	4			
IL 36X	Institute Level Optional Course- II	OE	2	1	3	-	3			
CE 391	Project A	ELC		6	—	3	3			
Total							22			
Course Code	Course Name	Examination Scheme								
		Theory					Exam Duration (Hrs)	Term Work	Oral/ Pract.	Total
		Internal Assessment			End Sem Exam					
		1	2	Average						
CE 310	System Programming Compiler Construction	40	40	40	60	2	25	25	150	
CE 311	Artificial Intelligence	40	40	40	60	2	25	25	150	
CE 3xx	Department Level Optional Course II	40	40	40	60	2	25	25	150	
CE 3xx	Department Level Optional Course III	40	40	40	60	2	25	25	150	
IL 36X	Institute Level Optional Course II	40	40	40	60	2	—	—	100	
CE 391	Project A						25	25	50	
Total				200	300		125	150	750	

Specializations→	Artificial Intelligence and Data Science	Cloud and Cyber Security	Robotics and Automation	Human Computer Interaction
Course Code	CE 312	CE 313	CE 314	CE 315
Department Level Optional Course II (DLOC II)	Big Data Analysis	Network & Cloud Security	Robotics & Applications	User Experience Design

Specializations→	Artificial Intelligence and Data Science	Cloud and Cyber Security	Robotics and Automation	Human Computer Interaction
Course Code	CE 316	CE 317	CE 318	CE 319
Department Level Optional Course III (DLOC III)	Natural Language Processing	Ethical Hacking and Cyber Laws	Control Systems for Automation	Human Computer Interaction

ILOC II - SEM VI

SN	Specialization	Course 2 (Semester VI)	
1	Entrepreneurship Development and Management	IL 370	Digital Business Management and Digital Marketing
2	Business Management	IL 37	Business Analytics
3	IP Management	IL 372	IPR and Patenting
4	Bioengineering	IL 373	Medical Image Processing
5	Bio Instrumentation	IL 374	Bio Mechanics
6	Engineering Design	IL 375	Product Design
7	Sustainable Technologies	IL 376	Technologies for Rural Development
8	Contemporary Studies	IL 377	Economics
9	Art and Journalism	IL 378	Journalism, Media and Communication studies
10	Applied Science	IL 379	Operation Research for Management
11	Green Technologies	IL 380	Weather and Climate Informatics
12	Maintenance Engineering	IL 381	Maintenance of Mechanical Equipment
13	Life Skills	IL 382	Physical Education
14	Environment & Safety	IL 383	Vehicle Safety / Industrial Safety Norms

* : Learner will select one course from any of these ILOC verticals.

Program Structure for Fourth Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2026-27

Semester VII

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned				
			Theo ry	Pract.	Theory	Pract.	Total		
CE 401	Deep Learning	PCC	3	2	3	1	4		
CE 402	Software Engineering and Project Management	PCC	3	-	3	-	3		
CE 403	Digital Image Processing	MDM	3	2	3	1	4		
CE 4xx	Department Level Optional Course IV	PEC	3	2	3	1	4		
CE 4xx	Department Level Optional Course V	PEC	3	2	3	1	4		
CE 491	Project B	ELC	-	8	-	4	4		
Total							23		
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Oral / Pract.	Total
		Internal Assessment			End Sem Exam	Exam Durat ion (Hrs)			
		1	2	Avera ge					
CE 401	Deep Learning	40	40	40	60	2	25	25	150
CE 402	Software Engineering and Project Management	40	40	40	60	2	-	-	100
CE 403	Digital Image Processing	40	40	40	60	2	25	-	125
CE 4xx	Department Level Optional Course IV	40	40	40	60	2	25	25	150
CE 4xx	Department Level Optional Course V	40	40	40	60	2	25	25	150
CE 491	Project B						25	25	50
Total				200	300		125	100	725

Specializations→	Artificial Intelligence and Data Science	Cloud and Cyber Security	Robotics and Automation	Human Computer Interaction
Course Code	CE 404	CE 405	CE 406	CE 407
Department Level Optional Course IV (DLOC IV)	Data Science	Vulnerability Assessment and Penetration testing	Industrial Automation	Mobile and Ubiquitous Computing

Specializations→	Artificial Intelligence and Data Science	Cloud and Cyber Security	Robotics and Automation	Human Computer Interaction
Course Code	CE 408	CE 409	CE 410	CE 411
Department Level Optional Course V (DLOC V)	Social Media Analytics	Digital Forensics	Ethics in Robotics	Usability Engineering

Program Structure for Fourth Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2026-27

Semester VIII

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned				
			Theory	Pract.	Theory	Pract.	Total		
CE 412	Parallel and Distributed Systems	PCC	3	2	3	1	4		
CE 413	Research Methodology	ELC	3	2	3	1	3		
CE 493	Internship/ OJT	Experiential Learning Courses	-	16	-	8	8		
CE 494	Project C		-	8	-	4	4		
Total			6	28	6	14	19		
Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Oral/ Pract.	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Average					
CE 412	Parallel and Distributed Systems	40	40	40	60	2	25	25	150
CE 413	Research Methodology	40	40	40	60	2	25	25	150
CE 493	Internship/ OJT	-	-	-	-	-	100	100	200
CE 494	Project C						50	50	100
Total				80	120		200	200	600

**BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING**

(Semester I)

CO2	3	2	1								1	1
CO3	3	2	1								1	1
CO4	3	2	1								1	1
CO5	3	2	1								1	1
CO6	3	2	1								1	1

3. Detailed Theory Syllabus:

Module	Detailed Contents	Hrs.	CO
1	Complex Numbers Prerequisite: Review of Complex Numbers-Algebra of Complex Number, Cartesian, polar and exponential form of complex number. 1.1. De Moivre's Theorem.(Without Proof) 1.2. Expansion of $\sin n\theta$, $\cos n\theta$ in terms of powers of $\sin\theta$, $\cos\theta$ and Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ . 1.3. Powers and Roots of complex numbers.	6	CO1
2	Hyperbolic , Inverse Hyperbolic and Logarithmic functions 2.1 Introduction to Hyperbolic functions, Inverse Hyperbolic Functions. 2.2 Logarithmic functions, Separation of real and Imaginary parts.	6	CO2
3	Successive Differentiation and Expansion of Function Prerequisite :- Derivative of standard functions and Rules of derivative. 3.1 Successive differentiation: nth derivative of standard functions. Leibnitz's Theorem (without proof) and problems 3.2 Taylor's Theorem (Statement only) and Taylor's series, Maclaurin's series (Statement only). Expansion of e^x , $\sin(x)$, $\cos(x)$, $\tan(x)$, $\sinh(x)$, $\cosh(x)$, $\tanh(x)$, $\log(1+x)$, $\sin^{-1}(x)$, $\cos^{-1}(x)$, $\tan^{-1}(x)$.	5	CO3
4	Partial Differentiation and Applications of Partial Differentiation. 4.1 Partial Differentiation: Function of several variables, Partial derivatives of first and higher order. Differentiation of composite function. 4.2. Euler's Theorem on Homogeneous functions with two independent variables (without proof). Deductions from Euler's Theorem. 4.3 Maxima and Minima of a function of two independent variables, Lagrange's method of undetermined multipliers with one constraint. Jacobian of two independent variables.	7	CO4
5	Matrices :- Pre-requisite: Inverse of a matrix, addition, multiplication and transpose of a matrix ,Elementary row and column transformation 5.1. Symmetric, Skew- Symmetric, Hermitian, Skew Hermitian, Unitary, Orthogonal Matrices and properties of Matrices (Without Proof). 5.2 Rank of a Matrix using Echelon forms, reduction to normal form and PAQ form. 5.3. System of homogeneous and non –homogeneous equations, their consistency and solutions.	6	CO5

6	Numerical Methods 6.1 Solution of system of linear algebraic equations , (1) Gauss Elimination, (2)Gauss Jacobi Iteration Method (3) Gauss Seidel Iteration Method, 6.2 Solutions of Transcendental equations (1) Bisection Method (2) Secant Method (3) Newton Raphson Method.	6	CO6
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4. Suggested Experiments:

General Instructions: Each student has to perform at least 4 SCILAB /MATLAB practical's and at least 6 assignments on the entire syllabus.

List of Scilab Programing:

1. Gauss Elimination
2. Gauss Seidel Iteration method
3. Gauss Jacobi Iteration Method
4. Bisection method
5. Secant Method
6. Newton Raphson
7. Matrices
8. Maxima and Minima

5. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

B. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 5 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on the maximum contents of the syllabus.
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

6. Practical Assessment: The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of 8 practical based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 10 Marks (Practical) + 10 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

1. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 9th Ed.
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication, Matrices, Shanti Narayan, S. Chand publication.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill .

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY102	Engineering Physics I	Contact Hours	2	1	-	3
		Credits	3	-	1	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY102	Engineering Physics I	30	30	30	45	25	-	-	100

1. Course Objectives :

The course is aimed to:

1. To impart knowledge of basic concepts in applied physics and founding principles of technology..
2. To provide the knowledge and methodology necessary for solving problems in the field of engineering.
3. To develop scientific temperament for scientific observations, recording, and inference drawing essential for technology studies.

2. Course Outcomes :

On successful completion of course learner/student will be able to:

1. Explain the functioning of lasers and their various applications.
2. Explain the working principle of optical fibres and their applications especially in the field of communication.
3. Understand fundamental concepts of classical optics to study Interference of light in thin films
4. Apply the knowledge of Interference of light in various applications.
5. Explain the limits of Classical Physics and apply the fundamentals of quantum mechanics to study the one dimensional motion of microscopic particles.
6. Apply the knowledge of superconductivity to SQUID and Magnetic levitation.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	2	1	1	1	1	1	1	1	1
CO2	1	3	2	2	2	3	1	1	1	2	2	1
CO3	1	3	3	3	2	3	2	2	2	2	2	2
CO4	1	2	3	3	1	1	2	2	1	2	2	1
CO5	1	2	3	2	1	1	1	1	1	1	1	1
CO6	1	2	3	3	2	2	2	2	2	2	2	2

3. Detailed Theory Syllabus:

Module	Detailed Contents of Module	Hrs.
1.	Lasers: 1.1 Basic Definitions and explanation of terms: Spontaneous emission and stimulated emission; metastable state, population inversion, types of pumping, resonant cavity, Einstein's Coefficients and their derivation. 1.2. 3-level and 4-level lasing system and need for at least a 3-level system for lasing action. 1.3. Helium Neon laser: Construction, working and Energy level Diagram. 1.4. Nd: YAG laser: Construction, working and Energy level Diagram. 1.5. Application of Lasers: Holography.	4
2.	Optical Fibres: 2.1. Working Principle and Structure 2.2. Derivation of expression for Numerical Aperture for step index fibre. Expression for Critical angle; angle of acceptance for a step Index Fibre. 2.3. Classification of optical fibres. 2.4. Expression for V-number and modes of propagation for a step index fibre. 2.5. Applications : Fibre optic communication system	3
3.	Interference in Thin Films: 3. Interference in Thin Films 3.1. Interference by division of amplitude and by division of wave front. 3.2. Interference in thin films of constant thickness due to reflected light: Conditions for maxima and minima 3.3. Interference in thin films of constant thickness due to transmitted light: Conditions for maxima and minima 3.4. Interference in Wedge shaped film: Conditions for maxima and minima 3.5. Newton's Rings: Diameter of dark and bright rings	4
4.	Applications of Interference of light: 4.1: Thin Films of constant thickness: Origin of colours and estimation of absent colours in interference pattern, Conditions for refractive index and thickness for Highly reflecting and Anti-reflecting thin films on glass. 4.2: Wedge Shaped Thin Film: Relation between fringe width and wedge angle, Estimation of film thickness of a thin foil or wire. 4.3: Newton's Rings: Estimation of ring diameter for a particular wavelength and estimation of refractive index of gap medium.	3
5.	Quantum Mechanics: 5.1. De Broglie wave hypothesis, properties of matter waves: wave packet, Derivation of expressions for phase velocity and group velocity and their relationship. 5.2. Wave Function, its physical interpretation and salient features. 5.3. Heisenberg's Uncertainty principle statements and their interpretation: momentum and position/energy time forms. 5.4. Derivation of Schrodinger's Time Dependent Wave equation and Schrodinger's Time Independent Wave Equation 5.5. Energy Levels and distribution of probabilities of a charged particle bounded in an infinite potential well	7
6.	Superconductivity: 6.1. Critical temperature, critical magnetic field of a superconductor. 6.2. Meissner Effect, Type I and Type II and high T _c superconductors 6.3. BCS Theory (concept of Cooper pair) 6.4. Applications of superconductors: MAGLEV and qualitative discussion of Josephson effect and SQUID.	3

4. Suggested Experiments:

1. Determination of angular divergence of laser beam.
2. Determination of wavelength of laser light using Diffraction grating. (Laser source)
3. Determination of Numerical Aperture of an optical fibre.
4. Study of a Fibre Optic Communication system (Demonstration only)
5. Determination of Thickness of thin paper sheet using Wedge Shaped film
6. Determination of wavelength of monochromatic source using Newton's Rings
7. Determination of Planck's constant 'h' using LEDs of different colours .

5. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

B. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on the maximum contents of the syllabus.
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

6. Practical Assessment: The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

C. Term Work: Term Work shall consist of 7 practical based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

D. Term Work Marks: 25 Marks (Total marks) = 10 Marks () + 10 Marks (Group Project or Topic Presentation) + 5 Marks (Attendance)

7. Books and References:

1. A text book of Engineering Physics-Avadhanulu & Kshirsagar, S. Chand
2. A textbook of Optics - N. Subramanyam and Brijlal, S.Chand
3. Fundamentals of optics by Jenkins and White, McGrawHill
4. Modern Engineering Physics – Vasudeva, S.Chand
5. Concepts of Modern Physics- Arther Beiser, Tata McGraw Hill
6. A TextBook of Engineering Physics, S. O. Pillai, New Age International Publishers.
7. Optics - Ajay Ghatak, Tata McGraw Hill8. Introduction to Electrodynamics- D. J. Griffiths, Pearson publication .
8. Physics for Engineers, M.R. Srinivasan, New Age International Publishers.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY103	Engineering Chemistry I	Contact Hours	2	1	-	3
		Credits	2	1	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY103	Engineering Chemistry I	30	30	30	45	25	-	-	100

1. Course Objectives:

The course is aimed to:

1. To appreciate the need and importance of engineering chemistry in the industry and Engineering field.
2. To include the importance of water in industrial usage.
3. To provide the knowledge of lubrication aspects of machine components.
4. To enable the students to understand the role of engineering materials such as polymers.
5. To introduce composite materials and their applications.
6. To provide an understanding of the fundamental chemical processes that cause environmental problems.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. To analyze the quality of water for application in industries and to suggest methods to improve water quality.
2. To acquire knowledge on physical / chemical / biological characteristics of water and the treatment technique for sewage.
3. To select various lubricants for different industrial applications.
4. To identify various polymeric materials and their applications in engineering.
5. To identify, describe and evaluate the properties of different types of composite materials.
6. To develop an understanding of the environmental challenges and suggest methods for their minimisation based on green chemistry principles.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1			1					1	1
CO2	3	2	1								1	1
CO3	3	2	1	1							1	1
CO4	3	2	1	1							1	1
CO5	3	2	2	1			2				1	1

CO6												
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3. Detailed Theory Syllabus:

Module	Detailed Contents	Hrs
1	Module 1 - Hardness of water Pre - requisites : Knowledge of sources of water, Possible impurities in water, Characteristics imparted by impurities in water. Hardness in water – Types & its units, Determination of hardness by EDTA method, numerical problems. Effects of Hard water in Industries - Boiler corrosion, Priming and Foaming, Scales and Sludges, caustic embrittlement, (Causes, methods of prevention), Langlier Index Softening of water- Ion exchange process.	3
2	Module 2 - Water Treatment Domestic water treatment : Steps involved in domestic water treatment - screening, sedimentation, filtration, disinfection - chlorination ,treatment with ozone. Desalination of brackish water- Reverse Osmosis, Electro dialysis, Ultrafiltration Sewage water treatment : BOD and COD, determination and numerical problems, Steps involved in sewage water treatment- primary, secondary (activated sludge process)	3
3	Module 3 - Lubricants Pre - requisites : Definition of Lubricants and Lubrication, functions of lubricants Functions of lubricants, Mechanisms of lubrication – Thick film, Thin film and Extreme pressure Classification of lubricants - Solid (MoS_2 , graphite), Semi solid (greases), Liquid (animal/vegetable oils, mineral oils, Blended oils) Lubricants for special applications Properties of lubricants and their significance - Viscosity and Viscosity Index, Flash and Fire Points, Cloud and Pour Points, Acid Number, Saponification Number, and related numerical problems.	4
4	Module 4 - Polymeric materials Pre - requisite : Polymer, Monomer, Polymerization, Degree of polymerisation, Classification of polymers, Mechanism of polymerisation. Molecular weight of polymers: Average molecular weight (weight average and number average) of a polymer, Polydispersity Index, Numerical problems. Polymer crystallinity - glass transition temperature and factors affecting T _g , Viscoelasticity Additives in polymers Commercially important polymers - Polyethylene, Polyvinyl acetate, Polydimethyl Siloxane , Epoxy resins , Polylactic acid (PLA) Conducting polymers - Mechanism of conduction in polymers, Examples and applications.	6

5	Module 5: Polymer Composites Prerequisite : Definition and basic understanding of composite materials. Constitution of composite materials- Matrix and Dispersed phase Classification of composite materials - Particle reinforced composites, Fibre reinforced composites, structural composites . Advantages and Applications of composite materials	4
6	Module 6 - Environmental Chemistry Pre- requisites: Definition of Environment and Primary concept of environmental pollution. Industrial Pollution- Causes, Effects and solutions, a case study on industrial pollution E-pollution- Causes, concerns and management , Carbon credit Concept of 12 principles of Green chemistry, discussion with examples (synthesis of indigo, adipic acid), numericals on atom economy.	4

4. Suggested Experiments:

1. Determination of Hardness in water.
2. Determination of Chloride content in water.
3. Acid value of lubricating oil.
4. Viscosity Index by Redwood viscometer.
5. Determination of Dissolved oxygen in water.
6. Determination of COD.
7. Viscoelasticity of Silly putty.
8. Synthesis of conducting polyaniline from aniline by chemical oxidative polymerization

5. Theory Assessment:

- A. Internal Assessment (IA):** Two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.
- B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
 1. Question paper will consist of 5 questions, each carrying 20 marks.
 2. Question number 1 will be compulsory and based on the maximum contents of the syllabus.
 3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
 4. Total three questions need to be solved.

6. Practical Assessment: The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

- A. Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
- B. Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

1. Engineering Chemistry – P.C.Jain and Monika Jain, Dhanpat Rai Publications
2. A Textbook of Engineering Chemistry, - Shashi Chawla (DhanpatRai publications)
3. A textbook of Engineering Chemistry - S.S. Dara, S. Chand Publishing House
4. Environmental Pollution Control Engineering - C.S.Rao (New Age International)
5. Environmental Chemistry – A.K.De, New Age International

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY104	C Programming	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY104	C Programming	40	40	40	60	25	25	-	150

1. Course Objectives:

The course is aimed to:

1. To provide exposure to problem-solving by developing algorithms and designing flowchart.
2. Implement the logic to solve real world problems using the C programming language.
3. To develop solutions using different programming concepts.
4. To decompose solutions into smaller units using functions.
5. To create different types of data-structure using structure and arrays.
6. Describe the dynamics of memory using a pointer.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Understand the basic terminology used in computer programming.
2. Use different data types, operators and keywords to write programs
3. Able to logically code using control statements and loops.
4. Design programs involving functions and recursive functions.
5. Use the concepts of arrays, strings and Structures to structure complex programs
6. Use of pointers to access different user defined data types like arrays, Strings and Structures

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1						1	1	1		2
CO2	2	1						1	1	1		2
CO3	2	1						1	1	1		2
CO4	2	2	2	1		1		1	1	1		2
CO5	2	2	2	1		1		1	1	1		2
CO6	2	2	2	1		1		1	1	1		2

3. Detailed Theory Syllabus:

Module	Detailed Contents	Hrs
1	History of C programming language and its features 1.1 Algorithm & Flowchart : Three construct of Algorithm and flowchart: Sequence, Decision (Selection) and Repetition 1.2 Character Set, Identifiers and keywords, Data types, Constants, Variables. 1.3 Operators-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators. Expression, statements, Preprocessor, Structure of basic C program.	5
2	Control Flow statements: 2.1 Decision making statements- if statement, if-else statement , if-else-if ladder, nested if-else, switch statement 2.2 Looping – while , do-while, for 2.3 Jump Statements- break, continue, goto, return, exit	10
3	Functions: 3.1 Introduction to Functions, declaring and defining function, calling function, passing arguments to a function, recursion and its application. 3.2 Library functions – getchar(), putchar(), gets(), puts(), Math function, Ctype functions 3.3 Storage classes in C-auto, extern, static, register.	5
4	Arrays and Strings: 4.1 Array Introduction, Declaration, Initialization, Accessing array element, One and Two-dimensional array. 4.2 Strings Introduction, String using char array, String handling functions	7
5	Structures: 5.1 Structure Introduction, Declaration, Initialization, operations on structure. 5.2 Nested structure, Array of Structure.	3
6	Pointers: 6.1 Pointer :Introduction, Definition, Pointer Variables, Referencing and Dereferencing operator, Pointer Arithmetic, Pointers to Pointers, void Pointer, 6.2 Pointers to Array and Strings, Passing Arrays to Function, Accessing structure using pointers, Array of Pointers, call by value and call by reference. 6.3 Dynamic Memory Allocation using malloc, calloc, realloc, free	6

4. Suggested Experiments:

1. Write algorithm and draw flowchart to find roots of quadratic equation
2. Write a program to swap two integers with and without using temporary variables.
3. Write a program to calculate the volume of a cone. Accept radius & height from the user.
4. Write a program to find the greatest among three integers using ternary operator & if-else.
5. An electric power distribution company charges its domestic customer as follows

Consumption Units	Rate of charge
0 - 200	0.50 per unit
201 - 400	Rs. 100 plus 0.65 per unit excess of 200 units

401 - 600	Rs. 230 plus 0.85 per unit excess of 400 units
601 above	Rs. 390 plus 1.00 per unit excess of 600 units.

Program should read units consumed for a customer and calculate the total bill.

6. Write a program to take input for a character and print the month names starting with that character using a switch case. (Ex: I/P = 'A', O/P = April, August).

7. Write a program to find the result of the series:

$$1 - 2^{2/3} + 3^{2/5} \dots \dots \dots + n^{2/(2n-1)}$$

8. Write a program to print the following pattern : (Take input for the no. of lines 'N').

```
*
* *
* * *
* * * *
```

9. Write a program to print the following pattern : (Take input for the no. of lines 'N').

```
1
12A
123BA
1234CBA
```

10. Write a program to find if the given number is a palindrome number or not.

11. Write a program for the sum of natural numbers using a recursive function.

12. Write a program to illustrate different ways of passing parameters to a function to demonstrate increment/decrement operators.

13. Write a program to cyclically rotate elements of the integer array in the right direction.

14. Write a program to find transpose using the same matrix.

15. Write a program to find the reverse of a string using another string (Define a user defined function to find the length of the string).

16. Write a program using Structure to accept employee name, emp_id, date_of_joining and salary. Display the result in descending order of salary. Store data for N Employees.

17. Write a program to dynamically allocate memory for the user entered size 'N' of an array, accept 'N' integers from the user and find the average of these integers using function and pointer (Pass array to the function using pointer).

5. Theory Assessment:

Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.

2. Question number 1 will be compulsory and based on the maximum contents of the syllabus.

3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)

4. Total three questions need to be solved.

6. Practical Assessment: The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of a minimum of 5 practical based on the above list. Also Term work Journal must include at least 4 assignments based on the topics mentioned in the syllabus.

Term Work Marks: 25 Marks (Total marks) = 10 Marks (Practical) + 10 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

1. "Programming in ANSI C", by E. Balaguruswamy, Tata McGraw-Hill Education
2. "A Computer Science –Structure Programming Approaches using C ", by BehrouzForouzan , Cengage Learning
3. "Let Us C", by Yashwant Kanetkar, BPB Publication
4. "MASTERING C" by K.R.Venugopal and SudeepR.Prasad , Tata McGraw-Hill Publications.
5. "Programming Techniques through C", by M. G. Venkateshmurthy, Pearson Publication.
6. "Programming in C", by Pradeep Dey and Manas Gosh, Oxford University Press.
7. Schaum's outlines "Programming with C", by Byron S. Gottfried, Tata McGraw-Hill Publications.
8. "Basics of Computer Science", by BehrouzForouzan , Cengage Learning .

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY105	Basic Electrical Engineering	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY105	Basic Electrical Engineering	40	40	40	60	-	-	-	100

1.Course Objectives:

1. To provide knowledge on fundamentals of D.C. circuits.
2. To provide knowledge of D.C network theorems and its applications.
3. To impart knowledge on fundamentals of A.C. circuits
4. To impart knowledge on fundamentals of single phase A.C circuits and its applications.
5. To impart knowledge on fundamentals of 3- Φ A.C. circuits and its applications.
6. To impart knowledge on basic operation and applications of electrical machines.

2. Course Outcomes:

On successful completion of course learner/student will be able to

1. Apply basic concepts to analyse D.C circuits.
2. Apply various D.C network theorems to determine the circuit response/ behavior.
3. Apply basic concepts to analyse A.C waveforms.
4. Evaluate and analyse single phase A.C circuits.
5. Evaluate and analyse three phase A.C circuits.
6. Understand the constructional features and operation of electrical machines.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	--	1	--	1	1	--	--	1
CO2	3	2	1	1	--	1	--	1	1	--	--	1
CO3	3	2	1	1	--	1	--	1	1	--	--	1
CO4	3	2	1	1	--	1	--	1	1	--	--	1
CO5	2	1	1	1	--	1	--	1	1	--	--	1
CO6	1	1	1	1	--	1	--	1	1	--	--	1

3. Detailed Theory Syllabus:

Prerequisite: Resistance, inductance, capacitance, series and parallel connection of resistance, concept of voltage, current, power and energy and its units.

Sr. No.	Module	Detailed Contents of Module	Hrs.
1	Dc Circuits	DC Circuits	

		Series and Parallel circuits, Concept of short and open circuits, Star-delta transformation, Ideal and practical voltage and current source, Kirchhoff's laws, Mesh and Nodal analysis (super node and super mesh included), Source transformation.	6
2	DC Theorems	DC Theorems Linear and Nonlinear Circuit, Active and passive network, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, (Source transformation not allowed for Superposition theorem).	8
3	AC fundamentals	AC fundamentals Generation of alternating voltages, A.C terminology, RMS and Average value, form factor, crest factor, Phasor representation of alternating quantities, addition and subtraction of alternating quantities using phasors.	3
4	Single-Phase AC Circuits	Single Phase AC Circuits AC through pure resistor, inductor and capacitor. AC through R-L , R-C and R-L-C series and parallel circuits, phasor diagrams, power and power factor, series and parallel resonance, Q-factor .	1
5	Three-Phase AC Circuits	Three Phase AC Circuits Three phase voltage and current generation, star and delta connections (balanced load only), relationship between phase and line currents and voltages, Phasor diagrams, Basic principle of wattmeter, measurement of power by two wattmeter method .	6
6	Electrical Machines	Electrical Machines Working principle of single-phase transformer, EMF equation of a transformer, Transformation Ratio, Transformer Rating. Losses in transformer.	3

4. Assessment:

I. Internal Assessment Test:

Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

II. End Semester Examination:

1. Question paper will consist of 5 questions, each carrying 20 marks.
2. Total 3 questions need to be solved.
3. Q.1 will be compulsory, based on the entire syllabus.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of marks should be proportional to number of hours assigned to each module

5. Books and References:

1. "Basic Electrical Engineering", by Prof. B. R. Patil, Oxford Higher Education
2. "Basic Electrical Engineering (BEE)", by Prof. Ravish Singh", McGraw Hill Education
3. B.L. Theraja "Electrical Technology" Vol-I and II, S. Chand Publications, 23rd ed. 2003.
4. Joseph A Edminister, "Schaum's outline of theory and problems of electric circuits" Tata McGraw Hill, 2nd edition
5. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY109	Basic Electrical Engineering Lab	Contact Hours	-	2	-	2
		Credits	-	1	-	1

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY109	Basic Electrical Engineering Lab	-	-	-	-	25	-	25	50

Basic Electrical Engineering Laboratory

Hardware Requirements: Hardware Kits, Three phase power supply.

List of Suggested Experiments:

1. Mesh and Nodal analysis.
2. Verification of Superposition Theorem.
3. Verification Thevenin's Theorem.
4. Study of R-L series and R-C series circuits.
5. R-L-C series resonance circuit
6. R-L-C parallel resonance circuit
7. Relationship between phase and line currents and voltages in three phase system (star & delta)
8. Power and phase measurement in a three phase system by one wattmeter method.
9. Power and phase measurement in a three phase system by two wattmeter method.

Lab Assessment:

I. Term work Assessment:

Term work consists of performing minimum 06 practical's. Final certification and acceptance of the term work ensures satisfactory performance of laboratory work.

The distribution of Term Work marks will be as follows:

Attendance (Theory, Practicals) : 5 marks

Assignment on entire syllabus : 10 marks

Practicals : 10 marks

II. Oral/Viva Assessment:

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY111	Basic Workshop Practice I	Contact Hours	-	3	-	3
		Credits	-	1.5	-	1.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY111	Basic Workshop Practice I	-	-	-	-	50	-	-	50

1. Course Objectives :

The course is aimed to:

1. To impart training to help the students develop engineering skill sets
2. To inculcate respect for physical work and hard labour
3. To get exposure to interdisciplinary engineering.
4. To get exposure to the spirit of teamwork.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. To develop the necessary skill required to handle / use different fitting tools.
2. To develop skills required for hardware maintenance.
3. Able to install an operating system and system drives.
4. Able to prepare the edges of jobs and do simple arc welding.
5. Demonstrate the turning operation with the help of a simple job.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2							1	1		1	2
CO2	2							1	1		1	2
CO3	2							1	1		1	2
CO4	2							1	3		1	2
CO5	2							1	1		1	2

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Fitting	Fitting: Use and setting of fitting tools for chipping, cutting, filing, marking, center punching, drilling, tapping. Term work to include one job involving following operations : filing to size, one simple male- female joint, drilling and tapping	10

2	Hardware and Networking	Hardware and Networking: Dismantling of a Personal Computer (PC), Identification of Components of a PC such as power supply, motherboard, processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc. · Assembling of PC, Installation of Operating System (Any one) and Device drivers, Boot-up sequence. Installation of application software (at least one) · Basic troubleshooting and maintenance · Identification of network components: LAN card, wireless card, switch, hub, router, different types of network cables (straight cables, crossover cables, rollover cables) Basic networking and crimping. NOTE: Hands on experience to be given in a group of not more than four students	8
3	Welding	Welding: Edge preparation for welding jobs. Arc welding for different job like, Lap welding of two plates, butt welding of plates with simple cover, arc welding to join plates at right angles.	6
4	Machine Shop	Machine Shop: At least one turning job is to be demonstrated and a simple job to be made for Term Work in a group of 4 students.	6
5	Plumbing	Plumbing: Use of plumbing tools, spanners, wrenches, threading dies, demonstration of preparation of a domestic line involving fixing of a water tap and use of coupling, elbow, tee, and union etc.	6
6	Adaptive Manufacturing Technology	Adaptive Manufacturing Technology: History of adaptive manufacturing, 3D Printer: - how a 3D printer works, Parts of 3D Printer and their functions, Constructional details of 3D printer.	6

Note:- Trade 1 & 2 are compulsory and select any one trade from trade 3 to 6.

4. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of practical's based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: 50 Marks (Total marks) = 30 Marks (Experiment) + 10 Marks (Assignments) + 10 Marks (Attendance)

7. Books and References:

1. Workshop Technology by H K Hajara Choudhary
2. Manufacturing Technology by R C Jain
3. Workshop Technology by R S Khurmi and J S Gupta
4. Workshop Technology by Chapman.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY113	Indian Knowledge System	Contact Hours	1	2	-	3
		Credits	1	1	-	2

Course Code	Course Name	Examination Scheme				
		Theory Marks	Term Work	Practical	Oral	Total
		End Sem Exam				
FY113	Indian Knowledge System	20	30	-	-	50

1. Course Objectives:

The course is aimed to:

1. Creating awareness amongst the youths about the true history and rich culture of the country
2. Understanding the scientific value of the traditional knowledge of Bhārata
3. Promoting the youths to do research in the various fields of the Bhāratiya knowledge system
4. Converting the Bhāratiya wisdom into the applied aspect of the modern scientific paradigm; Adding career, professional, and business opportunities to the youths

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Understand the importance of ancient Indian knowledge in today's world and its historical background.
2. Gain an appreciation for the valuable cultural heritage found in our traditions.
3. Discover the history and the scientific aspects behind our traditional arts, practices, and rituals.

3. Detailed Theory Syllabus:

Module	Detailed Contents	Hrs
1	Indian Knowledge Systems: An Overview Traditional Knowledge System, Introduction to the Vedas, Chhandas, Veda and Vedāṅga, Itihāsa and Purāṇa, Dharmasāstra, Darśanas, Nyāya. The role of Itihasas and Puranas in understanding the Vedas.	4
2	History of Indian Knowledge Systems Bhagwat Purana, Arthashastra, The importance of Sthapatya-veda. The ancient cities of the Indus Sarasvati region. Town planning and drainage systems. Irrigation and Dams, Decline of Knowledge system, Attack on the Universities and Knowledge Creation	4
3	Iron and Steel Technology in Ancient India Vedic references to metals and metal working. Mining and manufacture in India of Zinc, Iron, Copper, Gold, etc., from ancient times. Significance and wide prevalence of ironsmith and other metal workers in the pre-modern era.	4

4. Theory Assessment:

A. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Written Examination for 20 marks
2. Weightage of each module will be proportional to the number of respective lectures mentioned in the syllabus.

5. Term Work: Project and Presentation for 30 marks based on the syllabus

6. Books and References:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).
4. An Introduction to Indian Knowledge Systems: Concepts and Applications, B Mahadevan, V R Bhat, and Nagendra Pavana R N; 2022 (Prentice Hall of India).
5. Indian Knowledge Systems: Vol I and II, Kapil Kapoor and A K Singh; 2005 (D.K. Print World Ltd).

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY114	Co curricular course-I	Contact Hours	-	4	-	4
		Credits	-	1	-	2

Course Code	Course Name	Examination Scheme				
		Theory Marks	Term Work	Practical	Oral	Total
		End Sem Exam				
FY114	Co curricular course-I	-	50	-	-	50

Sr No.	Name of Activity	Number of Hours
1	Meditation	3
2	Makers Day	2
3	Pre-Placement Talk	2
4	NPTEL Course	
5	Any other Activity	

Activity 1 - Meditation

Every student has to attend 3 sessions of Meditation activity. Each session will fetch 1 point. A student can score a maximum of 3 points. Their presence and participation in the activity will be certified by the faculty in charge.

Activity 2 - Makers Day

MAKERS DAY gives the spirit of hands-on learning by providing opportunities to explore various engineering-oriented projects from various domains of engineering. This will provide a chance to create new ideas and gain practical experience that goes beyond traditional classroom learning.

A visit to all the assigned laboratories, the students can score a maximum of 2 points. Their presence and participation in the activity will be certified by the faculty in charge.

Activity 3- Pre placement talk

Pre placement talk is scheduled for all the students, branch wise, where the students will be able to understand the aspects that they need to improve, criteria for the placement etc.

All the students have to attend the pre placement talk and will gain 2 points. Their presence and participation in the activity will be certified by the faculty in charge.

Activity 4 - NPTEL course

The students have to get enrolled in one NPTEL course related to their subjects.

On completing and submitting all the assignments, the students will get 2 points (they need to attach the summary of assignment to gain these points).

If the student has attended the examination, he /she will be given 5 points. Extra 3 points are also allotted on passing the course . If the student gets an ELITE grade, he/she will be given 5 extra points (They need to attach the certificate)

AY 2023-24

**BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING**

(Semester II)

3. Detailed Theory Syllabus:

Prerequisite: Engineering Mathematics I

Sr. No.	Module	Detailed Contents of Module	Hrs.
1	Differential Equations of First Order and First Degree	1.1 Exact Differential Equations, Equations reducible to exact form by using integrating factors. 1.2 Linear differential equations, Equations reducible to linear form.	6
2	Linear Differential Equations With Constant Coefficients and Variable coefficients of higher order	2.1. Linear Differential Equation with constant coefficient- complementary function, particular integrals of differential equation of the type $f(D)y = X$ where X is e^{ax} , $\sin(ax + b)$, $\cos(ax + b)$, x^n , $e^{ax}V$, xV . 2.2. Cauchy Differential equation, 2.3. Method of variation of parameters two variables	8
3	Beta and Gamma Function	3.1 Gamma Functions and its properties. 3.2 Beta Functions and its properties.	4
4	Double Integration	Prerequisite: Tracing of curves 4.1. Double integration- Evaluation of Double Integrals.(Cartesian & Polar), Change of order of Integration and evaluation 4.2. Evaluation of integrals over the given region.(Cartesian & Polar) 4.3. Evaluation of double integrals by changing to polar coordinates.	8
5	Applications of integration	5.1. Application of double integrals to compute Area 5.2. Triple integration: Evaluation only (Cartesian, cylindrical and spherical polar coordinates)	4
6	Numerical Techniques	6.1. Numerical solution of ordinary differential equation (a) Euler's method (b) Modified Euler method, (c) Runge-Kutta fourth order method 6.2. Numerical integration- (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule	6

4. Theory Assessment:

- A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.
- B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
1. Question paper will consist of 5 questions, each carrying 20 marks.
 2. Total three questions need to be solved.
 2. Question number 1 will be compulsory and based on the maximum contents of the syllabus.
 3. Remaining questions will be randomly selected from modules.

4.Weightage of each module will be proportional to the number of respective lectures mentioned in the syllabus.

5. Books & References:

1. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 9th Ed.
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication,
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill .

Engineering Mathematics II Laboratory:

General Instructions: Each student has to perform at least 4 SCILAB /MATLAB practical's and at least 6 assignments on the entire syllabus.

List of Scilab Programing

1. Euler's Method
2. Euler's Modified Method
3. Runge Kutta Fourth Order
4. Trapezoidal Rule
5. Simpson's 1/3rd Rule
6. Simpson's 3/8th Rule
7. Differential Equations
8. Integration.

Term Work:

The distribution of Term Work marks—

- | | | |
|------------------------------------|---|----------|
| 1. Attendance (Theory, Practicals) | : | 05 marks |
| 2. Assignments on entire syllabus | : | 10 marks |
| 3. SCILAB Practicals | : | 10 marks |

3. Detailed Theory Syllabus:

Sr. No.	Module	Detailed Contents of Module	Hrs.
1	Semiconductors	1.Semiconductors: 1.1 Relation between Conductivity, Mobility, Current density; relation between conductivity, charge concentration, and mobility for metals and semiconductors 1.2 Splitting of energy levels for band formation in semiconductors; classification of semiconductors(doping): Intrinsic and Extrinsic; classification of semiconductors(band gap): Direct and Indirect band gap, Classification of semiconductors (composition):elemental and compound 1.3 Fermi Dirac distribution function: Calculation of energy from probability of occupancy, Fermi level in intrinsic and extrinsic semiconductors; Qualitative discussion on effect of temperature and charge concentration on the fermi levels of n-type and p-type semiconductors, Proof of position of Fermi level in midway of bandgap for an intrinsic semiconductors. 1.4 Energy level diagrams for unbiased and biased P-N junction. 1.5 Hall Effect: Derivation of expression for Hall Voltage and Hall coefficient. 1.6 Semiconductor Devices: I-V curves and mechanism for Solar Cell, LED and Zener Diode	7
2	Electron Optics and CRO	Electron Optics and CRO: 2.1. Bethe's law 2.2 Electrostatic and Magnetic focussing 2.3 Cathode Ray Tube and its applications. 2.4. Block diagram of a CRO: CRT, Sawtooth Sweep Generator, Synchronisation and power supply 2.5. Applications of CRO: Measurement of : DC and AC voltages, frequency value and phase difference	4
3	Physics of Sensors	Physics of Sensors: 3.1.Temperature Sensor 3.2.Pressure Transducer: Capacitive and Inductive types 3.3.Photodiode: IV characteristics and use in measurement of light intensity 3.4.Moisture sensor	4
4	Electrodynamics	Electrodynamics: 4.1.Scalar and Vector fields, gradient, curl and divergence 4.2.Determination of Maxwell's equations for static and varying fields 4.3.Significance of Maxwell's equations and their application in Antenna design and waveguide. 4.4.Numerical Problems	5
5	Material Characterisation Techniques	Material Characterisation Techniques 5.1 X-Ray Diffraction: Bragg's law and its application in measuring crystal lattice parameters.	3

		5.2 STM and AFM, SEM and TEM: Principle of operation and working using schematic diagrams.	
6	Ultrasonics	Ultrasonics : 6.1. Ultrasonic Wave generation; Magnetostriction Oscillator; Piezoelectric Oscillator; 6.2. Applications of ultrasonic: Echo sounding; NDT; ultrasonic cleaning(cavitation); ultrasonic sensors; 6.3.Industrial applications of ultrasonic(soldering, welding, cutting, drilling)	2

4. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

B. End Semester Theory Examination: In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

5. Books & References:

1. A text book of Engineering Physics-Avadhanulu & Kshirsagar, S. Chand
2. A textbook of Optics - N. Subramanyam and Brijlal, S.Chand
3. Fundamentals of optics by Jenkins and White, McGrawHill
4. Modern Engineering Physics – Vasudeva, S.Chand
5. Concepts of Modern Physics- Arther Beiser, Tata McGraw Hill
6. A TextBook of Engineering Physics, S. O. Pillai, New Age International Publishers.
7. Optics - Ajay Ghatak, Tata McGraw Hill
8. Introduction to Electrodynamics- D. J. Griffiths, Pearson publication .
8. Physics for Engineers, M.R. Srinivasan, New Age International Publishers.

Engineering Physics-II Laboratory

Suggested Experiments:

1. I-V characteristics of a solar cell and calculation of efficiency.
2. I-V characteristics of a Zener diode and its use as a voltage regulator
3. Demonstration of Hall Apparatus.
4. Use of CRO to determine: DC voltage, frequency and amplitude of AC signals.
5. I-V curves of a photodiode at various light intensities and verification of Inverse Square Law for Light Intensity.
6. Voltage vs. Temperature characteristics of a Temperature Sensor.
7. Use of Ultrasonic distance meter for determination of distance.

Term work:

Term Work shall consist of a minimum six experiments.

Overall Rubric for the distribution of term work marks:

Laboratory work (Experiments and Journal) : 10/20 marks

Group Project **or** Topic Presentation (Optional) : 10 marks

Attendance (Theory and Practical) : 05 marks

Note: Individual teachers may follow a different rubric for distribution of marks for term work.

The final certification and acceptance of Term Work ensures the satisfactory performance of laboratory work and minimum passing in the Term Work.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY117	Engineering Chemistry II	Contact Hours	2	1	-	3
		Credits	2	1	-	2.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY117	Engineering Chemistry II	30	30	30	45	25	-	-	100

1. Course Objectives:

The course is aimed to:

1. To familiarize the students with the basic concepts of chemistry in the industry and Engineering field.
2. To understand the chemistry of various fuels and their combustion mechanism.
3. To acquire knowledge of electrochemical energy systems.
4. To introduce the underlying science of corrosion and the significance of corrosion control to protect the structures.
5. To educate the theory and applications of spectroscopic techniques.
6. To provide an introduction to and an overview over nanomaterials.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. To understand and analyze the combustion mechanisms of various fuels and be able to characterize the fuels.
2. To develop knowledge on electrochemical energy systems considering the operation.
3. To acquire knowledge of the different battery technologies and understanding the basic mechanisms allowing electrochemical energy storage in batteries
4. To become familiarized with corrosion forms and their effects and to recognize and use the method of corrosion protection.
5. To describe the theoretical background of spectroscopic techniques such as NMR, IR, spectroscopy to apply them for the various fields.
6. To acquire basic knowledge of types of nanomaterials and their synthesis and applications.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1								1	1
CO2	3	2	2	1	1						1	1
CO3	2	2	1	1	1			1			1	2
CO4	2	2	1	1	1				1		1	1
CO5	2	2	1								1	
CO6	1	1	1	2							1	1

3. Detailed Theory Syllabus:

Sr. No.	Module	Detailed Contents of Module	Hrs.
1	Fuels and combustion	Module -1 - Fuels and combustion Pre- requisites : What are fuels, Types of fuels, Characteristics of fuels. Calorific value of a fuel - HCV and LCV, Units of Calorific value, Theoretical determination of calorific value of fuel by Dulong's formula, Numerical problems Solid fuels : Coal (Definition and Ranking) Analysis of coal - Proximate and Ultimate analysis, Numerical problems Liquid fuels: Petroleum -Composition, classification (Mining, Refining - Various fractions , their boiling points, composition and uses), Fuels for Internal Combustion Engines - Knocking, Octane number, Anti Knocking agents, Cetane number. Gaseous Fuels: Natural gas, CNG and LPG, (Composition, Properties and uses) Combustion of fuels – Numerical problems for calculating the amount of air needed for the complete combustion of solid and gaseous fuels. Green fuels - Biodiesel	6
2	Engineering Electrochemistry	Module 2- Engineering Electrochemistry Pre -requisite : redox reaction, cell reaction, electrode and its type, salt bridge Electrode potential, electrode reaction, derivation of Nernst equation for single electrode potential, numerical problems. Electrochemical cells, Concentration cells. Reference electrodes -Types of reference electrodes, Construction, working of SHE, Calomel electrode	3
3	Battery Technology	Module 3- Battery Technology Battery- classification – primary, secondary and reserve batteries. Characteristics – Capacity, Electricity storage density, energy efficiency, cycle life and shelf life. Construction, working, applications and limitations of Lead acid storage battery, Modern Batteries - Lithium and Lithium ion batteries Fuel Cells: Introduction, classification of fuel cells, limitations & advantages of fuel cells, Construction of Hydrogen oxygen alkaline fuel cells.	3

4	Corrosion and its Control	Module -4- Corrosion and its Control Pre- requisites : corrosion , corrosion product, corrosive and non corrosive metals. Galvanic series and electrochemical series. Mechanism of corrosion - Chemical and Electrochemical corrosion. Types of corrosion : Galvanic corrosion, Differential aeration corrosion, Pitting corrosion, Intergranular corrosion, Waterline corrosion, Stress corrosion. Factors Affecting Corrosion Rate : - (i) Nature of metal, (ii) Nature of environment. Methods of Corrosion Control : Material selection, Design, Cathodic protection Protective Coatings: Metallic coatings - anodic coating (galvanizing) and cathodic coating (Tinning) Methods of Applying Metallic Coatings - Hot dipping, Metal Spraying, Electroplating and Diffusion coating Organic coatings – Paints	6
5	Spectroscopic Techniques	Module 5- Spectroscopic techniques Pre-requisites : Electromagnetic radiation, characteristics of electromagnetic radiation, electromagnetic spectrum. Spectroscopy - Principle, Interaction of radiation with matter, Selection rules. Classification of spectroscopy - Based on atomic or molecular level, absorption or emission, electronic or magnetic level Types of spectroscopy - IR and NMR Spectroscopy Fluorescence and its applications	3
6	Nanomaterials	Module 6 -Nanomaterials Prerequisites: Concept of nano scale, definition of nanoparticles Types of nanomaterials - Fullerenes, Carbon Nanotubes, Properties of nanomaterials – Optical properties, magnetic properties, electrical properties Preparation of Nanomaterials - Top down and Bottom up approach Synthesis of Nanomaterials -Chemical vapour deposition (CVD) method and Laser Ablation Method Applications of nano materials	3

4. Theory Assessment:

- A. Internal Assessment (IA):** Two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 75 minutes.
- B. End Semester Theory Examination:** In the question paper, the weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
1. Question paper will comprise 4 questions, each carrying 15 marks.
 2. Question number 1 will be compulsory and based on maximum contents of the syllabus
 3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
 4. Total three questions need to be solved

5. Books & References:

1. Engineering Chemistry – P.C.Jain and Monika Jain, Dhanpat Rai Publications

2. A Textbook of Engineering Chemistry, - Shashi Chawla (Dhanpat Rai publications)
3. A textbook of Engineering Chemistry - S.S. Dara, S. Chand Publishing House
4. Instrumental methods of Chemical Analysis - B.K. Sharma, Goel Publishing House
5. Fundamentals of Molecular Spectroscopy - C.N. Banwell, Tata Mc Graw Hill.

Engineering Chemistry-II Laboratory

List of Suggested Experiments:

1. Determination of moisture content and ash value in coal sample.
2. Preparation of bio- diesel.
3. Preparation of Fe₂O₃ nanoparticles.
4. Cu-Zn electrochemical cell- Effect of conc. on cell potential.
5. Determination of thinner content in paint.
6. Determination of strength of a strong acid by pH meter
7. Determination of strength of a strong acid by conductivity meter
8. EMF measurement

Term work:

Each student has to perform a minimum of five experiments and four assignments based on the entire syllabus.

The distribution of marks for term work shall be as follows:

Laboratory work (Experiments and Journal) : 10 marks

Assignments and Viva on modules : 10 marks

Attendance (Theory and Practical) : 05 marks

Note: The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY107	Engineering Mechanics & Graphics*	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY107	Engineering Mechanics & Graphics*	40	40	40	60	-	-	-	100

1. Course Objectives:

The course is aimed to:

1. To develop the capacity to predict the effects of force and motion and to acquaint the concept of static and dynamic equilibrium.
2. Ability to visualize physical configurations in terms of actual systems and its constraints, and able to formulate the mathematical function of the system.
3. To study, analyze and formulate the motion of moving particles/bodies.
4. To impart and inculcate proper understanding of the theory of projection
5. To impart the knowledge of reading a drawing and to improve the visualization skill.
6. To teach basic utility of computer aided drafting (CAD) tools.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in two and three dimensional systems with the help of FBD.
2. Illustrate different types of motions and establish Kinematic relations for a particle & rigid body.
3. Analyze particles in motion using force-acceleration, work-energy and impulse momentum principles.
4. Apply the basic principles of projections in reading and converting 3D view to 2D drawing.
5. Visualize an object from the given two views and convert 2D view to 3D drawing.
6. Create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2						1	1			1
CO2	2	2						1	1			1
CO3	2	2						1	1			1
CO4	2	2	1		1			1	1	1	1	1
CO5	2	2	1		1			1	1	1	1	1
CO6	2	2	1		1			1	1	1	1	1

3. Detailed Theory Syllabus:

Module	Detailed Contents	Hrs
1	Coplanar and Non-Coplanar Force System and Resultant: 1.1 System of Coplanar Forces: Classification of force systems, Principle of transmissibility, composition and resolution of forces. 1.2 Resultant: Resultant of coplanar and non-coplanar force system (Concurrent forces, parallel forces and non-concurrent non-parallel system of forces). Moment of force about a point, Couples, Varignon's Theorem. Force couple system. Distributed Forces in plane.	06
2	2.1 Equilibrium of System of Coplanar Forces: Conditions of equilibrium for concurrent forces, parallel forces and non-concurrent non-parallel general forces and Couples. Equilibrium of rigid bodies' free body diagrams. 2.2 Equilibrium of Beams: Types of beams, simple and compound beams, type of supports and reaction. Determination of reactions at supports for various types of loads on beams. (Excluding problems on internal hinges)	06
3	Kinematics of Particle and Rigid Body: 3.1 Kinematics of Particles: Motion of particles with variable acceleration. General curvilinear motion. Tangential and Normal component of acceleration, Motion curves (a-t, v-t, s-t curves). 3.2 Kinematics of Rigid Body: Translation, Rotation & General Plane motion of Rigid body. The concept of Instantaneous center of rotation (ICR). Location of ICR of mechanism. Velocity analysis of rigid bodies using ICR.	06
4	Kinetics of a Particle: 4.1 Force and Acceleration: - Introduction to basic concepts, D'Alemberts Principle, concept of Inertia force, Equations of dynamic equilibrium, Newton's second law of motion. (Analysis limited to simple systems only.) 4.2 Work and Energy: Work Energy principle for a particle in motion. Application of Work-Energy principle to a system consists of connected masses and Springs. 4.3 Impulse and Momentum: Principle of linear impulse and momentum. Impact and collision: Law of conservation of momentum, Coefficient of Restitution. Direct Central Impact and Oblique Central Impact. Loss of Kinetic Energy in collision of inelastic bodies.	06
5	5.1 *Introduction to Engineering Graphics Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per IS conventions. Introduction to plain and diagonal scales. 5.2 @Introduction to Auto CAD:- Basic Drawing and Editing Commands. Knowledge of setting up layers, Dimensioning, Hatching, plotting and Printing. 5.3 *Orthographic and Sectional Orthographic Projections: - Fundamentals of orthographic projections. Different views of a simple machine part as per the first angle projection method recommended by I.S. Full or Half Sectional views of the Simple Machine parts. 5.4 @ Drawing of orthographic projections using Autocad.	06
6	6.1 *Isometric Projection: Principles of Isometric projection – Isometric Scale, Isometric Views, Conversion of Orthographic Views to Isometric Views (Excluding Sphere). 6.2 @ Drawing of Isometric projections using Autocad.	06

*Will be covered during practical hours. @ Will be covered during Autocad practical hours.

4. Theory Assessment:

- A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 90 minutes.
- B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
 - 1. Question paper will consist of 4 questions, each carrying 15 marks.
 - 2. Question number 1 will be compulsory and based on the maximum contents of the syllabus
 - 3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
 - 4. Total three questions need to be solved.

6. Practical Assessment: The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

- C. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
- D. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

- 1. Engineering Mechanics by Beer & Johnston, Tata McGrawHill
- 2. Engineering Mechanics (Statics) by Meriam and Kraige, Wiley Books
- 3. Engineering Mechanics (Dynamics) by Meriam and Kraige, Wiley Books
- 4. Engineering Mechanics by F. L. Singer, Harper & Row Publication
- 5. Engineering Mechanics by Shaum Series
- 6. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.
- 7. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.
- 8. M.B Shah & B.C Rana, "Engineering Drawing", Pearson Publications.
- 9. P.J. Shah, "Engineering Graphics", S Chand Publications.
- 10. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY118	Java Programming	Contact Hours	3	2	-	4
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY118	Java Programming	40	40	40	60	25	25	-	150

1. Course Objectives:

The course is aimed to:

1. To learn the basic concepts of object-oriented programming
2. To understand the importance of Classes & objects along with constructors
3. To study and understand Arrays, Strings and vectors
4. To study various concepts of JAVA programming like multithreading, exception Handling, packages, etc.
5. To explain components of GUI based programming.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. To apply fundamental programming constructs
2. To illustrate the concept of packages, classes and objects.
3. To elaborate the concept of strings, arrays and vectors
4. To implement the concept of inheritance and interfaces
5. To implement the concept of exception handling and multithreading
6. To develop GUI based applications.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1		2			1	1	2		2
CO2	3	2	2		2			1	1	2		2
CO3	3	3	2	1	2	1		1	1	2		2
CO4	3	3	2	1	2	1		1	1	2		3
CO5	3	3	2	2	2	1		1	1	2		3
CO6	3	3	3	2	2	1		1	2	2		3

3. Detailed Theory Syllabus:

Prerequisite: Basics of Computer Programming

Sr. No.	Module	Detailed Contents of Module	Hrs.
1	Introduction to Object	Overview of procedure and object oriented Programming, Introduction to the principles of object oriented programming:	08

	Oriented Programming	Classes, Objects, Abstraction, Encapsulation, Inheritance, Polymorphism, Message passing Features of Java Language , JDK, JRE , keywords, Data types, Variables, Operators, Expressions, Types of variables and methods. Control Statements: If Statement, If-else, Nested if, switch Statement, break, continue. Iteration Statements: for loop, while loop, and do- while loop	
2	Class, Object, Packages and Input/output	Classes & Objects: Reference Variables, Passing parameters to Methods and Returning parameters from the methods, Static members, Non-Static members, Method overloading, Recursive method Constructors: Types of Constructors, chaining of constructor, finalize() Method, Constructors Overloading. Packages in java, types, user defined packages Defining packages, creating packages and Importing and accessing packages Input and output functions in Java, Command Line Arguments, Scanner class	08
3	Array, String and Vector	Array, Strings, String Buffer class, Wrapper classes, Vectors	03
4	Inheritance, Abstract Class and Interfaces	Inheritance: Inheritance Basics, Types of Inheritance in Java, member access, using Super- to call superclass Constructor, to access member of super class(variables and methods), creating multilevel hierarchy, Constructors in inheritance, method overriding, Abstract classes and methods, using final, Dynamic Method Dispatch Interfaces: Defining, implementing and extending interfaces, variables in interfaces, Default Method in Interface, Static Method in interface, Abstract Classes vs Interfaces.	08
5	Exception handling and Multithreading	Exception Handling: Exception Handling Fundamentals, Exception Types, Exception class Hierarchy, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses Multithreaded Programming: The Java Thread Model and Thread Life Cycle, Thread Priorities, creating a Thread, Implementing Runnable, Extending Thread, Creating Multiple Threads, Synchronization: Using Synchronized Methods, The synchronized Statement	05

6	GUI programming in JAVA	Designing Graphical User Interfaces in Java: Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components Event-Driven Programming in Java: Event-Handling Process, Event-Handling Mechanism, Event Listeners Introducing Swing: AWT vs Swings, Components and Containers, Swing Packages, A Simple Swing Application, Painting in Swing, Designing Swing GUI Application using Buttons, JLabels, Checkboxes, Radio Buttons, JScrollPane, JList, JComboBox, etc. Introduction to JDBC: Introduction to JDBC, JDBC-ODBC connectivity, JDBC architecture.	08
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4. Assessment:

I.Internal Assessment :

Two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

II.End Semester Theory Examination:

In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

5. Books & References:

1. Herbert Schildt, "Java-The Complete Reference", Tenth Edition, Oracle Press, Tata McGraw Hill Education.
2. E. Balaguruswamy, "Programming with Java A primer", Fifth edition, Tata McGraw Hill Publication
3. Anita Seth, B.L.Juneja, "Java One Step Ahead", Oxford university press.
4. D.T. Editorial Services, "Java 8 Programming Black Book", Dreamtech Press.
5. Learn to Master Java by Star EDU Solutions
6. Yashvant Kanetkar, "Let Us Java", 4th Edition, BPB Publication

Java Programming- Laboratory

List of Suggested Experiments:

Hardware & Software Requirements:

Hardware Requirements	Software Requirements	Other Requirements
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PC With Following Configuration: 1. Intel PIV Processor 2. 2 GB RAM 3. 500 GB Hard disk 4. Network interface card	1. Windows or Linux Desktop OS 2. JDK 1.8 or higher 3. Notepad ++ 4. JAVA IDEs like Netbeans or Eclipse	1. Internet Connection for installing additional packages if required
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1. Programs on Basic programming constructs like branching and looping
2. Programs on Basic programming constructs like branching and looping
3. Programs on class and objects
4. Program on method and constructor overloading.
5. Program on Packages
6. Program on 2D array, strings functions
7. Program on StringBuffer and Vectors
8. Program on types of inheritance
9. Program on Multiple Inheritance
10. Program on abstract class and abstract methods
11. Program using super and final keyword
12. Program on Exception handling
13. Program on user defined exception
14. Program on Multithreading
15. Program to create GUI application
16. Mini Project based on the content of the syllabus (Group of 3-4 students)

Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of practical's based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

CO4								3		2		3
CO5								3	3	2	2	3
CO6										2		3

3. Detailed Theory Syllabus:

Sr. No.	Module	Detailed Contents of Module	Hrs.
1	The Importance and Strategies of Effective Listening	The Importance and Strategies of Effective Listening Prerequisite: Able to listen, read, speak, write and comprehend the target language Introduction to communication 1.1 Importance and relevance of communication 1.2 Listening skill a) Ability to discriminate stress and intonation b) Comprehend meaning of audio text-graded on the basis of vocabulary, sentence construction and theme. c) Potential barriers	5 Hrs
2	Developing Speaking Skills	Developing Speaking Skills 2.1 Intensive Speaking- on the spot topics 2.2 Responsive speaking-answering a question 2.3 Interactive speaking-conversations 2.4 Extensive speaking-speech, oral presentations-specific emphasis on plagiarism check and generating the report	6 Hrs
3	Strategies and Techniques to build Reading Skills	Strategies and Techniques to build Reading Skills 3.1 Develop the process of reading- a) predicting content from the given title, b) anticipating content from the given sentence, c) skimming for understanding the theme of the passage, d) scanning for specific information, e) guessing the meaning of unfamiliar words from the context, that is, the careful analysis of structural words f) inferring from the content- conclusion reached on the basis of evidence and reasoning g) deduction- logical conclusions based on the information given in a text Special emphasis on reading comprehension exercises and summarisation	5 Hrs
4	Developing Professional Writing Skills	Developing Professional Writing Skills 4.1 Effective introduction with emphasis on general statement, opposing statement and thesis statement 4.2 Critical response to a text with special reference to purpose, evaluation of the content, theme and style of a text 4.3 Organization of ideas, sentence construction and word choice, grammar and usage 4.4 Explanation and support of ideas (special reference to writing paragraphs and business letters- Sales and Claim letters}	6 Hrs

5	Etiquette and Grooming for Personality Development	Etiquette and Grooming for Personality Development 5.1 Social Etiquette 5.2 Corporate etiquette 5.3 Confidence building and Personality development	1 Hr
6	Vocabulary and Grammar	Vocabulary and Grammar 6.1 Contextual vocabulary Development- Word Maps 6.2 Identifying errors in a sentence.	1 Hr

4. Assessment:

I. Internal Assessment Test: Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 60 minutes .

(Note: Summarization should be a compulsory question in Test II and not in the End Semester Theory Examination)

II. End Semester Theory Examination:

Total marks 30, duration 1 and half hours.

1. Question paper will consist of 5 questions, each carrying 10 marks.
2. Total 3 questions need to be solved.
3. Q.1 will be compulsory, based on the entire syllabus.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of marks should be proportional to the number of hours assigned to each module.

5. Books & References:

1. Raman Meenakshi & Sharma Sangeeta, *Communication Skills*, Oxford University Press
2. Kumar Sanjay & Lata Pushp, *Communication Skills*, Oxford University Press
3. Locker, Kitty O. Kaczmarek, Stephen Kyo. (2019). *Business Communication: Building Critical Skills*. Place of publication not identified: Mcgraw-hill.
4. Murphy, H. (1999). *Effective Business Communication*. Place of publication not identified: Mcgraw-Hill.
5. Lewis, N. (2014). *Word power made easy*. Random House USA.

Professional Communication and Ethics - I Laboratory

Lab Prerequisite: Basic language skills

Sr. No.	Level	Detailed Lab/Tutorial Description	LO Mapping
	1. Basic 2. Design 3. Advanced 4. Project/Case Study/Seminar		
1	Assignment 1	Written record of listening activities-Listening practice tasks of 3 types (through audio recordings of (1) Monologues (2) Dialogues (3) Formal/Expert Talk or Lecture)	LO1
2	Assignment 2	Transcription of the public speech along with a plagiarism report-Practice public speech	LO2

3	Assignment 3	Summarization through graphic organisers (1. Text to graphic organizer 2. Graphic organizer to text)	LO3
4	Assignment 4	1. Case studies on critical thinking 2. 2 business letters in complete block format.	LO4
5	Assignment 5	Documentation of case studies/Role play based on Module 5	LO5
6	Assignment 6	1. Contextual Vocabulary Development 2. Aptitude Test	LO6

Term work:

Term Work shall consist of 6 Assignments .

The distribution of marks for term work shall be as follows:

1.Assignments : **10 marks**

2.Oral Exam/ Public Speaking : **10 marks**

3.Attendance (Theory and Tutorial) : **05 marks**

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY123	Basic Workshop Practice-II	Contact Hours	-	2	-	2
		Credits	-		-	1

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY123	Basic Workshop Practice-II	-	-	-	-	50	-		50

1. Course Objectives

1. To Impart Training Help the students develop engineering skills sets.
2. To inculcate respect for physical work and hard labor.
3. To Get Exposure To Interdisciplinary Engineering Domain.

2. Course Outcomes:

Learner will be able to

1. Develop the necessary skill required to handle/use different carpentry tools.
2. Identify and understand the safe practices to adopt in the electrical environment.
3. Demonstrate the wiring practices for the connection of simple electrical load/equipment.
4. Design, fabricate and assemble PCB.
5. Develop the necessary skill required to handle/use different measuring tools.
6. Develop the necessary Skill required to use different sheet metal tools.
7. Able To demonstrate the operation, forging with the help of a simple job.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	1							2	2			2
CO2	1							2	2			2
CO3	1							2	2			2
CO4	1							2	2			2
CO5	1							2	2			2
CO6	1							2	2			2
CO7	1							2	2			2

3. Detailed Syllabus

Module	Detailed Contents	Hrs.
	Module 1 and 2 are compulsory. Select any one trade topic out of the topic trade 3 and 5. Demonstrations with hands-on experience to be provided during the periods. Report on the demonstration including suitable sketches to be included in term work. Trade evaluation is to be done according to the opted Trades in addition to compulsory trades.	5 Hrs
1	Carpentry (Compulsory) Use and setting of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood tuning and modern wood turning methods. Term work to include one carpentry job involving a joint and report on demonstration of a job involving wood turning	8
2	Basic Electrical workshop:(Compulsory): Single phase and three phase wiring. Familiarization. of protection switchgears and their ratings (fuse, MCB, ELCB). Wiring standards, Electrical safety in the work place safe work practices. Protective equipment, measures and tools. Layout drawing, layout transfer to PCB, etching and drilling and soldering technique	8
3	Measurement* Vernier Height gauge, wire gauge, Dial gauge of the listed guages and precaution.	4
4	Sheet metal working and Brazing: Use of sheet metal, working hand tools, cutting , bending , spot welding.	
5	Forging (Smithy): At least one forging job to be demonstrated and a simple job to be made for Term Work in a group of 4 students	

1. Students can choose one trade out of Trades 3,4 & 5.

Total hours= 8+8+4=20 hours

2. Complete Work-Shop Book giving details of drawing of the job and time sheet

The distribution of marks for Term work shall be as follows:

1. Job Work: 30 Marks
2. Workshop book 10 marks
3. Attendance : 10 marks

5. Books & References:

1. Workshop Technology by H K Hajara Choudhary
2. Manufacturing Technology by R C Jain
3. Workshop Technology by R S Khurmi and J S Gupta

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY125	Co-curricular course - II	Contact Hours	-	4	-	4
		Credits	-	1	-	2

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY125	Co-curricular course - II	-	-	-	-	50	-		50

Sr No.	Name of Activity	Number of Hours
1	Yoga Day	6
2	F.E Sports Day	6
3	Mathematics Quiz	3
4	Treasure Hunt	3
5	Environmental Activity-I	4
6	Environmental Activity-II	4
7	NPTEL/Value Added Course	10
8	Cultural Activity(Algeria/ University level/ Inter college Level)	3
9	NSS/ NCC Attended camp	3
10	Any other Activity	

**BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING**

(Semester III)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 201	Engineering Mathematics III	Contact Hours	3	-	1	4
		Credits	3	-	1	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 201	Engineering Mathematics III	40	40	40	60	25	-	-	125

1. Course Objectives:

The course is aimed to:

1. Learn the Laplace Transform, Inverse Laplace Transform of various functions, its applications.
2. Understand the concept of Fourier Series, its complex form and enhance the problem-solving skills.
3. Understand Matrix algebra for engineering problems
4. Understand the concept of complex variables, C-R equations with applications.
5. Understand the concept of Relation and function
6. Understand the concept of coding theory

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Apply the concept of Laplace transform and its application to solve the real integrals, understand the concept of inverse Laplace transform of various functions and its applications in engineering problems.
2. Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems.
3. Apply the concepts of eigenvalues and eigenvectors in engineering problems.
4. Apply complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic functions.
5. Apply the concept of relation and function
6. Use groups and codes in Encoding-Decoding

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	2	1						3			1
CO2	3	2	1						3			1
CO3	3	2	1						3			1
CO4	3	2	1						3			1
CO5	3	2	1						3			1
CO6	3	2	1						3			1

3. Detailed Theory Syllabus:

Prerequisite: Engineering Mathematics I, Engineering Mathematics-II

Sr. No.	Module	Detailed Contents of Module	Hrs.
1	Laplace Transform	Definition of Laplace transform and Laplace transform of standard functions, Properties of Laplace Transform: Linearity, First Shifting Theorem, change of scale Property, multiplication by t, Division by t, (Properties without proof). Inverse of Laplace Transform by partial fraction and convolution theorem.	7
2	Fourier Series , Fourier Transform	Fourier series of periodic functions with period 2π , Fourier series for even and odd functions, Half range sine and cosine Fourier series, Orthogonal and Ortho-normal functions, Fourier Transform.	6
3	Linear Algebra, Matrix Theory	Eigenvalues and eigenvectors, Diagonalization of matrices; Cayley-Hamilton Theorem, Functions of square matrix, Singular Value Decomposition	7
4	Complex Variables and conformal mappings	Function $f(z)$ of complex variable, Analytic function: Necessary and sufficient conditions for $f(z)$ to be analytic, Cauchy-Riemann equations in Cartesian coordinates, Milne-Thomson method: Determine analytic function $f(z)$ when real part(u), imaginary part (v) is given, Conformal mapping, Linear and Bilinear mappings, cross ratio	6
5	Relations and Functions	Partition of A Set, Relation, Diagram of A Relation, Matrix of A Relation, Digraph of A Relation, Types of Relation, Equivalence Relation, Relation of the Path, Operations on Relations, Closures, Warshall's Algorithm,	7
6	Algebraic Structures, coding theory	Properties of Binary Operations,, Group, Ring, Group Code, Decoding and Error Correction, Maximum Likelihood Technique, parity-check matrix.	6

4. Theory Assessment:

C. Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

D. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

5. Tutorial Assessment: The final certification and acceptance of TW ensures the satisfactory performance of tutorials and minimum passing in the TW.

A. Term Work: Batch wise tutorials have to be conducted. Students must be encouraged to write at least 6 class tutorials on the entire syllabus. Also Term Work Journal must include at least 2 assignments based on topics mentioned in the syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Class Tutorials on entire syllabus)
+ 5 Marks (Assignments on entire syllabus) + 5 Marks (Attendance)

6. Books and References:

A. Books:

1. Advanced Engineering Mathematics H.K. Das, S . Chand, Publications.
2. Higher Engineering Mathematics B. V. Ramana, Tata Mc-Graw Hill Publication
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication
4. Advanced Engineering Mathematics Wylie and Barret, Tata Mc-Graw Hill.
5. Beginning Linear Algebra Seymour Lipschutz Schaum's outline series, Mc-Graw Hill Publication

B. References:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons.
3. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramana, Pearson Education
4. Discrete Mathematical Structures D. S. Malik and M. K. Sen ,Course Technology Inc (19 June 2004)
5. Discrete Mathematics and its Applications Kenneth H. Rosen, "", Tata McGrawHill

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 202	Data Structures	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 202	Data Structures	40	40	40	60	25	25	--	150

1. Course Objectives :

The course is aimed to:

1. To understand the need and significance of Data structures as a computer Professional.
2. To teach concept and implementation of linear and nonlinear data structures.
3. To analyse various data structures and select the appropriate one to solve a specific real-world problem.
4. To introduce various techniques for representation of the data in the real world.
5. To teach various searching techniques.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Students will be able to implement linear and Non-Linear data structures.
2. Students will be able to handle various operations like searching, insertion, deletion and traversals on various data structures.
3. Students will be able to explain various data structures, related terminologies and its types.
4. Students will be able to choose appropriate data structure and apply it to solve problems in various domains.
5. Students will be able to analyse and Implement appropriate searching techniques for a given problem.
6. Students will be able to demonstrate the ability to analyse, design, apply and use data structures to solve engineering problems and evaluate their solutions.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	2								1
CO2	1	3	2	1								1
CO3	2											1
CO4	1	3	2	1								1
CO5	1	2	1	1								1
CO6	1	2	1	1								1

3. Detailed Theory Syllabus:

Prerequisite: Knowledge of C programming language

Sr. No.	Module	Detailed Contents of Module	Hrs
1	Introduction to Data Structures	Introduction to Data Structures, Concept of ADT, Types of Data Structures - Linear and Nonlinear, Operations on Data Structures.	3
2	Linear Data Structures - Stack, Queue	Introduction to Stack : LIFO structure, ADT of Stack , Operations on Stack : Create, POP, PUSH, delete stack, Array Implementation of Stack: Create, POP, PUSH, PEEK, Display, delete stack, Applications of Stack: Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation, Recursion. Introduction to Queue : FIFO structure, ADT of Queue, Operations on Queue : Create, ENQUEUE, DEQUEUE, delete Queue, Array Implementation of Queue : Create, ENQUEUE, DEQUEUE, PEEK, Display, delete Queue, Types of Queue - Circular Queue, Priority Queue, Applications of Queue.	10
3	Linear Data Structures - Linked List	Introduction, Representation of Linked List, Linked List v/s Array, Types of Linked List - Singly Linked List, Circular Linked List, Doubly Linked List, Operations on Singly Linked List and Doubly Linked List: Create List, Insert Node (empty list, beginning, Middle, end), Delete node (First, general case), Search List, Retrieve Node, Print List, Stack and Queue using Singly Linked List, Singly Linked List Application - Polynomial Representation and Addition.	10
4	Non Linear Data Structures - Trees	Introduction, Tree Terminologies, Binary Tree, Binary Tree Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Trees, Operations on Binary Search Tree, AVL tree : inserting, Searching, traversing and rotation: RR, LL, RL, LR in AVL tree, Expression Trees : Construction, Infix, Prefix, Postfix Traversals, heaps : Structure, – Reheap Up, Reheap Down, Build heap, Insert, Delete	9
5	Non Linear Data Structures - Graphs	Introduction, Graph Terminologies, Representation of Graph : Adjacency Matrix, Adjacency List, Operations : Add vertex, Delete vertex, Add Edge, Delete Edge, Find vertex, Graph Traversals - Depth First Search (DFS) and Breadth First Search (BFS)	4
6	Searching Techniques and Hashing	Linear Search, Binary Search, random search, Hashing - Concept, Hash Functions, Address calculation techniques, Common hashing functions, Collision resolution Techniques: Separate Chaining, Open Addressing (Linear probing, Quadratic, Double hashing).	4

4. Suggested Experiments:

1. Implement Stack ADT using array.
2. Convert an Infix expression to Postfix expression using stack ADT.
3. Evaluate Postfix Expression using Stack ADT.
4. Implement Linear Queue ADT using array.
5. Implement Circular Queue ADT using array.
6. Implement Singly Linked List ADT.
7. Implement Circular Linked List ADT.
8. Implement Stack / Linear Queue ADT using Linked List.
9. Implement Binary Search Tree ADT using Linked List.
10. Implement Graph Traversal techniques : a) Depth First Search b) Breadth First Search

5. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

B. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

6. Practical Assessment: A Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of 10 practical based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

A. Books:

1. Aaron M Tenenbaum, YedidyaLangsam, Moshe J Augenstein, "Data Structures Using C", Pearson Publication.
2. Richard F. Gilbert and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition, CENGAGE Learning.
3. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications", McGraw-Hill Higher Education
4. Data Structures Using C, ISRD Group, 2nd Edition, Tata McGraw-Hill.
5. Reema Thareja, "Data Structures using C", Oxford Press.

B. References:

1. Prof. P. S. Deshpande, Prof. O. G. Kakde, "C and Data Structures", DreamTech press.
2. E. Balagurusamy, "Data Structure Using C", Tata McGraw-Hill Education India.
3. Rajesh K Shukla, "Data Structures using C and C++", Wiley-India
4. GAV PAI, "Data Structures", Schaum's Outlines.
5. Robert Kruse, C. L. Tondo, Bruce Leung, "Data Structures and Program Design in C", Pearson Edition

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 203	Database Management Systems	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 203	Database Management Systems	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. Identify the need of a database management system.
2. Develop entity relationship data model and its mapping to relational model.
3. To give a foundation on Relational Model of data and usage of relational Algebra.
4. To introduce the concepts of SQL queries.
5. Demonstrate Design Approach of Database through Normalization.
6. Understand the concept of transaction, concurrency control and recovery techniques.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Recognize the need of database management systems.
2. Design ER and EER diagram for real life applications
3. Construct relational models and write relational algebra queries.
4. Retrieve information from the database by formulating SQL queries, procedure cursor using PL/SQL.
5. Apply the concept of normalization to relational database design.
6. Describe the concept of transaction management.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								2		
CO2	3	3								2		
CO3	3	3								2		
CO4	3	3	2							2		
CO5	3	3										
CO6		2	2							2	2	

3. Detailed Theory Syllabus:

Prerequisite : Basic knowledge of file system, any programming language

Module No	Module	Detailed Contents of Module	Hrs.
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1	Introduction to Database Concepts	Introduction, Characteristics of databases, File system v/s Database system, Data abstraction and data Independence, Schemas and Instance, Users of Database System, Three level schema Architecture, Database Administrator.	4
2	Entity-Relationship Data Model	Introduction to Data Models, Entity The Entity-Relationship (ER) Model, Entity, Entity Set, Strong and weak entity, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation.	7
3	Relational Model and relational Algebra	Introduction to the Relational Model, Mapping the ER and EER Model to the Relational Model, Relational schema Design, Introduction to Relational Algebra, Relational algebra-operators, Relational Algebra Queries.	7
4	Structured Query Language (SQL)	Overview of SQL, Data Definition Language Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity, check constraints, Data Manipulation commands, Data Control commands, Set and string operations, aggregate function-group by, having, Views in SQL, joins, Nested and complex queries, Triggers(ECA Model), Security and Authorization in SQL. Introduction to PL/SQL, Procedure, Cursor.	12
5	Relational-Database Design	Decomposition, Functional Dependency Concept of normalization, First Normal Form, 2NF, 3NF, BCNF.	5
6	Introduction to Transactions Management	Transaction concept, Transaction states, ACID properties, Transaction Control Commands, Concurrent Executions, Serializability-Conflict and View.	4

4. Suggested Experiments:

Software Requirements if any: DBMS like Postgresql, Oracle.

1. Identify the case study and detailed statement of the problem. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model.
2. Mapping ER/EER to Relational schema model.
3. Create a database using Data Definition Language (DDL) and apply integrity constraints for the specified System.
4. Apply DML Commands for the specified system.
5. Perform Simple queries, string manipulation operations and aggregate functions.
6. Implement various Join operations.
7. Perform Nested and Complex queries.
8. Perform DCL and TCL commands.
9. Implementation of procedure cursor.
10. Implementation of Views and Triggers.
11. Implementation and demonstration of Transaction

5. Theory Assessment:

- A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hour.
- B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
 1. Question paper will consist of 3 questions, each carrying 20 marks.
 2. Question number 1 will be compulsory and based on the maximum contents of the syllabus.

3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3).
4. Total three questions need to be solved.

6. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).

7. Books and References:

A. Books:

1. Korth, Silberchatz, Sudarshan, Database System Concepts, 6thEdition, McGraw Hill.
2. Elmasri and Navathe, Fundamentals of Database Systems, 5thEdition, Pearson Education.
3. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH.

B. References:

1. G. K. Gupta, Database Management Systems, McGraw Hill, 2012.
2. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 204	Digital Logic and Computer Architecture	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 204	Digital Logic and Computer Architecture	40	40	40	60		—		100

1. Course Objectives:

The course is aimed to:

1. To study basic computer structure and compare computer architecture models
2. To discuss operation of the arithmetic logic unit for the algorithms & implementation of integer arithmetic.
3. To have an understanding of processor organization.
4. To study the characteristics of memory systems including internal and cache memories.
5. To study the different ways of communicating with I/O devices and standard I/O interfaces.
6. To study the different parallel processing concepts and pipelines.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Understand the basic computer architectures
2. Demonstrate ALU arithmetic algorithms for different operations.
3. Understand different Processor Organization concepts
4. Understand memory hierarchy and organization with different types of memories
5. Identify various types of buses, interrupts and I/O operations in a computer system
6. Describe Parallel processing and Pipeline concepts

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										1
CO2	2	3										1
CO3	3	1										2
CO4	3	3										2
CO5	2	1										1
CO6	3	1										2

3. Detailed Theory Syllabus:

Sr. No.	Module	Detailed Contents of Module	Hrs
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1	Overview of Computer Architecture and Organization	Introduction of Computer Organization and Architecture, Basic organization of computer and block level description of the functional units, Evolution of x86 Computers, Von Neumann model, Harvard Model, Embedded system .Performance Issues: Designing for performance, Amdahl's Law.	6
2	Computer Arithmetic Algorithms	Number representation: 1's and 2's complement representation. Binary Arithmetic: Addition, Subtraction, Multiplication, Division using 2's complement, BCD and Hex Arithmetic Operation. Addition, Subtraction Multiplication using Booth's algorithm, Division using Restoring and non-restoring division algorithms. IEEE 754 floating point number representation.	9
3	Processor Organization	CPU Architecture, Register Organization, Instruction formats, Basic instruction cycle. Addressing modes. Control Unit: hardwired control unit and its design methods, Soft wired (Micro-programmed) control unit design.	7
4	Memory Organization	Introduction to Memory, Memory Hierarchy, Characteristics of memory systems, Internal Memory: Types of RAM and ROM Cache Memory: Design Principles, Memory mappings, Replacement Algorithms, Cache Coherence. Interleaved and Associative Memory.	8
5	Input/ Output	Input/output systems, I/O module, Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA. Introduction to buses: Bus structure, Bus Contention, Bus Arbitration and its types	4
6	Advanced Processors	Parallel Architecture: Classification of Parallel Systems, Flynn's Taxonomy, Instruction Pipelining- Pipelining Strategy, Pipeline Performance, Pipeline Hazards, Dealing with Branches, Introduction to Multiprocessor Systems, Multi-Core Computers	4

4. Suggested Experiments:

1. Verify the truth table of various logic gates using ICs / virtual lab
2. Realize the gates using universal gates
3. Code conversion
4. Realize half adder and full adder
5. Binary addition, subtraction, Booth's Algorithm, Restoring and Non restoring Division, IEEE representation
6. Computer Components- Memory, Ports, Motherboard and add-on cards
7. Assembling and Dismantling and PC
8. ALU Design, CPU Design
9. Memory design, Cache Memory design
10. Case study on buses like ISA, PCI, USB etc
11. Case Study on multi-core Processors

5. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

B. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus

3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

6. Practical Assessment: An Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of 10 practical based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

A. Books:

1. R. P. Jain, "Modern Digital Electronic", McGraw-Hill Publication, 4th Edition.
2. William Stalling, "Computer Organization and Architecture: Designing and Performance", Pearson Publication 10TH Edition.
3. John P Hayes, "Computer Architecture and Organization", McGraw-Hill Publication, 3RD Edition.
4. Dr. M. Usha and T. S. Shrikanth, "Computer system Architecture and Organization", Wiley publication.

B. References:

1. Malvino, "Digital computer Electronics", McGraw-Hill Publication, 3rd Edition.
2. B. Govindarajalu, "Computer Architecture and Organization", McGraw-Hill Publication.
3. Smruti Ranjan Sarangi, "Computer Organization and Architecture", McGraw-Hill Publication.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 205	Human Values and Social Ethics	Contact Hours	2	-	-	2
		Credits	2	-	-	2

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 205	Human Values and Social Ethics	-	-	-	-	50	-	-	50

1. Course Objectives :

The course is aimed to:

1. To enable learners to understand the core values that shape the ethical behaviour of a professional.
2. To develop an awareness of the different ethical dilemmas at the workplace and society.
3. To inculcate the ethical code of conduct in writing technical articles and technology development.
4. To internalize ethical principles and code of conduct of a good human being at home, society and at work place.

2. Course Outcomes :

On successful completion of course learner/student will be able to:

1. Learners will be able to recognize the relation between ethics and values pertinent for an engineering professional.
2. Learners will be able to exercise the responsibility for establishing fair and just processes for participation and group decision making
3. Learners will be able to demonstrate an awareness of self-held beliefs and values and how they are altered in interactions with others.
4. Learners will be able to acquire the writing skills necessary to analyse data from research and attribute the source with proper citation.
5. Learners will be competent to incorporate values and ethical principles in social and professional situations.
6. Learners will be able to evaluate technology development and its application on the basis of moral issues and individual rights.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						1		3				1
CO2		1			1	1		3				1
CO3								3	1			1
CO4			2					3				1
CO5						1		3			1	1

CO6		1			2			3			1	1
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3. Detailed Theory Syllabus:

Prerequisite: Should have respect for justice and be able to reflect on one's personal beliefs and values.

Sr. No.	Module	Detailed Contents of Module	Hrs
1	Ethics and Values	Meaning & Concept of Ethics Difference between Ethics and Values Ethical code of conduct	3
2	Professional Ethics	Professional Ethics vs Personal ethics Components of professional ethics Professional values and its importance	5
3	Ethics and Society	Relevance of values and ethics in social work Ethical dilemmas Values and ethical principles of social work - Service - Dignity and worth of a person - Importance of Human relationships - Integrity - Competence - Social Justice	5
4	Ethics in Technical writing	Documenting sources Presentation of Information Ethics & Plagiarism	5
5	Ethics and Technology Development	Risk management and Individual rights Moral issues in development and application of technology Privacy/ confidentiality of information Managing Technology to ensure fair practices	6

4. Assessment:

Term Work : 50 marks (Continuous Evaluation)

Activities based on the ethics could be created based on the content of the syllabus (Debates, Presentations, Group Discussions)

The evaluation can be based on the activities

Quiz on various professional ethics can be conducted.

5. Books and References:

1. Martin Cohen, 101 Ethical Dilemmas Routledge, 2nd edition, 2007
2. M. Govindarajan, S. Natarajan & V.S. Senthil kumar, Professional Ethics and Human Values,
3. Prentice Hall India Learning Private Limited, 2013 Mike W. Martin, Ethics in Engineering, McGraw Hill Education; Fourth edition, 2017

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 206	Python Programming Lab	Contact Hours	-	2+2#	-	2
		Credits	-	2	-	2

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 206	Python Programming Lab	-	-	-	-	50	25	--	75

1. Lab Objectives:

The lab is aimed to:

1. Basics of python including data types, operator, conditional statements, looping statements input and output functions in Python
2. List, tuple, set, dictionary, string, array
3. Functions, Concepts of modules, packages
4. Object Oriented Programming concepts in python
5. Concept of exception handling and File handling operations
6. Graphical User Interface and SQLite Database

2. Lab Outcomes:

On successful completion of lab learner/student will be able to:

1. To understand the structure, syntax of the Python language
2. To interpret varied data types in python
3. To implement functions, modules and packages
4. To illustrate the concepts of object-oriented programming as used in Python
5. To raise and handle exceptions through exception handling mechanisms and to implement File handling programs
6. To gain proficiency in creating GUI applications and implement database connectivity in python

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			1							1
CO2	3	3	2		2							1
CO3	3	3	3	2	3				1			2
CO4	3	3	3	3	3				1			2
CO5	3	3	3	3	3							1
CO6	3	3	3	3	3				2	1	1	3

3. Detailed Theory Syllabus:

Prerequisite: Programming Language (C/Java), Python IDE installation and environment setup.

Sr. No.	Module	Detailed Contents of Module	Hrs
1	Basics of Python	Introduction, Features, Python building blocks – Identifiers, Keywords, Indentation, Variables and Comments, Basic data types (Numeric, Boolean, Compound) Operators: Arithmetic, comparison, relational, assignment, logical, bitwise, membership, identity operators, operator precedence, Control flow statements: Conditional statements (if, if...else, nested if), Looping in Python (while loop, for loop, nested loops), Loop manipulation using continue, pass, break, Input/output Functions,.	06
2	Data types	Lists: a) Defining lists, accessing values in list, deleting values in list, updating lists b) Basic list operations c) Built-in list functions. Tuples: a) Accessing values in Tuples, deleting values in Tuples, and updating Tuples b) Basic Tuple operations c) Built-in Tuple functions. Dictionaries: a) Accessing values in Dictionary, deleting values in Dictionary, and updating Dictionary b) Basic Dictionary operations c) Built-in Dictionary functions Sets: a) Accessing values in Set, deleting values in Set, updating Sets b) Basic Set operations, c) Built-in Set functions Strings: a) String initialization, Indexing, Slicing, Concatenation, Membership & Immutability b) Built-in String functions Arrays: a) Working with Single dimensional Arrays: Creating, importing, Indexing, Slicing, copying and processing array arrays. b) Working with Multi-dimensional Arrays using Numpy: Mathematical operations, Matrix operations, aggregate and other Built-in functions	10
3	Functions, modules and packages	Functions: a) Built-in functions in python b) Defining function, calling function, returning values, types of parameters c) Nested and Recursive functions d) Anonymous Functions (Lambda, Map, Reduce, Filter) e) List Comprehension Modules: Writing modules, importing objects from modules, Python built-in modules (e.g. Numeric and Mathematical module, Functional Programming module, Regular Expression module), Namespace and Scoping. Decorators, Iterators and Generators. Packages: creating user defined packages and importing packages.	08
4	Object Oriented Programming	Overview of Object-oriented programming, Creating Classes and Objects, Self-Variable, Constructors, Inner class, Static method, Namespaces. Inheritance: Types of Inheritance (Single, Multiple, Multi-level, Hierarchical), Super() method, Constructors in inheritance, operator overloading, Method overloading, Method overriding, Abstract class, Abstract method, Interfaces in Python.	03
5	Exception handling and File Handling	Exception handling: Compile time errors, Runtime errors, exceptions, types of exception, try, block, except block, final block, raise statement, Assert statement, User-Defined Exceptions. Debugging: Programming Challenges, Classes of Tests, Bugs, Debugging, Debugging Examples– Assertions and Exceptions File Handling: Opening file in different modes, closing a file, Writing to a file, accessing file contents using standard library	05

		functions, Reading from a file – read(), readline(), readlines(), Renaming and Deleting a file, File Exceptions, Directories.	
6	GUI & database programming	Graphical user interface (GUI): Overview of different GUI tools in python (Tkinter, PyQt, Kivy etc.), Working with containers, Canvas, Frame, Widgets (Button, Label, Text, Scrollbar, Check button, Radio button, Entry, Spinbox, Message etc.) Connecting GUI with databases to perform CRUD operations. (on supported databases like SQLite, MySQL, Oracle, PostgreSQL etc.).	06

4. Suggested Experiments:

Hardware & Software Requirements:

Minimum Hardware Requirements	Software Requirements	Other Requirements
PC With following Configuration 1. Intel Dual core Processor or higher 2. Minimum 2 GB RAM 3. Minimum 40 GB Hard disk 4. Network interface card	1. Windows or Linux Desktop OS 2. Python 3.6 or higher 3. Notepad ++ 4. Python IDEs like IDLE	1. Internet Connection for installing additional packages

- 1 Write python programs to understand
 - a. Basic data types, Operators, expressions and Input Output Statements
 - b. Control flow statements: Conditional statements (if, if...else, nested if)
 - c. Looping in Python (while loop, for loop, nested loops)
 - d. Decorators, Iterators and Generators.
- 2 Write python programs to understand
 - a. Different List and Tuple operations using Built-in functions
 - b. Built-in Set and String functions
 - c. Basic Array operations on 1-D and Multidimensional arrays using Numpy
 - d. Implementing User defined and Anonymous Functions
- 3 Write python programs to understand
 - a. Classes, Objects, Constructors, Inner class and Static method
 - b. Different types of Inheritance
 - c. Polymorphism using Operator overloading, Method overloading, Method overriding, Abstract class, Abstract method and Interfaces in Python.
- 4 Write python programs to understand
 - a. Creating User-defined modules/packages and import them in a program
 - b. Creating user defined multithreaded application with thread synchronization and deadlocks
 - c. Creating an menu driven applications which should cover all the built-in exceptions in python
- 5 Write python programs to understand
 - a. Different File Handling operations in Python
 - b. Designing Graphical user interface (GUI) using built-in tools in python (Tkinter, PyQt, Kivy etc.).

- c. GUI database connectivity to perform CRUD operations in python (Use any one database like SQLite, MySQL, Oracle, PostgreSQL etc.)

5. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

- A. Term Work:** Term Work shall consist of at least 15 practical based on the above list. Also Term work Journal must include at least 2 Programming assignments. The Programming assignments should be based on real world applications which cover concepts from more than one module of syllabus. Mini Project based on the content of the syllabus (Group of 3-4 students)
- B. Term Work Marks:** 50 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 20 Marks (Mini Project) + 5 Marks (MCQ as a part of lab assignments) + 5 Marks (Attendance)

6. Books and References:

A. Books:

1. Dr. R. Nageswara Rao, "Core Python Programming", Dreamtech Press, Wiley Publication
2. M. T. Savaliya, R. K. Maurya, "Programming through Python", StarEdu Solutions.
3. E Balagurusamy, "Introduction to computing and problem solving using python", McGraw Hill-Publication.

B. References:

1. Zed A. Shaw, "Learn Python 3 the Hard Way", Zed Shaw's Hard Way Series.
2. Martin C. Brown, "Python: The Complete Reference", McGraw-Hill Publication.
3. Paul Barry, "Head First Python", 2nd Edition, O'Reilly Media, Inc.

**BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING**

(Semester IV)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 208	Engineering Mathematics IV	Contact Hours	03	--	01	04
		Credits	03	--	01	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 208	Engineering Mathematics IV	40	40	40	60	25	--	--	125

1. Course Objectives:

The course is introduced to

1. Understand the basic techniques of statistics like correlation, regression, and curve fitting for data analysis, Machine learning, and AI.
2. Acquainted with the concepts of probability, random variables with their distributions and expectations.
3. Understand the concepts of vector spaces used in the field of machine learning and, engineering problems, To learn the Non-Linear Programming Problems techniques.
4. Introduce students to Lattice theory, recurrence relations.
5. Learn sampling theory and Number theory.
6. Introduce students to graphs, and trees.

2. Course Outcomes:

The learner will be able to

1. Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning, and AI.
2. Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
3. Apply the concept of vector spaces and orthogonalization process in Engineering Problems. Solve Non-Linear Programming Problems to engineering problems of optimization.
4. Express recursive functions of other subjects like Data Structures as recurrence relations.
5. Use the concept of sampling theory and Number theory to engineering problems.
6. Understand the use of functions, graphs and trees in programming applications.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1						3			1
CO2	3	2	1						3			1
CO3	3	2	1						3			1
CO4	3	2	1						3			1

CO5	3	2	1						3			1
CO6	3	2	1						3			1

3. Detailed Theory Syllabus:

Prerequisite: Engineering Mathematics I, Engineering Mathematics-II, Engineering Mathematics-III

Sr. No.	Module	Detailed Content	Hours
1	Correlation and Regression	Scattered diagrams, Karl Pearson's coefficient of correlation, covariance, Spearman's Rank correlation(non-repeated and repeated ranks) Regression coefficient & Lines of Regression, Fitting of the straight line and parabolic curve.	6
2	Probability, Probability Distributions,	Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expectation, Variance, Binomial distribution, Poisson distribution, Normal distribution.	6
3	Linear Algebra :Vector Spaces and NonLinear programming (NLPP)	Vectors in n-dimensional vector space, norm, dot product, The Cauchy Schwarz inequality, Unit vector ; Linear combinations, Orthogonal projection, Orthonormal basis, Gram-Schmidt process for vectors ; Vector spaces over real field,. NLPP with one equality constraint (two variables) using the method of Lagrange's multipliers, NLPP with one inequality constraint (two variables) using Kuhn-Tucker conditions.	7
4	Lattice Theory & Recurrence relation,	Poset, Hasse Diagram, Lattices, Special Types of Lattices, Solving Recurrence relation, Linear Homogeneous Recurrence relation with constant coefficients,	6
5	Sampling Theory, Number Theory,	Small Sample test, Large Sample test, chi-square test, Euler's, Fermat's Little Theorem, Congruences, Computing Inverse in Congruences, Chinese Remainder Theorem, Euclid's algorithm,	8
6	Graphs and Trees:	Types of Graphs, And Isomorphism Of Graphs, Subgraphs, Types of Graphs, Complement of Graphs, Connected Graphs, Eulerian And Hamiltonian Graphs, Trees, Minimum Spanning Tree, Kruskal's Algorithm.	6

4. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

A. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on the maximum contents of the syllabus.
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3).
4. Total three questions need to be solved.

5. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of tutorial work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of tutorials based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).

6. Books and References:

A. Books:

1. Advanced Engineering Mathematics H.K. Das, S . Chand, Publications.
2. Higher Engineering Mathematics B. V. Ramana, Tata Mc-Graw Hill Publication.
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K Iyengar, Narosa publication
4. Advanced Engineering Mathematics Wylie and Barret, Tata Mc-Graw Hill.
5. Beginning Linear Algebra Seymour Lipschutz Schaum's outline series, Mc-Graw Hill Publication.

B. References:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons.
3. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramana, Pearson Education.
4. Discrete Mathematical Structures D. S. Malik and M. K. Sen ,Course Technology Inc (19 June 2004).
5. Discrete Mathematics and its Applications Kenneth H. Rosen, Tata McGrawHill.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 209	Design and Analysis of Algorithms	Contact Hours	3	2	-	5
		Credits	3	1	--	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 209	Design and Analysis of Algorithms	40	40	40	60	25	25	--	150

1. Course Objectives:

The course is aimed to:

1. To conceptualize learners with mathematical models for analysis of algorithm
2. Describe, apply and analyze the complexity of divide and conquer strategy
3. Describe, apply and analyze the complexity of dynamic programming strategy
4. Describe, apply and analyze the complexity of greedy strategy
5. Explain and apply backtracking, branch and bound and to deal with computationally hard problems.
6. Describe the classes P, NP, and NP-Complete

2. Course Outcomes:

Learner should be able to:

1. Analyze space and time complexity of various algorithms
2. Understand and Apply divide and conquer strategy.
3. Describe, apply and Analyze design strategy and complexity for optimization problems.
4. Describe, apply and Analyze design and complexity of Backtracking.
5. Describe, apply and Analyze design strategy and complexity of Branch and Bound.
6. Understand concepts of various complexity classes.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	1	1						
CO2	1	1	2	2	1	1						
CO3	1	1	2	1	1	1						
CO4	1	1	1	1	1	1						
CO5	1	1	1	1								1
CO6	1	1	1	1								1

3. Detailed Theory Syllabus:

Prerequisite : C Programming, Python Programming

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to analysis of algorithm	Problems and Instances, RAM model of computation and costing methods(uniform costing), time and space complexity, <u>Analysis of algorithm</u> :- Asymptotic notations, Best, average and worst case analysis (example:- <u>Incremental sorting algorithm</u> :- Insertion Sort on an array input)	4
2	Divide and Conquer Approach	General Method, Analysis of D&C algorithm:-General equation, solution using Recursion tree, Master Theorem, Applications- Large number multiplication, Sorting problem:- Merge sort, Quick sort, Order statistic problem:- Finding kth smallest element of an array	8
3	Dynamic Programming Approach	General method, <u>Applications</u> -Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Single source shortest path problem	9
4	Greedy Method Approach	General method, <u>Applications</u> -Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.	8
5	Backtracking and Branch-and-bound	<u>Backtracking</u> : General method, <u>Applications</u> -n-queen problem, sum of subsets problem, graph coloring <u>Branch and Bound</u> : General method, <u>Applications</u> - Travelling salesperson problem, 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution.	6
6	Introduction to Computational Complexity Theory	Decision problems, Languages and Encoding schemes, Complexity class P, Non-deterministic computation and class NP, Relationship between P and NP, Concept of polynomial reduction and NP-completeness, class NP-Hard	4

4. Suggested Experiments:

Software Requirements if any: C, Python wherever required

- All 3 Programs
 - Implement Insertion sort, Merge sort, Quicksort on array input
 - Write a program, analyze it and find time complexity with various cases.
- Both Programs
 - Implement D&C approach to Large number multiplication, Finding kth smallest element of a given array input
 - Write a program, analyze it and find time complexity with various cases.
- Any two Programs
 - Implement DP approach to Matrix chain multiplication/Optimal binary search

- trees/0/1 knapsack problem/All pairs shortest path problem.
 - b) Write a program, analyze it and find time complexity with various cases.
- 4. Any two Programs
 - a) Implement a greedy approach to Fractional knapsack problem/ Minimum cost spanning trees/ Single source shortest path problem.
 - b) Write a program, analyze it and find time complexity with various cases.
- 5. Any two Programs
 - a) Implement backtracking approach to n-queen problem/ sum of subsets problem/ graph coloring.
 - b) write a program, analyze it and find time complexity with various cases.
- 6. Write a case study on TSP.

5. Theory Assessment:

- A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.
- B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
 - 1. Question paper will consist of 3 questions, each carrying 20 marks.
 - 2. Question number 1 will be compulsory and based on the maximum contents of the syllabus.
 - 3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3).
 - 4. Total three questions need to be solved.

6. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

- A. Term Work:** Term Work shall consist of practical's based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
- B. Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

- A. Books:**
 - 1. Ellis Horowitz, Satraj Sahni and Rajasekaran, *Fundamentals of Computer Algorithms*, Galgotia publications pvt. Ltd.
 - 2. Parag Himanshu Dave, Himanshu Bhalchandra Dave, *Design and Analysis of Algorithms* Pearson Education, 2007
 - 3. T. H. Cormen, C.E.Leiserson, R.L.Rivest, C. Stein, *Introduction to Algorithms*, 2nd edition, Prentice-Hall India, 2001
 - 4. Michael R. Garey and David S. Johnson. *Computers and Intractability: A Guide to the Theory of NP-Completeness*. W. H. Freeman, 1979.
- B. References:**
 - 1. J. Kleinberg and E. Tardos, *Algorithm Design*, Pearson International Edition, 2005.
 - 2. G. Brassard and P. Bratley, *Fundamentals of Algorithmics*, Prentice Hall India, 1996

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 210	Operating Systems	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 210	Operating Systems	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. To introduce basic concepts and functions of operating systems.
2. To introduce the concept of a process, thread and its management.
3. To introduce the basic concepts of Inter-process communication (IPC) and to understand concepts of process synchronization and deadlock.
4. To understand the concepts and implementation of memory management policies and virtual memory.
5. To understand functions of Operating Systems for file management and device management.
6. To study the need and fundamentals of special-purpose operating systems with the advent of new emerging technologies.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Understand the role of Operating System in terms of process, memory, file and I/O management.
2. Apply and analyse the concept of a process, process scheduling and threads.
3. Understand and apply the concepts of synchronization and deadlocks.
4. Apply and analyse the concepts of memory management techniques. Evaluate the performance of memory allocation and replacement techniques.
5. Apply and analyse different techniques of file and I/O management.
6. Compare the functions of various special purpose Operating Systems.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				2	2							
CO2		3										
CO3		1	2	1	1							
CO4					2							1
CO5					2							1
CO6					2		1					2

3. Detailed Theory Syllabus:

Prerequisite : Basic knowledge of Data structures and Computer architecture, Any programming language

Module No	Module	Detailed Contents of Module	Hrs.
1	Operating system Overview	Introduction, Objectives, Functions and Types of Operating System, Operating System Services and Interface, Operating system structures: Layered, Monolithic and Microkernel. Linux Kernel, Shell and System Calls.	03
2	Process and Process Scheduling	Concept of a Process, Process States, Process Description, Process Control Block, Operation on Process Uniprocessor Scheduling-Types: Pre-emptive and Non-pre-emptive, scheduling algorithms (FCFS, SJF, SRTN, Priority, RR) Threads: Definition and Types, Concept of Multithreading, Introduction to Linux Scheduling.	08
3	Process Synchronization and Deadlocks	Principles of Concurrency, Inter-Process Communication, Process Synchronization, Mutual Exclusion: Peterson Solution, Hardware Support (TSL), Operating System Support (Semaphores), Classic problem of Synchronization, Principles of Deadlock: Conditions and Resource, Allocation Graphs, Deadlock Handling Mechanism, Dining Philosophers Problem.	09
4	Memory Management	Basic Concept of Memory Management; Swapping; Contiguous Memory Allocation Techniques; Paging; TLB, Segmentation; Basic Concepts of Virtual memory; Demand Paging, Copy-on Write; Page Replacement Algorithms; Thrashing	10
5	File Management and Input /Output	Overview, File Organization and Access, File Allocation Method, File Directories, Free Space management, Linux Virtual File System. Operating System Design Issues, I/O Buffering, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C- LOOK, Linux I/O.	6
6	Special purpose Operating Systems	Fundamental of NOS, DOS, Comparison between Functions of various Special-purpose Operating Systems.	3

4. Suggested Experiments:

Software Requirements if any: C, IDE/Compiler (Geany). Bash shell, Bourne shell, Operating System

- Explore usage of basic and advanced Linux Commands For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc).
- Explore the file and process management system calls.
- Write shell scripts to do the following:
 - Display OS version, release number, kernel version, current shell, home directory, operating system type, current path setting, current working directory.
 - Display top 10 processes in descending order. Display processes with highest memory usage. Display current logged in user and log name.
- Create a child process in Linux using the fork system call. From the child process obtain the process ID of both child and parent by using getpid and getppid system calls.
- Write a program to demonstrate the concept of non-pre-emptive and preemptive scheduling algorithms.
- Write a C program to implement the solution of the Producer consumer problem through Semaphore.

7. Write a program to demonstrate the concept of deadlock avoidance through Banker's Algorithm
8. Write a program to demonstrate the concept of dynamic partitioning placement algorithms i.e. Best Fit, First Fit, Worst-Fit etc.
9. Write a program in C demonstrating the concept of page replacement policies for handling page faults eg: FIFO, LRU etc.
10. Write a C program to simulate File allocation strategies typically sequential, indexed and linked files.
11. Write a C program to simulate file organization of multi-level directory structure.
12. Write a program in C to do disk scheduling - FCFS, SCAN, C-SCAN.

5. Theory Assessment:

- A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.
- B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
 1. Question paper will consist of 3 questions, each carrying 20 marks.
 2. Question number 1 will be compulsory and based on maximum contents of the syllabus
 3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
 4. Total three questions need to be solved.

6. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

- A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
- B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).

7. Books and References:

A. Books:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918 .
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons , Inc., 9th Edition, 2016, ISBN 978-81-265-5427-0.
3. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rd Edition.

B. References:

1. D.M Dhamdhare, Operating Systems: A Concept Based Approach, Mc-Graw Hill.
2. Principles of Operating Systems, Naresh Chauhan, First Edition, Oxford university press.
3. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rd Edition.
4. The Linux Kernel Book, Remy Card, Eric Dumas, Frank Mevel, Wiley Publications.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 211	Computer Graphics and Virtual Reality	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 211	Computer Graphics and Virtual Reality	40	40	40	60	-	----	-	100

1. Course Objectives:

The course is aimed to:

1. To introduce the use of the components of a graphics system and become familiar with building the approach of graphics system components and algorithms related to them.
2. To learn the basic principles of 3-dimensional computer graphics.
3. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
4. Provide an understanding of mapping from world coordinates to device coordinates, clipping, and projections.
5. To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.
6. To comprehend and analyse the fundamentals of augmented reality, Virtual reality, underlying technologies, principles, and applications.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. To list the basic concepts used in computer graphics.
2. To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
3. To describe the importance of viewing and projections.
4. To define the fundamentals of augmented virtual reality and its related technologies.
5. To understand a typical graphics pipeline
6. To design an application with the principles of virtual reality and augmented reality

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								2		
CO2	3	3								2		
CO3	3	3								2		
CO4	3	3	2							2		
CO5	3	3										
CO6		2	2							2	2	

3. Detailed Theory Syllabus:

Prerequisite: Knowledge of Mathematics

Sr. No.	Module	Detailed Contents of Module	Hrs
1	Introduction to Computer graphics and Output primitives	Introduction: Display Devices, Bitmap and Vector based graphics, Overview of Coordinate System. Introduction to OpenGL: Scan Conversion of: point, line using Digital differential analyzer & Bresenham's algorithm, circle using midpoint approach, Curve Generation: Bezier and B-Spline curves. Introduction to fractals: generation procedure, classification, dimension and Koch Curve.	7
2	Area Filling, Transformations (2D and 3D)	Area filling: Inside/Outside Test, Scan line Polygon Fill Algorithm, Boundary Fill and Flood Fill algorithm. Basic Geometrical 2D Transformations: Translation, Rotation, Scaling, Reflection, Shear, their homogeneous Matrix representation and Composite transformation. Three Dimensional transformations: Translation, Scaling, Rotations, Composite.	7
3	Viewing (2D and 3D) and Clipping, Projection	Viewing: Introduction, Viewing Pipeline, Window to viewport transformation. Clipping: Point clipping, Line clipping: Cohen Sutherland Algorithm, Liang Barsky algorithms, Polygon clipping: Sutherland Hodgeman polygon clipping and Weiler Atherton. Text Clipping. Projections: Parallel (Oblique and orthographic), perspective (one, two and three Point) with matrix representation.	7
4	Introduction to Virtual Reality	Virtual Reality: Basic Concepts, Overview and perspective on virtual reality, Human sensation and perception. Classical Components of VR System, Types of VR Systems, Navigation and Manipulation Interfaces, Gesture Interfaces, Input Devices, Graphical Display. Graphical Rendering Pipeline, Haptic Rendering Pipeline, Applications of Virtual Reality.	6
5	VR Modeling and Programming	Geometric Modeling: Virtual Object Shape, Object Visual Appearance. Kinematics Modeling: Object Position, Transformation Invariants, Object Hierarchies, Physical Modeling: Collision Detection, Surface Deformation, Force Computation. Behavior Modeling. Programming through VRML: VRML Browsers, Java 3D, OpenCV for augmented reality.	6
6	Augmented and Mixed Reality	Technology and features of augmented reality, Difference between AR and VR, Mixed reality. Challenges with AR, Augmented reality methods, visualization techniques for augmented reality	4

4. Suggested Experiments:

1. Implement DDA Line Drawing algorithm
2. Implement midpoint Circle algorithm.
3. Implement Area Filling Algorithm: Boundary Fill, Flood Fill.
4. Implement Curve: Bezier for n control points
5. Character Generation: Bitmap method or Stroke Method
6. Implement 2D Transformations: Translation, Scaling, Rotation
7. Implement Line Clipping Algorithm: Cohen Sutherland
8. Implement polygon clipping algorithm : Sutherland Hodgeman
9. Perform projection of a 3D object on Projection Plane
10. Perform Animation (Use multiple objects)
11. Create interactive application(games)

12. Design VR system for real time requirement (e.g. car driving simulator for driving learners)

5. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

B. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

6. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW. Mini Project to be performed using C /C++/OpenGL/Blender/ any other tool (2/3 students per group), possible Ideas: Game development with audio, Graphics editor: Like Paint brush, Text editor etc.

A. Term Work: Term Work shall consist of 10 practical based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: Total 25 Marks (Experiments: 10-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks, Mini Project: 5-marks)

7. Books and References:

A. Books:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics", Pearson Education.
2. R. K Maurya, "Computer Graphics with Virtual Reality", Wiley India.

B. References:

1. Grigore Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley.
2. Steven Harrington, "Computer Graphics", McGraw Hill.
3. Rogers, "Procedural Elements of Computer Graphics", Tata McGraw Hill.
4. Vince, "Virtual Reality Systems", Pearson Education.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 212	Entrepreneurship	Contact Hours	2	-	-	2
		Credits	2	-	-	2

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 212	Entrepreneurship	20	20	20	40	-	--	--	60

1. Course Objectives:

The course is aimed to:

1. Understand the Fundamentals of Entrepreneurship
2. Identify and Evaluate Business Opportunities
3. Develop a Comprehensive Business Plan
4. Secure and Manage Funding and Operations
5. Leverage Technology and Demonstrate Entrepreneurial Readiness

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Develop a comprehensive business plan.
2. Understand the process of identifying and evaluating business opportunities.
3. Gain practical knowledge of financial management, marketing, and operations.
4. Develop skills in pitching, networking, and scaling a business.
5. Be prepared to launch and manage own entrepreneurial venture

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3		2	1	1					
CO2	2	3	2		2	2	3	3		3	2	

CO3	2	2	1		2	3	3	3		3	2	
CO4					1	2			2	1	1	
CO5	1								1	1	1	2

3. Detailed Theory Syllabus:

Module No	Detailed Content	Hrs.
1	Introduction to Entrepreneurship Overview of Entrepreneurship: Definition and importance of entrepreneurship, Characteristics of successful entrepreneurs Entrepreneurial Mindset and Motivation: Developing an entrepreneurial mindset Sources of entrepreneurial motivation Types of Entrepreneurship: Small businesses, startups, and social enterprises Identifying Opportunities and Market Needs: Techniques for opportunity recognition, Conducting Internal and External feasibility analysis	3
2	Entrepreneurial Business Types: A. Overview of Franchising and Their Advantages and Disadvantages B. Overview of Buyouts & Their Advantages and Disadvantages C. Overview of Family Businesses and Their Advantages and Disadvantages Institutions Supporting Entrepreneurship A brief overview of financial institutions in India- Central level and state level institutions- SIDBI- NABARD- IDBI- SIDCO- Indian Institute of Entrepreneurship- DIC- Single Window- Latest Industrial Policy of Government of India.	4
3	Business Planning Components of a Business Plan: Market Analysis and Competitive Research, Marketing mix (4 Ps- Product, price, place, promotion), Financial Planning and Budgeting, Developing a marketing strategy Legal and Ethical Issues in Business: Understanding business law, Ethical considerations and responsibilities Presentation of the Business Plan: Matching the Business Plan to the Needs of the Firm, Prepare business document.	4

4	Business Operations and Management Operations Management: Setting up business operations, Process and workflow optimization Human Resource Management : Recruiting and managing a team, Building a positive company culture Product Development and Management: Product lifecycle and development stages, Quality assurance and control Sales and Customer Relationship Management: Sales strategies and techniques, Managing customer relationships Funding and Financial Management: Sources of Funding for Startups, Managing cash flow, Financial ratios and KPIs, Identifying and mitigating risks, Insurance and contingency planning Technology and Tools for Entrepreneurs: Leveraging technology for business growth, Practical session on using business management tools Business Failure Analysis Entrepreneurial failure, early stage failure, late stage failure	8
5	Practical Experience and Business Plan Development Drafting business plans, Mentorship and Networking, Connecting with mentors and industry expert (Building a professional network) Digital Marketing and Online Presence-Digital marketing strategies Building and managing an online presence, Scaling and Growth Strategies-Strategies for scaling the business, International expansion considerations.	7

4. Assessment:

Internal Assessment: 20 marks, IA 1 should be on 40% of the syllabus, IA2 should be carried out as a presentation on the basis of mini projects where students need to showcase their entrepreneur knowledge for any business idea of their choice.

End Semester Examination: 40 Marks

5. Books and References:

1. Fundamentals of Entrepreneurship by H. Nandan, PHI
2. Entrepreneurship by Robert Hisrich, Michael Peters, Dean Shepherd, Sabyasachi Sinha, McGraw Hill
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler, Hermawan Kartajaya, and Iwan Setiawan
4. Blue Ocean Strategy by W. Chan Kim and Renée Mauborgne

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 213	Web Programming	Contact Hours	-	2+2#	-	4
		Credits	-	2	-	2

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 213	Web Programming	-	-	-	-	50	25	-	75

1. Course Objectives:

The course is aimed to:

1. To get familiar with the basics of Internet Programming.
2. To acquire knowledge and skills for creation of a website considering both client and server side programming.
3. To gain the ability to develop responsive Web Applications.
4. To explore different Web extensions and Web Services Standards.
5. To learn characteristics of RIA
6. To be familiarized with Python Web Framework-Flask.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Implement interactive web page(s) using HTML,CSS and JavaScript.
2. Design a responsive web site using HTML5 and CSS3.
3. Demonstrate Rich Internet Application.
4. Build Dynamic web site using server side PHP Programming and Database connectivity
5. Describe and differentiate different Web Extensions and Web Services.
6. Demonstrate web application using Python web Framework-Flask.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3		3				1	1		2
CO2	3	2	3	2	3				1	1		2
CO3	3	3	3	3	3				2	2	1	2
CO4	3	3	3	3	3				2	2	1	2
CO5	3	2	2	2	2				1	1		1
CO6	3	3	3	3	3				2	2	1	3

3. Detailed Theory Syllabus:

Prerequisite : Basic of Programming and Web

Module No	Module	Detailed Contents of Module	Hrs.
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1	HTML, CSS and JavaScript	Basic of HTML: Web System architecture-1,2,3 and n tier architecture, URL, domain name system, overview of HTTP and FTP, Cross browser compatibility issues, W3C Validators. Formatting and Fonts, Anchors, images, lists, tables, frames and forms. Introduction to CSS: Evolution of CSS, Syntax of CSS, Exploring CSS Selectors, Inserting CSS in an HTML Document, Defining Inheritance in CSS. Introduction to JavaScript: JavaScript language constructs, Objects in JavaScript- Built in, Browser objects and DOM objects, event handling, form validation and cookies.	10
2	Web Design with HTML5 and CSS3	Native Audio and Video, Geo-location, Canvas, CSS3 and Responsive Web Design: Media Queries, Selectors, Typography and color Modes, CSS3 Transitions, Transformations and Animations.	5
3	Rich Internet Application (RIA)	Introduction to XML, Introduction to AJAX :AJAX design basics, AJAX vs Traditional Approach, Rich User Interface using Ajax. Working with JavaScript Object Notation(JSON): Create data in JSON format, JSON Parser .	4
4	Server Side Programming: PHP	Introduction to PHP- Data types, control structures, built in functions, Building web applications using PHP- tracking users, PHP and Mysql database connectivity with example. Introduction to PHP Framework,	5
5	Python Web Framework: Flask	Introduction to Flask, Creating Flask application, "Hello World" Application.	2

4. Suggested Experiments:

Software Requirements if any: Windows or Linux Desktop OS, HTML5 compatible web browsers(Chrome, Opera, Firefox, Safari etc), HTML, CSS editors like Dreamweaver, Notepad++ etc. Netbeans or Eclipse IDE, XAMPP.

1. A Write five HTML programs showing use of: Links, images, table, lists, forms
2. Create a HTML document and style it using three ways of applying CSS.
3. Create a HTML document applying following CSS styles: color, background, border, margins, padding, text alignment, font.
4. Write a program for form validation using JavaScript
5. Create a HTML document to display audio and video files.
6. Create a HTML showing use of canvas.
7. Create a HTML showing use of media queries.
8. Write a program using geolocation api.
9. Write a program showing use of AJAX.
10. Write five PHP programs showing use of: server side form validation, session tracking, MySQL connection.
11. Any two programs creating basic flask applications.

5. Practical Assessment: A Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

- **Term Work:** The Term work shall consist of at least 10 experiments based on the above list. The term work Journal must include at least 2 Programming assignments. The Programming assignments should be based on real world applications which cover concepts from more than one module of syllabus. Mini Project based on the content of the syllabus (Group of 3-4 students)

- **Term Work Marks** - Total 50-Marks: Experiments: 15 Marks, Attendance: 05 Marks, Assignments: 05 Marks, Mini Project: 25 Marks

6. Books and References:

- **Books:**
 1. HTML 5 Black Book: Kogent Learning solutions.
 2. “Learning PHP 5”, David Sklar, O’Reilly Publication.
 3. Rich Internet Application AJAX and Beyond WROX press.
 4. Responsive Web Design with HTML5 and CSS3, Ben Frain, PACKT Publication.
- **References:**
 1. “Web Technologies: Black Book”, Dreamtech publication.
 2. HTML5 Cook-book, By Christopher Schmitt, Kyle Simpson, O'Reilly Media.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 214	Personal Finance Management	Contact Hours	2	-	-	2
		Credits	2	-	-	2

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 214	Personal Finance Management	20	20	20	40	-	-	--	60

1. Course Objectives: The course is aimed

1. Understand the fundamentals of budgeting and create effective personal budgets.
2. Gain knowledge of investment options, risks, and returns for informed decision-making.
3. Learn how to assess insurance needs and implement tax-saving strategies for financial security.

2. Course Outcomes: On successful completion of course learner/student will be able:

1. Understand the principles of budgeting
2. Comprehend various investment types, risks, and returns.
3. Develop skills to assess insurance needs and select appropriate coverage.
4. Master tax planning strategies for effective tax management.
5. Identify and prevent financial scams and fraud.
6. Integrate personal financial planning concepts into real-world scenarios.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3					2	1	2	2	2
CO2	1	2		1	1			2	2	3	1	3
CO3		2	2	2		3	2	1		2	2	
CO4		2		3		2			2	2		1
CO5	2	2	1		1	1		1	3		2	2
CO6		2			2		2	2	2	2	3	3

3. Prerequisite : NA

4. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Budgeting	Understanding Income and Expenses: Identifying sources of income, tracking expenses, balancing necessary vs. discretionary spending.	4

		Creating a Personal Budget: Applying budgeting methods (e.g., 50/30/20 rule), setting financial goals, and allocating for savings and debt repayment. Budgeting Tools and Techniques: Exploring budgeting apps and tools to automate savings and expense tracking.	
2	Investment	Types of Investments: Equities (stocks), Fixed Income (bonds), Real Estate, and Mutual Funds/ETFs. Understanding Investment Risks: Market risk, credit risk, liquidity risk, and interest rate risk. Risk and Return Relationship: How risk affects returns, diversification, and assessing personal risk tolerance. Evaluating Investment Opportunities: Analysing potential investments and choosing based on financial goals and risk profile.	5
3	Insurance	Types of Insurance: Health, Life, Disability, Auto, and Property Insurance. Key Insurance Concepts: Premiums, deductibles, coverage limits, and policy terms, Grace Period, Free Look period, revival of policy. Evaluating Insurance Needs: Calculating the right coverage for personal risks and financial security. Choosing the Right Insurance Products: Comparing different policies, terms, and conditions based on personal needs.	5
4	Tax Planning	Tax Savings Strategies: Contributions to tax-advantaged accounts and using tax-efficient investments. Tax Deductions: Common deductions like mortgage interest, medical expenses, and charitable contributions. Tax Exemptions: Exemptions for personal income, dependent exemptions, and specific retirement income. Understanding Tax Planning Tools: Leveraging tools and resources to maximize tax efficiency.	5
5	Financial Scams & Frauds	Common Financial Scams: Ponzi schemes, phishing, identity theft, and online fraud. Recognizing Red Flags of Fraud: Identifying warning signs of financial scams. Preventing Financial Scams: Best practices for protecting personal information and avoiding scams. Reporting Scams: How to report financial fraud to relevant authorities like FTC, SEC, and local consumer agencies.	5

5. Theory Assessment:

Internal Assessment: 20 marks

Consisting of Two compulsory internal assessments 20 Marks each. The final marks will be the average score of both the assessments.

End Semester Examination: 40 Marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

6. Books and References:

1. "Personal Financial Planning" Lawrence J. Gitman, Michael D. Joehnk, Pearson Education
2. "Personal Finance: A Practical Guide", Randy D. Brown, South-Western College Publishing
3. "Financial Planning: A Guide to Personal Finance", Peter J. S. Brow, McGraw-Hill Education
4. "Principles of Personal Financial Planning", Michael J. O'Hara, Cengage Learning
5. "Financial Planning: Theory and Practice", E. Thomas Garman, Raymond E. Forgue, Cengage Learning

**BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING**

(Semester V)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 301	Theory of Computation	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 301	Theory of Computation	40	40	40	60	-	-	-	100

1. Course Objectives :

The course is aimed to:

1. Acquire conceptual understanding of the fundamentals of grammar and languages.
2. Build concepts of the theoretical design of deterministic and non-deterministic finite automata
3. To learn how to design PDA.
4. Develop understanding of different types of Turing machines and applications.
5. To understand the relation between Regular Languages, Contexts free Languages, PDA and TM.
6. Understand the concept of Undecidability.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Identify the central concepts in theory of computation and differentiate between deterministic and nondeterministic automata, also obtain equivalence of NFA and DFA.
2. Infer the equivalence of languages described by finite automata and regular expressions.
3. Devise regular, context free grammars while recognizing the strings and tokens.
4. Design pushdown automata to recognize the language.
5. Develop an understanding of computation through the Turing Machine.
6. Acquire fundamental understanding of decidability and undecidability.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	2	2	1	1	2		1					2
CO2	2	1	1	1	1		1					2
CO3	2	1	1	1	1		1					2
CO4	2	2	1	1	2		1					2
CO5	2	2	1	1	2		1					2
CO6	2	2	1	1	2		1					2

3. Detailed Theory Syllabus:

Prerequisite : Discrete Mathematics

Module No	Module	Detailed Contents of Module	Hrs	COs
1	Basic Concepts and Finite Automata	Alphabets, Strings, Languages, Closure properties. Finite Automata (FA) and Finite State machine (FSM), Deterministic Finite Automata (DFA) and Nondeterministic Finite Automata (NFA): Definitions, transition diagrams and Language recognizers NFA to DFA Conversion Equivalence between NFA with and without ϵ -transitions Minimization of DFA, FSM with output: Moore and Mealy machines, Equivalence Applications and limitations of FA.	12	CO 1
2	Regular Expressions and Languages	Regular Expression (RE), Regular Language (RL), Equivalence of RE and FA: Arden's Theorem, State Elimination, RE Applications, Closure properties of RLs, Pumping lemma for RLs.	6	CO 2
3	Grammars	Grammars and Chomsky hierarchy, Regular Grammar (RG), Equivalence of Left and Right linear grammar, Equivalence of RG and FA Context Free Grammars (CFG): Definition, Sentential forms, Leftmost and Rightmost derivations, Parse tree, Ambiguity. Simplification and Applications. Normal Forms: Chomsky Normal Forms (CNF) and Greibach Normal Forms (GNF). CFLs -Pumping lemma, Closure properties.	8	CO 3
4	Pushdown Automata(PDA)	Definition, Transitions, Language of PDA, Language acceptance by final state and empty stack PDA as generator, decider and acceptor of CFG. Deterministic PDA, Non-Deterministic PDA, Application of PDA.	5	CO 4
5	Turing Machine (TM)	Definition, Transitions, Design of TM as generator, decider and acceptor. Variants of TM: Multitape, Universal TM. Applications, Power and Limitations of TMs.	5	CO 5
6	Undecidability	Decidability and Undecidability, Recursive and Recursively Enumerable Languages. Halting Problem, Rice's Theorem, Post Correspondence Problem.	3	CO 6

4. Theory Assessment:

- A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approximately. 40% of the syllabus is completed, and the second class test when an additional 35% of the syllabus is completed. Duration of each test shall be one and a half hour.
- B. **End Semester Theory Examination:** In question paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
 1. Question paper will consist of 3 questions, each carrying 20 marks.
 2. Question number 1 will be compulsory and based on the maximum contents of the syllabus.
 3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3).
 4. Total three questions need to be solved.

5. Books and References:

A. Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, —Introduction to Automata Theory, Languages and Computation, Pearson Education

2. J. C. Martin, —Introduction to Languages and the Theory of Computation, Tata McGraw Hill.
3. Vivek Kulkarni, —Theory of Computation, Oxford University Press, India
4. Kavi Mahesh, —Theory of Computation: A Problem Solving Approach, Wiley-India.

B. References:

1. Michael Sipser, —Theory of Computation, Cengage learning
2. N. Chandrasekhar, K.L.P. Mishra, “Theory of Computer Science, Automata Languages & Computation”, PHI publications.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 302	Machine Learning	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 302	Machine Learning	40	40	40	60	25	----	25	150

1. Course Objectives:

The course is aimed to:

1. Understand basics of Machine Learning.
2. Understand and Apply concepts of supervised and unsupervised learning to real world applications.
3. Evaluate various supervised and unsupervised learning models.
4. Aware of Machine Learning models.
5. Understand various performance measures.
6. Understand and apply optimization techniques.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Explain the processes involved in machine learning life cycle.
2. Apply various Feature Engineering techniques on diverse Datasets.
3. Analyze the performance of supervised learning models using metrics.
4. Implement and Evaluate ensemble models using modern machine learning libraries.
5. Apply clustering techniques to uncover patterns and structures in real-world datasets.
6. Design and Analyse real world applications using specialised ML Models.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2	3	3		3	2							
CO3	3	3		3	3							
CO4	2		3	3	3							1
CO5	2	2		3	3							1
CO6	3	3	2	2	2	2	2	2	2	2	2	2

1. Detailed Theory Syllabus:

Prerequisite: Probability, Statistics

Module No	Module	Detailed Contents of Module	Hrs.	COs
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1	Introduction to Basics of Machine Learning and ML Tools	What is Machine Learning? AI Vs ML Vs DL, Types of Machine Learning, Challenges in Machine Learning, Application of Machine Learning, Machine Learning Development Life Cycle. Machine Learning Languages - Python, R	4	CO1
2	Feature Engineering	Feature Transformation, Feature Construction, Feature Selection, Feature Extraction, Principal Component Analysis	4	CO2
3	Supervised Learning and Performance Metrics	Regression: Simple Linear Regression, Multiple Linear Regression, Regression Metrics, Gradient Descent: Batch, Stochastic, Mini Batch, Polynomial Regression, Bias- Variance Trade-offs, Ridge Regression, Lasso Regression, ElasticNet Regression Classification: Logistic Regression, Derivative of Sigmoid Function and Gradient Descent, Classification Metrics, Softmax Regression, Polynomial Features in Logistic Regression. Logistic Regression Hyperparameters. Decision Tree: Gini Index, Decision tree hyperparameters, Regression tree	9	CO3
4	Ensemble Learning	Introduction to Ensemble Learning, Voting Ensemble, Bagging Ensemble, Stacking and Blending Ensembles, Random Forest, AdaBoost, Gradient Boosting, Bagging Vs Boosting	7	CO4
5	Unsupervised Learning: Clustering	Introduction to Unsupervised Machine Learning, Clustering- K-Means, Agglomerative Clustering, DBSCAN Clustering Algorithms	8	CO5
6	Specialized ML Algorithms	KNN, Support Vector Machine, Hard Margin, Soft Margin, Kernel Trick, Naive Bayes Classifier, Introduction to Artificial Neural Network	7	CO6

1. Suggested Experiments:

Hardware Requirements: High performance Systems

Software Requirements: Python, Tensorflow, Keras

- Learn various Libraries in Python used for Machine Learning using Breast Cancer Data
- Implement Any four
 - Implement Logistic regression with sample dataset and evaluate it using various performance measures
 - Implement KNN with sample dataset and evaluate it using various performance measure
 - Implement Decision tree with sample dataset and evaluate it using various performance measure
 - Implement multiclass classifier SVM with sample dataset and evaluate it using various performance measure
 - Implement Naive Bayes Classifier with sample dataset and evaluate it using various performance measure
- Implement any Two:
 - Implement PCA to find the first two principal components of the breast cancer dataset
 - Implement Multidimensional scaling (MDS) on the breast cancer dataset
 - Implement K-Means clustering using sample dataset
 - Implement agglomerative clustering using sample dataset
- Implement Ensemble Learning using a sample dataset.

5. Mini Project:

Guidelines for Mini Project in Machine Learning

1. The mini project work is to be conducted by a group of four students
2. The group should meet with the concerned subject faculty during Laboratory hours and the progress of work discussed must be documented.
3. Students should do surveys and identify latest topics in machine learning, which shall be converted into problem statements for mini projects in consultation with the subject faculty / internal committee of faculties.
4. Students should do the following steps in a mini project -Importing the required libraries, Loading the Data, Data pre-processing, Summarization, Visualization, Training and Evaluation of different models, Predictions and evaluation of the result.
5. The solution to be validated with proper justification and report to be created in standard format given by concerned faculty.

Guidelines for Assessment of Mini Project:

1. Mini Project shall be assessed through a presentation and demonstration of working model by the student project group/individual to a panel of Internal Examiners consisting of head of department, senior faculties of department.
2. Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Mini Project shall be assessed based on following points

1. Quality of problem and Clarity
2. Innovativeness in solutions
3. Cost effectiveness and Societal impact
4. Full functioning of working model as per stated requirements
5. Effective use of skill sets
6. Effective use of standard engineering norms
7. Contribution of an individual's as member or leader
8. Clarity in written and oral communication

2. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

B. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3.)
4. Total three questions need to be solved.

3. Practical/Oral Assessment:

A Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 10 Marks (Mini Project) + 5Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

4. Books and References:

A. Books:

1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2. Introduction to Machine Learning Edition 2, by Ethem Alpaydin

B. References:

5. Self Learning:

NPTEL Course on Machine Learning

Machine Learning For Absolute Beginners: A Plain English Introduction (Second Edition),
Oliver Theobald

Machine Learning: An Algorithmic Perspective, Second Edition, Stephen Marsland

Approaching (Almost) Any Machine Learning Problem, Abhishek Thakur

Machine Learning (in Python and R) For Dummies, John Paul Mueller

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 303	Microprocessor	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 303	Microprocessor	40	40	40	60	-	-	-	100

1. Course Objectives:

The course is aimed to:

1. Understand the architecture, pin configuration, and operational modes of the 8086/8088 microprocessor.
2. Understand various addressing modes and instruction sets to develop assembly language programs.
3. Analyze the interrupt structure of the 8086 microprocessor and the functioning of the Programmable Interrupt Controller 8259.
4. Explain interfacing techniques of the 8086 microprocessor with memory and peripheral devices.
5. Examine the architecture and operating modes of the Intel 80386 microprocessor and understand its memory management mechanisms.
6. Understand the Pentium Architecture and the characteristics of i3, i5, and i7 processors.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Explain the internal architecture, bus organization, and operational modes of the 8086/8088 microprocessor.
2. Demonstrate the application of various addressing modes and instruction sets by writing and debugging assembly programs.
3. Analyze interrupt handling in 8086.
4. Illustrate interfacing methods of 8086 with RAM, ROM, and peripheral devices.
5. Explain the 80386 microprocessor architecture and interpret its memory segmentation and paging mechanisms in protected mode.
6. Analyze the Pentium Architecture and evaluate the characteristics of i3, i5, and i7 processors.

3. CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										
CO2	2	1	2		2							
CO3	1	1	1		1							
CO4	2	1			1							
CO5	1				1							
CO6	1		1		1							

4. Detailed Theory Syllabus:

Prerequisite: Programming Fundamentals, Number Systems, Digital Logic, Computer Organization and Architecture

Module No	Module Name	Detailed Contents of Module	Hrs	COs
1	The Intel Microprocessors 8086/8088 Architecture	8086/8088 CPU Architecture, Functional Pin Diagram, Memory Segmentation, Banking in 8086, Demultiplexing of Address/Data bus, Functioning of 8086 in Minimum mode and Maximum mode, Timing diagrams for Read and Write operations in minimum and maximum mode, Study of 8284 Clock Generator, Study of 8288 Bus Controller.	8	CO1
2	Instruction Set and Programming	Addressing Modes, Instruction set – Data Transfer Instructions, String Instructions, Logical Instructions, Arithmetic Instructions, Transfer of Control, Instructions, Processor Control Instructions.	6	CO2
3	8086 Interrupts with multiprocessor system	Types of interrupts, Interrupt Service Routine, Interrupt Vector Table, Servicing of Interrupts by 8086 microprocessor. Programmable Interrupt Controller 8259 – Block Diagram, Interfacing the 8259 in single and cascaded mode, Operating modes.	6	CO3
4	Interfacing 8086 with peripherals	Memory Interfacing - RAM and ROM, Decoding Techniques – Partial and Absolute, 8255-PPI – Block diagram, Functional PIN Diagram, CWR, operating modes, interfacing with 8086. 8253 PIT- Block diagram, Functional PIN Diagram, operating modes, interfacing with 8086. 8257 DMAC – Block diagram, Functional PIN Diagram, Register organization, DMA operations and transfer modes	6	CO4
5	Intel 80386DX Processor	Architecture of 80386 microprocessor, 80386 registers – General purpose Registers, and Control registers Real mode, Protected mode, virtual 8086 mode, 80386 memory management in Protected Mode – Descriptors and selectors, the memory paging mechanism	7	CO5

6	Pentium Family	Pentium Architecture, Integer & Floating Point Pipeline Stages, Cache Organization, and i3, i5, i7 processor, features, characteristics.	6	CO6
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5. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

B. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3.)
4. Total three questions need to be solved.

6. Books and References:

A. Books:

1. 8086/8088 family: Design Programming and Interfacing: John Uffenbeck , PHI.
2. Advanced Microprocessors and Peripherals: K M Bhurchandani, A k Ray McGraw Hill
3. The 80386DX Microprocessor: hardware, Software and Interfacing, Walter A Triebel, Prentice Hall
4. Pentium Processor System Architecture: Tom Shanley & Don Anderson, Addison-Wesley.

B. References:

1. Intel Microprocessors: Barry B. Brey, 8th Edition, Pearson Education India
2. Microprocessor and Interfacing: Douglas Hall, Tata McGraw Hill.
3. Advanced MS DOS Programming – Ray Duncan BPB
4. Intel Manual
5. IBM PC Assembly language and Programming: Peter Abel, 5th edition, PHI
6. The Pentium Microprocessor, James Antonakons, Pearson Education

7. Self- Learning Activities

1. Write and Debug Assembly Programs
 - i. Write assembly programs on paper or text editors, manually simulate instruction execution.
 - ii. Use assembly compilers and debuggers (like NASM, MASM, or online assemblers) to test and understand code behavior.
2. Draw and Label Functional Pin Diagrams.
3. Enroll for MOOCs on microprocessors (for example, NPTEL, Coursera, etc).

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 304	Computer Network	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 304	Computer Network	40	40	40	60	25	----	25	150

1. Course Objectives:

1. To introduce students to the OSI and TCP/IP network reference models and enable them to understand functionality of each layer.
2. To develop an understanding of data link layer services, framing techniques, error detection/correction mechanisms, and flow control protocols.
3. To equip students with the skills to apply IPv4 and IPv6 addressing techniques including subnetting, supernetting, and address classification to design efficient subnetworks.
4. To analyze and compare different routing algorithms and protocols.
5. Analyze routing and transport layer mechanisms for data delivery and reliability.
6. Evaluate the role and functioning of application layer protocols in real-world communication.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Explore the functionalities of each layer of the network reference models and compare the Models.
2. Explain data link layer concepts, design issues and protocols.
3. Design subnetworks using the concept of IP addressing.
4. Analyze the strength and weaknesses of various routing protocols.
5. Explain the data transportation and session management issues and related protocols used for end to end delivery of data.
6. Represent the data using different data presentation techniques and relate real time applications with the application layer protocols.

CO-PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1								1		
CO2	2	1			2					1		
CO3	2	2	2		2					1		2
CO4	2	1			2					1		
CO5	2	1			2					1		
CO6	2	1			1	2		1		1		2

3. Detailed Theory Syllabus:

Prerequisite: Digital Logic, Computer Organization and Architecture, Data Structures & Algorithms, Programming Fundamentals

Module No	Module	Detailed Contents of Module	Hrs.	CO
1	Introduction	Introduction to Computer Networks and Applications, Basic Networking Devices: Repeater, Hub, Switch, Router, NIC, Modem, Network Topologies, Type of networks (LAN, WAN, MAN) Network Reference models - Layers of OSI and TCP/IP models Design Issues of Layers. Switching – Circuit-switched Networks – Packet Switching, Message switching. Self Study: Guided and Unguided media.	6	CO1
2	Data Link Layer	DLL Design Issues: Framing, Error Detection and Correction: Parity, CRC, Checksum, Hamming Code Data Link protocols: Flow control: Stop and Wait, Sliding Window (Go Back N, Selective Repeat), Piggybacking, HDLC. Medium Access Protocols: Channel Allocation, Random Access, Controlled Access Self Study: Ethernet Features, types and Standard Ethernet with frame format	8	CO2
3	Internet Protocols and Addressing	Introduction to Internet Protocols, IPV4 datagram format, IPv4 address, classful address, subnetting, supernetting, classless addressing, DHCP, IPV6 datagram format	7	CO3
4	Routing in Network Layer	Routing algorithms -The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Routing in the internet -RIP, OSPF	7	CO4
5	Transport Layer	User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Queuing, Discipline Introduction to Quality of Services (QOS).	6	CO5
6	Application Layer Protocols	Application Layer: HTTP, DNS, E-Mail, FTP, Telnet - SNMP.	5	CO6

4. Suggested Experiments: Minimum 8

Software Requirements if any: Wireshark, Cisco Packet Tracer, NS2

1. Fundamentals of Computer Network: Use basic networking commands in Linux (ping, tracer, nslookup, netstat, ARP, RARP, ip, ifconfig, dig, route)
2. Study packet capturing and header formats of all layers protocols using Wireshark
3. Error detection and correction protocols: CRC/ Hamming code implementation.
4. Simulation of Network Topology: Installation of packet Tracer and implement simple network Topologies and internet addressing configuration using Packet Tracer
5. Graphical simulation of a network with Static Routing Protocol and traffic consideration using Packet Tracer.
6. Graphical simulation of a network with Dynamic Routing Protocol and traffic consideration using Packet Tracer.

7. Socket Programming: Socket programming using TCP using C/java/python.
8. Socket Programming: Socket programming using UDP using C/java/python
9. Application layer protocols implementation using Packet Tracer.:
 - a. Perform File Transfer and Access using FTP
 - b. Perform Remote login using Telnet server
 - c. Perform DHCP using DHCP server
 - d. Perform DNS using DNS server
10. Installation and configuration of NS2 and introduction to TCL (Tool Command Language) Hello Programming.

5. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

B. End Semester Theory Examination: In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3.)
4. Total three questions need to be solved.

6. Practical/ Oral Assessment: A Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of at least 10 experiments based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the theory as well as lab syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

A. Books:

1. Andrew S Tanenbaum, Computer Networks -, 4th Edition, Pearson Education.
2. Behrouz A. Forouzan, Data Communications and Networking , 5th Edition, McGraw Hill education.
3. Computer Network Simulation in NS2 Basic Concepts and Protocol Implementation.-Prof Neeraj Bhargava, Pramod Singh Rathore, Dr.Ritu Bhargava, Dr.Abhishek Kumar, First Edition. BPB Publication
4. Packet analysis with Wire shark, Anish Nath, PACKT publishing
5. TCP/IP Protocol Suite 4th Edition by Behrouz A. Forouzan

B. References:

1. S. Keshav, An Engineering Approach to Computer Networks, 2nd Edition, Pearson Education.
2. B. A. Forouzan, "TCP/IP Protocol Suite", Tata McGraw Hill edition, Third Edition.
3. Ranjan Bose, Information Theory, Coding and Cryptography, Ranjan Bose, Tata McGrawHill , Second Edition.
4. Khalid Sayood, Introduction to Data Compression, Third Edition, Morgan Kaufman.:
5. NS2.34 Manual
6. Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems by Chris Sanders

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 305	Professional Communication and Ethics- II	Contact Hours	01	02	-	3
		Credits	-		-	2

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 305	Professional Communication and Ethics- II	-	-	-	-	50	-	--	50

Course Objectives:

By the end of the course, learners will be able to:

1. Develop awareness of academic discourse genres, their communicative purpose, rhetorical structure, and disciplinary conventions.
2. Enhance academic writing skills through practice in research paper writing, literature reviews, proposals, and abstracts.
3. Build precision, objectivity, and abstraction in language use through academic and technical features like nominalisation, modality, and lexical cohesion.
4. Train students in effective multimodal and oral communication through data presentation, proposal presentations, and academic discourse strategies.
5. Cultivate professional and interpersonal communication skills, including resume writing, interviews, and group discussions.
6. Promote ethical and responsible communication practices, including citation conventions, digital discourse, and professional etiquette.

Course Outcomes:

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

1. Identify, analyze and write research papers on the basis of the structure, purpose, and rhetorical features of academic and professional genres.
2. Define problem, solution of proposals, and literature reviews using genre-specific conventions.
3. Demonstrate professional communication skills through resume writing, group discussions, and interviews.

4. Present data effectively using visual-verbal coordination, discourse markers, and spoken register features.
5. Apply ethical use of language in digital communication and virtual collaboration.
6. Exhibit etiquette in email writing, academic and professional communication settings.

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3		2				3	2	3		2
CO2		3		2				3	2	3		2
CO3								3	2	3		2
CO4								3	3	3		2
CO5								3	1	3		2
CO6								1	2	3		2

3. Detailed Theory Syllabus:

Prerequisite: Basic language skills

Detail Tutorial Sessions

Sr. No.	Module	Detailed Content	Hours	CO Mapping
I	Research Paper Writing - Structure, Style and Language	Academic Discourse Genres: Purpose, aim, and format of research papers; acquisition of academic genre awareness Literature Review as Intertextual Practice: Summarising sources, citation as stance and voice, avoiding plagiarism using quotation and paraphrasing effectively; developing intertextual synthesis and citation skills Research Methodology: Disciplinary Discourse (the specific language and conventions used within a particular academic field), and Nominalisation (the transformation of verbs or adjectives into nouns to create a more formal, abstract style of writing, e.g., “analyse” → “analysis”); acquiring precision and abstraction in writing Presenting Data: Visual-verbal integration, cohesive devices in figure descriptions; developing multimodal expression and linguistic labelling skills Writing the Discussion: Move structure analysis, use of modality and evaluative language; acquiring evaluative and critical commentary skills Referencing Conventions: IEEE citation style, citation as grammatical metaphor; mastery of referencing conventions and stylistic precision Writing an Abstract: Genre analysis and rhetorical moves (Swales' IMRAD model); summarisation and structural awareness of academic abstracts Coherence and Cohesion: Anaphora, cataphora, lexical cohesion; theme–rheme structure, discourse markers and lexical bundles; acquiring cohesion strategies and discourse flow management	3	CO1

II	Writing Technical Proposals	Proposal as Genre: Move structure (problem-solution pattern), audience awareness, understanding persuasive academic genres Executive Summary: Information packaging, genre-specific register; acquisition of concise summarisation techniques Defining the Problem and Solution: Argumentation structure, lexical density, developing logical structuring and technical vocabulary Technical Language Use: Hedging, modality, nominal style; acquiring formality, objectivity, and linguistic caution in writing Writing with Purpose: Field, tenor, and mode (Systemic Functional Linguistics); enhancing genre and register control Presentation on Proposal: Spoken register features and visual-verbal coordination; developing professional oral communication strategies	3	CO2
III	Employability Skills	Group Discussion: Turn-taking, topic management, repair strategies, politeness theory; developing interactive and collaborative discourse skills Case-based Discussions: Conflict resolution using discourse strategies, team and cross-cultural communication (intercultural pragmatics), language use; developing problem-solving and culturally sensitive communication skills Cover Letter, Resume and Statement of Purpose: Genre conventions, stance and engagement; developing personal narrative and professional identity construction Interview Skills: Speech Acts (Self-introduction, requests, justifications), pragmatics of self-presentation; mastering pragmatic competence and strategic self-representation	3	CO3

		The interpersonal skills required for GD and Interview should be dealt with in the form of role play in the tutorial class.		
IV	Presentation Skills	Presentation Skills: Spoken academic discourse, paralinguistic features, discourse intonation; acquiring fluency and control in formal presentations All the strategies and skills required for preparing slides, delivering content should be adhered to while teaching presentation skills.	2	CO4
V	Ethics and Ethical Codes of Conduct	Engineering Ethics: Critical discourse analysis of professional language; acquiring critical evaluation of ethical language use Professional Responsibilities: Register variation and power relations; understanding discourse and institutional power Ethical Codes (IEEE, ASME): Institutional discourse analysis; acquisition of technical and regulatory genre conventions Digital and Cyber Ethics: Multimodal discourse and netiquette; mastering digital communication norms and ethical language use Virtual Collaboration: Language of professionalism in asynchronous communication; acquiring discourse strategies for virtual team environments	1	CO5
VI	Etiquettes	Classroom and Workplace Etiquette with special reference to email etiquette	1	CO6

Sr. No.	Tutorials	Details of Activities	Hours	CO Mapping
I	Tutorial 1	Role Play on Interpersonal Skills: Leadership Skills, Collaboration, Teamwork, Conflict Resolution, Negotiation, and Time Management	2 hrs	CO3 CO4
II	Tutorial 2	Student Grant Proposal Form and Group Discussion: Case-study Approach	2 hours	CO2, CO5, CO6
III	Tutorial 3	Group Discussion continued	2 hours	CO3, CO5, CO6
IV	Tutorial 4	Cover letter, Resume and SOP	2 hrs	CO3, CO5
V	Tutorial 5	Performing Mock-interview	2 hrs	CO3, CO5, CO6
VI	Tutorial 6	Mock Interview continued	2 hours	CO3, CO5, CO6
VII	Tutorial 7	Final Interview	2 hours	CO3, CO5, CO6
VIII	Tutorial 8	Final Interview	2 hours	CO3, CO5, CO6
IX	Tutorial 6	Performing Mock-Group Discussion	2 hours	CO3, CO5, CO6
X	Tutorial 7	Final Group Discussion	2 hours	CO3, CO5, CO6
XI	Tutorial 8	Research Methodology: Survey Method and Questionnaire	2 hours	CO1
XII	Tutorial 9	Final presentation on Research Paper	2 hours	CO4, CO5, CO6
XIII	Tutorial 10	Final Presentation on Proposal	2 hours	CO4, CO5, CO6

Assessment:

Term Work:

The distribution of marks for term work shall be as follows:

1. Research paper - 5 marks
2. Research paper presentation-10 marks
3. Group Discussion-10 marks
4. Interviews-5 marks

5. Technical Proposal- 5 marks
6. Proposal Presentation- 10 marks
7. Attendance -5 marks

The final certification and acceptance of term work ensures the satisfactory performance of Laboratory work and minimum passing in the term work.

Text Books and References:

1. Raman Meenakshi & Sharma Sangeeta, *Communication Skills*, Oxford University Press
2. Dr. S. S. Bhakar & Dr. Tarika Singh. A handbook for Writing Research Paper. First edition, Bharati Publications, New Delhi.
3. Virendra Singh Nirban, Krishna Mohan, RC Sharma, *Business Correspondence and Report Writing*

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 306	Data Warehouse and Data Mining	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 306	Data Warehouse and Data Mining	40	40	40	60	25	-	25	150

Course Objectives:

The course is aimed to:

1. To enhance query performance by enabling fast data access, efficient execution, and optimal resource usage.
2. To ensure reliable, secure, and consistent data access across distributed environments while maintaining transaction integrity and enforcing access controls.
3. To identify the scope and essentiality of Data Warehousing and ETL.
4. To analyze data, choose relevant models and algorithms for respective applications.
5. To study data mining techniques for various data mining algorithms.
6. To develop research interest towards advances in data mining.

Course Outcomes:

On successful completion of course learner/student will be able to:

1. Analyze the impact of improved query efficiency, reduced resource usage, and faster data retrieval on overall database performance.
2. Describe how distributed database systems ensure enhanced data security, consistency, and reliable performance.
3. Understand the fundamentals of Data Warehouse Architecture and ETL process, Explain the concepts of dimensional modeling and Online Analytical Processing (OLAP) operations.
4. Identify and Implement the appropriate data mining algorithms to solve real world problems.
5. Compare and evaluate different data mining techniques like classification, prediction, clustering.
6. Assess various data mining techniques for their suitability in association rule mining.

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2							
CO2	2	2	2	1	1	2	1					
CO3	2	2	2	2	1							2
CO4	2	2	2	2	2							
CO5	2	2	2	2	2							1

CO6	2	2	2	1	2						1
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Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.	CO's
1	Advanced Data Management System	Indexing and Hashing, Indexing Techniques; Static and dynamic Types of Single-Level & Multilevel Indexes; Dynamic Multilevel Indexes Using B-Trees and B+-Trees; Indexes on Multiple Keys, Hashing Techniques. Overview of Query Processing and Optimization, SQL Queries into relational algebra approaches and cost based optimization.	6	CO1
2	Advanced Transaction Management System	Transaction concept, Transaction states, ACID properties, Serializability, Recoverability, Concurrency Control: Lock-based, Time-stamp based, Deadlock handling, Recovery System: Failure Classification, Log based recovery, Checkpoints, Shadow Paging, ARIES Algorithm. Distributed Database Systems; Types, Architecture; Data Fragmentation, Replication and Allocation, 3PC locking protocol, Types of Access Control; DACB, MAC & RAC, Data Security in Distribution transaction.	7	CO2
3	Introduction to Data Warehousing and Dimensional Modelling, ETL and OLAP	Introduction to Data Warehouse : Components of Data warehouse Architecture, Data warehouse architecture, Data warehouse versus Data Marts, E-R Modeling versus Dimensional Modeling, Data Warehouse Schemas; Star Schema, Snowflake Schema, Fact Constellation Schema., ETL and OLAP : Major steps in ETL process, Data Extraction Methods, Data Transformation; Basic Tasks in Transformation, Data Loading Techniques, OLTP versus OLAP, OLAP operations: Slice, Dice, Rollup, Drilldown and Pivot.	8	CO3
4	Introduction to Data Mining, Data Exploration and Data Pre-processing	Data Mining Task Primitives, Architecture, KDD process, Issues in Data Mining, Applications of Data Mining, Data Exploration : Types of Attributes, Statistical Description of Data, Data Visualization; Data Preprocessing : Descriptive data summarization, Cleaning, Integration & transformation, Data reduction, Data Discretization & Concept hierarchy generation	5	CO4
5	Classification, Prediction and Cluster Analysis	Classification : Decision Tree: ID3, Bayesian Classification; Prediction : Logistic regression; Clustering : Partitioning Methods (<i>k</i> -Medoids), Hierarchical Methods (BIRCH), Density based Method, Grid based Method.	7	CO5

6	Mining frequent patterns and associations, Basics of Web mining	Basic concepts & a Road map: Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rule, Frequent Pattern Mining; Efficient and Scalable Frequent Itemset Mining Methods: Apriori Algorithm, Association Rule Generation, Improving the Efficiency of Apriori: FP growth, Web mining, Page rank algorithm, Text mining.	6	CO6
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Suggested Experiments:

Software Requirements if any: Python, WEKA Tool, ORACLE.

- Solve the given problem statement
 - To find the complexity for searching a record from disk storage using without index and with index based on sparse and dense index method.
 - Find the cost of a given problem statement for different operations with various algorithms in Query Processing and Optimization.
- Design of a distributed database design - Fragmentation
- Build Data Warehouse/Data Mart for a given problem statement
 - Identifying the source tables and populate sample data
 - Design dimensional data model i.e. Star schema, Snowflake schema and Fact Constellation schema (if applicable)
- To perform various OLAP operations such as slice, dice, drilldown, rollup, pivot
- Implementation of Data Preprocessing with sample dataset.
- Implementation of Classification algorithm(Bayesian classification) & Logistic Regression using WEKA.
- Implementation of Clustering algorithm(K-medoids/ DBSCAN) & Association Rule Mining algorithm (Apriori) using WEKA.
- Case Study on any Data Mining Tool other than WEKA. (Orange, Rapid Miner, XLMiner)
- Implementation of page rank algorithm.
- Implementation of Text Mining.

Theory Assessment:

A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35%

The syllabus is completed. Duration of each test shall be one and a half hours.

B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

- Question paper will consist of 3 questions, each carrying 20 marks.
- Question number 1 will be compulsory and based on maximum contents of the syllabus
- Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
- Total three questions need to be solved.

Term Work Assessment: The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

2. Books and References:

A. Books:

1. Elmasri & Navathe— fundamentals of Database Systems IV edition. PEARSON Education.
2. Korth, Silberschatz sudarshan— Database systems, concepts 5th edition McGraw Hill.
3. PaulrajPonniah, —Data Warehousing: Fundamentals for IT Professionalsl, Wiley India.
4. Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3rd edition.
5. Reema Theraja —Data warehousingl, Oxford University Press.
6. M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education

B. References:

1. Chhanda Ray,---- Distributed Database System, Pearson Education India.
2. Ian H. Witten, Eibe Frank and Mark A. Hall " Data Mining ", 3rd Edition Morgan kaufmann publisher
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining", Person Publisher
4. R. Chattamvelli, "Data Mining Methods" 2nd Edition Narosa Publishing House.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 307	Cryptography and System Security	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 307	Cryptography and System Security	40	40	40	60	25	25	-	150

1. Course Objectives:

The course is aimed to:

1. To understand the concepts of modular arithmetic and number theory and their application in Classical Encryption techniques.
2. To Understand the working principles and utilities of various cryptographic algorithms including Secret Key Cryptography and Public Key Cryptography.
3. To explore various hashing and Message Digest Algorithms to achieve Confidentiality and Integrity.
4. To explore the design issues and working principles of various authentication protocols, PKI standards and different digital signature algorithms to achieve authentication.
5. To explore various secure communication standards including Kerberos, IPsec, and SSL/TLS and email.
6. To Understand the ability to use existing cryptographic utilities to build programs for secure communication.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Develop system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory.
2. Analyze, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
3. Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
4. Apply different digital signature algorithms to achieve authentication and design secure applications
5. Apply and analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
6. Analyze and apply system security concepts to recognize malicious code.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1						1				1
CO2		2	1	1				1				1
CO3	2	2		2	2	1		1	3			1
CO4	2				2	1		1	3		2	1
CO5		2	2	2	2	1		1	3			1
CO6	2	2	3	3	3	2		1	3		2	1

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.	CO
1	Introduction and Number Theory	Security Goals, Services, Security Mechanisms and attacks, The OSI security architecture, Network Security Model, Classical Encryption Techniques, Symmetric cipher model, mono-alphabetic and poly-alphabetic substitution techniques: Vigenere cipher, playfair cipher, Hill cipher, transposition techniques: keyed and keyless transposition ciphers, steganography. Modular Arithmetic and Number Theory:- Euclid's algorithm, Prime numbers, Fermat's & Euler's theorem - Testing for primality, The Chinese remainder theorem and its application, Discrete logarithms.	9	CO1
2	Symmetric and Asymmetric key Cryptography and key Management	Block cipher principles, block cipher modes of operation, DES, Double DES, Triple DES, Advanced Encryption Standard (AES), Stream Ciphers: RC5 algorithm Public key cryptography: Principles of public key cryptosystems-The RSA algorithm, The knapsack algorithm, ElGamal Algorithm. Key management techniques: using symmetric and asymmetric algorithms. Diffie Hellman Key exchange algorithm.	8	CO2
3	Hashes, Message Digests and Digital Certificates	Cryptographic hash functions, Hash function requirements, Hash function uses, MD5, SHA-1, MAC, HMAC, CMAC Digital Certificate: X.509 format, PKI	4	CO3
4	Authentication Protocols & Digital signature schemes	Authentication Requirement and Functions, Types of Authentication, User Authentication and Entity Authentication, One-way and mutual authentication schemes, Needham Schroeder Authentication protocol, Kerberos Authentication protocol. Importance of Digital Signature, Digital Signature Schemes – RSA, ElGamal signature schemes	6	CO4

5	Network Security and Applications	Network Security Basics, TCP/IP Vulnerabilities (Layer-wise): Application layer: HTTP, DHCP Transport layer: TCP syn flood, Port Scanning, Network layer: IP Spoofing, Packet sniffing, Data link layer: ARP Spoofing, DNS Spoofing, ARP cache poisoning DOS: Classic DOS attacks: Ping flood, ICMP flood, UDP flood, Distributed DOS, Defenses against DOS attacks, Internet Security Protocols: SSL, IPSEC, Secure Email: PGP, Firewall, Honey Pots, IDS	8	CO5
6	System Security	Software Vulnerabilities: Buffer Overflow, Format string, SQL injection, Malwares: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits	4	CO6

4. Suggested Experiments:

1. Implement a product cipher using Substitution / Transposition methods.
2. Implement RSA cryptosystem.
3. Implement Diffie Hellman Key exchange algorithm.
4. For varying message sizes, calculate the message digests of a text using MD-5.
5. Implement a digital signature scheme using ElGamal Algorithm.
6. Study the use of network reconnaissance tools like whois, dig, traceroute, nslookup to gather the information about networks and Target Machine.
7. Study the packet sniffer tool wireshark,:-
 - a. Observe the performance in promiscuous as well as non-promiscuous mode.
 - b. Show how the packets can be traced based on different filters.
8. Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, etc.
9. Detects ARP spoofing using Ettercap, nmap and/or open source tools ARPWATCH and wireshark and DNS Spoofing in Kali linux.
10. Explore the GPG tool of linux to implement email security.

5. Theory Assessment:

- A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.
- B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
1. Question paper will consist of 3 questions, each carrying 20 marks.
 2. Question number 1 will be compulsory and based on maximum contents of the syllabus
 3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
 4. Total three questions need to be solved.

5. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of tutorial work and minimum passing in the TW.

- A. Term Work:** Term Work shall consist of tutorials based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
- B. Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).

6. Books and References:

A. Books:

1. William Stallings, Cryptography and Network Security, Principles and Practice, 6th Edition, Pearson Education, March 2013

2. Behrouz A. Ferouzan, —Cryptography & Network Securityl, Tata Mc Graw Hill
3. Bernard Menezes, —Cryptography & Network Securityl, Cengage Learning.
4. Network Security Bible, Eric Cole, Second Edition, Wiley.

B. References:

1. Applied Cryptography, Protocols Algorithms and Source Code in C, Bruce Schneier, Wiley.
2. Cryptography and Network Security, Atul Kahate, Tata Mc Graw Hill.
3. Build your own Security Lab, Michael Gregg, Wiley India
4. CCNA Security, Study Guide, TIm Boyles, Sybex.
5. Network Security Bible, Eric Cole, Wiley India.
6. Web Application Hacker's Handbook, Dafydd Stuttard, Marcus Pinto, Wiley India

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 308	IoT and Embedded System for Automation	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 308	IoT and Embedded System for Automation	40	40	40	60	25	25	--	150

1. Course Objectives:

The course is aimed to:

1. To Understand and explain the core concepts of IoT and embedded systems.
2. To Analyze and evaluate various communication protocols and select appropriate ones for IoT applications.
3. To Understanding IoT Hardware and Explore various IoT hardware platforms such as Arduino, Raspberry Pi, ESP32, Cloudbit/Littlebits, Particle Photon, and Beaglebone Black. Learn their capabilities, strengths, and application areas
4. To develop a thorough understanding of the essential IoT components—sensors, actuators, smart objects, and sensor networks—by analyzing their working principles, classifications, characteristics, and architectural integration in IoT ecosystems.
5. To Demonstrate an understanding of security protocols in IoT systems and implement security measures for device protection
6. To Design and implement an IoT-based automation system, integrating sensors, microcontrollers, and communication protocols with real-time data management.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Describe the core components and architecture of IoT systems and embedded devices, including sensors and actuators
2. Identify and analyze various IoT communication protocols, and choose suitable ones for data transmission in IoT applications.
3. Identify and differentiate among various IoT hardware platforms such as Arduino, Raspberry Pi, ESP32, Cloudbit/Littlebits, Particle Photon, and Beaglebone Black based on their architectural features, capabilities, and application suitability.
4. Explain the working principles, classifications, and specifications of sensors and transducers used in IoT.

5. Identify security vulnerabilities in IoT systems and apply security measures, including encryption and authentication protocols, to ensure safe communication and data privacy.
6. Design and implement a complete IoT-based automation project, integrating sensors, microcontrollers, communication protocols, and cloud platforms for real-time monitoring and control.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	1			1	1	1	
CO2	2	3	2	3	2	1			1	2	1	1
CO3	2	2	2	2	3	1			1	2	2	1
CO4	3	2	1	2	2	1				1	1	1
CO5	2	2	2	3	2	2	1	1	1	2	2	2
CO6	2	2	2	2	2	2	1	1	1	1	1	1

3. Detailed Theory Syllabus:

Prerequisite: Computer Networking, Microprocessors and Interfacing

Module No	Module	Detailed Contents of Module	Hrs.	COs
1	Introduction to IoT and Embedded Systems	Definition, Vision, and Characteristics of IoT, Evolution from M2M to IoT, IoT Architecture: Perception, Network, Application Layers, Enabling Technologies: RFID, Sensors, Actuators, Introduction to Embedded Systems: Microcontroller Basics, Architecture, and Types	4	CO1
2	Communication Protocols for IoT	IoT Protocol Stack Overview , MQTT, CoAP, and HTTP/HTTPS for IoT Communication , TCP, UDP, IPv6, 6LoWPAN , Wireless Protocols: Wi-Fi, BLE, Zigbee, LoRa , Serial Communication: UART, SPI, I2C	8	CO2
3	IoT Design and Prototype	IoT Hardware - Arduino, Raspberry Pi, ESP32, Cloudbit/Littlebits, Particle Photon, Beaglebone Black, IoT Software - languages for programming IoT hardware, A comparison of IoT boards and platforms in terms of computing, development environments and communication standards and connectivity, Software platform	10	CO3
4	Things in IoT	Sensors/Transducers – Definition, Principles, Classifications, Types, Characteristics and Specifications Actuators – Definition, Principles, Classifications, Types, Characteristics and Specifications Smart Object – Definition, Characteristics and Trends Sensor Networks –	6	CO4

		Architecture of Wireless Sensor Network, Network Topologies		
5	IoT Security and Privacy	Security Threats in IoT Environments, Lightweight Cryptography and Encryption Techniques, Authentication and Authorization Protocols , Secure Boot, Firmware Updates in Embedded Systems, Blockchain and Privacy in IoT	6	CO5
6	IoT Applications and System Design	Application Areas: Smart Home, Health, Agriculture, Industry , Automation Project Planning and Lifecycle , Sensor & Microcontroller Selection for Projects , IoT Cloud Platforms: ThingSpeak, Blynk, AWS IoT , Testing, Debugging, and Deployment	5	CO6

4. Theory Assessment:

- A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hour.
- B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
1. Question paper will consist of 3 questions, each carrying 20 marks.
 2. Question number 1 will be compulsory and based on maximum contents of the syllabus
 3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
 4. Total three questions need to be solved.

5. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of tutorial work and minimum passing in the TW.

- A. Term Work:** Term Work shall consist of tutorials based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
- B. Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).

6. Books and References:

A. Books:

1. Hassan, Q. F, "Internet of things A to Z: technologies and applications" Wiley; IEEE Press, 2018.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals – Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Published by Pearson Education, Inc, publishing as Cisco Press, 2017.
3. Arsheep Bahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", University Press, FIRST Edition, 2015

B. References:

1. Serpanos, Dimitrios, and Marilyn Wolf. Internet-of-things (IoT) systems: architectures, algorithms, methodologies. Springer, 2017
2. Donal Norris. "The Internet of Things", McGraw Hill 2015
3. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things Principles and Paradigms", Morgan Kaufmann Elsevier

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 309	Augmented Reality and Virtual Reality	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE 309	Augmented Reality and Virtual Reality	40	40	40	60	25	25	-	150

1. Course Objectives:

The course is aimed to:

- 1.To understand the need and significance of Virtual Reality
- 2.To analyse hardware & software technologies used in VR
3. To analyze various techniques for applying virtual reality
4. To study Principles of Augmented Reality
5. To provide a foundation to the fast growing field of AR and make the students aware of the various AR devices.
6. To study applications of ARVR in various engineering fields and case study projects.

2. Course Outcomes:

On successful completion of course learner/student will be able to:

1. Describe how VR systems work and list the applications of VR
2. Learn about hardware and 3D User interface technology in VR
3. Design and implementation of the hardware that enables VR systems to be built.
4. Understand basic principles of Augmented reality.
5. Analyze and understand the working of various state of the art AR devices
6. Students will Implement ARVR projects.

CO/PO Mapping

CO-PO Mapping (3 High , 2 Medium , 1 Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		2	2		2		1	2	1	1
CO2	2	3		2	2	2	3		1	2	1	1
CO3	2	3		3	2	2	2	2	1	2	1	1
CO4	3	3	2	2	2	2	2	2	1	2	1	1
CO5	3	3		2	2	2	2		1		1	1
CO6	3	3	2	2	2		2		1	2	1	1

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.	CO
1	Introduction to Virtual Reality	What is virtual reality? ,The beginnings of VR , VR paradigms , Collaboration, Virtual reality systems, Representation ,User interaction	4	CO1
2	3D-User Interface Input Hardware	Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input devices, Direct Human Input, Home Brewed input devices, Choosing input devices for 3D interfaces	5	CO2
3	Software Technologies in VR	Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market	8	CO3
4	Applying Virtual Reality	Virtual reality: the medium, Form and genre, What makes an application a good candidate for VR, Promising application fields, Demonstrated benefits of virtual reality , More recent trends in virtual reality application development, A framework for VR application development	6	CO4
5	Augmented Reality	Terminology, Simple augmented reality, Augmented reality as an emerging technology, Augmented reality applications, Marker detection, Marker pose, Marker types and identification: Template markers, 2D bar-code markers, Imperceptible markers: Image markers, Infrared markers, Miniature markers, Discussion on marker use, General marker detection application	8	CO5
6	ARVR Applications & Case study projects	Practical experiences with head-mounted displays , AR applications and future visions, How to design an AR application and where to use , implementation of projects using ARVR	8	CO6

4. Suggested Experiments:

6-8 experiments based on the modules mentioned in the theory to be performed

5. Theory Assessment:

- A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.
- B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.
 1. Question paper will consist of 3 questions, each carrying 20 marks.
 2. Question number 1 will be compulsory and based on maximum contents of the syllabus
 3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
 4. Total three questions need to be solved.

5. Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of tutorial work and minimum passing in the TW.

- A. Term Work:** Term Work shall consist of tutorials based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
- B. Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).

6. Books and References:

A. Books:

- 1.Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
- 2.Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)ll. Morgan Kaufmann Publishers, San Francisco, CA, 2002
- 3.Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig,William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.
- 4.Grigore Burdea, Philippe Coiffet “Virtual Reality Technology”, Wiley.

B. References:

1. AR Game Developmentll, 1st Edition,Allan Fowler, A press Publications, 2018, ISBN 978- 1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494
3. Learning Virtual Reality, Tony Parisi,O'Reilly Media, Inc., 2015, ISBN-9781491922835

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 360	IPR and Patenting	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 360	IPR and Patenting	40	40	40	60	-	-	--	100

Course Objectives:

1. To introduce fundamental aspects of Intellectual property Rights to learner who are going to play a major role in development and management of innovative projects in industries.
2. To get acquaintance with Patent search, patent filing and copyright filing procedure and applications, and can make career as a patent or copyright attorney.
3. To make aware about current trends in IPR and Govt. steps in fostering IPR,

Course Outcomes: Learner will be able to...

1. Understand the importance of IPR, types of Patent type and its importance in industries.
2. Able to search, draft and file the patent and copyright application to patent office.
3. Learn the recent trends of IPR and can open the way for the students to catch up Intellectual Property (IP) as a career option:
 - a) R&D IP Counsel in research organization
 - b) Government Jobs – Patent Examiner
 - c) Private Jobs
 - d) Patent agent and Trademark agent.

Module	Detail Content	Hrs.
1	Overview of Intellectual Property: 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 – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967, the Patent Cooperation Treaty, 1970, the TRIPS Agreement, 1994	9
2	Patents: Patents - Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and license, Restoration of lapsed Patents, Surrender and Revocation of Patents,	7

	Infringement, Remedies & Penalties - Patent office and Appellate Board	
3	Copyright: 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 license of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights	6
4	Trademark: 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 - Trademark's registry and appellate board.	6
5	Patent Acts: Section 21 of the Indian Patent Act, 1970 (and corresponding Rules and Forms) with specific focus on Definitions, Criteria of Patentability, Non-Patentable Subject Matters, Types of Applications, and Powers of Controllers. Section 25 - Section 66 of the Indian Patent Act, 1970 with specific focus on the Oppositions, Anticipation, Provisions of Secrecy, Revocations, Patent of Addition, and Restoration of Patents. Section 67 - Section 115 of the Indian Patent Act, 1970 with specific focus on Patent Assignments, Compulsory Licensing, Power of Central Government, and Infringement Proceedings. Section 116 - Section 162 of the Indian Patent Act, 1970 with specific focus on Convention/PCT Applications, Functions of Appellate Board and other Provisions. Amendment Rules 2016 with emphasis on important revisions to examination and Hearing procedures; provisions for start-ups and fees.	9
6	Indian IP Policy: India's New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP – IPR.	3

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

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.
3. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
4. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 361	E-Commerce and E-Business	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 361	E-Commerce and E-Business	40	40	40	60	-	-	--	100

Course Objectives:

1. To understand the factors needed in order to be a successful in ecommerce
2. Identify advantages and disadvantages of technology choices such as merchant server software and electronic payment options.
3. Analyse features of existing e-commerce businesses, and propose future directions or innovations for specific businesses.

Course Outcomes: Learner will be able to

1. Appreciate the global nature and issues of electronic commerce as well as understand the rapid technological changes taking place.
2. Define and differentiate various types of E-commerce
3. Discuss various E-business Strategies.

Module	Detail Content	Hrs.
1	E-commerce system: Introduction- scope of electronics commerce, definition of e-commerce, difference between e-commerce and e-business, business models of e-commerce transactions. E-commerce infrastructure: client server technology, two tier client server architecture for e-commerce, drawbacks, three tier architecture for e-commerce.	8
2	Business strategies for e-commerce: Introduction- elements of e-commerce strategy, simplicity, mobile responsiveness, choosing e-commerce store platform, user-based focus, compliance and security measures, e-commerce strategy: strategy overview, strategy task, technology issues. Case study: Flipkart v/s Amazon, competitive edge, marketing strategy, sales strategy	8
3	Design of E-commerce systems: e-commerce types- electronic market, electronics data interchange EDI, modeling of e-commerce system, three tier component model of e-commerce system, e-commerce system design- data model, web modeling, database structure design, process model, user friendly design of e-commerce site.	7
4	Technologies for e-commerce systems: Introduction- technologies for e-commerce, PHP and Java script, SEO, Social Plugins, payment processes, SSL Encryption, hosting server, Service oriented architecture.	7

5	Scalability of e-commerce systems: Web scalability- Vertical scalability , horizontal scalability, Load balancing- working of load balancers, global server load balancers, cloud load balancing- goals of cloud balancing, automated cloud balancing. web caching and buffering	6
6	E-commerce system implementation: E-commerce implementation, - website testing, web maintenance, web advertisement, copyright services, SMS alert services, bulk email services, Web personalization- techniques for gathering information, analysis techniques for website personalization, domain name registration and web hosting- different types of web hosting, different components of web hosting, features in web hosting.	6

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Reference Books:

1. Electronic Business and Electronic Commerce Management, 2nd edition, Dave Chaffey, Prentice Hall, 2006
2. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.
3. E-Commerce Strategies, Technology and applications (David Whitley) Tata McGrawHill
4. E-business- theory and practise, Brahm Canzer, cengage learning
5. Secure e-commerce systems (Kindle edition), Amazon publishing, P S Lokhande, B B Meshram, first edition

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 362	Introduction to Bioengineering	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 362	Introduction to Bioengineering	40	40	40	60	-	-	--	100

Course Objectives:

1. To understand and analyze the human body as a mechanical assembly of linkages and describe the fundamentals of biomechanics.
2. To Study the deformability, strength, visco elasticity of bone and flexible tissues, modes of loading and failure and describe the types and mechanics of skeletal joints.
3. To describe movement precisely, using well defined terms (kinematics) and also to consider the role of force in movement (kinetics).
4. To teach students the unique features of biological flows, especially constitutive laws and boundaries.
5. To teach students approximation methods in fluid mechanics and their constraints.
6. To consider the mechanics of orthopedic implants and joint replacement , mechanical properties of blood vessels and Alveoli mechanics

Course Outcomes: Learner will be able to

1. Apply a broad and coherent knowledge of the underlying principles and concepts of biomechanics, particularly in the fields of kinematics and kinetics as applied to human and projectile motion.
2. Understand and describe the properties of blood , bone and soft tissues like articular cartilage tendons and ligaments.
3. Gain broad knowledge about the mechanics of moving systems and familiarity with human anatomy to competently analyze gross movement of the human body.
4. Be able to computationally analyze the dynamics of human movement from the most commonly used measurement devices in the field, such as motion capture and force platform systems.
5. Use knowledge gained to competently interpret the current understanding of human movement and present recommendations for further study.

Module	Detail Content	Hrs.
1	Introduction: Definition of Biomechanics, Selected Historical highlights, The Italian Renaissance, Gait century, Engineering Physiology & Anatomy	6
2	Biomedical Instrumentation: Patient monitoring system, Arrhythmia and ambulatory monitoring instrumentation, cardiac pacemakers, cardiac defibrillators, physiotherapy and electrotherapy equipment, ventilators	8

3	Medical Image Processing: Introduction to X-rays based imaging systems, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), Single-Photon Emission Computerized Tomography (SPECT) scan, Computed Tomography (CT) scan and Ultrasound (sonography)	7
4	Biomaterials: Brief Anatomy, Bone, cartilage, ligament, tendon, Muscles, biofluid their physical properties	6
5	Implants: General concepts of Implants, classification of implants, Soft tissues	6
6	Application of advanced engineering techniques to the human body, case studies.	6

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

1. Nigg, B.M. and Herzog, W., "BIOMECHANICS of Musculo skeleton system", John Wiley & Sons, 1st Edition.
2. Saltzman, W.L., "BIOMEDICAL ENGINEERING: Bridging medicine and Technology", Cambridge Text, First Edition.
3. Winter, D., "BIOMECHANICS and Motor Control of Human Movement", WILEY Interscience Second edition
4. "Biomedical Instrumentation and Measurements" by Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer
5. W. Birkfellner, Applied Medical Image Processing: A Basic Course, CRC Press , Second Edition, 2014
6. Prof. Ghista, Biomechanics, Private Publication UAF, 2009
7. White & Puyator, Biomechanics, Private publication UAE, 2010
8. R. M. Kennedy, A textbook of Biomedical Engineering, GTU, 2010
9. Richard Shalak & ShuChien, Handbook of Bioengineering,
10. Sean P. Flanagan, Flanagan, Biomechanics: A case based Approach, Jones & Bartlett Publishers, 2013
11. Y. C. Fung, Yuan-Cheng Fung, Biomechanics: mechanical Property of living Tissue, Springer, 1996.
12. Carol A. Oatis, The Mechanics and Pathomechanics of Human Movement, Lippincott Williams & Wilkins, 2010

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 363	Biomedical Instrumentation	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 363	Biomedical Instrumentation	40	40	40	60	-	-	--	100

Course Objectives:

1. Develop a fundamental understanding of human physiology and anatomy to comprehend the sources of biomedical signals and their role in medical diagnosis and treatment.
2. Understand the origin and characteristics of bioelectric signals and learn about the various types of electrodes, biosensors, smart sensors, and biomedical recorders used in healthcare.
3. Gain knowledge of biomaterials, bone structure, composition, and the biomechanics of soft tissues and joints, as well as their applications in implants, prosthetics, and orthotics.
4. Learn about the operation and application of diagnostic instruments
5. Understand the principles and applications of therapeutic instruments
6. Study the integration of AI in healthcare

Course Outcomes: Learner will be able to

1. Explain the fundamentals of human physiology and anatomy and identify the sources of biomedical signals critical to medical diagnostics and instrumentation.
2. Analyze the structure and properties of biomaterials, bones, soft tissues, and joints, and evaluate their applications in developing implants, prosthetics, and orthotic devices.
3. Describe the principles, design, and functionality of basic and intelligent medical instrumentation systems.
4. Assess the functionality and clinical applications of diagnostic instruments.
5. Explain the working principles and applications of therapeutic instruments.
6. Illustrate the role of artificial intelligence in healthcare.

Module	Detail Content	Hrs
1	Fundamentals of Bioengineering: A brief on human physiology and anatomy, sources of biomedical signals, basic medical instrumentation system, intelligent medical instrumentation systems, regulation of medical devices.	6

2	Biomaterials and Biomechanics: Introduction to biomaterials, Bone structure & composition, Structure and functions of Soft Tissues, types of joint , Implants, Prosthetics and orthotics.	6
3	Bioelectric signals and electrodes: Origin of Bioelectrical signals, Recording electrodes, Microelectrodes, Biosensors, Smart Sensors, Biomedical recorders.	8
4	Introduction to Diagnostics Instruments: Patient monitoring system, Arrhythmia and ambulatory monitoring instrumentation, oximeters, Blood flowmeter, Cardiac output measurement, Pulmonary analyzers, Blood gas analyzers, Blood cell counters.	7
5	Introduction to Therapeutic Instruments: cardiac pacemakers, cardiac defibrillators, instruments for surgery, physiotherapy and electrotherapy equipment, hemodialysis machine, ventilators	6
6	AI for Health care: Medical Imaging, Surgical Assistance, Personalized medicine, Wearable Devices and monitoring, Healthcare management system	6

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

1. "Handbook of Biomedical Instrumentation" by R. S. Khandpur
2. "Biomedical Instrumentation and Measurements" by Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer
3. "Medical Instrumentation: Application and Design" by John G. Webster
4. "Biomechanics: Principles and Applications" by Donald R. Peterson and Joseph D. Bronzino
5. "Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again" by Eric Topol

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 364	Design of Experiments	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 364	Design of Experiments	40	40	40	60	-	-	--	100

Course Objectives:

1. To understand the issues and principles of Design of Experiments (DOE)
2. To list the guidelines for designing experiments
3. To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization

Course Outcomes: Learner will be able to...

1. Fundamentals of experiments and its uses
2. Basic statistics including ANOVA and regression
3. Experimental designs such as RCBD, BIBD, Latin square, factorial and fractional factorial designs.
4. Apply statistical models in analyzing experimental data
5. RSM to optimize response of interest from an experiment
6. Use software such as Minitab

Module	Detailed Contents	Hrs
1	Introduction 1. Why experiment? 2. Terms and Component of Experiment 3. Experimental Units and Responses 4. Types of Data ,Plots and Charts 5. Importance of Product Reliability 6. Uncertainty of Measurement 7. Classification of DOE 8. Software for DOE 9. Principle of Experimental Design 10. Types of Experimental Design	08

2	Basic Statistics and ANOVA 1. Random Variable and Probability Distribution 2. Normal Distribution 3. Sampling Distribution 4. Estimation 5. Hypothesis Testing 6. Determination of Sample size 7. Analysis of Variance(ANOVA) 8. Estimation of model parameters and Adequacy test 9. ANOVA-Pair wise comparison and Tukey's and Fishers LSD test 10. Two way ANOVA 11. Multi way ANOVA 12. Determination of Sample Size for ANOVA	08
3	Regression 1. Introduction to Multiple Linear Regression(MLR) 2. Sampling distribution of Regression coefficients 3. MLR: Hypothesis testing and Model Adequacy Test 4. MLR:Diagnostic and Testing for Lack of Fit 5. Regression approach to ANOVA	07
4	Experimental Designs 1. Randomized Complete block design (RCBD) 2. RCBD-Estimation of Parameters 3. RCBD-Balanced Incomplete block design(BIBD) 4. RCBD-Latin square design 5. Introduction to Factorial Design 6. Statistical Analysis of Factorial Design 7. Estimation of parameters and Model Adequacy test 8. Full factorial design 9. Two level factorial design 10. Statistical Analysis of the 2^k Design 11. Blocking and Confounding in the 2^k Design 12. Fractional Factorial Design	08
5	Response Surface Methods and Designs 1. Introduction to Response Surface Methodology 2. RSM-First order model 3. Experimental design for fitting Response Surfaces 4. RSM-Fitting Second order model	06
	5. Analysis of Second order RSM	

6	Taguchi Approach 1. Crossed Array Designs and Signal-to-Noise Ratios 2. Analysis Methods 3. Robust design examples	04
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Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

1. Raymond H. Mayers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition, John Wiley & Sons, New York, 2001
2. D.C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001
3. George E P Box, J Stuart Hunter, William G Hunter, Statistics for Experimenters: Design, Innovation and Discovery, 2 nd Ed. Wiley
4. W J Diamond, Practical Experiment Designs for Engineers and Scientists, John Wiley and Sons Inc. ISBN: 0-471-39054-2
5. Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D. T.Voss

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 365	Design for Sustainability	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 365	Design for Sustainability	40	40	40	60	-	-	--	100

Course Objectives:

1. Understand the complex environmental, economic, and social issues related to sustainable engineering
2. Become aware of concepts, analytical methods/models, and resources for evaluating and comparing sustainability implications of engineering activities
3. Critically evaluate existing and new methods
4. Develop sustainable engineering solutions by applying methods and tools to research a specific system design
5. Clearly communicate results related to their research on sustainable engineering

Course Outcomes: Learner will be able to

1. Account for different theoretical and applied design principles and models for sustainable design
2. Account for and critically relate to sustainable design from an ethical, cultural and historical perspective
3. Critically review different design solutions ecological, social and economical consequences, risks, possible uses and functions in the work for a sustainable development
4. Independently apply a specific design theory on a specific challenge within the sustainability field.

Module	Detailed Contents	Hrs
1	Introduction - Need, Evolution of sustainability within Design, environmental - economic sustainability concept, Challenges for sustainable development, Environmental agreement & protocols	6
2	Product Life Cycle Design – Life Cycle Assessment, Methods & Strategies, Software Tools	6
3	Sustainable Product - Service System Design, Definition, Types & Examples ,Transition Path and Challenges, Methods and Tools, Design thinking and design process for sustainable development	8
4	Design for Sustainability – Engineering Design Criteria and Guidelines	6

5	Design for Sustainability – Architecture, Agriculture, Cities & Communities, Carbon Footprint	6
6	Green Building Technologies - Necessity, Principles, low energy materials, effective systems	6

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

1. C. Vezzoli, System Design for sustainability. Theory, methods and tools for a sustainable / satisfaction system/design, Rimini, Maggioli Edition, 2007.
2. C. Vezzoli and E. Manzini, Design for Environmental Sustainability, Springer – Verlag, London, 2008.
3. L. Nin and C. Vezzoli, Designing Sustainable Product-Service Systems for all. Milan: Libreria, CLUP, 2005
4. A. Tukker and U. Tischner (eds.), New Business for Old Europe, Product Services, Sustainability and Competitiveness, Greenleaf Publishing, Sheffield, 2008.
5. A. Tukker, M. Charter, C. Vezzoli, E. Sto and M.M. Andersen (eds.), System innovation for Sustainability Perspective on Radical Changes to sustainable consumption and production, Greenleaf Publishing, Sheffield, 2008
6. UNEP, Product-Service Systems and Sustainability. Opportunities for sustainable solutions, CEDEX, Paris, 2002, at <http://www.uneptie.org/pc/sustain/reports/pss/pss-imp-7.pdf>

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 366	Political Science	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 366	Political Science	40	40	40	60	-	-	--	100

Course Objectives:

1. Provide a good grounding in the basic concepts of Political Theory.
2. Familiarize learners with fundamental rights and duties.
3. Teach students the structure and process of the electoral system, the features and trends of the party system and create an awareness of the social movements in India.
4. To inculcate the values of renowned thinkers on law, freedom of thought and social justice.
5. To prepare the learners for understanding the importance of Comparative Government and Politics.
6. To train learners in understanding International Relations.

Course Outcomes: Learner will be able to

1. Acquire conceptual and theoretical knowledge in the basic concepts of political theory.
2. Demonstrate understanding of fundamental rights and duties and directive principles.
3. Perform successfully in expressing the process of the electoral system, the features and trends of the party system and the importance of the social movements in India.
4. Illustrate the contribution of renowned thinkers and relate it to the current scenario.
5. Compare and contrast Indian Government and Politics with European countries.
6. Develop an understanding of International Relations with respect to Indian foreign policy.

Module	Detail Content	Hrs.
1	Understanding Political Theory- Evolution of State, Nation, Sovereignty, Types and Linkages between Power and Authority; Interrelationships between Law, Liberty, Equality, Rights; Justice and Freedom, Democracy vs Authoritarianism	4
2	Constitutional Government in India - Evolution of the Indian Constitution, Fundamental Rights and Duties. Directive Principles. Union-State Relations, Union Legislature: Rajya Sabha, Lok Sabha: Organisation, Functions – Law making procedure, Parliamentary procedure, Government in states: Governor, Chief Minister and Council of Ministers: position and functions – State Legislature: composition and	6

	functions. Judiciary: Supreme Court and the High Courts: composition and functions – Judicial activism. Constitutional amendment. Major recommendations of National Commission to Review the Working of the Constitution.	
3	Politics in India: Structures and Processes- Party system: features and trends – major national political parties in India: ideologies and programmes. Coalition politics in India: nature and trends. Electoral process: Election Commission: composition, functions, role. Electoral reforms. Role of business groups, working class, peasants in Indian politics, Role of (a) religion (b) language (c) caste (d) tribe. Regionalism in Indian politics. New Social Movements since the 1970s: (a) environmental movements (b) women's movements (c) human rights movements.	6
4	Indian Political Thought- Ancient Indian Political ideas: overview. Kautilya: Saptanga theory, Dandaniti, Diplomacy. Medieval political thought in India: overview (with reference to Barani and Abul Fazal). Legitimacy of kingship. Principle of Syncretism, Modern Indian thought: Rammohun Roy as pioneer of Indian liberalism – his views on rule of law, freedom of thought and social justice. Bankim Chandra Chattopadhyay, Vivekananda and Rabindranath Tagore: views on nationalism. M.K. Gandhi: views on State, Swaraj, Satyagraha.	7
5	Comparative Government and Politics- Evolution of Comparative Politics. Scope, purposes and methods of comparison. Distinction between Comparative Government and Comparative Politics.	6
6	Perspectives on International Relations- Understanding International Relations: outline of its evolution as academic discipline. Major theories: (a) Classical Realism and Neo-Realism (b) Dependency (c) World Systems theory. Emergent issues: (a) Development (b) Environment (c) Terrorism (d) Migration. Making of foreign policy. Indian foreign policy: major phases: 1947-1962; 1962-1991; 1991-till date. Sino-Indian relations; Indo-US relations.	7

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

1. O.P. Gauba. (2021). *An Introduction to Political Theory*. Mayur books
2. Vibhuti Bhushan Mishra. (1987). *Evolution of the Constitutional History of India (1773-1947 : With Special Reference to the Role of the Indian National Congress and the Minorities)*. South Asia Books
3. Chetna Sharma Pushpa Singh. (2019). *Comparative Government and Politics*. SAGE Publications India Pvt Ltd.
4. Henry R. Nau. (1900). *Perspectives on International Relations: Power, Institutions and Ideas*. CQ Press

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 367	Visual Arts	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 367	Visual Arts	40	40	40	60	-	-	--	100

Course Objectives:

1. To enable learners to develop aesthetic judgement, visual perception, critical thinking skills in the different forms of art and understand its application.
2. To promote the concept of visual design and understand the different meanings assigned to colours, its impact and problems.
3. To provide the opportunity and scope to use the image editing software for creating images for Web and Video.
4. To inculcate the basic skills required in drawing and painting through exposure in nature and study of still objects.
5. To train students to express their feelings and write imaginatively.
6. To prepare the learners for the use of clay modelling techniques and its industrial applications.

Course Outcomes: Learner will be able to

1. Acquire the skills necessary for aesthetic judgement, visual perception and critical thinking required in different forms of art.
2. Demonstrate the understanding of the concept of visual design with respect to the different meanings assigned to colours and the problems associated.
3. Illustrate effective use of image editing software for creating images for the Web and Video.
4. Determine the importance of drawing and painting with respect to nature and still objects.
5. Perform successfully in expressing their feelings creatively.
6. Develop the techniques required for clay modelling and sculpture for industrial use.

Module	Detail Content	Hrs.
1	History of Art and Architecture- Changing needs and forms of art from the Palaeolithic period to The Renaissance period with special reference to Roman, Indian and Chinese art	4
2	Introduction and concepts of visual design with special emphasis on the psychological impact of colour	5
3	Introduction to image editing software, tools, application and creating Images for Web and Video. With special reference to Adobe Photoshop	7

4	Fundamentals of Drawing- study of forms in nature, study of objects and study from life, creative painting- basic techniques, tools and equipment, medium of painting.	6
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5	Creative writing- Movie critique, book reviews, Poems, short plays and skits, Humorous Essays, Autobiography and short stories.	7
6	Creative sculpture- Introduction to clay modelling techniques, study of natural and man-made objects in clay, Sculpture with various materials - Relief in Metal Sheets – Relief on Wood – Paper Pulp - Thermocol. Sculpture with readymade materials.	7

Assessments:

Internal Assessment: 40 marks

End Semester Examination: 60 marks

Reference Books:

1. Gill Martha. (2000). Color Harmony Pastels: A Guidebook for Creating Great Color Combinations. Rockport Publishers.
2. Janson, Anthony F. (1977). History of art, second edition, H.W. Janson. Instructor's manual. Englewood Cliffs, N.J.: Prentice-Hall.
3. Brommer, Gerald F. (1988). Exploring Drawing. Worcester, Massachusetts: Davis Publications.
4. Wendy Burt Thomas. (2010). The Everything Creative Writing Book: All you need to know to write novels, plays, short stories, screenplays, poems, articles, or blogs: All You Need ... - Stories, Screenplays, Blogs and More. Fw Media; 2nd edition.
5. Élisabeth Bonvalot. (2020). Sculpting Book: A Complete Introduction to Modeling the Human Figure.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 368	Modern Day Sensor Physics	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 368	Modern Day Sensor Physics	40	40	40	60	-	-	--	100

Course Objectives:

1. Acquire knowledge about the principles and analysis of sensors.
2. Emphasis on characteristics and response of micro sensors.
3. Acquire adequate knowledge of different transducers and Actuators.
4. Learn about the Micro sensors and Micro actuators.
5. Selection of sensor materials for fabrication for different applications

Course Outcomes: On successful completion of course learner/student will be able to:

1. Analyze the basics and design the resistive sensors.
2. Identify the materials and designing of inductive and Capacitive Sensors.
3. Analyze various types of Actuators.
4. Design Micro sensors and Micro Actuators for various applications.
5. Implement fabrication process and technologies and compare various Micro machining processes

Module	Detail Content	Hrs.
1	Fundamentals of Sensors : Difference Between Sensor, Transducer And Actuators- Classification Of Sensors: Proprioceptive And Exteroceptive – Active And Passive– Contact And Non-Contact, Selection And Characteristics: Range; Resolution, Sensitivity, Error, Repeatability, Linearity And Accuracy, Primary Sensing Elements.	6
2	Temperature sensors: Principle of operation, construction details, characteristics and applications of Bimetallic thermometer, Resistance thermometer, Thermistor, Thermocouples and Total radiation Pyrometers	8

3	Strain, Force, Torque and Pressure Sensors Strain gauges, strain gauge beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo- resistive and capacitive pressure sensor, Manometer, vacuum sensors, Pirani gauge.	6
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4	Displacement, Level and Flow Sensors Displacement Sensors: LVDT, RVDT, eddy current, transverse inductive, Hall Effect, magneto resistive, magnetostrictive sensors. Liquid level sensor: Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor. Flow sensors: pressure gradient technique, ultrasonic, electromagnetic sensors and Hot wire anemometer. Micro flow sensor, Coriolis mass flow and drag flow sensor.	8
5	Micro Machining Technologies Overview of silicon processes techniques, Photolithography, Ion Implantation, and Diffusion, Chemical Vapor Deposition, Physical vapor Deposition, Epitaxy, Etching, Bulk micromachining, Surface Micromachining, LIGA and other techniques.	6
6	Actuators Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator, Hydraulic actuator - Control valves and cylinders Electrical actuating systems: Solenoids, Electric Motors- D.C motors - AC motors - Three Phase Induction Motor, Stepper motors -Piezoelectric Actuator.	5

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/Reference:

1. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
2. Thomas. G. Bekwith and Lewis Buck.N, "Mechanical Measurements", Oxford and IBH publishing Co. Pvt. Ltd.,
3. Massood Tabib and Azar, "Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edition, Kluwer academic publishers, Springer, 1999.
4. Manfred Kohl, Shape Memory Actuators, first edition, Springer.
5. Patranabis.D, Sensors and Transducers, Wheeler publisher, 1994.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 369	Energy Audit and Management	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 369	Energy Audit and Management	40	40	40	60	-	-	--	100

Course Objectives:

1. To impart basic knowledge to the students about current energy scenario, energy conservation, audit and management.
2. To inculcate among the students systematic knowledge and skill about assessing the energy efficiency, energy auditing and energy management.
3. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management
4. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

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

1. To identify and describe the present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of an utility
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.
5. To analyze the data collected during performance evaluation and recommend energy saving measures

Module	Detail Content	Hrs.
1	Energy Scenario: Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act 2001 and its features.	4
2	Energy Management and Audit: Definition, Energy audit- need, Types of energy audit, Energy	10

	management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments. Material and Energy balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams. Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs	
3	Energy Management and Energy Conservation in Electrical System: Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, Lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.	10
4	Energy Management and Energy Conservation in Thermal Systems: Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities.	10
5	Energy Performance Assessment: On site Performance evaluation techniques, Case studies based on: Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.	3
6	Energy conservation in Buildings: Energy Conservation Building Codes (ECBC): Green Build Building, LEED rating, Application of NonConventional and Renewable Energy Sources	3

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B.Smith, Pergamon Press
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 370	Maintenance of Electronics Equipment	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 370	Maintenance of Electronics Equipment	40	40	40	60	-	-	--	100

Course Objectives:

1. To demonstrate use of different instruments used in electronics lab.
2. To understand testing of different active and passive components mounted on PCB
3. To understand functionality TTL and CMOS digital ICs.
4. To understand software required for simulation of electronic circuit.
5. To understand software required for PCB design.
6. To understand concept of designing, manufacturing electronic circuit.

Course Outcomes:

1. Able to use different types of instruments used in electronics lab
2. Able to test different active and passive components mounted on PCB.
3. Able to understand functionality TTL and CMOS digital ICs.
4. Able to do simulation of electronic circuit.
5. Able to Design PCB using software tools.
6. Able to design, manufacture electronic circuit.

Detailed Lab/Tutorial Description: Students will have to perform five to six experiments / tutorials based on the syllabus and design, assemble electronic circuit in lab and write journal and project report as a term work.

SN	Detailed Lab/Tutorial Description	Hrs.
1	Demonstrate working, use of two instruments in electronics laboratory.	4
2	Test the performance of different passive electronic components (fixed/variable), Test the performance of active electronic components like Diode, Transistor.	4
3	Verify the functionality of TTL and CMOS Digital IC's.	4
4	Design of electronic circuit using IC and various active and passive components.	4

5	Simulation of electronic circuit using TINA software. Design of PCB for electronic circuit.	6
6	PCB manufacturing, soldering of components, troubleshooting of the circuit. Output checking on CRO, Report writing.	8

The students will have to submit a project report in prescribed format and give a presentation at the end of semester.

Assessments:

Internal Assessment: 40 marks (IA-I, IA-II Based on practical and project work)

End Semester Examination: 60 marks (Based on practical, project work, report and presentation, question-answer session)

Books/References:

1. Troubleshooting and Maintenance of Electronics Equipment, Singh K. Sudeep, Katson Book, New Delhi, II edition, Reprint 2014
2. Troubleshooting Electronic Equipment: Includes Repair and Maintenance, Second Edition, Khandpur R. S., Tata McGraw-Hill Education, New Delhi, India, latest edition.
3. Data Books, National semiconductor.
4. Modern Digital Electronics, Fourth edition, R. P. Jain, Tata McGraw-Hill Education, New Delhi, India.
5. Manuals of instruments in electronics laboratories

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 371	Cooking and Nutrition	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 371	Cooking and Nutrition	40	40	40	60	-	-	--	100

Course Objectives: The course is aimed to

1. To understand nutrition and of health problems related to diet and various factors affect diet
2. To various statistical tools required to analyze the experimental data in nutrition and community research
3. Gain information about various food constituents, and changes that occur in them during food processing.
4. To gain food-related knowledge and skills so that they can organise and manage family resources effectively according to the needs and lifestyles of family members
5. To be able to make informed judgements and choices about the use of food available.
6. To create interest in the creative side and enjoyment of food and the skills necessary for food preparation and food preservation. And to be aware of relevant mandatory and other necessary safety and hygiene requirements

Course Outcomes: On successful completion of course learner/student will be able to

1. To understand the importance and mechanisms of the food components taking place during food processing,
2. To understand nutrition and of health problems related to diet and various factors affect diet
3. To aware how eating patterns and dietary needs depend on age and social group
4. Ability to assess the effectiveness and validity of claims made by advertisers
5. To enhance aesthetic and social sensitivity to dietary patterns and to develop an interest in the creative aspect and enjoyment of food
6. To develop skills necessary for food preparation and food preservation and knowledge of safety and hygiene requirements

Module	Detail Content	Hrs.
1	Nutritional terms: proteins (high biological and low biological value), carbohydrates (monosaccharide, disaccharide and polysaccharide), fats, vitamins (A, C, D, E, K, B group – thiamin, riboflavin, nicotinic acid and cobalamin), mineral elements (calcium, iron, phosphorous, potassium,	3

	sodium, iodide) water Sources and uses of food energy. Sources and functions of dietary fibre.	
2	Kitchen equipment & Kitchen planning: Selection, Use and care of: modern cookers, thermostatic control and automatic time-controlled ovens, microwave ovens, slow electric cook pots, refrigerators and freezers, small kitchen equipment, e.g. knives, pans, small electrical kitchen equipment, e.g. food processors, electric kettles, Advantages and disadvantages of microwave ovens, Organisation of cooking area and equipment for efficient work., Selection, Use and care of: work surfaces, flooring, walls and wall coverings, lighting, ventilation	4
3	Meal planning and guidelines: Factors affecting food requirements, Planning and serving of family meals, Meals for different ages, occupations, cultures and religions, Special needs of: people with food allergies and intolerances, people with medical conditions linked to diet, such as diabetes, convalescents, vegetarians, including vegans and lacto-vegetarians, Meals for special occasions, festivals, packed meals, snacks, beverages, Use of herbs, spices and garnishes, Attractive presentation of food, Terminology describing recommended dietary intakes, e.g. Dietary Reference Value (DRV) and Reference Daily Intake (RDI).	6
4	Strategic cooking: Transfer of heat by conduction, convection and radiation. Principles involved in the different methods of cooking, baking, boiling, braising, cooking in a microwave oven, frying, grilling, poaching, pressure cooking, roasting, simmering, steaming, stewing, use of a slow cooker. Reasons for cooking food, Sensory properties of food (flavour, taste, texture), Effect of dry and moist heat on proteins, fats and oils, sugars and starches, and vitamins to include: caramelisation, coagulation dextrinization, enzymic and non-enzymic browning, gelatinisation, rancidity, smoking point, Preparation and cooking of food to preserve nutritive value, Economical use of food, equipment, fuel and labour.	6
5	Convenience foods and Basic proportions: Foods partly or totally prepared by a food manufacturer – dehydrated, tinned, frozen, ready-to-eat, Intelligent use of these foods, Advantages and disadvantages, Food additives – types and function, Packaging – types, materials used, Labelling – information found on labels, Importance of maintaining proportions, maintaining proportions for : Bakery products, melting, rubbing-in and whisking methods, Pastries – shortcrust, flaky and rough puff, Sauces – pouring and coating, roux and blended methods, Batters –	5

	thin (pouring) and coating, Sweet and savoury yeast products	
6	Food preservation & Kitchen safety and first aid: Food preservation & Kitchen safety and first aid: Reasons for preserving food, Methods of preservation and an understanding of the principles involved: heating – canning, bottling; removal of moisture – dehydrating; reduction in temperature – freezing; chemical preservation – sugar, salt, vinegar; modified atmosphere packaging; irradiation;	5
	Awareness of potential danger areas in the kitchen. Safety precautions. First aid for burns and scalds, cuts, electric shock, fainting, shock.	

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

1. Fundamentals of Food and Nutrition by Tejmeet Rekhi, Heena Yadav
2. Food Process Engineering And Technology by Akash Pare, B L Mandhyan

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 372	Environmental Management	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 372	Environmental Management	40	40	40	60	-	-	--	100

Course Objectives:

1. To promote the safety, health, and welfare of people and the environment through engineering professionals.
2. To encourage students to be productive and contributing members of the environmental profession as practitioners, entrepreneurs, researchers, or teachers.
3. To develop environmental awareness among students that meet specified engineering needs with consideration of public health, safety, and welfare, as well as global, environmental, and legal factors.

Course Outcomes: On successful completion of the course learner/student will be able to:

1. Understand core concepts and methods from ecological sciences and their application in environmental problem-solving.
2. Recognize different types of toxic substances and analyze toxicological information
3. Acquire and apply environmental knowledge to the engineering field as needed.
4. Assist industries and projects in obtaining environmental clearance and compliance with other environmental laws.
5. Interpret appropriate environment-related legislation.
6. Develop a thorough understanding of practice and procedure followed by various enforcing agencies/bodies/countries.

Module	Detail Contents	Hrs.
1	Fundamentals of Environmental Sciences Definition, Principles, and Scope of Environmental Science. Structure and composition of the atmosphere, hydrosphere, lithosphere, and biosphere. Concept of Ecology- Ecosystem, Food chain, Food web, Ecological pyramid, Ecological succession, limiting factor, and carrying capacity. Global Environmental Concerns (Global warming, Loss in Bio-diversity, Ozone depletion, E-waste management) and Renewable	8

	Energy Resources (Solar Energy, Wind Energy, Hydrothermal Energy, etc.)	
2	Environmental Chemistry Toxic chemicals: Pesticides and their classification and effects. Biochemical aspects of heavy metals (Hg, Cd, Pb, Cr) and metalloids (As, Se), Sewage treatment, Concept of DO, BOD, and COD. Composition of air-chemical processes in the formation of inorganic and organic particulate matter, Thermochemical and photochemical reactions in the atmosphere, Oxygen and Ozone chemistry. Photochemical smog, Air Quality Index	8
3	Fundamentals of Environmental Management Concept of Environmental Management, Need & Objective of Environmental Management, Role of Engineers in Environmental Management, Career Opportunities. The need for sustainable development, Sustainable Development Goals	5
4	Scope of Environmental Management Role and functions of Government as a planning and regulatory agency. Environment Quality Management and Corporate Environmental Responsibility. Total quality Environmental management: ISO 14000, EMS Certification. Environmental Management System Standards (ISO-14000 series). Environment and Social Management Plan	7
5	Overview of Environmental Laws in India Constitutional provisions in India (Articles 48A and 51A). Wildlife Protection Act, 1972 Indian Forest Act, Water (Prevention and Control of Pollution) Act, Air (Prevention and Control of Pollution) Act, Environmental (Protection) Act, 1986, The e-waste (Management) Rules 2016	5
6	Environmental Conventions and Agreements Stockholm Conference on Human Environment 1972, Montreal Protocol, 1987, Earth Summit at Rio de Janeiro, 1992, Agenda-21, Convention on Biodiversity (1992), UNFCCC, Kyoto Protocol, 1997, Copenhagen Summit, Paris Agreement, CITES.	6

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G.Oakwell, Edward Elgar Publishing
3. Environmental Management, V Ramachandra and Vijay Kulkarni, TERI Press
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 373	Vehicle Safety	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 373	Vehicle Safety	40	40	40	60	-	-	--	100

Course Objectives:

1. To familiarize basic concepts of vehicle safety.
2. To familiarize accident reconstruction analysis methods
3. To acquaint with different issues related to vehicle safety in India

Course Outcomes: Learner will be able to

1. Comprehend Vehicle design from safety point of view.
2. Apply concepts of accident reconstruction analysis in real world.
3. Enumerate interrelationship among occupant, restraint systems and vehicles in accidents.
4. Illustrate role and significance of seat in Rear crash safety
5. Demonstrate different active and passive safety systems available in vehicles
6. Contribute to the society by being proactive to the cause of safety on roads and in vehicles

Module	Detailed Contents	Hrs.
1	Introduction to vehicle safety-the integrated approach and its classification SAVE LIVES- by WHO Importance of Risk evaluation and communication, Concepts of Universal design, India's BNVSAP and its outcomes	6
2	Crash and distracted driver, Human error control Crash Testing, Use of Dummies, evolution and built of dummies. Relevance of Star ratings, NCAPs around the world- Accident Data, Biomechanics and Occupant Simulation Vehicle Body Testing, Dynamic Vehicle Simulation Tests Occupant Protection, Compatibility, Interrelationship Among Occupants, Restraint Systems and Vehicle in Accidents	8
3	Significance of Rear Crash Safety Role of seat in Rear crash safety Self aligning head restraints Pedestrian Protection testing and systems Under run Protection Devices	6

4	Introduction to Accident Analysis Reconstruction methods Skid distances and Critical speed from Tire Yaw marks Reconstruction of Vehicular Rollover Accidents Analysis of Collisions Reconstruction Applications Impulse Momentum Theory Crush Energy Photogrammetry for accident constructions	8
5	Antilock braking system Electronic Stability Program Low tire pressure warning system Collision avoidance systems	5
6	Basic Vehicle Operations and Road/Helmet Safety Activity	6

Assessment:

Internal Assessment: 40 marks

End Semester Examination: 60 Marks

Books/References:

1. Automotive vehicle safety by George Peters and Barbara Peters, CRC Press, 2002.
2. Vehicle Accident Analysis and Reconstruction Methods by Raymond M. Brach and R. Matthew Brach, SAE International, Second Edition, 2011.
3. Role of the seat in rear crash safety by David C. Viano, SAE International, 2002.
4. Automotive Safety Handbook by Ulrich W. Seiffert and Lothar Wech, SAE International, 2007.
5. Public Safety Standards of the Republic of India