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.

PCE
PILLAI COLLEGE OF ENGINEERING
AUTONOMOUS

Department of Computer Engineering

Syllabus

of

B.Tech. in Computer Engineering

for

The Admission Batch of AY 2022-23

First Year - Effective from Academic Year **2022-23**

Second Year - Effective from Academic Year **2023-24**

Third Year - Effective from Academic Year **2024-25**

Fourth Year - Effective from Academic Year **2025-26**

as per

Choice Based Credit and Grading System

Mahatma Education Society's

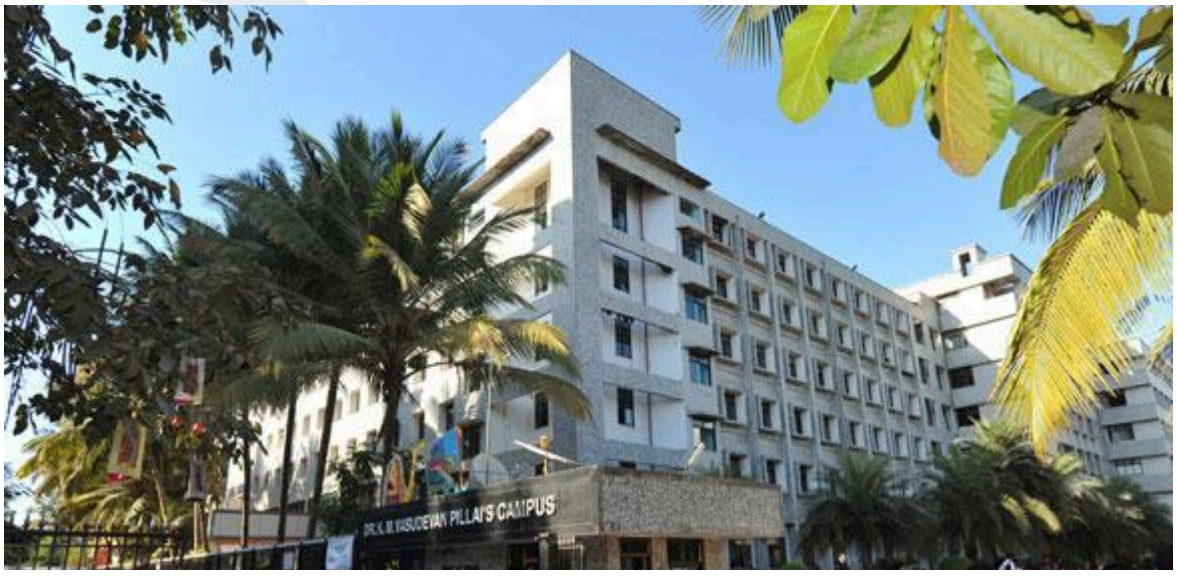
Pillai College of Engineering

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 every 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 C1, C2, C3, C4 and C5 and learners grade points in these courses are G1, G2, G3, G4 and G5 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,

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

The Department of Computer Engineering offers a B. Tech. programme in Computer Engineering. This is an eight-semester course. The complete course is a 161 credit course which comprises core courses and elective courses. The department level elective courses are distributed over 4 specializations. The specializations are:

1. Data Analytics and Language Processing.
2. Network and Information Security.
3. Computational Intelligence and Automation.
4. Systems and Computing.

The students also have a choice of opting for Institute level specializations. These are

1. Business and Entrepreneurship
2. Bioengineering
3. Engineering Design
4. Art and Humanities
5. Applied Science
6. Life Skills, Repair, Maintenance and Safety

As minimum requirements for the credits to be earned during the B.Tech in Computer Engineering program, a student will have to complete a minimum of three specializations of which two are to be chosen from the department list and one has to be from the Institute level specialization list. In order to complete each specialization, a minimum of three courses under that specialization has to be completed. 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

Category	Credits
Humanities and Social Sciences including Management courses	9
Basic Science courses	22
Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	25
Professional core courses	56
Professional Elective courses relevant to chosen specialization/branch	24
Open subjects – Electives from other technical and /or emerging subjects	6
Project work, seminar and internship in industry or elsewhere	19
Mandatory Courses - Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge	Non credit courses
Total Credits	**161**

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. Madhura Vyavahare	Member

Program Structure for First Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2022-23

Semester I

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
FY101	Engineering Mathematics I	TLP	3	2	3	1	4
FY103	Engineering Physics I	TL	2	1	2	0.5	2.5
FY105	Engineering Chemistry I	TL	2	1	2	0.5	2.5
FY111	C Programming	TLP	3	2	3	1	4
FY107	Basic Electrical Engineering*	TL	3	2	3	1	4
FY117	**Basic Workshop Practice-I**	L	-	**2**	-	1	**1**
Total			**13**	**10**	**13**	**5**	**18**

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
FY103	Engineering Physics I	30	30	30	45	2	25	-	100
FY105	Engineering Chemistry I	30	30	30	45	2	25	-	100
FY111	C Programming	40	40	40	60	2	25	25	150
FY107	Basic Electrical Engineering*	40	40	40	60	2	25	25	150
FY117	Basic Workshop Practice-I	-	-	-	-		50	-	50
Total				**180**	**270**		**175**	**50**	**675**

T- Theory , L- Lab , P-Programming, C- Communication

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

Program Structure for First Year
Bachelor of Technology in Computer Engineering
W.E.F. A.Y. 2022-23

Semester II

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
FY102	Engineering Mathematics II	TLP	3	2	3	1	4
FY104	Engineering Physics II	TL	2	1	2	0.5	2.5
FY106	Engineering Chemistry II	TL	2	1	2	0.5	2.5
FY108	Engineering Mechanics and Graphics*	TL	2	4	2	2	4
FY113	Java Programming	TLP	3	2	3	1	4
FY114	Professional communication and Ethics I	TLC	2	2	2	1	3
CE 118	**Basic Workshop Practice-II**	L	-	**2**	-	**1**	**1**
			14	**14**	**14**	**7**	**21**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Oral/ Pract.	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Average					
FY102	Engineering Mathematics II	40	40	40	60	2	25	-	125
FY104	Engineering Physics II	30	30	30	45	2	25	-	100
FY106	Engineering Chemistry II	30	30	30	45	2	25	-	100
FY108	Engineering Mechanics and Graphics*	40	40	40	60	2	25	25	150
FY113	Java Programming	40	40	40	60	2	25	25	125
FY114	Professional communication and Ethics I	20	20	20	30	1	25	-	75
CE 118	Basic Workshop II	-		-	-	-	50	-	50
Total				**190**	**285**		**200**	**50**	**725**

T- Theory , L- Lab , P-Programming, C- Communication

***- 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. 2023-24
Semester III

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
CE 201	Engineering Mathematics III	T	3	-	1*	3	-	1	4
CE 202	Data Structures	TL	3	2	-	3	1	-	4
CE 203	Computer Graphics Virtual Reality	TL	3	2	-	3	1	-	4
CE 204	Digital Logic and Computer Architecture	T	3	-	-	3	-	-	3
CE 205	Database Management Systems	TL	3	2	-	3	1	-	4
CE 206	Human Values and Social Ethics	T	2	-	-	2	-	-	2
CE 207	Python Programming Lab	LP	-	2+2#	-	-	2	-	2
Total			**17**	**10**	**1**	**17**	**5**	**1**	**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 201	Engineering Mathematics III	40	40	40	60	2	25	-	125
CE 202	Data Structures	40	40	40	60	2	25	25	150
CE 203	Computer Graphics Virtual Reality	40	40	40	60	2	25	--	125
CE 204	Digital Logic and Computer Architecture	40	40	40	60	2	25	-	100
CE 205	Database Management Systems	40	40	40	60	2	25	25	150
CE 206	Human Values and Social Ethics	-	-	-	-	-	50	-	50
CE 207	Python Programming Lab	-	-	-	-	-	50	25	75
Total				**200**	**300**		**225**	**75**	**800**

T- Theory , L- Lab , P-Programming, C- Communication

*** 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. 2023-24

Semester IV

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
CE 208	Engineering Mathematics IV	T	3	-	1*	3	-	1	4
CE 209	Design and Analysis of Algorithms	TL	3	2	-	3	1	-	4
CE 210	Operating Systems	TL	3	2	-	3	1	-	4
CE 211	Computer Network	TL	3	2	-	3	1	-	4
CE 212	Microprocessors and Interfacing	TL	3	2	-	3	1	-	4
CE 213	Web Programming	LP	-	2+2#	-	-	2	-	2
Total			**15**	**10**	**1**	**15**	**6**	**1**	**22**

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 Network	40	40	40	60	2	25	25	150
CE 212	Microprocessors and Interfacing	40	40	40	60	2	25	--	125
CE 213	Web Programming	-	-	-	-	-	50	25	75
Total				**200**	**300**		**175**	**100**	**775**

T- Theory , L- Lab , P-Programming, C- Communication

*** 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. 2024-25
Semester V

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)			Credits Assigned			
			Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
CE 301	Theory of Computation	T	3	-	1*	3	-	1	4
CE 302	Machine Learning	TL	3	2	-	3	1	-	4
CE 303	Software Engineering and Project Management	TL	3	2	-	3	1	-	4
CE 304	Personal Financial Management	T	2	-	-	2	-	-	2
CE 305	Professional Communication Skills II	LC	-	2+2#	-	-	2	-	2
CE 3xx	Department Level Optional Course I	T	3	2	-	3	1	-	4
CE 3xx	Department Level Optional Course II	T	3	2	-	3	1	-	4
Total			**17**	**10**	**1**	**17**	**6**	**1**	**24**

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	Software Engineering and Project Management	40	40	40	60	2	25	--	125
CE 304	Personal Financial Management	20	20	20	40	1.5	-	-	60
CE 305	Professional Communication Skills II	-	-	-	-	-	50	-	50
CE 3xx	Department Level Optional Course I	40	40	40	60	2	25	25	150
CE 3xx	Department Level Optional Course II	40	40	40	60	2	25	25	150
Total				**220**	**340**		**150**	**75**	**785**

T- Theory , L- Lab , P-Programming, C- Communication

*** Batchwise tutorial of One hour to be conducted.**

 # Theory class to be conducted for full class .

Specializations□	Data Analytics and Language Processing	Network and Information Security	Computational Intelligence and Automation	Systems and Computing
Course Code	CE 306	CE 307	CE 308	CE 309
Department Level Optional Course I (DLOC I)	Advanced DBMS	Cryptography and Network Security	IoT Systems and Applications	Advanced OS

Specializations□	Data Analytics and Language Processing	Network and Information Security	Computational Intelligence and Automation	Systems and Computing
Course Code	CE 310	CE 311	CE 312	CE 313
Department Level Optional Course II (DLOC II)	Data Warehouse and Data Mining	Ethical Hacking and Cyber Laws	Robotics and its Applications	Distributed Systems

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

Semester VI

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
CE 314	System Programming Compiler Construction	TL	3	2	3	1	4
CE 315	Artificial Intelligence and Cognitive computing	TL	3	2	3	1	4
CE 3xx	Department Level Optional Course III	TL	3	2	3	1	4
CE 3xx	Department Level Optional Course IV	TL	3	2	3	1	4
IL 3xx	Institute Level Optional Course I	T	3	-	3	-	3
CE 391	Project A	LP	-	6	-	3	3
Total			**15**	**14**	**15**	**7**	**22**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Oral/ Pract.	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Average					
CE 314	System Programming Compiler Construction	40	40	40	60	2	25	25	150
CE 315	Artificial Intelligence and Cognitive computing	40	40	40	60	2	25	25	150
CE 3xx	Department Level Optional Course III	40	40	40	60	2	25	25	150
CE 3xx	Department Level Optional Course IV	40	40	40	60	2	25	25	150
IL 3xx	Institute Level Optional Course I (ILOC I)	40	40	40	60	2	-	-	100
CE 391	Project A	-	-	-	-	-	50	25	75
Total				**200**	**300**		**150**	**125**	**775**

T- Theory , L- Lab , P-Programming Component, C- Communication component

Specializations	Data Analytics and Language Processing	Network and Information Security	Computational Intelligence and Automation	Systems and Computing
Course Code	CE 316	CE 317	CE 318	CE 319
Department Level Optional Course III (DLOC III)	Big Data Analysis	Advanced System Security	Internet of Everything	Block chain technology

Specializations	Data Analytics and Language Processing	Network and Information Security	Computational Intelligence and Automation	Systems and Computing
Course Code	CE 320	CE 321	CE 322	CE 323
Department Level Optional Course IV (DLOC IV)	Natural Language Processing	Network and Cloud security	Digital Image Processing	Human Computer Interaction

Specializations	Business and Entrepreneurship	Bioengineering	Engineering Design	Art and Humanities	Applied Science	Life Skills, Repair, Maintenance and Safety
Course Code	IL 360	IL 361	IL 362	IL 363	IL 364	IL 365
Institute Level Optional Course I (ILOC-I)*	IPR and Patenting	Introduction to Bioengineering	Product Design	Visual Art	Computational Physics	Vehicle Safety

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

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

Semester VII

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
CE 401	Software Testing and Quality Assurance	TL	3	2	3	1	4
CE 4xx	Department Level Optional Course V	TL	3	2	3	1	4
CE 4xx	Department Level Optional Course VI	TL	3	2	3	1	4
IL 4xx	Institute Level Optional Course II	T	3	-	3	-	3
CE 491	Project B	LP	-	8	-	4	4
Total			**12**	**14**	**12**	**7**	**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 401	Software Testing and Quality Assurance	40	40	40	60	2	25	25	150
CE 4xx	Department Level Optional Course V	40	40	40	60	2	25	25	150
CE 4xx	Department Level Optional Course VI	40	40	40	60	2	25	25	150
IL 4xx	Institute Level Optional Course II	40	40	40	60	2	-	-	100
CE 491	Project B	-	-	-	-	-	100	50	150
Total				**160**	**240**		**175**	**125**	**700**

T- Theory , L- Lab , P-Programming, C- Communication

Specializations	Data Analytics and Language Processing	Network and Information Security	Computational Intelligence and Automation	Systems and Computing
Course Code	CE 402	CE 403	CE 404	CE 405
Department Level Optional Course V (DLOC V)	Data Science	Pentresting and vulnerability Assessment	Deep Learning	User Experience Design

Specializations	Data Analytics and Language Processing	Network and Information Security	Computational Intelligence and Automation	Systems and Computing
Course Code	CE 406	CE 407	CE 408	CE 409
Department Level Optional Course VI (DLOC VI)	Social Media Analytics	Digital Forensics	Computer Vision	High Performance Computing

Specializations	Business and Entrepreneurship	Bioengineering	Engineering Design	Art and Humanities	Applied Science	Life Skills, Repair, Maintenance and Safety
Course Code	IL 470	IL 471	IL 472	IL 473	IL 474	IL 475
Institute Level Optional Course II (ILOC II)*	e- Commerce and e-Business	Medical Image Processing	Technologies for Rural Development	Economics	GIS and Remote Sensing	Maintenance of Electronics and Mechanical Equipment

*** : 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. 2025-26

Semester VIII

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
CE 492	Project C	LP	-	8	-	4	4
CE 496	Industry Internship	PC	-	16	-	8	8
Total			-	24	-	12	12

Course Code	Course Name	Examination Scheme							
		Theory							
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)	Term Work	Oral/ Pract.	Total
		1	2	Average					
CE 492	Project C	-	-	-	-	-	50	50	100
CE 496	Industry Internship	-	-	-	-	-	100	100	200
Total				-	-		150	150	300

T- Theory , L- Lab , P-Programming, C- Communication

BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING

(Semester I)

`

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 101	Engineering Mathematics I	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 101	Engineering Mathematics I	40	40	40	60	25	--	--	125

1. **Course Objectives**:

The course is aimed

1. To develop the basic Mathematical skills of engineering students that are imperative for effective understanding of complex numbers in engineering subjects.
2. To acquaint students with the hyperbolic, logarithmic functions and Logic.
3. To understand differentiation and expansions of functions. which will serve as basic tools for specialized studies in many fields of engineering and technology.
4. To learn the partial differentiation techniques and its applications used in engineering problems.
5. To learn the applications of Matrices useful in engineering.
6. To provide hands on experience using SCILAB software to handle Mathematical modelling.

2. **Course Outcomes**:

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

1. Apply the basic concept of complex numbers and use it to solve problems in engineering.
2. Apply the basic concept of Hyperbolic, logarithmic functions and Logic in engineering problems.
3. Apply the concept of expansion of functions, successive differentiation and vector differentiation in optimization problems.
4. Use the basic concepts of partial differentiation in finding the Maxima and Minima required in engineering problems.
5. Use the concept of matrices in solving the system of equations used in many areas of research..
6. Apply the concept of numerical Methods for solving the engineering problems with the help of SCILAB software.

3. Detailed Theory Syllabus:

Module No.	Module	Detailed Content	Hrs.
1	Complex Numbers	**Complex Numbers** **Pre-requisite:** 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 sinnθ, cosnθ in terms of sines and cosines of multiples of θ and Expansion of sinnθ, cosnθ in powers of sinθ, cosθ 1.3. Powers and Roots of complex numbers.	6

2	Hyperbolic , Logarithm functions and Logic	**Hyperbolic , Logarithm functions and Logic** 2.1 Introduction to Hyperbolic functions, Logarithmic functions, Separation of real and Imaginary parts. 2.2 Propositional logic, logical equivalence, Negation of given statement, predicates & Quantifiers, Normal form, mathematical induction	6
3	Successive Differentiation, Expansion of Function and Vector Differentiation	**Successive Differentiation, Expansion of Function and Vector Differentiation** **Pre-requisite : 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$e^{\wedge}$ (x), sin(x), cos(x), tan(x), sinh(x), cosh(x), tanh(x),log(1+x), $\sin^{-1}(x)$, $\cos^{-1}(x)$,$\tan^{-1}(x)$. 3.3 Vector function of scalar quantities, Vector operator del, gradient, Grad Phi ,Directional derivatives. Divergence and curl and their Physical interpretation	6
4	Partial Differentiation and Applications of Partial Differentiation	**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.	6
5	Matrices	**Matrices** **Prerequisite:** 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
6	Numerical Methods	**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	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 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 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 (Experiments) + 5 Marks (Assignments) + 5 Marks (Attendance)

General Instructions:

1. Batch wise practical's are to be conducted. The number of students per batch should be as per norms.
2. Students must be encouraged to write SCILAB Programs in the laboratory. Each student has to perform at least 4 SCILAB practical's and at least 6 assignments on the entire syllabus.
3. SCILAB Practical's will be based on (i) Gauss Elimination(ii) Gauss Seidel Iteration method (iii) Gauss Jacobi Iteration Method (iv) Bisection method (v) Secant Method (vi) Newton Raphson (vii) Matrices (viii) Maxima and Minima.(At least four).

6. Books and References:

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

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 102	Engineering Physics I	Contact Hours	2	1	-	3
		Credits	2	0.5	-	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					
CE 102	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 limits of Classical Physics and apply the fundamentals of quantum mechanics to study the one dimensional motion of microscopic particles.
2. Apply the knowledge of superconductivity to SQUID and Magnetic levitation.
3. Able to understand fundamental concepts of classical optics and applications of interference in science and technology.
4. Understand the fundamentals of Theory of relativity and its use in various technological applications.
5. Comprehend the concepts of electrodynamics and Maxwell's equations and their use in telecommunication systems.
6. Apply the concepts of electromagnetism in focusing systems and CRO.

3. Detailed Theory Syllabus:

Module No.	Module	Detailed Content	Hrs.
1	Quantum Mechanics	Quantum Mechanics: De Broglie hypothesis of matter waves; properties of matter waves; wave packet, phase velocity and group velocity; Wave function; Physical interpretation of wave function; Heisenberg uncertainty principle; nonexistence of electron in nucleus; Schrodinger's time dependent wave equation; time independent wave equation; Free electron, Particle trapped in one dimensional infinite potential well, Quantum Computing.	6
2	Superconductivity	Superconductivity: Critical temperature, critical magnetic field, Meissner's effect, Type I and Type II and high Tc superconductors; BCS Theory (concept of Cooper pair);	3

		Josephson effect, Applications of superconductors- SQUID, MAGLEV	
3	Thin Film Interference	Thin Film Interference : Interference by division of amplitude and by division of wave front; Interference in thin film of constant thickness due to reflected and transmitted light; origin of colours in thin film; Wedge shaped film(angle of wedge and thickness measurement); Newton's rings Applications of interference - Determination of thickness of very thin wire or foil; determination of refractive index of liquid; wavelength of incident light; radius of curvature of lens; testing of surface flatness; Anti-reflecting films and Highly reflecting film.	6
4	Special theory of relativity	Special theory of relativity: Postulates of special theory of relativity, Inertial and non-inertial frames of refrances. Gallilian transformation equations, Limitations of gallilian transformation equations Lorentz Transformation equations Length contraction and time dilation. Einstein's Mass energy relation. LIGO Project, Discovery of 4 degree Kelvin Cosmic background radiation	4
5	Electrodynamics	Electrodynamics: Scalar and vector fields, Cartesian, Cylindrical and Spherical Coordinate system, gradient, curl and divergence in Cartesian coordinate system, line integral, surface integral, volume integral, divergence theorem, Stoke's theorem, Maxwell's Equations.	4
6	Electron Optics	Electron Optics: Electrostatic focusing, Magnetostatic focusing, Cathode Ray Tube(CRT), Construction and working of CRO. Lissajous figures.	2

4. Suggested Experiments:

1. Determination of radius of curvature of a lens using Newton's ring set up
2. Determination of diameter of wire/hair or thickness of paper using Wedge shape film method and estimation of Young's modulus of the material.
3. Brewster's law (Polarisation of light by reflection through glass slab.)
4. To study the nature of polarisation of laser light using photocell and quarter wave plate (QWP)
5. Use of CRO for measurement of frequency and amplitude.
6. Determination of unknown frequency by Lissajous figures.

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 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 (Experiments) + 5 Marks (Assignments) + 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- ArtherBeiser, 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. Introduction to Electrodynamics- D. J. Griffiths, Pearson publication
9. Physics for Engineers, M.R. Srinivasan, New Age International Publishers.
10. Introduction to Special Relativity- Robert Resnick, John Wiley and sons

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 103	Engineering Chemistry I	Contact Hours	2	1	-	3
		Credits	2	0.5	-	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					
CE 103	Engineering Chemistry I	30	30	30	45	25	-	-	100

1. Course Objectives:

The course is aimed to:

1. To impart a scientific approach and to familiarize the applications of chemistry in the field of engineering.
2. The student with the knowledge of the basic chemistry, will understand and explain scientifically the various problems related to chemistry in the industry/engineering field.
3. To develop abilities and skills that are relevant to the study and practice of chemistry.

2. Course Outcomes:

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

1. To understand and analyse the combustion mechanisms of various fuels and be able to characterize the fuels.
2. To select various lubricants for different industrial applications.
3. To become familiarized with corrosion forms and their effects and to recognize and use the method of corrosion protection.
4. To analyse the quality of water and will be able to suggest methods to improve water quality.
5. To assess the environmental impact and understand the methods for their minimisation.

3. Detailed Theory Syllabus:

Module No.	Module	Detailed Content	Hrs.
1	**Fuels And Combustion**	**Prerequisite:** What are fuels, Types of fuels, Characteristics of fuels. 1.1. Calorific value of a fuel - HCV and LCV, Theoretical determination of calorific value of fuel by Dulong's formula, Numerical problems. 1.2 Solid fuels : Coal, Analysis of coal - Proximate and Ultimate analysis, Numerical problems Liquid fuels: Composition and Classification, Octane number, Cetane number, Biodiesel Gaseous Fuels: LPG and CNG 1.3. Combustion of fuels – Numerical problems for calculating the amount of air needed for the complete combustion of solid and gaseous fuels	5
2	**Lubricants**	**Prerequisites** : Definition of Lubricants and Lubrication, functions of lubricants 2.1 Mechanisms of lubrication – Thick film, Thin film and Extreme pressure	4

		2.2 Classification of lubricants - Solid (MoS_2, graphite), Semi solid (greases), Liquid (animal/vegetable oils, mineral oils, synthetic oils) 2.3 Properties of lubricants and their significance - Viscosity and Viscosity Index, Flash and Fire Points, Cloud and Pour Points, Acid Number, Saponification Number, Steam Emulsification Number and related numerical problems.	
3	**Corrosion**	**Prerequisite:-** corrosion , corrosion product, electrochemical series, corrosive and non corrosive metals. 3.1 Mechanism of corrosion - Chemical and Electrochemical corrosion. 3.2 Types of corrosion : Galvanic corrosion, Differential aeration corrosion, Pitting corrosion, Intergranular corrosion, Waterline corrosion, Stress corrosion. 3.3 Factors Affecting Corrosion Rate : - (i) Nature of metal, (ii) Nature of environment.	4
4	**Corrosion Prevention**	**CORROSION PREVENTION** 4.1 Methods of Corrosion Control : Material selection, Design, Cathodic protection, Anodic protection 4.2 Protective Coatings: Metallic coatings anodic coating (galvanizing) and cathodic coating (Tinning), Different Methods of Applying Metallic Coatings (No explanation needed) 4.3 Organic coatings – Paints and Special Paints.	3
5	**Water And Its Treatment**	**Prerequisite** : Knowledge of sources of water, Possible impurities in water, Characteristics imparted by impurities in water. 5.1 Hardness in water – types & its units, Determination of hardness by EDTA method, and numerical problems. 5.2. Effects of Hard water in boilers - Priming and Foaming, Scales and Sludges, Boiler corrosion, caustic embrittlement 5.3 Softening of water- Ion exchange process. 5.4 Desalination of brackish water- Reverse Osmosis, Electrodialysis, Ultrafiltration. 5.5 Municipal water treatment – Primary, secondary and tertiary, BIS specification of drinking water	5
6	**Environmental Chemistry**	**Prerequisites:** Definition of Environment and Primary concept of environmental pollution**.** 6.1 Concept and Scope of Environmental Chemistry. 6.2 Environmental Pollution and Control, Water Pollution - BOD and COD, determination and numerical problems, E- pollution and N-pollution 6.3 Concept of 12 principles of Green chemistry, discussion with examples, numerical on atom economy.	3

4. Suggested Experiments:

1. Determination of Hardness in water
2. Determination of Viscosity of oil by Redwood Viscometer
3. Determination of Flash point of a lubricant using Abel‘s apparatus
4. Determination of Acid Value and Saponification Value of an oil.
5. Determination of Chloride content of water by Mohr‘s Method
6. Determination of moisture content in coal sample.
7. Study of the effect of different environments (Acid, Base) on corrosion rate.
8. Determination of COD Value of water.
9. Removal of hardness using ion exchange column.
10. Calorific value of liquid fuel

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 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 (Experiments) + 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. Engineering Chemistry – O.G. Palanna , Tata Mc Graw Hill
5. Environmental Chemistry – A.K.De, New Age International

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 104	Programming with C	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 104	Programming with C	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 be able to write and read data from files.
5. To decompose solutions into smaller units using functions.
6. To create different types of data-structure using structure, arrays and pointers.

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. Use the concepts of arrays, strings, functions and Structures to structure complex programs
5. Use of pointers to access different user defined data types like arrays, Strings and Structures
6. Use different data structures and open/create/update basic data files.

3. Detailed Theory Syllabus:

Module No.	Module	Detailed Content	Hrs.
1	Fundamentals of C Programming	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, Strings and Structures	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 4.3 Structure Introduction, Declaration, Initialization, Nested structure, Array of Structure.	10
5	Pointers	5.1 Pointer :Introduction, Definition, Pointer Variables, Referencing and Dereferencing operator, Pointer Arithmetic, Pointers to Pointers, void Pointer, 5.2 Pointers to Array and Strings, Passing Arrays to Function, Accessing structure using pointers, Array of Pointers, call by value and call by reference. 5.3 Dynamic Memory Allocation using malloc, calloc, realloc, free	6
6	File Handling	6.1 Introduction, types of Files, File Operations- Opening, Modes of opening a file, Closing, Creating, Reading, Processing File.	3

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 switch case. (Ex: I/P = ‘A’, O/P = April, August).
7. Write a program to find the result of the series: 1 - 22/3 + 32/5 - .....+ n2/(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
```

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).
18. Write a program to accept a set of characters from the user until the user presses the full stop ('.') and store it in a text file. Read from the file and display the contents of the file.

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 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 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 (Experiments) + 5 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

A. Books:

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

B. References:

1. "Programming Techniques through C", by M. G. Venkateshmurthy, Pearson Publication.
2. "Programming in C", by Pradeep Dey and Manas Gosh, Oxford University Press.
3. Schaum's outlines "Programming with C", by Byron S. Gottfried, Tata McGraw-Hill Publications.
4. "Basics of Computer Science", by BehrouzForouzan , Cengage Learning .

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 105	Basic Electrical and Electronics Engineering*	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 105	Basic Electrical and Electronics Engineering*	40	40	40	60	25	25	-	150

1. Course Objectives:

The course is aimed to:

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 OP-AMP and IC555.

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/ behaviour.
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. Implement applications using OPAMP and timer circuit.

3. Detailed Theory Syllabus:

Module No.	Module	Detailed Content	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).	6

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**.**	9
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 in star and delta connections, Phasor diagrams, Basic principle of wattmeter, measurement of power by two wattmeter method.	6
6	Operational Amplifier and Integrated Circuits	**Operational Amplifier and Integrated Circuits** Basics of semiconductor devices, Ideal characteristics of operational amplifier (OP-AMP), concept of virtual ground, OP-AMP as inverting and non-inverting amplifier, adder and subtractor, integrator and differentiator, OP-AMP as a comparator with different applications. Introduction to IC555 as a timer circuit, internal block diagram of IC555, Astable and Monostable Multivibrator using IC 555.	6

4. Suggested Experiments:

1. Mesh and Nodal analysis. (Module 1)
2. Verification of Superposition Theorem. (Module 2)
3. Verification Thevenin's Theorem. (Module 2)
4. Study of R-L series and R-C series circuit. (Module 3 and Module 4)
5. R-L-C series resonance circuit / parallel resonant circuit. (Module 3 and Module 4)
6. Relationship between phase and line currents and voltages in three phase system (star & delta). (Module 5)
7. Power and phase measurement in three phase system by one wattmeter method. (Module 5)
8. Power and phase measurement in three phase system by two wattmeter method. (Module 5)
9. LTSpice Simulation of OPAMP as an integrator/ differentiator. (Module 6)
10. LTSpice Simulation of 555 Timer as an Astable Multivibrator/ Monostable Multivibrator. (Module 6)

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.

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 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. "Basic Electrical & Electronics Engineering (BEE)", by Prof. B. R. Patil, Oxford Higher Education
2. "Basic Electrical & Electronics Engineering (BEE) by Prof.Ravish Singh", McGraw Hill Education

B. References:

1. B.L.Theraja, "Electrical Technology" Vol-I and II, S. Chand Publications, 23 rd ed. 2003.
2. Joseph A Edminister, "Schaum's outline of theory and problems of electric circuits", Tata McGraw Hill, 2 nd edition
3. "Electronics Devices & Circuit Theory", by Boylestad, Pearson Education India
4. D P Kothari and I J Nagrath, "Theory and Problems of Basic Electrical Engineering", PHI 13 th edition 2011

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 106	Basic Workshop 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					
CE 106	Basic Workshop 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 domain.
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.

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	6

		plates with simple cover, arc welding to join plates at right angles.	
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.

BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING

(Semester II)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 107	Engineering Mathematics II	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 107	Engineering Mathematics II	40	40	40	60	25	-	-	125

1. Course Objectives:

The course is aimed to:

1. To develop the basic mathematical skills of differential equations of engineering students
2. To understand the linear differential equation with constant coefficients used in mathematical modelling.
3. To acquaint the students with the Beta, Gamma functions and set theory.
4. To learn different techniques to solve double integrations.
5. To learn the applications of integration in solving the complex engineering problems.
6. To provide knowledge of numerical techniques using SCILAB software to handle Mathematical modelling.

2. Course Outcomes:

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

1. Apply the basic concept of linear differential equations to solve problems in engineering.
2. Apply the basic concept of applications of higher order differential equations in mathematical modelling to solve real life problems.
3. Apply the basic concepts of beta ,gamma and set theory to solve engineering problems.
4. Apply the concept of double integration in solving problems of engineering and technology.
5. Apply the concept of double integrations to find length, area and volume.
6. Apply the concept of differentiation and integration numerically for solving the engineering problems with the help of SCILAB software.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Differential Equations of First Order and First Degree	**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, equation reducible to linear form. 1.3 Application of differential equation of first order and first degree in engineering.	6
2	Linear Differential Equations With Constant Coefficients and Variable coefficients of higher order	**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*, *x V*.	6

		2.2.Cauchy Differential equation, Method of variation of parameters two variables	
3	Beta and Gamma Function, Set theory	**Beta and Gamma Function, Set theory** 3.1 Beta and Gamma functions and its properties. 3.2 Basics of set theory and set operations, law of set, partition of set, Power set, cartesian product, Inclusion-Exclusion Principle	6
4	Double Integration	**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.	6
5	Applications of integration	**Applications of integration** :- 5.1 Rectification of plane curves.(Cartesian and polar) 5.2. Application of double integrals to compute Area 5.3.Triple integration**:** Evaluation (Cartesian, cylindrical and spherical polar coordinates)	6
6	Numerical Techniques	**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 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 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)

General Instructions:

1. Batch wise practical's are to be conducted. The number of students per batch should be as per norms.
2. Students must be encouraged to write SCILAB Programs in the laboratory. Each Student has to perform at least 4 SCILAB practical's and at least 6 assignments on the entire syllabus.
3. SCILAB Practical's will be based on (i) Euler's method (ii) Modified Euler method, (iii)Runge-Kutta fourth order method (iv) Trapezoidal (v) Simpson's 1/3rd (vi) Simpson's 3/8th rule(vii) Differential equations (viii) Integration. (At least four)

6. Books and References:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publication.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 9thEd.
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

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 110	Engineering Mechanics and Graphics*	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 110	Engineering Mechanics and Graphics*	40	40	40	60	25	25	-	150

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 it's constraints, and able to formulate the mathematical function of the system.
3. To study, analyse 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
6. To improve the visualization skill.

2. Course Outcomes:

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

1. To verify the law of moments and draw a Free Body Diagram and label the reactions on it.
2. To Determine the centroid and MI of plane lamina.
3. To apply equilibrium equations in statics.
4. To Apply the basic principles of projections in Projection of Lines
5. To Apply the basic principles of projections in reading and converting 3D view to 2D drawing.
6. To Visualize an object from the given two views.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Coplanar and Non-Coplanar Force System and Resultant	**Coplanar and Non-Coplanar Force System and Resultant:** System of Coplanar Forces: Classification of force systems, Principle of transmissibility, composition and resolution of forces. Resultant: Resultant of coplanar and non-coplanar force systems (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.	6
2	Equilibrium of System of	**Equilibrium of System of Coplanar Forces and Beams:** Conditions of equilibrium for concurrent forces, parallel forces and non-concurrent non- parallel general forces and	6

	Coplanar Forces and Beams	Couples. Equilibrium of rigid bodies free body diagrams. 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)	
3	Kinematics of Particle	**Kinematics of Particle:** Motion of particle with variable acceleration. General curvilinear motion. Tangential & Normal component of acceleration, Application of concepts of projectile motion and related numerical.	6
4	Projection of Points and Lines	**Projection of Points and Lines:** Lines inclined to both the Reference Planes (Excluding Traces of lines) and simple application-based problems on Projection of lines.	6
5	Orthographic and Sectional Orthographic Projections	**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.	6
6	Isometric Views	**Isometric Views:** Principles of Isometric projection – Isometric Scale, Isometric Views, Conversion of Orthographic Views to Isometric Views (Excluding Sphere).	6

4. Suggested Experiments:

Hardware Requirements: Pentium / Windows

Software Requirements: Autocad

Minimum three experiments from the following list (1-4) of which minimum one should from dynamics.

1. Verification of Polygon law of coplanar forces
2. Verification of Principle of Moments (Bell crank lever.)
3. Determination of support reactions of a Simply Supported Beam.
4. Kinematics of particles. (Uniform motion of a particle, Projectile motion, motion under gravity)
5. One sheet on Orthographic projection. (minimum 2 problem)
6. One sheet on Sectional Orthographic projection. (minimum 2 problem)
7. One sheet on Isometric drawing. (minimum 2 problems)

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 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.

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:

1. Engineering Mechanics by Beer &Johnston, Tata McGrawHill
2. Engineering Mechanics (Statics) by Meriam and Kraige, Wiley Bools
3. Engineering Mechanics (Dynamics) by Meriam and Kraige, Wiley Bools
4. Engineering Mechanics by F. L. Singer, Harper& Raw 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.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 108	Engineering Physics II	Contact Hours	2	1	-	3
		Credits	2	0.5	-	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					
CE 108	Engineering Physics II	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. Able to explain the working principle of optical fibres and their applications especially in the field of communication.
3. To comprehend the basic concepts of semiconductor physics and apply the same to electronic devices.
4. To analyse digital logic processes and implement logical operations using various combinational logic circuits.
5. To analyse design and implement logical operations using various sequential logic circuits.
6. Interpret and explore basic sensing techniques for physical measurements in modern instrumentations.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Lasers	Lasers : spontaneous emission and stimulated emission; metastable state, population inversion, types of pumping, resonant cavity, Einstein's equations; Helium Neon laser; Nd:YAG laser; Semiconductor laser, Applications of laser- Holography (construction and reconstruction of holograms) and industrial applications(cutting, welding etc), Applications in the medical field.	4
2	Optical Fibres	Optical Fibres: Working Principle and structure , Numerical Aperture for step index fibre; critical angle; angle of acceptance; V number; number of modes of propagation; types of optical fibres; (Applications :) Fibre optic communication system; sensors (Pressure, temperature, smoke, water level), applications in the medical field.	4

3	Semiconductor Physics	SEMICONDUCTOR PHYSICS Splitting of energy levels for band formation; Classification of semiconductors(direct & indirect band gap, elemental and compound); Conductivity, mobility, current density (drift & diffusion) in semiconductors(n type and p type); Fermi Dirac distribution function; Fermi energy level in intrinsic & extrinsic semiconductors; effect of impurity concentration and temperature on fermi level; Fermi Level diagram for p-n junction(unbiased, forward bias, reverse bias); Breakdown mechanism (zener avalanche), Hall Effect, Applications of semiconductors: Rectifier diode, LED, Zener diode, Photo diode, Photovoltaic cell, BJT, FET, SCR., MOSFET	7
4	Logic gates and combinational Logic circuits	Logic gates and combinational Logic circuits: Review of Binary, Octal and Hexadecimal Number systems and their interconversion, Difference between analog and digital signal, Logic levels, Digital logic gates,, Universal gates, Realization using NAND and NOR gates, Half adder and Full adder circuit, MUX - DEMUX, ENCODERS and DECODERS.	3
5	Sequential Logic Circuits	Sequential Logic Circuits: Flip Flops: R-S and J-K Flip Flops, Conversion of flip-flops to shift registers. Counters: Up/Down and BCD counter.	4
6	Physics of Sensors	Physics of Sensors: Temperature Sensor- Resistance Temperature Detectors(RTDs) (PT-100), LM 35 Temperature sensor, Soil Moisture sensor, Gas sensor MQ135,Pressure Transducers- Capacitive pressure transducer, Inductive pressure transducer. Piezoelectric transducers: Concept of piezoelectricity, use of piezoelectric transducer as ultrasonic generator and application of ultrasonic transducer for distance measurement, liquid and air velocity measurement. Ultrasonic Hc04	3

4. Suggested Experiments:

1. Determination of number of lines on the grating surface using LASER Source.
2. Determination of Numerical Aperture of an optical fibre.
3. Determination of wavelength using Diffraction grating. (Laser source)
4. Determination of angular divergence of laser beam.
5. Study of Hall Effect.
6. Determination of energy band gap of semiconductor.
7. Study of I-V characteristics of LED.
8. Determination of 'h' using Photocell.
9. Study of I-V characteristics of semiconductor photodiode and determination of its spectral response.
10. Study of I-V characteristics of a photovoltaic solar cell and finding the efficiency.
11. Design AND, OR, NOT, EXOR, EXNOR gates using Universal gates: NAND and NOR
12. Implement Half adder, Full adder, Half subtractor and Full subtractor circuits.
13. Verify the truth table of different types of flip flops.
14. Design asynchronous/synchronous MOD N counter using IC7490.
15. Zener Diode as a voltage regulator.

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 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:

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- ArtherBeiser, Tata McGraw Hill
6. A TextBook of Engineering Physics, S. O. Pillai, New Age International Publishers.
7. Optics - Ajay Ghatak, Tata McGraw Hill
8. Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher
9. R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill Education, Fourth Edition (2010).
10. Handbook of Modern Sensors Physics design and application- Jacob Fraden, Springer, AIP press.
11. Physics for Engineers, M.R. Srinivasan, New Age International Publishers.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 109	Engineering Chemistry II	Contact Hours	2	1	-	3
		Credits	2	0.5	-	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					
CE 109	Engineering Chemistry II	30	30	30	45	25	-	-	100

1. Course Objectives:
The course is aimed to:

1. With the knowledge of the basic chemistry, the student will be able to understand and explain scientifically the various chemistry related problems in the industry/engineering field.
2. The student will be able to understand the new developments and breakthroughs efficiently in engineering and technology.

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

1. To recognize the electrochemical processes and apply the concepts in electrochemistry.
2. To develop knowledge on electrochemical energy storage systems considering the operation and design of various battery technologies.
3. To identify various polymeric materials and their applications in engineering.
4. To acquire theoretical background of types of nanomaterials and their applications.
5. To describe the theoretical background of spectroscopic techniques such as NMR, IR, UV spectroscopy.
6. To identify DNA as a genetic material in the molecular basis of information transfer

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	**Engineering Electrochemistry**	**Prerequisite:** Redox reaction, cell reaction, electrode and its type, salt bridge 1.1. Electrode potential, electrode reaction, derivation of Nernst equation for single electrode potential, numerical problems.. 1.2 Electrochemical cell -Weston standard Cadmium cell 1.3 Reference electrodes -Introduction, Construction, working of SHE, Calomel electrode.	**3**
2	**Battery Technology**	**Prerequisite** : Electrochemical Reactions, Cell potential, Electrochemical series 2.1 Introduction, classification – primary, secondary and reserve batteries. Characteristics – Capacity, Electricity storage density, energy efficiency, cycle life and shelf life.	**5**

		2.2 Construction, working and applications of Ni – Cd rechargeable batteries 2.3 Lithium batteries - Introduction, construction, working and applications of Li-MnO2 2.4 Fuel Cells: Introduction, classification of fuel cells, limitations & advantages of fuel cells, Construction of Hydrogen oxygen alkaline fuel cells. 2.5 Electrochemical Sensors	
3	**Polymeric Materials**	**Prerequisite** : Polymer, Monomer, Polymerization, Degree of polymerisation, Classification of Polymers, Mechanism of polymerisation. 3.1 Molecular weight of polymers: number average and weight average, numerical problems. , Polydispersity Index, 3.2 Polymer crystallinity - glass transition temperature and its significance 3.3 Thermoplastic & Thermosetting polymers- Characteristics 3.4 Preparation , properties and uses of PMMA, Urea-Formaldehyde, Phenol - formaldehyde 3.5 Conducting polymers – Types, Mechanism of conduction in polymers, Examples, and applications. 3.6 Polymer films in sensor applications.	**5**
4	**Nanochemistry**	**Prerequisite:** Concept of nano scale, definition of nanoparticles 4.1. Importance of nano size, Properties of nanomaterials – Size, optical properties, magnetic properties, electrical properties. 4.2 Nanoscale materials- fullerenes, nanotubes, nano wires, nanorods 4.3 Synthesis of Nano materials - Chemical vapor deposition (CVD) method and Laser Ablation Method 4.4 Application of Nanomaterials – for communication, data storage	**5**
5	**Spectroscopic Techniques**	**Pre-requisites :** Electromagnetic radiation, characteristics of electromagnetic radiation, electromagnetic spectrum. 5.1. Spectroscopy - Principle, Interaction of radiation with matter, Selection rules. 5.2 Types of spectroscopy,: IR, UV, NMR, Emission Spectroscopy, (Flame Photometry), 5.3 Fluorescence and Phosphorescence, Jablonski diagram 5.4 NMR and Magnetic Resonance Imaging	**4**
6	**Biomolecules**	Molecules of life – Cellulose, Amino acids , proteins, Nucleotides and DNA, DNA as genetic material, Concept of genetic code, Universality and degeneracy of genetic code. Molecular basis of Information transfer.	**3**

4. Suggested Experiments:

Software Requirements if any:.

1. Determination of Cell potential of Zn- Cu system
2. Molecular weight determination of polymers by Oswald Viscometer
3. Preparation of Urea Formaldehyde / phenol formaldehyde
4. Preparation of biodegradable polymer using corn starch or potato starch.

5. Preparation of Magnetic Nanoparticles.
6. Synthesis of Biodiesel
7. Determination of electrical conductivity of unknown solution.
8. Preparation of Hand Sanitizer using ethyl alcohol
9. Determination of Caffeine in Tea
10. Determination of pH using glass electrode.

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 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:

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. Engineering Chemistry – O.G. Palanna , Tata Mc Graw Hill
5. Molecular Genetics – Stent G.S and Calendar, R.W.H Freeman and Company
6. Fundamentals of Molecular Spectroscopy – C.N . Banwell, Tata Mc Graw Hill
7. Instrumental methods of chemical analysis – B.K.Sharma, Goel Publishing House
8. "Nanomaterials: Synthesis, Properties and Applications", A. S. Edelstein and R. C. Cammarata- Institute of Physics Pub., 2001

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 111	Object Oriented Programming with Java	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					
CE 111	Object Oriented Programming with Java	40	40	40	60	25	25	-	125

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 application

3. Detailed Theory Syllabus:

Prerequisite: Basics of Computer Programming

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

		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	
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

4. Suggested Experiments:

Hardware & Software Requirements:

Hardware Requirements	Software Requirements	Other Requirements
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

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)

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 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. Herbert Schildt, "Java-The Complete Reference", Tenth Edition, Oracle Press, Tata McGraw Hill Education.
2. E. Balguruswamy, "Programming with Java A primer", Fifth edition, Tata McGraw Hill Publication
3. Anita Seth, B.L.Juneja, " Java One Step Ahead", Oxford university press.

B. References:

1. D.T. Editorial Services, "Java 8 Programming Black Book", Dreamtech Press.
2. Learn to Master Java by Star EDU Solutions
3. Yashvant Kanetkar, "Let Us Java" ,4th Edition ,BPB Publication

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 113	Basic Workshop II	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					
CE 113	Basic Workshop II	-	-	-	-	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 labor.
3. To get exposure to interdisciplinary engineering domain.

2. Course Outcomes:

On successful completion of course learner/student 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 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 masons tools.
6. Develop the necessary skill required to use different sheet metal and brazing tools.
7. Able to demonstrate the operation, forging with the help of a simple job.

3. Detailed Theory Syllabus:

Note:

Trade 1 and 2 are compulsory. Select any ONE trade topics out of the topic trade 3 to 5. Demonstrations and hands on experience to be provided during the periods allotted for the same. Report on the demonstration including suitable sketches is also to be included in the term work

CO-1 is related to Trade-1

CO-2 to CO-4 is related to Trade-2 CO-5 is related to Trade-3

CO-6 is related to Trade-4 CO-7 is related to Trade-5

CO evaluation is to be done according to the opted Trades in addition to Compulsory Trades.

Module No	Module	Detailed Contents of Module	Hrs.
1	Trade-1 Carpentry	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	10
2	Trade-2 Basic Electrical work shop	Basic Electrical work shop:(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.	8

		Layout drawing, layout transfer to PCB, etching and drilling and soldering technique	
3	Trade-3 Masonry	Masonry: Use of masons tools like trowels, hammer, spirit level, square, plumb line and pins etc. demonstration of mortar making, single and one and half brick masonry , English and Flemish bonds, block masonry, pointing and plastering.	6
4	Trade-4 Sheet metal working and Brazing	Sheet metal working and Brazing: Use of sheet metal, working hand tools, cutting , bending , spot welding.	6
5	Trade-5 Forging (Smithy)	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	6

4. 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 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)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 112	Professional communication Skills I	Contact Hours	2	2	-	4
		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					
CE 112	Professional communication Skills I	20	20	20	30	25	-	-	75

1. Course Objectives:

The course is aimed to:

1. To understand, compare and demonstrate the importance and relevance of communication with specific emphasis on listening skill.
2. To promote practice in speaking skill and encourage learners to compose on the spot speeches for the purpose of developing and generating ideas.
3. To train learners in reading strategies that will enhance their global understanding of the text and help them to comprehend academic and business correspondence.
4. To illustrate effective writing skills in business, academic and technical areas.
5. To inculcate confident personality traits with grooming and social etiquette.
6. To train learners in producing words on the basis of contextual cues and reflect on errors in sentences.

2. Course Outcomes:

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

1. Listen, comprehend and identify potential barriers in spoken discourse with ease and accuracy.
2. Develop confidence and fluency in speaking at social, academic and business situations as well as make effective professional presentations.
3. Implement reading strategies for systematic, logical understanding, that will enhance the skill of comprehension, summarisation and evaluation of texts.
4. Understand and demonstrate effective writing skills in drafting academic, business and technical documents.
5. Communicate effectively in academic as well as business settings, displaying refined grooming and social skills.
6. Anticipate the meaning of unfamiliar words with the help of contextual cues and construct grammatically correct sentences.

3. Detailed Theory Syllabus:

Module 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 - Ability to discriminate stress and intonation	**4**

		- Comprehend meaning of audio text-graded on the basis of vocabulary, sentence construction and theme. -potential barriers	
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	**4**
3	Strategies and Techniques to build Reading Skill	Strategies and Techniques to build Reading Skill 3.1 Global understanding of the text- inference, anticipation and deduction 3.2 Detailed understanding of text-scanning for specific information (special emphasis on reading comprehension exercises and summarisation)	**2**
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 complain letters}	**4**
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**
6	Vocabulary and Grammar	Vocabulary and Grammar 6.1 Contextual vocabulary Development- Word Maps 6.2 Identifying errors in a sentence.	**1**

4. Suggested Experiments:

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)
2. Transcription of the public speech along with a plagiarism report-Practice public speech
3. Summarization through graphic organisers (1. Text to graphic organizer 2. Graphic organizer to text)
4. a. Case studies on critical thinking b. business letters in complete block format
5. Documentation of case studies/Role play based on Module 5
6. a. Contextual Vocabulary Development b. Aptitude Test

5. Theory Assessment:

A. Internal Assessment (IA): 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 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 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 number of hours assigned to each module.

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:

1. Raman Meenakshi & Sharma Sangeeta, Communication Skills, Oxford University Press
1. Kumar Sanjay & Lata Pushp, Communication Skills, Oxford University Press
2. Locker, Kitty O. Kaczmarek, Stephen Kyo. (2019). Business Communication:
3. 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 it easy. Random House USA.

BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING

(Semester III)

STATUS OF SYLLABUS REVIEW OF SEM III

Sr. No.	Name of Faculty	Subject Name	Status (Done/Not Done)	Remarks (Modification in CO, Hr, Content, Scheme(PR/OR/ TW), Reference books)	UPDATED STATUS WITH DATE
1.	Savita Bingi, Archan I , Mahesh Kudre	Engineering Mathematics III	**DONE**	Removed Dirichlet's conditions, Fourier series of periodic functions with period 2L, Fourier Integral Representation, Inverse Fourier transform of constant and exponential function, Introduction to Limit, Continuity and Differentiability of (z),.Determine analytic function f(z)when its combination (u+v / u-v) is given, Number of Binary Relations, Number of Reflexive Relations, Semi-Group. Monoid, Isomorphism, Homomorphism,	updated as on 9 Jan 2024
2.	Smita J , Suhas L , Sunil S	Data Structures	**DONE**	**Removed** B tree, B+	updated as on 9 Jan 2024

				tree, Huffman tree, Trie. **Introduced** Heap Data structure	
3.	Sunil S , Sheetal Shimpikar	Computer Graphics Virtual Reality	**DONE**	—----------	updated as on 9 Jan 2024
4	Deepti L , Tejali M , Asmita D	Digital Logic and Computer Architectu re	**DONE**	suggestions- 1. If the digital logic part is covered in previous semesters then remove from here and accordingly update module 1. 2. If the subject does not have practicals then remove experiment lists from the syllabus.	
5	Smita J, Jinesh M , Shubhangi C	Database Manageme nt Systems	**DONE**	CO and Contact Hrs modified, pl/sql added in chapter 4 with procedure cursor. chapter 6 modified for transaction management.mo dification of experiment list.	Updated as on 9/1/2024
6	Shreedevi K	Human Values and Social Ethics	**DONE**	**The assignments can be evaluated**	

				based on activities. The evaluation can be based on the activities Quiz on various professional ethics can be conducted. A psychometric test could be conducted to understand behaviour patterns (if possible)	
7	Sangeetha S , Vasavi A	Python Programming Lab	**DONE**	Removed Decorators, Iterator and Generators from module 1 and added in module 3. Added Debugging concept in module 5.	Updated as on 09-01-2024

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

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:

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. 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.

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 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.

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, YedidyahLangsam, Moshe J Augenstein, “Data Structures Using C”, Pearson Publication.
2. Richard F. Gilberg 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	Computer Graphics 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 203	Computer Graphics and Virtual Reality	40	40	40	60	25	----	25	150

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 a 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

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,	7

		Reflection, Shear, their homogeneous Matrix representation and Composite transformation. Three Dimensional transformations: Translation, Scaling, Rotations, Composite.	
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: Bit Map 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 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.

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 204	Digital Logic and Computer Organization and Architecture	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 204	Digital Logic and Computer Organization and Architecture	40	40	40	60	25	—	25 (no exam	150

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

3. Detailed Theory Syllabus:

Sr. No.	Module	Detailed Contents of Module	Hrs
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 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.

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, 4thEdition.
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, 3rdEdition.
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	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 205	Database Management System	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.

3. Detailed Theory Syllabus:

Prerequisite : Basic knowledge of file system, any programming language

Module No	Module	Detailed Contents of Module	Hrs.
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, Slberchatz, 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 206	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 206	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.

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 207	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 207	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

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, Indention, 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.	10

		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	
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 functions, Reading from a file – read(), readline(), readlines(), Renaming and Deleting a file, File Exceptions, Directories.	05
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 ++ 1. 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
   a. Control flow statements: Conditional statements (if, if…else, nested if)
   b. Looping in Python (while loop, for loop, nested loops)
   c. Decorators, Iterators and Generators.

2. Write python programs to understand
   a. Different List and Tuple operations using Built-in functions
   a. Built-in Set and String functions
   b. Basic Array operations on 1-D and Multidimensional arrays using Numpy
   c. Implementing User defined and Anonymous Functions

3. Write python programs to understand
   a. Classes, Objects, Constructors, Inner class and Static method
   a. Different types of Inheritance
   b. 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
   a. Creating user defined multithreaded application with thread synchronization and deadlocks
   b. 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
   a. Designing Graphical user interface (GUI) using built-in tools in python (Tkinter, PyQt, Kivy etc.).
   b. 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)

STATUS OF SYLLABUS REVIEW OF SEM IV

Sr. No	Name of Faculty	Subject Name	Status (Done/Not Done)	Remark (Modification in CO, Hr, Content, Scheme (PR/OR/TW), Reference books)	Updated as On
1.	Savita Bingi, Archan I, Mahesh Kudre	Engineering Mathematics IV	**DONE**	Removed Conditional probability, Total Probability and Baye's Theorem, subspaces.,NLPP with three variables,Isomorphism, Extremal Elements of Posets, Non-Homogeneous Recurrence relation, Testing for primality., Homomorphism , Binary trees.	Updated as on 09-01-2024

2.	Suhas L, Sunil S	Design and Analysis of Algorithms	**DONE**	***Course Objectives=*** 1 objective changed ***Course outcomes=*** 1 outcome changed ***Unit-1=topics added*** RAM model of computation, costing methods (uniform costing). Contact hours ***changed to 4 hrs***. ***Unit-5-String Matching removed*** and a ***New Unit 2 on Divide and Conquer Approach*** added with ***8 contact hrs***. ***Previously Unit-2*** on ***DP*** is now pushed down as ***Unit-3***. Subtopic of ***Reliability design*** is ***removed*** from new Unit 3. ***Contact hours*** changed to ***9 hrs***. ***Unit-6*** = ***renamed*** as ***Introduction to computational complexity theory***.	Updated as on 09-01-2024

				Subtopics ***added= Decision problems, encoding schemes, , Concept of Polynomial time reduction***. Lab= ***Changes*** All ***3*** programs mentioned in experiment 1 are made ***compulsory***. ***A new experiment 2 is added*** with ***2*** programs to be implemented ***compulsorily***. ***Reference books=*** ***2*** books are added as reference books.	
3.	Shubhangi C	Operating Systems	**DONE**	Practical exam removed, only the oral exam. Contact hrs modified for chapter 3 and 6. File Allocation Method added in Chapter 5. Types of I/O removed from chapter 5.	Updated as on 9/1/2024
4	Payel Thakur, Sureh babu	Computer Network	**DONE**	RPC from session layer (Module 5) removed.Huffman coding removed from	Updated as on 9/1/2024

				presentation layer (module 6).	
5	Rupali Sharma Rohit Sharma	Microprocessors and Interfacing	**DONE**	Contents are modified in chapter 2,3 & 5. Corrected the typos. Such as the study of descriptor tables is removed from chapter 5. Replaced 3 experiments in the list.	Updated as on 10/1/2024
6	Sangeetha S, Vasavi A, Dhiraj Amin	Web Programming	**DONE**	Changed module 2 name to Web Design with HTML5 and CSS3	8th Jan 2024

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.

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.

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, *Analysis of algorithm*:- Asymptotic notations, Best, average and worst case analysis (*example:- Incremental sorting algorithm:- Insertion Sort on an array input*)	4
2	Divide and	General Method, *Analysis of D&C algorithm*:-General	8

	Conquer Approach	equation, solution using Recursion tree, Master Theorem, *Applications*- Large number multiplication, Sorting problem:- Merge sort, Quick sort, Order statistic problem:- Finding k^{th} smallest element of an array	
3	Dynamic Programming Approach	General method, *Applications*-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, *Applications*-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.	8
5	Backtracking and Branch-and-bound	*Backtracking*: General method, *Applications*-n-queen problem, sum of subsets problem, graph coloring *Branch and Bound*: General method, *Applications* - 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

1. All 3 Programs
   a) Implement Insertion sort, Merge sort, Quicksort on array input
   b) Write a program, analyze it and find time complexity with various cases.
2. Both Programs
   a) Implement D&C approach to Large number multiplication, Finding k^{th} smallest element of a given array input
   b) Write a program, analyze it and find time complexity with various cases.
3. Any two Programs
   a) 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.

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.

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.

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)	08

		Threads: Definition and Types, Concept of Multithreading, Introduction to Linux Scheduling.	
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

1. Explore usage of basic and advanced Linux Commands For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc).
2. Explore the file and process management system calls.
3. Write shell scripts to do the following:
   a) Display OS version, release number, kernel version, current shell, home directory, operating system type, current path setting, current working directory.
   b) Display top 10 processes in descending order. Display processes with highest memory usage. Display current logged in user and log name.
4. 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.
5. Write a program to demonstrate the concept of non-pre-emptive and preemptive scheduling algorithms.
6. 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 Dhamdhere, 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 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 211	Computer Network	40	40	40	60	25	----	25	150

1. **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 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.

3. Detailed Theory Syllabus:

Prerequisite: Digital Logic and Computer Organization and Architecture

Module No	Module	Detailed Contents of Module	Hrs.
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 Design Issues of Layers. Guided and Unguided media .Switching – Circuit-switched Networks – Packet Switching, Message switching.	6
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, Channelization. **Self Study:** Ethernet Features, types and Standard Ethernet with frame format	8
3	Internet Protocols and Addressing	Introduction to Internet Protocols, IPV4 datagram format,IPv4 address,classful address,subnetting,supernetting,classless	7

		addressing,DHCP,NAT,IPV6 datagram format, Transition from IPV4 to IPV6	
4	Routing in Network Layer	**Routing algorithms**-The Link-State (LS) Routing Algorithm,The Distance-Vector (DV) Routing Algorithm,Hierarchical Routing **Routing in the internet-**RIP,OSPF,BGP **Broadcast and multicast routing** -DVMRP,PIMRP	6
5	Transport Layer	User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Queuing, Discipline Introduction to Quality of Services (QOS).	6
6	Application Layer Protocols	**Application Layer:** HTTP, DNS, E-Mail, FTP, SSH, Telnet - SNMP.	6

4. Suggested Experiments:

Software Requirements if any: NS2

1. Fundamentals of Computer Network: Use basic networking commands in Linux (ping, tracert, nslookup, netstat, ARP, RARP, ip, ifconfig, dig, route)
    a. Set up multiple IP addresses on a single LAN.
    b. Using netstat and route commands of Linux, do the following:
        1. View current routing table
        2. Add and delete routes
        3. Change default gateway
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 and Dynamic Routing Protocols (Distance Vector-RIP) and traffic consideration using Packet Tracer.
6. Graphical simulation of a network with static and Dynamic Routing Protocols (Link State Routing-OSPF/EIGRP) and traffic consideration using Packet Tracer.
7. Graphical simulation of a network with static and Path vector routingProtocols (Border Gateway Protocol-BGP) and traffic consideration using Packet Tracer.
8. Socket Programming: Socket programming using TCP or 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. Basics of Network simulation with different Protocols:
    Installation and configuration of NS2.
    a. Introduction to Tcl Hello Programming
    b. Number of nodes and physical layer configuration
    c. Simulation of traffic using TCP and UDP
    d. Simulation of traffic using Distance vector protocol
    e. Simulation of traffic using Link State protocol
11. Data Link Control Protocols Simulation: Stop and wait protocol/ sliding window (selective repeat / Go back N)

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 212	Microprocessors and Interfacing	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 212	Microprocessors and Interfacing	40	40	40	60	25	---	-	125

1. **Course Objectives:**
   The course is aimed to:
   1. Equip students with the fundamental knowledge and basic technical competence in the field of Microprocessors.
   2. Emphasize on instruction set and logic to build assembly language programs.
   3. Understand the concept of interrupts.
   4. Prepare students for higher processor architectures and embedded systems.
   5. Emphasize the use of Assembly language programs.
   6. Prepare students for advanced subjects like embedded systems and IOT.
2. **Course Outcomes:**
   On successful completion of course learner/student will be able to:
   1. Describe architecture of x86 processors.
   2. Interpret the instructions of 8086 and write assembly and Mixed language programs.
   3. Explain the concept of interrupts.
   4. Identify the specifications of peripheral chips.
   5. Design 8086 based system using memory and peripheral chips.
   6. Understand the architecture of advanced processors.

3. **Detailed Theory Syllabus:**

Prerequisite: Digital Logic and Computer Organization and Architecture

Module No	Module	Detailed Contents of Module	Hrs
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
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

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

4. Suggested Experiments:

1. Study of 8086 Microprocessor with block diagram and pin diagram
2. Use of programming tools (Debug/TASM/MASM/8086 kit) to perform basic arithmetic operations on 8 bit/16 bit data
3. Assembly programming for 8-bit addition, subtraction, multiplication and division
4. Assembly programming for 16-bit addition, subtraction, multiplication and division (menu based)
5. Assembly program based on string instructions (overlapping/ non-overlapping block transfer)
6. Assembly program to display the contents of the flag register.
7. Assembly program to find factorials of a number.
8. Assembly program to find fibonacci of a number.
9. Assembly program to find the GCD/ LCM of two numbers
10. Assembly program to sort numbers in ascending/ descending order.
11. Assembly program to find whether the number is even or odd.
12. Assembly program to find minimum/maximum no from a given array.
13. Program and interfacing using 8255/8253
14. Program and interfacing of ADC/DAC/Stepper motor

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 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. 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

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.

3. Detailed Theory Syllabus:

Prerequisite : Basic of Programming and Web

Module No	Module	Detailed Contents of Module	Hrs.
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.	10

		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.	
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.

BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING

(Semester V)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 210	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 210	Theory of Computation	40	40	40	60	-	-	-	100

1. Course Objectives:

The course is aimed to:

1. Acquire conceptual understanding of fundamentals of grammars and languages.
2. Build concepts of 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.

3. Detailed Theory Syllabus:

Prerequisite : Discrete Mathematics

Module No	Module	Detailed Contents of Module	Hrs.
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

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
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
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
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
6	Undecidability	Decidability and Undecidability, Recursive and Recursively Enumerable Languages. Halting Problem, Rice‘s Theorem, Post Correspondence Problem.	3

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 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 303	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 303	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 deep learning and reinforcement 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. Distinguish between classification and regression problems.
   2. Identify and apply supervised learning models on real world problems.
   3. Identify and apply unsupervised learning models on real world problems
   4. Implement and analyze simple machine learning models
   5. Optimize the data using dimensionality reduction techniques
   6. Implement classifier for image data

3. **Detailed Theory Syllabus:**
   Prerequisite: Probability, Statistics

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Basics of Machine Learning and ML Tools	Machine Learning, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing a Machine Learning Application. Machine Learning Languages - Python, R	4
2	Supervised Learning : Boosting/Bagging and Regression	Introduction to Supervised Machine Learning, Classification and Regression Overfitting and Underfitting, Bagging , Boosting, Linear Regression, Least-Squares, Ridge, Lasso, and Polynomial Regression, Logistic Regression	5

3	Classification Models	K-Nearest Neighbors: Classification, Binary Decision Tree, Binary regression tree, Support vector Machine, Multi class classification, Kernelized Support Vector Machines, Naive Bayes Classifier, Random Forest, Neural Network	10
4	Performance Measures	Performance Measures : Model evaluation and selection, Confusion Matrices & Basic Evaluation Metrics, Precision-recall and ROC curves, Multi-Class Evaluation, Regression Evaluation, Model Selection: Optimizing Classifiers for Different Evaluation Metrics, Cross validation	9
5	Unsupervised Learning: Clustering, Dimensionality Reduction	Introduction to Unsupervised Machine Learning, Clustering- K-Means, Agglomerative Clustering, Dimensionality Reduction and Manifold Learning, PCA	8
6	Reinforcement Learning and Introduction to Deep Learning	Introduction to Reinforcement Learning, Introduction to Markov Decision Processes, Goal of Reinforcement Learning, Bellman equations, Introduction to Neural Network, Types of NN, CNN, Hyper parameter optimization, RNN, LSTM	3

4. Suggested Experiments:

Hardware Requirements: High performance Systems

Software Requirements: Python, Tensorflow, Keras

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

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 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)

1. 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:

1. Machine Learning For Absolute Beginners: A Plain English Introduction (Second Edition), Oliver Theobald
2. Machine Learning: An Algorithmic Perspective, Second Edition, Stephen Marsland
3. Approaching (Almost) Any Machine Learning Problem, Abhishek Thakur
4. Machine Learning (in Python and R) For Dummies, John Paul Mueller

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 303	Software Engineering and Project Management	Contact Hours	3	02	-	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 303	Software Engineering and Project Management	40	40	40	60	125	-	--	125

1. Course Objectives: The course is aimed to

1. To understand the nature of software development and software life cycle process models, agile software development, SCRUM and other agile practices.
2. To Explain methods of capturing, specifying, visualizing and analyzing software requirements.
3. To understand concepts and principles of software design and user-centric approach and principles of effective user interfaces.
4. To know the basics of testing and understanding the concept of software quality assurance and software configuration management process.
5. To understand the need of project management and project management life cycle.
6. To understand project scheduling concepts and risk management associated with various types of projects

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

1. Define various software application domains and remember different process models used in software development.
2. Explain needs for software specifications also they can classify different types of software requirements and their gathering techniques.
3. Convert the requirements model into the design model and demonstrate use of software and user-interface design principles.
4. Distinguish among SCM and SQA and can classify different testing strategies and tactics and compare them.
5. Justify the role of SDLC in Software Project Development and they can evaluate the importance of Software Engineering in PLC.
6. Generate project schedule and can construct, design and develop network diagrams for different types of Projects. They can also organize different activities of the project as per Risk impact factor.

3. Detailed Theory Syllabus:

Prerequisite:

1. Concepts of Object Oriented Programming & Methodology
2. Knowledge of developing applications with front end & back end connectivity.
3. Nature of Software, Software Definition, Software Characteristics, Software Application Domains

Module No	Module	Detailed Contents of Module	Hrs.

1	Introduction to Software Engineering, Software Process Models	Software Engineering Fundamentals: Nature of Software, Software Engineering Principles, The Software Process, Software Myths. Process Models :A Generic Process Model, Prescriptive Process Models: The Waterfall, Incremental Process(RAD), Evolutionary Process, Concurrent. Agile software development: Agile methods, Extreme programming Practices, SCRUM. Introduction to agile tools: JIRA, Kanban.	6
2	Software Requirements Engineering and Cost Estimation	Requirement, Types of Requirements, Requirement gathering, Requirement Engineering Task, Identifying Stakeholders, Multiple viewpoints, SRS (Software Requirement Specification) Project Estimation, LOC based, FP based and Use case based estimation.	6
3	Design Engineering	Analysis and Design Engineering Introduction of Analysis elements, Scenario based, Flow based, behavior and class based Design Concepts and Principles, Architecture Design, Component Level Design, System Level Design,User Interface Design.	8
4	Software Quality & Configuration Management	McCall's Quality Factor, Software Configuration Management, SCM Process.Need for Testing, Testing Tactics, Testing strategies.Introduction to Software Testing, Principles of Testing, Testing Life Cycle, Phases of Testing, Types of Testing, Verification & Validation,Maintenance & Reengineering.	6
5	Project Management:	Project Management Concepts: The Management Spectrum, People, Product, Process, Project, The W5HH Principle,Project Life cycle and ITPM, Project Feasibility, RFP, PMBOK Knowledge areas, Business Case, Project Planning, Project Charter and Project Scope.	7
6	Risk Management and Project Scheduling	WBS, Developing the Project Schedule, Network Diagrams (AON, AOA), CPM and PERT, Gantt Chart, Project Risk Management : Risk Analysis & Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement,Risk Identification, Risk Projection and RMMM	6

4. Software Engineering and Project Management Lab (Credit-01)

Objectives

1. Learn basic concepts of UML.
2. Master the vocabulary, rules, and idioms of the UML and learn how to model it effectively.
3. Understand how to apply the UML to solve a number of common modeling problems.
4. Model the systems, from concept to executable artifact, using object-oriented techniques.
5. Apply the knowledge of Software engineering and project management.
6. Understand the software development process using tools.

Outcomes

1. Sketch a Modeling with UML.
2. Deploy Structural Modeling.
3. Deploy Behavioral Modeling
4. Deploy Architectural Modeling.
5. Examine estimation about schedule and cost for project development.
6. Select project development tool.

Software Requirements: IBM Rational Rose Modeler, Dia, StarUML (Any One) Orange Scrum, Xampp, GitHub

Hardware Requirements:PC i3 or above.

Suggested List of Experiments

1. Students should take one case study as a mini project work which is to be conducted by a group of three students.
2. Orangescrum DEMO
3. To study SRS
4. To study Use case diagram
5. To study class diagrams and Object diagrams.
6. To study Sequence and Collaboration diagrams.
7. To study Activity and statechart diagrams
8. To conduct FP point estimation for the project.
9. To Conduct COCOMO estimation for the project
10. To generate project scheduling for the project
11. Risk management
12. Software testing

5. Theory Assessment:

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**

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

3. **Termwork Assessment:** Term Work shall consist of at least 10 to 12 practical's based on the above list. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).
4. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

6. Books and References:

A. Text Books:

1. Roger S Pressman Software Engineering : A Practitioner's Approach 7th Edition Mcgraw-Hill ISBN:0073375977
2. Jack T. Marchewka, Information Technology Project Management 4th Edition ,Wiley India
3. "The Unified Modeling Language User Guide" by Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Publication,ISBN 978-81-7758-372-4

B. References:

1. Software Engineering : A Precise Approach Pankaj Jalote , Wiley India
2. Ian Sommerville Software Engineering 9th edition Pearson Education SBN-13: 978-0-13703515-1, ISBN-10: 0-13-703515-2

3. John M. Nicholas, Project Management for Business and Technology, 3rd edition, Pearson Education.
4. Software Project management by Bob Hughes, Mike Cotterell , Rajib Mall
5. UML – Tutorial "www.tutorialspoints.com/uml/"
6. "An Introduction to Object-Oriented Analysis: Objects and UML in plain English" by Davis William Brown, Wiley, Second Edition
7. "Fundamentals of Object-Oriented Design in UML", Meilir Page-Jones, Pearson Education
8. UML in 24 Hours
9. UML Basics— an Introduction to the Unified Modeling Language – IBM "www.ibm.com › Learn › Rational"

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 304	**Personal Financial 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 304	**Personal Financial Management**	20	20	20	40	-	-	--	60

1. Course Objectives: The course is aimed

1. To introduce the basic concepts of finance and their practical application .
2. To demonstrate the process of drafting a financial budget.
3. To explain investment avenues and planning of personal finance.
4. To develop portfolio strategies for individual and institutional investor
5. To discuss various components of insurance and tax management.
6. To introduce financial frauds , measures to avoid frauds and resources of frauds .

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

1. To know the basic concepts of finance and interpret current business positions by reading books of accounts .
2. To analyze investment avenues and plan personal finance to develop portfolio strategies for individuals .
3. To Develop skills to interpret current market position.
4. To Create analytical approach for financial decisions.
5. To learn and understand Tax and Insurance management.
6. To identify financial frauds and understand the level of financial aspects .

3. Prerequisite : NA

4. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Personal Financial Planning	Financial Planning Process: Goal, Vision and mission , Components of Personal Financial Plan, Advantages and developing personal financial plan	3
2	Financial Budget	Meaning and Process of Drafting Financial Budget,Components of Financial Budget,Drafting Financial Budget	3
3	Investment Management	Meaning of Investment,Concept of Risk and Return and Time Value of Money,Investment Avenues,Portfolio Creation and Management	6

4	Insurance and Spending Management	Components of Insurance: Life Insurance, Health Insurance ,Property Insurance ,Spending Management	3
5	Tax Management	Introduction to Tax Regime and Tax Returns,Introduction to Income Tax and its impact on Incomes ,Tax on property: Revenue and Capital Incomes,Tax Management, Tax Saving, Tax Avoidance	3
6	Financial Frauds	Meaning and Types of Fraud,Investment Frauds, Online Payment Frauds, Identity Theft, Mass Marketing Fraud ,Measures to avoid frauds,Recourse from frauds,Cases of Frauds	6

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. Financial Management: I M Pandey, Vikas Publishing House.
2. Financial Management: M.Y. Khan, P.K. Jain, Tata McGraw Hill.
3. Financial Management: Prassana Chandra, Prentice Hall.
4. Investment Analysis & Portfolio Management- Prasanna Chandra, Tata McGrawHill
5. Wealth Management- Dun & Bradstreet, Tata McGrawHill
6. Wealth Management- S.K .Bagachi, Jaico publishing house

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 305	Professional Communication Skills II	Contact Hours	-	02+02#	-	4
		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 Skills II	-	-	-	-	50	-	--	50

Course Objectives: The course is aimed

1. To enable learners to formulate professional documents in a structured manner that meets the corporate requirements.
2. To provide an appropriate environment, opportunity and scope to the learners to acquire skills such as collaboration, leadership qualities, assertiveness etc. necessary for group discussion and team building.
3. To promote the importance of having an impressive personality that will enhance self-esteem, build self-confidence and sensitize the learners in appropriate behavior.
4. To prepare the learners for campus placement, employability and competitive examination required for lifelong learning.
5. To inculcate the ethical code of conduct and corporate etiquettes.
6. To develop effective presentation, research and organizational and creative skills necessary for global and industrial set up.

Course Outcomes: At the end of the course Learner will be able to

1. Acquire the writing skills necessary for professional documents to meet the corporate requirement.
2. Demonstrate the skills required for self-improvement and effective communication.
3. Develop self-confidence and behave professionally.
4. Perform successfully in competitive exams like GRE, CET and TOEFL
5. Determine the importance of ethics and etiquettes in social and professional situations.
6. Illustrate effective presentation, research organizational and creative skills necessary for lifelong learning.

Prerequisite: Basic language skills

Module No	Module	Detailed Contents of Module	Hrs.

1	Structure, Style and Language of Report Writing	1.1 Introducing the purpose , aim, objective and format of report 1.2 Literature review-ability to gather and analyze information from different sources and summarize. Specific emphasis on plagiarism, use of quotation marks appropriately. 1.3 Research Methodology 1.4 Presenting data-figures, diagrams and labeling 1.5 How and why to write discussion 1.6 Citing and referencing- IEEE format 1.7 Writing an abstract	6
2	Writing Technical Proposals	2.1 Format 2.2 Executive summary 2.3 Defining the problem and presenting the solution 2.4 Summarizing a technical Proposal	4
3	Oral Skills for Employability	3.1 Group Discussion- with special reference to leadership qualities, assertiveness, analyzing the topic, developing different perspectives, introducing and concluding the discussion. 3.2 Interview-with special reference to introducing oneself and answering questions with confidence. 3.3 Presentation Skills-with special reference to preparing slides, dress code, non-verbal communication including paralinguistic features, introduction and conclusion.	4
4	Personality Development and Social Etiquettes	4.1. Personality Development: Improving self-awareness-analyzing our own experiences, looking at ourselves through the eyes of others, Knowing and Building your own identity, Discovering and Developing your talents, Teamwork/collaboration 4.2. Social Etiquettes : Formal Dining Etiquettes, Cubicle Etiquettes, Responsibility in Using Social Media, Showing Empathy and Respect, Learning Accountability and Accepting Criticism, Demonstrating Flexibility and Cooperation, Selecting Effective Communication Channels	5
5	Ethics and Ethical codes of conduct	5.1Writing Resume and statement of purpose 5.2 Business and corporate activities(special emphasis on business meetings) 5.3 Personal ethics, conflicting values, choosing a moral response, the process of making ethical decisions.	3
6	Content writing	6.1 Research Skills 6.2 Organizational skills 6.3 Creative Writing- Blog posts, Web pages etc.	4

List of assignments:

Sr. No.	Details of Assignments	Details of Activities	Hours

1	Written assignment on Literature Review 20 page report on technical topic	Sample IEEE papers to be shared with students and train them to identify contributions of each author. These contributions can then be written in the format required in journals.	5
2	Written assignment on summarizing a technical proposal :4 page technical proposal	Example of summarizing techniques to be demonstrated.	4
3	Oral Skills for Employability	Role play and mock interviews Mock group discussion Mock presentation	2 4 4
4	Written Assignment on Documentation of Business Meeting	Mock meetings	2
5	Written Assignment on Resume writing/Statement of Purpose.	NA	2
6	Written Assignment on Blog Posts	NA	2

Assessment:

Term Work:

1 Term work shall consist of a minimum of 6 assignments.

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

1. Assignments-10 marks
2. Group Discussion-10 marks
3. Interviews-5marks
4. Report- 5 marks
5. Technical Proposal- 5 marks
6. Attendance -5 marks
7. Presentation- 10 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.Kumar Sanjay & Lata Pushp, *Communication Skills*, Oxford University Press

3.Virendra Singh Nirban, Krishna Mohan, RC Sharma, *Business Correspondence and Report Writing*

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 306	Advanced Database Management System	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	Advanced Database Management System	40	40	40	60	25	25	--	150

1. Course Objectives:

The course is aimed to:

1. To provide an overview of indexing and hashing techniques.
2. To impart knowledge related to query processing and query optimizer phases of a database management system
3. To introduce advanced concepts of transaction management and recovery techniques.
4. To introduce concepts of advanced data models.
5. To provide an overview of Distributed Database Design & Techniques.
6. To introduce the concepts of Database security and authorization.

2. Course Outcomes:

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

1. Build indexing mechanisms for efficient retrieval of information from databases.
2. Measure query costs and design alternate efficient paths for query execution.
3. Learn the concept of a transaction , properties of transaction, concurrency control and recovery in database
4. Analyze advanced data models like spatial, mobile and Temporal data models.
5. Understand the Design, query processing, concurrency, recovery in Distributed Database.
6. Understand the concepts of Database Security & Access control

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Indexing and Hashing Techniques	Indexing and Hashing: Operation on Files Hashing Techniques; Static and dynamic Types of Single-Level Ordered Indexes; Multilevel Indexes; Dynamic Multilevel Indexes Using B-Trees and B+-Trees; Indexes on Multiple Keys	**7**
2	Query Processing and Optimization	Query Processing : Overview, Measures of Query cost, Selection operation, Sorting, Join Operations, and other Operations, Evaluation of Expression, Query Optimization : Translations of SQL Queries into relational algebra Heuristic approach & cost based optimization	7
3	Transactions Management and	Transaction concept, Transaction states, ACID properties, Concurrent Executions, Serializability, Recoverability, Concurrency Control: Lock-based, Time-stamp based	8

	Concurrency	Deadlock handling, Recovery System: Failure Classification, Storage structure, Log based recovery, Checkpoints, Shadow Paging, ARIES Algorithm	
4	Advanced data models	Temporal data models :- Aspects of valid time , Bi-temporal time and bi-temporal time with examples of each. Spatial model :- Types of spatial data models - Raster, Vector and Image, Mobile databases, Multimedia databases	6
5	Distributed Databases	Types of Distributed Database Systems; Distributed Database Architectures; Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Distributed Query Processing (Semi join), distributed Transaction Management in Distributed Databases, Distributed Concurrency Control (locking) , Recovery in Distributed Databases {2PC/3PC) and deadlock management.	6
6	Access Control and Data Security	Introduction to Database Security Issues; authorization , Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based Access Control for Multilevel Security, SQL Injection, Introduction to Statistical Database Security, Introduction to Flow Control.	5

4. Suggested Experiments:

1. Case study on Hashing and Indexing Techniques.
    a. 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.
    b. Find the cost of a given problem statement and create Index to reduce the query cost in any DBMS platform.
    c. Implementation of any one operation in binary search method using python.
2. To Find the cost of a given problem statement for different operations with various algorithms in Query Processor and Optimization.
3. Find the corresponding schedule for given data and how to manage the transactions if the system crash using Concurrency Control and Recovery Problems
4. Design of a distributed database design - Fragmentation
5. Case study on Mobile database data model with real world applications on new trends.
6. Implementation of SQL Injection for authentication and authorization on databases.

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.

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. Elmasri & Navathe— fundamentals of Database Systems IV edition. PEARSON Education.
2. Korth, Silberschatz sudarshan —Database systems, concepts 5th edition McGraw Hill
3. Raghu Ramkrishnan & Johannes Gehrke —Database Management System Tata McGraw Hill. 3rd edition.
4. Ruosell J.T. Dyer, Learning MySQL and Mariadb.

B. Reference Books:

1. Chhanda Ray , —Distributed Database System, Pearson Education India.
2. Hector Garcia-Molina, Jeffery D. Ullman, Jennifer Widom , — Database system Implementation‖
3. Thomas M. Connolly Carolyn Begg, Database Systems : A practical Approach to Design, Implementation and Management, 4/e.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 307	Cryptography and Network 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 Network Security	40	40	40	60	25	25	-	150

1. Course Objectives:

The course is aimed to:

1. To introduce the concepts of modular arithmetic and number theory and their application in Classical Encryption techniques.
2. To explore 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 develop 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. Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory.
2. Understand, 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. Understand network security basics, 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.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
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	9

		theorem - Testing for primality, The Chinese remainder theorem and its application, Discrete logarithms.	
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
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
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, EIGamal signature schemes	6
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, ARP cache poisoning DOS: Classic DOS attacks: Ping flood, ICNP flood, UDP flood, Distributed DOS, Defenses against DOS attacks, Internet Security Protocols: SSL, IPSEC, Secure Email: PGP, Firewall, Honey Pots, IDS	8
6	System Security	Software Vulnerabilities: Buffer Overflow, Format string, SQL injection, Malwares: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits	4

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.
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 nmap and/or open source tools ARPWATCH and wireshark.
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 Security‖, Tata Mc Graw Hill
3. Bernard Menezes, ―Cryptography & Network Security‖, 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 Systems and Applications	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 Systems and Applications	40	40	40	60	25	25	--	150

1. Course Objectives:

The course is aimed to:

1. To understand the basic concepts of IoT.
2. To learn the architecture and levels in IoT
3. To identify the different technologies for implementing IoT
4. To study different types of sensors and its applications
5. To learn different applications in IoT.

2. Course Outcomes:

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

1. Describe the basic concepts of IoT
2. Design architecture for an IoT application
3. Apply IoT technologies and communication to design an application
4. Identify the requirements for the real world problems.
5. Develop solutions for different real time IoT applications
6. Design and implement different IoT applications in IoT

3. Detailed Theory Syllabus:

Prerequisite: Computer Networking, Microprocessors and Interfacing

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to IoT	Basics of Internet of Things, Smart Objects, Smart Environments, Machine to Machine Communications, Industrial Internet of Things, Who Works on the Internet of Things?, Internet of Things Framework	3
2	Architecture of IoT	Convergence of IT and OT, IoT Challenges, M2M IoT Standardized Architecture, The IoT World Forum (IoTWF) Standardized Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack – Design considerations and Data related problems, Fog Computing, Edge Computing, The Hierarchy of Edge, Fog and Cloud	7
3	Technologies in IoT	WSN: ZigBee, BLE, WiFi, LTE, IEEE 802.15.4,Cloud Computing, Big Data Analytics. Middleware Technologies Service Discovery, Data Exchange, Computation, Application Layer Technologies, Identity-Related Services, Information Aggregation Services, Collaborative Aware Services, Ubiquitous Services, Business Layer Technologies, Semantics IoT Platforms and Operating Systems	10

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 – Architecture of Wireless Sensor Network, Network Topologies	6
5	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	5
6	IoT Applications	Introduction, Internet of Things -Based Precision Agriculture, IoT Application in Agriculture Irrigation, IoT Application in Agriculture Fertilization, IoT Application in Crop Disease and Pest Management. The Internet of Things and People in HealthCare- The Smart Health Care Ecosystem, The Patient at the Center, HealthCare Providers, Devices and Sensors, Applications and Interfaces	5

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 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", Mc Graw 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	Advanced Operating System	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	Advanced Operating System	40	40	40	60	25	25	--	150

1. Course Objectives:

The course is aimed to:

1. To learn the architectural differences and issues related to the Advanced Operating System.
2. To learn the Parallel system.
3. To get a comprehensive knowledge of the distributed systems.
4. To get a comprehensive knowledge of Real time operating systems.
5. To get a thorough knowledge of database operating systems
6. To get a thorough knowledge of various operating systems.

2. Course Outcomes:

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

1. Apply the principles and concepts in analyzing and designing Advance Operating Systems.
2. Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating systems.
3. Analyze the performance and reliability of different Advanced Operating Systems.
4. Demonstrate the various Scheduling Algorithms.
5. To be able to understand the database Operating system.
6. To be able to understand the various Operating Systems.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Operating Systems,	Introduction to Operating Systems, Design Principles & Concepts, Operating System History and Evolution, Processes, Processes scheduling, Memory Management, Virtual Memory	5
2	Parallel Systems	Shared memory machines, Synchronization Communication, Lightweight RPC, Scheduling, Shared memory multiprocessor OS	6
3	Distributed Operating System	Issues in Distributed Operating System, Architecture, Communication Primitives, Lamport's Logical clocks, Causal Ordering of Messages, Distributed Mutual Exclusion Algorithms, Centralized and Distributed Deadlock Detection Algorithms, Agreement Protocols. Distributed File Systems Design Issues Distributed Shared Memory, Algorithms for Implementing Distributed Shared memory, Issues in Load Distributing, Scheduling Algorithms, Synchronous and Asynchronous Check pointing and Recovery Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection.	8
4	Real Time and Mobile	Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling	8

	Operating System	- Handling Resource Sharing - Mobile Operating Systems –Micro Kernel Design, Resource Access, Processes and Threads : Scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals- Memory Management - File system.	
5	Database Operating systems	Concurrency control : Database systems, Concurrency control model of database systems, Problem of Concurrency Control, serializability theory, Distributed Database Systems Concurrency Control Algorithms : Basic synchronization Algorithms, Lock based, Timestamp based and Optimistic Algorithms, Concurrency Control Algorithms : Data Replication	6
6	Case Study	DOS: Mach, .RTOS : UNIX as RTOS , Windows as RTOS, Linux OS, Mobile OS.	5

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 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.

B. 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. Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems" .MC Graw Hill education.
2. Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson education.

B. References:

1. Andrew S.Tanenbaum, "Modern Systems Principles and Paradigms". PHI.
2. Pradeep K.Sinha, "Distributed Operating System-Concepts and design", PHI.
3. Andrew S.Tanenbaum, "Distributed Operating System", Pearson Education.
4. Jane W. S. Liu, “Real Time Systems”, Pearson education

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 310	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 310	Data Warehouse and Data Mining	40	40	40	60	25	25	-	150

1. Course Objectives:

The course is aimed to:

1. To identify the scope and essentiality of Data Warehousing and Mining.
2. To analyze data, choose relevant models and algorithms for respective applications.
3. To study spatial and web data mining.
4. To develop research interest towards advances in data mining.

2. Course Outcomes:

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

1. Understand Data Warehouse fundamentals, Data Mining Principles
2. Design data warehouse with dimensional modelling and apply OLAP operations.
3. Identify appropriate data mining algorithms to solve real world problems
4. Compare and evaluate different data mining techniques like classification, prediction, clustering Credits and association rule mining
5. Describe complex data types with respect to spatial and web mining.
6. Benefit the user experiences towards research and innovation.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	Introduction to Data Warehousing and Dimensional Modelling	Introduction to Data Warehouse, Components of Data warehouse Architecture, Data warehouse architecture, Data warehouse versus Data Marts, E-R Modeling versus Dimensional Modeling, Dimensional process, Data modeling tool, Information Package Diagram, Data Warehouse Schemas; Star Schema, Snowflake Schema, Factless Fact Table, Fact Constellation Schema. Update to the dimension tables.	9
2	ETL and OLAP	Major steps in ETL process, Data Extraction Methods, Data Transformation; Basic Tasks in Transformation, Major Data Transformation Types, Data Loading Techniques, OLTP versus OLAP, Hypercubes, OLAP operations: Slice, Dice, Rollup, Drilldown and Pivot.	8
3	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	6

4	Classification, Prediction and Cluster Analysis	**Classification:** Decision Tree: ID3, Bayesian Classification; **Prediction:** Logistic regression; **Clustering:** Partitioning Methods (*k*-Medoids), Hierarchical Methods (BIRCH), Density based Method, Grid based Method.	4
5	Mining frequent patterns and associations	**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.	8
6	Web & Text Mining	**Web Mining:** Page rank algorithm, VIPS, Block based. Text mining, Text Data Analysis, Information Retrieval Techniques, Dimensionality Reduction for Text, Text Mining Approaches, Boolean Model, Keyword based retrieval, similarity based retrieval, Indexing Techniques, Vector space model.	4

4. Suggested Experiments:

Software Requirements if any: Python, WEKA Tool, ORACLR/PG Admin

1. Build Data Warehouse/Data Mart for a given problem statement
   i) Identifying the source tables and populate sample data
   ii) Design dimensional data model i.e. Star schema, Snowflake schema and Fact Constellation schema (if applicable)
2. To perform various OLAP operations such as slice, dice, drilldown, rollup, pivot
3. Implementation of Data Preprocessing with sample dataset.
4. Implementation of Classification algorithm(Bayesian classification)
5. Implementation of Logistic Regression.
6. Implementation of Clustering algorithm(K-medoids/ DBSCAN)
7. Implementation of Association Rule Mining algorithm (Apriori).
8. Perform data Pre-processing task and Demonstrate performing Classification, Clustering, Association algorithm on data sets using data mining tool (WEKA,R tool, XL Miner, etc.)
9. Implementation of page rank algorithm.
10. Implementation of Text Mining.

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 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.

6. 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)

7. Books and References:

A. Books:

1. PaulrajPonniah, ―Data Warehousing: Fundamentals for IT Professionals‖, Wiley India.
2. Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3rd edition.
3. Reema Theraja ―Data warehousing‖, Oxford University Press.
4. M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education

B. References:

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

add here

Course Code	Course Name	Teaching Scheme	Contact Hours				Credits Assigned			
			TH	Pract	Tut	Total	TH	Pract	Tut	Total
CE 311	Ethical Hacking and Cyber Law		3	2	-	5	3	1	-	4
		Examination Scheme	Internal Assessment			End Sem Exam		Term Work	Pract	Oral	Total Marks
			IA1	IA2	Avg	TH	Hrs				
			40	40	40	60	2	25	-	25	150

1. **Prerequisite:** Computer Network, Operating System, Cryptography and network Security

2. Course Objectives: The course / instructor aims to

1. To understand the basic of ethical Hacking
2. To understand the various tools and techniques use for ethical hacking
3. To understand the concept of OS fingerprinting
4. To explore the knowledge of privilege escalation
5. To explore in linux system hacking
6. To explore Cyber Law

3. Course Outcomes: On successful completion of this course, learner/ student will be able to:

1. To understand the basic of ethical Hacking
2. To understand the various tools and techniques use for ethical hacking
3. To understand the concept of OS fingerprinting
4. To explore the knowledge of privilege escalation
5. To explore in linux system hacking
6. To explore Cyber Law

4. Detailed Theory Syllabus

SN	Module Name	Detailed Content	Hrs	COs
1	Introduction to Ethical Hacking, Ethics, and Legality	Defining Ethical Hacking ,Understanding the Purpose of Ethical Hacking,An Ethical Hacker's Skill Set, Ethical Hacking Terminology ,The Phases of Ethical Hacking Identifying Types of Hacking Technologies,Identifying Types of Ethical Hacks,Understanding Testing Types,How to Be Ethical,Performing a Penetration Test,	6	CO1
2	Gathering Target Information: Reconnaissance, Footprinting, and Social Engineering	Reconnaissance,Understanding Competitive Intelligence, Information-Gathering Methodology ,Footprinting, Using Google to Gather Information,Understanding DNS Enumeration,Understanding Whois and ARIN Lookups Identifying Types of DNS Records,Using Traceroute in Footprinting ,Understanding Email Tracking, Understanding Web Spiders,Social Engineering ,The Art of Manipulation,Types Social engineering-Attacks,Social-Engineering Countermeasures	8	CO2
3	Gathering Network and	Scanning,The CEH Scanning Methodology,Ping Sweep Techniques,nmap Command Switches,Scan Types,TCP	7	CO3

	Host Information: Scanning and Enumeration	Communication Flag Types ,War-Dialing Techniques,Banner Grabbing and OS Fingerprinting Techniques,Scanning Anonymously ,Enumeration ,Null Sessions ,SNMP Enumeration, Windows 2000 DNS Zone Transfer		
4	System Hacking: Password Cracking, Escalating Privileges, and Hiding Files	The Simplest Way to Get a Password,Types of Passwords,Passive Online Attacks ,Active Online Attacks ,Offline Attacks , Nonelectronic Attacks Cracking a Password,Understanding the LAN Manager Hash,Cracking Windows 2000 Passwords, Redirecting the SMB Logon to the Attacker, SMB Relay MITM Attacks and Countermeasures,NetBIOS DoS Attacks,Password-Cracking Countermeasures ,Understanding Keyloggers and Other Spyware Technologies,Escalating Privileges,ExecutingApplications,Buffer overflows,Understanding Rootkits,Planting Rootkits on Windows 2000 and XP Machines,Rootkit Embedded TCP/IP Stack, Rootkit Countermeasures, Hiding Files,NTFS File Streaming,NTFS Stream Countermeasures,Understanding Steganography Technologies , Covering Your Tracks and Erasing Evidence	6	CO4
5	Denial of Service and Session Hijacking	Denial of Service,How DDoS Attacks Work,How BOTs/BOTNETs Work ,Smurf and SYN Flood Attacks,DoS/DDoS Countermeasures,Session Hijacking, SequencePrediction,Dangers Posed by Session Hijacking,Preventing Session Hijacking Attacking Applications: SQL Injection,Wireless Network Hacking,Bypassing Network Security,Hacking Linux Systems	6	CO5
6	Cyber Law	Keeping It Legal,Cyber Security Enhancement Act and SPY ACT USC §1029 and 1030 ,U.S. State Laws,Federal Managers Financial Integrity Act ,Freedom of Information Act (FOIA) Federal Information Security Management Act (FISMA) Privacy Act of 1974 ,USA PATRIOT Act ,Government Paperwork Elimination Act (GPEA)Cyber Laws in Other Countries	6	CO6

5. DETAILED PRACTICAL SYLLABUS:

Lab Prerequisite: Knowledge of Digital Forensics

Suggested List of Experiments:

1. Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
2. Study of packet sniffer tools like wireshark, ethereal, tcpdump etc. Use the tools to do the following
   1. Observer performance in promiscuous as well as non-promiscuous mode.
   2. Show that packets can be traced based on different filters.
3. Download and install nmap. Use it with different options to scan open ports,perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc.
4. Detects ARP spoofing using open source tool ARPWATCH.
5. Use the Nessus tool to scan the network for vulnerabilities.
6. Implement a code to simulate buffer overflow attack.
7. Set up IPSEC under LINUX
8. Install IDS (e.g. SNORT) and study the logs.
9. Use of iptables in linux to create firewalls.

10. Case study on cyber Law

6. Theory Assessments:

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
   - Question paper will consist of 5 questions, each carrying 20 marks.
   - Total 3 questions need to be solved.
   - Q.1 will be compulsory, based on the entire syllabus.
   - Remaining questions will be randomly selected from all the modules.
   - Weightage of marks should be proportional to the number of hours assigned to each **module.**

7. Practical Assessments:

1. **Termwork Assessment:** Term Work shall consist of at least 8 practical's based on the above list. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).
2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

8. Text Books:

1. Certified Ethical Hacker STUDY GUIDE, Kimberly Graves
2. Hacking: The Art of Exploitation by Jon Erickson
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 312	Robotics and its Applications	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 312	Robotics and its Applications	40	40	40	60	25	25	-	150

1. Course Objectives:

The course is aimed to:

1. Learn the basics of Robots.
2. Learn the concepts of Direct and Inverse Kinematics of Robotics.
3. Learn the concepts of Motions, velocities and dynamic analysis of force.
4. Learn the concepts of Trajectory planning.
5. Learn the concepts of Motion Planning
6. Learn the concepts of Potential Functions and Visibility Graphs

2. Course Outcomes:

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

1. Apply the basic concepts of Robots.
2. Apply and evaluate the concepts of Direct and Inverse Kinematics of Robotics.
3. Apply and evaluate the Motions, velocities and dynamic analysis of force.
4. Apply and evaluate Trajectory Planning for rigid robots and mobile robots.
5. Apply the concepts of Motion planning.
6. Apply the concepts of Potential Functions and Visibility Graphs

3. Detailed Theory Syllabus:

zxzxxModule No	Module	Detailed Content	Hrs.
1	Introduction to Robotics	Robot Classification, Robot Components, Degrees of freedom, Joints, Coordinates, Coordinate frames, workspace, applications, Soft and Hard automation	3
2	Direct and Inverse Kinematics	Homogeneous transformation ,matrices, Inverse transformation matrices, Forward and inverse kinematic equations – position and orientation, Denavit- Hatenberg representation of forward kinematics, Inverse kinematic solutions, 4-axis Scara Robot	8
3	Motions, velocities and dynamic analysis of force	Differential relationship, Jacobian, Lagrangian mechanics, Moments of Inertia, Transformation of forces and moment between coordinate frames	6
4	Trajectory Planning	Trajectory planning, Joint-space trajectory planning, Cartesian-space trajectories	7
5	Motion Planning	Concept of motion planning, Bug Algorithms – Bug1, Bug2, Tangent Bug	5

6	Potential Functions and Visibility Graphs	Attractive/Repulsive potential, Gradient descent, wave-front planner, navigation potential functions, Visibility map, Generalized Voronoi diagrams and graphs	8

4. Suggested Experiments:

1. Forward Kinematics of Cylindrical Robot Coordinates
2. Forward Kinematics of 3 DOF Robot using D-H algorithm
3. Inverse Kinematics of 2 DOF Robots.
4. Inverse Kinematics of 3 DOF Robot
5. Inverse Kinematics of 3 DOF Robot Arm
6. Trajectory using Third Order Polynomial.
7. Simulation of BUG 2 Algorithm
8. Simulation of Tangent BUG
9. Simulation of Potential Field
10. Simulation of Visibility Graphs

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 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.

6. 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 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. Saeed Benjamin Niku, "Introduction to Robotics – Analysis, Control, Applications", Wiley India Pvt. Ltd., Second Edition, 2011
2. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia E. Kavraki and Sebastian Thrun, "Principles of Robot Motion – Theory, Algorithms and Implementations", Prentice-Hall of India, 2005.

B. References:

1. Mark W. Spong & M. Vidyasagar, "Robot Dynamics & Control", Wiley India Pvt. Ltd., Second Edition, 2004
2. John J. Craig, "Introduction to Robotics – Mechanics & Control", Third Edition, Pearson Education, India, 2009
3. Aaron Martinez & Enrique Fernandez, "Learning ROS for Robotics Programming", Shroff Publishers, First Edition, 2013.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 313	Distributed System	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 313	Distributed System	40	40	40	60	25	25	-	150

1. Course Objectives:

The course is aimed to:

1. To introduce basic concepts, goals, issues of distributed systems.
2. To introduce basic concepts of NOS,DOS and middleware.
3. To understand the concept of Inter process communications ,Message oriented communication, stream oriented communications.
4. To equip students with skills to analyse and design distributed applications.
5. To provide master skills to measure the performance of distributed synchronization algorithms.
6. To study emerging technologies and distributed file systems.

2. Course Outcomes:

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

1. Understand the basic elements and concepts related to distributed systems technologies.
2. Illustrate the middleware technologies that supports distributed applications such as RPC, RMI and object based middleware.
3. Analyse various techniques used for clock synchronization, election of coordinators and distributed mutual exclusion.
4. Demonstrate the concepts of resource and process management.
5. Demonstrate the concepts of consistency and replication.
6. Apply the knowledge of Distributed File System to analyse various file systems like NFS, AFS and the experience in building large-scale distributed applications.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	Introduction to Distributed Systems	Characterization of Distributed Systems: Issues, Goals, and Types of distributed systems, Distributed System Models, Middleware: Models of Middleware, Services offered by middleware, Comparison between DOS, NOS, middleware.	5
2	Communication	Interprocess communication, Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI), Message Oriented Communication ((IPC): MPI), Stream Oriented Communication, Group Communication (consistent, absolute, causal ordering)	8
3	Synchronization	Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm	8

		Non Token based Algorithms: Lamport Algorithm, Ricart–Agrawala's Algorithm, Token Based Algorithms: Raymond's Tree based algorithm(The spanning tree),Comparative Performance Analysis.	
4	Resource and Process Management	Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach. Introduction to Process management, process migration, threads, code migration.	6
5	Consistency, Replication and Fault Tolerance	Introduction to replication and consistency, Data-Centric and Client-Centric Consistency Models, Fault Tolerance: Introduction, Reliable client-server, Recovery	6
6	Distributed File Systems and Name Services	Introduction and features of DFS, File models, File Accessing models, File-Caching Schemes, File Replication, Case Study: Distributed File Systems (DSF), Network File System (NFS), Introduction to Name services and Domain Name System, Directory Services	5

4. Suggested Experiments:

1. To implement Remote Procedure Call/Remote Method Invocation.
2. To implement deadlock management in distributed systems.
3. To implement Logical Clock Synchronization algorithm(Lamport clock)
4. To implement an election algorithm.
5. To implement a distributed mutual exclusion algorithm(Token and non token based).
6. To implement Load balancing algorithm
7. To implement a multithreaded application.
8. To implement Name Resolution protocol.
9. Explore Distributed file system
10. Explore Distributed applications like CORBA.
11. Google case study.

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 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.

6. 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)

7. Books and References:

A. Books:

1. Andrew S. Tanenbaum and Maarten Van Steen, ―Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems:Concepts and Design", 4th Edition, Pearson Education, 2005.

B. References:

1. A. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
2. M. L. Liu, ―Distributed Computing Principles and Applications‖, Pearson Addison Wesley, 2004.
3. Pradeep K Sinha, “Distributed Operating Systems : Concepts and design”, IEEE computer society press.
4. Ajay D. Kshemkalyani, Mukesh Singhal “Distributed Computing Principles, Algorithms, and Systems.

BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING

(Semester VI)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 314	System Programming Compiler Construction	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 314	System Programming Compiler Construction	40	40	40	60	25	25	--	150

1. Course Objectives:

The course is aimed to:

1. To understand the role and functioning of various system programs over application programs.
2. To understand basic concepts and designing of assembler and Macro processor
3. To understand the role of static and dynamic loaders and linkers.
4. To understand the need to follow the syntax in writing an application program and to learn how the analysis phase of a compiler is designed to understand the programmer‘s requirements without ambiguity.
5. To understand the various parsers used in syntax analysis.
6. To synthesize the analysis phase outcomes to produce the object code that is efficient in terms of space and execution time.

2. Course Outcomes:

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

1. Identify the relevance of different system programs.
2. Describe the various data structures and passes of assembler design.
3. Identify the need for different features and designing of macros.
4. Distinguish different loaders and linkers and their contribution in developing efficient user applications.
5. Construct different parsers for given context free grammars.
6. Justify the need for analysis and synthesis phase to produce object code optimized in terms of high execution speed and less memory usage.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	Introduction to System Software	Concept of System Software, Goals of system softwares, system program and system programming, Introduction to various system programs such as Assembler, Macro processor, Loader, Linker, Compiler, Interpreter, Device Drivers, Operating system, Editors, Debuggers.	2

2	Assemblers	Elements of Assembly Language programming, Assembly scheme, pass structure of assembler, Assembler Design: Two pass assembler Design and single pass Assembler Design for Hypothetical machines , data structures used.	8
3	Macros and Macro Processor	Introduction, Macro definition and call, Features of Macro facility: Simple, parameterized, conditional and nested. Design of Two pass macro processor for Hypothetical machines, data structures used.	6
4	Loaders and Linkers	Introduction, functions of loaders, Relocation and Linking concept, Different loading schemes: Relocating loader, Direct Linking Loader, Dynamic linking and loading.	6
5	Compilers: Analysis Phase	Introduction to compilers, Phases of compilers: Lexical Analysis- Role of Finite State Automata in Lexical Analysis, Design of Lexical analyser, data structures used Syntax Analysis- Role of Context Free Grammar in Syntax analysis, Types of Parsers: Top down parser- LL(1), Bottom up parser- SR Parser, Operator precedence parser, SLR, Semantic Analysis, Syntax directed definitions.	10
6	Compilers: Synthesis phase	Intermediate Code Generation: Types of Intermediate codes: Syntax tree, Postfix notation, Three address codes: Triples and Quadruples, indirect triple Code Optimization: Need and sources of optimization, Code optimization techniques: Machine Dependent and Machine Independent. Code Generation: Issues in the design of code generator, code generation algorithm. Basic block and flow graph.	8

4. Suggested Experiments:

Software Requirements if any: Basic C, Java

1. Implementations of two pass Assembler
2. Implementation of single pass Macro Processor.
3. Implementation of Lexical Analyzer.
4. Implementation of Parser (Any one)
5. Implementation of Intermediate code generation phase of compiler
6. Implementation of code generation phase of compiler.
7. Study and implement experiments on LEX. YACC

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 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.

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. D. M Dhamdhere: Systems programming, Tata McGraw Hill
2. A. V. Aho, R. Shethi, Monica Lam , J.D. Ulman : Compilers Principles, Techniques and Tools , Pearson Education , Second Edition.
3. J. J. Donovan: Systems Programming Tata McGraw Hill Publishing Company
4. Modern Compiler. Implementation in Java, Second. Edition. Andrew W. Appel Princeton University. Jens Palsberg Purdue University. CAMBRIDGE.
5. Crafting a compiler with C, Charles N. Fischer, Ron K. Cytron, Richard J. LeBlanc .

B. References:

1. Lex & yacc, 2nd Edition by John R. Levine, Tony Mason & Doug Brown O‘Reilly
2. Compiler construction D,M. Dhamdhere second edition MACMILLAN.
3. Compiler construction : principles and practices , Kenneth C.Louden ,CENGAGE Learning
4. System software : An introduction to system programming , Leland L. Beck, Pearson
5. Lex & yacc, 2nd Edition by John R. Levine, Tony Mason & Doug Brown O‘Reilly
6. Compiler construction D,M.Dhamdhere second edition MACMILLAN.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 315	Artificial Intelligence and Cognitive Computing	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 315	Artificial Intelligence and Cognitive Computing	40	40	40	60	25	25	--	150

1. Course Objectives:

The course is aimed to:

1. To Conceptualize basic ideas of artificial intelligence and cognitive science
2. To distinguish various knowledge representation, planning and reasoning techniques.
3. To familiarize with various learning methods and uncertainty handling techniques
4. To distinguish various computational methods of cognitive science.

2. Course Outcomes:

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

1. Understand fundamentals of artificial intelligence and formulate problem statements along with problem solving techniques for intelligent agents.
2. Analyze and apply knowledge representation, planning and reasoning techniques
3. Choose appropriate learning method for given problem
4. Understand and handle uncertainty problems.
5. Understand cognitive computing with AI as the foundation.
6. Analyze and apply appropriate cognitive computational models for complex problems.

3.Software Requirements: Prolog, Python, Tensorflow, PDDL,Keras

4. Detailed Theory Syllabus:

Unit No.	Module	Detailed content	Hrs
1	Introduction to AI with Intelligent Agents and Problem solving techniques	Definition of AI, Types of AI, Application of AI, Definition of agent, types of agent, Automated problem solving, state space search, Informed Search- Best first Search, A*, AO*, Local search techniques- hill climbing- Scholastic, simulated annealing, Game tree search- min-max tree, α-β pruning	7
2	Knowledge, planning	Propositional logic, Propositional Logic to	8

	and Reasoning	Predicate Logic,Predicate Logic Fundamentals, Resolution Refutation, Constraint Satisfaction Problems, Planning - Block world problem, POP, GraphPlan	
3	Learning	Introduction to learning, types, Reinforcement learning-An n-Armed Bandit Problem, Finite Markov Decision Processes, Monte Carlo Methods, Temporal-Difference Learning, Approximate Solution Methods	8
4	Uncertainty	Handling Uncertainty, Axioms of Probability, Belief network, Inferences using belief networks, Dempster-Shafer Theory, Fuzzy Logic- crisp set, fuzzy set, membership function, operation on fuzzy set, fuzzy relation, composition of fuzzy set, fuzzy relation, composition of relation, fuzzy proposition, fuzzification, Defuzzification	7
5	Introduction to Cognitive Computing	Definition and overview of Cognitive Computing, Biological Neurons and Artificial Neural Network (ANN) Models, AI as the Foundation of Cognitive Computing, Architecture of Cognitive Computing.	3
6	Computational Models of Cognition	Definition and importance of Computational Models in Cognitive Science, Overview of Different types of Computational Models-Symbolic models, Connectionist networks, and Bayesian models, Real-world Applications of Cognitive computing and its Computational Models.	5

5.Suggested Experiments:

1.Identify a problem statement for an Intelligent Agent.

a. Solve 8 puzzle problem using A* Algorithm

b. Solve 8 queen problem using Local Search.

2. Formulate Constraint Satisfaction Problems:Cryptarithmetic Problem and Optimization Problem
3. Study of Prolog, PDDL.
4. To implement Plan for given planning problem using PDDL
5. To implement a multi-layer feed forward neural networks for any classification problem.
6. To implement a Baysian belief network to handle the uncertainty.
7. To perform sentiment analysis on written context.

6.Books and References:

A. Books:

1. Artificial intelligence : A Modern Approach, Stuart Russell, Peter Norvig, Prentice Hall,Fourth edition

2. Reinforcement Learning: An Introduction, Richard S. Sutton and Andrew G. Barto,Second edition.
3. Artificial Intelligence: Foundations of Computational Agents,David Poole and Alan Mackworth, second edition, Cambridge University Press
4. A first course in Artificial Intelligence, Deepak Khemani, McGraw Hill
5. Make Your Own Neural Network, Tariq Rashid
6. Practical Artificial Intelligence: Machine Learning, Bots, and Agent Solutions Using C#,Arnaldo Pérez Castaño
7. Applied Artificial Intelligence: A Handbook For Business Leaders, Mariya Yao, Adelyn Zhou, Marlene Jia
8. Cognitive Science- An introduction to the Science of the mind by Jose Luis Bermudez.
9. The Cambridge Handbook of Computational Cognitive Sciences by Ron Sun

References:

1. Artificial Intelligence (2nd ed) by Elaine Rich and Kevin Knight, McGraw Hill (1991).
2. Artificial Intelligence (3rd ed) by P H Winston, Addison-Wesley (1992)
3. AI-Structures and Strategies for Complex Problem Solving., George Lugar, . 4/e, 2002,Pearson Education.
4. https://courses.cs.washington.edu/courses/cse473/06sp/pddl.pdf
5. “Foundations of Cognitive Psychology: Core Readings" edited by Daniel J. Levitin
6. "The Oxford Handbook of Computational and Mathematical Psychology" edited by Jerome R. Busemeyer, Zheng Wang, James T. Townsend, and Amos Tversky
7. "Computational Models of Cognitive Processes: Proceedings of the 13th Neural Computation and Psychology Workshop" edited by R. West and T. Keane

7. 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 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.

8 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)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 316	Big Data Analysis	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 316	Big Data Analysis	40	40	40	60	25	-	25	150

1. Course Objectives:

The course is aimed to:

1. To provide an overview of an exciting growing field of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map-Reduce.
3. To introduce programming skills to build simple solutions using big data technologies such as NoSql, Map-Reduce and write the parallel algorithm for multi process execution.
4. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5. To enable students to have skills that will help them to solve complex real-world problems in decision support.

2. Course Outcomes:

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

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
3. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
4. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	Overview Of big data analytics	Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach Big Data Challenges, Examples of Big Data in Real Life, Big Data Applications	3
2	Data analytics using MapReduce/ Hadoop	Introduction to Big Data Frameworks: Hadoop, Core Hadoop Components; Hadoop Ecosystem-Overview, Hadoop Limitations. MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce, Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce	10
3	No SQL	Introduction to NoSQL, NoSQL Business Drivers, NoSQL Data Architecture Patterns: Key-value stores, Graph stores, Column family	6

		(Bigtable)stores, Document stores, Variations of NoSQL architectural patterns, NoSQL Case Study, NoSQL solution for big data, Understanding the types of big data problems; Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer; NoSQL systems to handle big data problems.	
4	Mining Data Streams	The Stream Data Model: A Data- Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream : Sampling Techniques. Filtering Streams: The Bloom Filter Counting Distinct Elements in a Stream : The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-Indyk-Motwani Algorithm, Query Answering in the DGIM Algorithm.	12
5	Finding Similar Items and Clustering	Distance Measures: Definition of a Distance Measure, Euclidean Distances, Jaccard Distance, Cosine Distance, Edit Distance, Hamming Distance. CURE Algorithm, Stream-Computing , A Stream-Clustering Algorithm, Initializing & Merging Buckets, Answering Queries.	10
6	Real-Time Big Data Models	PageRank Overview, Efficient computation of PageRank: PageRank Iteration Using MapReduce, Use of Combiners to Consolidate the Result Vector. Introduction to Recommendation System: content based Recommendation System, collaborative Recommendation System, hybrid Recommendation System. Issues and challenges Recommendation System ,	4

4. Suggested Experiments:

Software Requirements if any: Windows / Linux Desktop OS / Kali Linux, Hadoop, R studio, Mongodb

1. HDFS Basics, Hadoop Ecosystem Tools Overview.
   Installing Hadoop.
2. Copying File to Hadoop.
3. Copy from Hadoop File system and deleting file.
4. Moving and displaying files in HDFS.
5. Programming exercises on Hadoop.
6. To install and configure MongoDB/ Cassandra/ HBase/ Hypertable to execute NoSQL commands.
7. Experiment on Hadoop Map-Reduce / PySpark:
8. Write a program to implement a word count program using MapReduce.
9. Implementing simple algorithms in Map-Reduce: Matrix multiplication, Aggregates, Joins, Sorting, Searching, etc.
10. Implementing DGIM algorithm using any Programming Language/ Implement Bloom Filter using any programming language
11. Implementing any one Clustering algorithm (K-Means/CURE) using Map-Reduce
12. Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web)

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 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.

6. 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 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. CreAnand Rajaraman and Jeff Ullman Mining of Massive Datasets, Cambridge University Press,
2. Alex Holmes Hadoop in Practice, Manning Press, Dreamtech Press.
   3Dan Mcary and Ann Kelly Making Sense of NoSQL – A guide for managers and the rest of us Manning Press

B. **References:**

1. Anand Rajaraman and Jeff Ullman "Mining of Massive Datasets", Cambridge University Press
2. Alex Holmes "Hadoop in Practice", Manning Press, DreamTech Press. [3] Dan McCreary and Ann Kelly "Making Sense of NoSQL" – A guide for managers and the rest of us, Manning Press.
3. Bill Franks , "Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics", Wiley
4. Chuck Lam, "Hadoop in Action", Dreamtech Press
5. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies",
6. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf, O'Reilly Publications

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 318	Internet of Everything	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 318	Internet of Everything	40	40	40	60	25	-	25	150

1. Course Objectives:

The course is aimed to:

1. To learn the concepts of IOT.
2. To identify the different technologies.
3. To learn different applications in IOT.
4. To learn different protocols used in IOT.
5. To learn the concepts of smart city development in IOT.
6. To learn how to analyze the data in IOT.

2. Course Outcomes:

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

1. Apply the concepts of IOT.
2. Identify the different technologies.
3. Apply IOT to different applications.
4. Analysis and evaluate protocols used in IOT.
5. Design and develop smart city in IOT.
6. Analysis and evaluate the data received through sensors in IOT.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	Introduction	Definition of Internet of Everything (IoE), Pillars of IoE, Relationship between M2M, IoT and IoE, Objects and Identifier.	3
2	RFID Technology	Introduction, Principle, Components and Architecture of RFID, RFID middleware, Issues in RFID, IPv6 Addressing Schemes and Electronic Product Code, RFID Applications and case studies, Hardware issues.	8
3	RFID Protocols	Types of Protocols : Pure, Slotted, Frame slotted ALOHA, Tree protocols, Tree splitting algorithms, Binary search algorithms, Bitwise arbitration protocols, Main query tree protocols. Basic Differences between protocols.	8
4	Communication Protocols and Localization	Introduction to Wireless Sensor Network, Protocols: MQTT, CoAP, REST Transferring data, Basic Difference between Protocols, Security IoT Protocols and Technology: CoAP and DTLS, Localization, mobility management	8
5	Industrial Internet of Things	Introduction ,Industry 4.0 , Industrial Internet of Things (IIoT) , IIoT Architecture , Basic Technologies Applications and Challenges	8
6	Data Analytics for IoE	Big Data Analytics, Cloud and Fog Computing in the Internet of Things: IoT System Requirements, Cloud Computing in IoT	4

		,Advantages of Using the Cloud for IoT, Examples of Cloud - Based IoT	

4. Suggested Experiments:

Software Requirements if any: Arduino IDE, Tinkercad, Proteus

1. Create a Problem statement based on Survey, identify the Hardware and software requirement for their mini project problem statement.
2. Study of IoT architecture with respect to your mini project.
3. Identify and design the required hardware and sensors for your circuit board configuration.
4. Use suitable software and an emulator for coding the input devices and sensors.
5. Interface hardware with Web to publish or remotely access the data on the Internet.
6. Analyze the readings obtained in the project and identify its future scope
7. Documentation (PPT + Report) of mini-project and technical paper writing.

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 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.

6. 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)

7. Books and References:

A. Books:

1. Hassan, Q. F, "Internet of things A to Z: technologies and applications",Wiley; IEEE Press, 2018
2. Internet of Things connecting objects to the web, by Hakima Chaouchi, Wiley.
3. Internet of Things (A Hands-on-Approach) by Arshdeep Bhaga and Vijay Madisetti.
4. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
5. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3642-19156-5 e-ISBN 978-3-642-19157-2, Springer

B. References:

1. The Internet of Things (MIT Press) by Samuel Greengard.
2. The Internet of Things (Connecting objects to the web) by Hakima Chaouchi (Wiley Publications).
3. RFID and the Internet of Things, by Herve chabanne, Wiley
4. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 978-1-4493-9357-1

5. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess River Publishers, 2013, ISBN: 978-87-92982-96-4 (E-Book), ISBN: 978-87-92982-73-5 (Print)
6. "The Internet of Things Connecting Objects to the Web" Hakima Chaouchi, ISBN: 978-184821-140-7, Willy Publications
7. Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Manoel Carlos Ramon Apress, 2014.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 319	BlockChain Technology	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 319	BlockChain Technology	40	40	40	60	25	-	25	150

1. Course Objectives:

The course is aimed to:

1. Understand how blockchain systems work
2. To securely interact with Blockchains
3. Integrate ideas from blockchain technology into their own projects.
4. Understand distributed consensus mechanisms
5. Understand the concepts of decentralization in blockchain
6. Design, build, and deploy smart contracts and distributed applications using cryptocurrency

2. Course Outcomes:

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

1. Able to explore the working of blockchain systems
2. Able to securely interact with Blockchains
3. Able to Integrate ideas from blockchain technology into their own projects.
4. Able to explore distributed consensus mechanisms
5. Able to identify the concepts of decentralization in blockchain
6. Able to Design, build, and deploy smart contracts and distributed applications using cryptocurrency.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	Introduction to Blockchain Technology	Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Revolutionizing the Traditional Business Network, Tracing Blockchain's Origin, Key concepts of blockchain,	5
2	Blockchain 101	The growth of blockchain technology, Generic elements of a blockchain, Benefits and limitations of blockchain, Working principle, Types of blockchain, Tiers of blockchain technology, Features of a blockchain	6
3	Blockchain in Action: Use Cases	Financial Services, Insurance, Government, Supply Chain Management, Healthcare, Healthcare payments pre-authorization, The Internet of Things (IoT)	6
4	Distributed Consensus	Consensus mechanism, Types of consensus mechanisms, The structure of the network: consensus algorithm, CAP theorem and blockchain, SybilAttack, Energy utilization and alternate.	7
5	Decentralization Concepts in BlockChain	Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Blockchain and full ecosystem decentralization, Smart contracts, Definition, Ricardian contracts,	8

		Smart contract templates, Deploying smart contracts on a blockchain. Etherium: Concept, notion of decentralization, Ethereum mining, forking, and block architecture, Ethereum wallets and client interfaces , Comparison to bitcoin,.	
6	Cryptocurrency	History, Distributed Ledger, Hyperledger, a Linux Foundation Project, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, GHOST, Vulnerability, Attacks, Sidechain.	7

4. Suggested Experiments:

Software Requirements if any: Python, Java Scripts, Geth

1. Implementation of any symmetric and asymmetric cryptosystem.
2. Simple blockchain implementation in any suitable programming language
3. Block chain implementation with database
4. Smart contract with token/coin.
5. Smart Contract to solve/optimize a problem using Ethereum
6. Use Geth to Implement Private Ethereum BlockChain
7. Create a DApp, with Ethereum
8. Build Hyperledger Fabric Client Application.
9. Build Hyperledger Fabric with Smart Contract
10. Create a Case study of BlockChain being used in illegal activities in the real world.

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 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.

6. 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)

7. Books and References:

A. Books:

1. Blockchain IBM Limited Edition by Manav Gupta
2. Mastering Blockchain Second Edition by Imran Bashir
3. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions Joseph J. Bambara Paul R. Allen, Copyright © 2018 by McGraw-Hill Education.
4. A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph J. Bambara Paul R. Allen
5. Ethereum Smart Contract Development, Mayukh Mukhopadhyay, packt
6. Blockchain A Beginners Guide, BlockchainHub

B. References:

1. BLOCKCHAIN BASICS A NON-TECHNICAL INTRODUCTION IN 25 STEPS
2. Introduction to Blockchain Technology Author: Tiana Laurence
3. Mastering Etherium, Andreas M. Antonopoulos, O'relly
4. Mastering Bitcoin by Andreas M. Antonopoulos, O'relly
5. Mastering Blockchain, ImranBashir,packt
6. https://solidity.readthedocs.io/en/v0.6.2/
7. Bitcoin whitepaper
8. Blockchain For Dummies, Tiana Laurence

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 320	Natural Language Processing	Contact Hours	03	02	-	5
		Credits	03	01	-	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 320	Natural Language Processing	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. To understand natural language processing and to learn how to apply basic algorithms in this field.
2. To understand the basic text processing techniques and significance of morphology.
3. To get acquainted with the basic concepts and algorithmic description of the main language levels: syntax, semantics.
4. To understand language models generation and applications.
5. To recognize the significance of pragmatics and discourse for natural language understanding.
6. To design and implement applications based on natural language processing

2. Course Outcomes:

On successful completion of course learners student:

1. Have a broad understanding of the field of natural language processing.
2. Be able to apply text processing techniques and analysis of morphology of text
3. Be able to model linguistic phenomena with formal grammars and design semantic structure
4. Be able to create language model and apply it for NLP applications
5. Understand the mathematical and linguistic foundations underlying approaches to analyze pragmatic and resolve coreference
6. Be able to apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction...etc.

3. Detailed Theory Syllabus:

Prerequisite: Data structure & Algorithms, Theory of computer science, Probability Theory.

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction	Introduction, Need of NLP, Goals of NLP, History of NLP , Generic NLP system, Knowledge of Language, Ambiguity in Natural language, Stages in NLP, Challenges of NLP, Applications of NLP	3
2	Morphology analysis and Language modeling	Tokenization, Morphology analysis, Survey of English Morphology, Inflectional morphology & Derivational morphology, Stemming, Lemmatization, Regular expression Morphological Models : Dictionary lookup, Finite state Morphological parsing, Finite State Transducer, Applications of Morphology N-grams and its variation: Bigram, Trigram, Language model, N-grams Language model, N-grams Challenges, N-gram for spelling correction	8

3	Syntax analysis	Part-Of-Speech tagging(POS), Tag set for English (Penn Treebank), Difficulties /Challenges in POS tagging, Rule based POS tagging, Stochastic POS tagging, Transformation-based Tagging, Hidden Markov Model (HMM Viterbi) for POS tagging; Issues in HMM POS tagging Parsers: Parsing With Context Free Grammar, Constituency Parsing, Top down parser; Bottom Up Parser: Problems areas of Context Free Grammars: Agreement, Subcategorization, Movement, Challenges of Parsing Natural Language, Sequence labeling, Methods of Sequence Labeling: Hidden Markov Model (HMM), Maximum Entropy, Conditional Random Field (CRF), Applications of Syntax analysis	8
4	Semantic Analysis	Lexical Semantics, Compositional semantics, Semantic analysis vs. other areas of natural language processing, Approaches to semantic analysis: Predicate logic, Statistical approach, Information Retrieval, Domain knowledge driven analysis, Applications of semantic analysis, Challenges in semantic analysis, Attachment for fragment of English sentences, Representing Meaning, Lexeme and Lexicon, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, WordNet Relations, WordNet Application, Word Sense Disambiguation (WSD), Approaches and Methods to Word Sense Disambiguation (WSD), Challenges in WSD	6
5	Discourse Context and World Knowledge	Pragmatic analysis: Five aspects of pragmatics Discourse - reference resolution: Reference Phenomena, Syntactic and Semantic Constraints on Coreference, Preferences in Pronoun Interpretation, An Algorithm for Pronoun Resolution Coreference Resolution- Coreference, Distinctions in Coreference, Coreference Resolution, Hobbs Algorithm, Why Coreference Resolution is Hard, Coreference vs. Anaphora, Application	6
6	Applications of NLP	Machine Translation, Information Retrieval, Question Answers System, Text Categorization, Summarization, Sentiment analysis, Named Entity Recognition, Plagiarism Detection	8

4. Suggested Experiments:

- **A.** Write a program to implement tokenization, filtration and script validation, stop words, stemming, part of speech tagging, named entity recognition, lemmatization, corpora, wordnet and morphology.
- **B.** Write a program to generate a parse tree from text and extract nouns and verb phrases of text.
- **C.** Natural Language Processing case study for News classification.

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) = 10 Marks (Mini Project) + 5 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

7. Books and References:

A. Books:

1. Sharvari Govilkar, Sagar Kulkarni, Dhiraj Amin ― Natural Language Processing, 2018, StartEDU solutions.
2. Daniel Jurafsky, James H. Martin ―Speech and Language Processing‖ Second Edition, Prentice Hall, 2008.
3. Christopher D.Manning and Hinrich Schutze, ― Foundations of Statistical Natural Language Processing ―, MIT Press, 1999.

B. References:

1. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
2. Daniel M Bikel and ImedZitouni ― Multilingual natural language processing applications Pearson, 2013.
3. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) ― The Handbook of Computational Linguistics and Natural Language Processing
4. Steven Bird, Ewan Klein, Natural Language Processing with Python, O‘Reilly
5. Brian Neil Levine, An Introduction to R Programming
6. Niel J le Roux, Sugnet Lubbe, A step by step tutorial: An introduction into R application and programming.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 322	Digital Image Processing	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 322	Digital Image Processing	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. To learn about sampling and reconstruction
2. To understand spatial domain image enhancement techniques.
3. To apply image transform operations like DFT and DCT
4. To learn about edge detection techniques
5. To understand image compression techniques like Huffman coding
6. To understand binary image processing operations

2. Course Outcomes:

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

1. Sample and Reconstruct a signal.
2. Implement Image Enhancement Techniques.(**Apply Image Enhancement Techniques.**)
3. Implement operations like DFT and DCT (image transform
4. Implement Edge Detection techniques using first order Derivative Filters.**(Analyse Edge Detection techniques)**
5. Implement Image Compression Algorithms
6. Perform Binary Image Processing Operations.

3. Detailed Theory Syllabus:

Prerequisite: Computer CGVR

Module No	Module	Detailed Contents of Module	Hrs.
1	Image Fundamentals	Introduction, Origin, Fundamental Steps in Digital Image Processing, Applications of Digital Image Processing, Components of digital image processing system, Image Sampling and Quantization, Pixel connectivity, Distance Transform	5
2	Enhancement in Spatial Domain	Introduction, Point Operation, Zero memory point operations , Histogram Processing, Image smoothening, Sharpening of the Image.	8
3	Image Transforms	Introduction, Need for transform, Fourier Transform, 2D Discrete Fourier Transform, Properties of 2D DFT(without proof), Hadamard Transform, Walsh Transform, FFT, Discrete Cosine Transform (2D-DCT), Introduction to wavelet transform	8

4	Image Segmentation	Introduction, Classification, region based segmentation, Image segmentation based on thresholding- Local and Global, Segmentation based on discontinuities - Edge , line and Point Detection	8
5	Image Compression	Introduction, Redundancy, Fidelity Criteria, Classification of Image Compression Techniques, Run-length Coding, Huffman Coding, Improved Gray Scale Quantization,Vector Quantization	7
6	Binary Image Processing	Introduction, Structuring element, Binary Morphological Operators, Hit-or-Miss Transformation, Boundary Extraction	3

4. Suggested Experiments:

Software Requirements if any:

1. Sampling and Reconstruction
2. To perform Discrete Correlation
3. To perform Discrete Convolution
4. To perform Discrete Fourier Transform
5. To perform Fast Fourier Transform
7. Implementation of Image negative, Gray level Slicing and Thresholding
8. Implementation of Contrast Stretching ,Dynamic range compression & Bit plane Slicing
9. Implementation of Histogram Processing
10. Implementation of Image smoothing/ Image sharpening
11. Implementation of Edge detection using Sobel and Prewitt masks

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 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.

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. Rafel C. Gonzalez and Richard E. Woods, 'Digital Image Processing', Pearson Education Asia, Third Edition, 2009,

2. S. Jayaraman, E.Esakkirajan and T.Veerkumar, "Digital Image Processing" Tata McGraw Hill Education Private Ltd, 2009,

3. S. Sridhar, "Digital Image Processing", Oxford University Press, Second Edition, 2012.

4. Anil K. Jain, “Fundamentals and Digital Image Processing”, Prentice Hall of India Private Ltd, Third Edition

B. References:

1. B. Chandra and D.Dutta Majumder, “Digital Image Processing and Analysis”, Prentice Hall of India Private Ltd, 2011
2. Dwayne Phillps, “Image Processing in C”, BPB Publication, 2006
3. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, Prentice Hall of India Private Ltd, Third Edition

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 323	Human Computer Interaction	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 323	Human Computer Interaction	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. Understand the history of screen designing.
2. Understand the importance of human characteristics, design goals and business functions in interface design.
3. Understand functions of Menus, Windows and importance of graphical user interface.
4. Understand characteristics and selection of device based controls.
5. Understand different types of software tools to design interfaces.
6. Understand various design technologies to meet user requirements..

2. Course Outcomes:

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

1. Describe and apply core theories, models and methodologies from the field of HCI
2. Identify User Interface (UI) design principles.
3. Apply an interactive design process and universal design principles to designing HCI systems.
4. Evaluate interactive software using guidelines from human factor theories.
5. Conduct user and task analysis
6. Implement graphical user interfaces with modern software tools

3. Detailed Theory Syllabus:

Prerequisite: GUI Basics

Module No	Module	Detailed Contents of Module	Hrs.
1	Overview of HCI	Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user	5
2	Design process	Design process: Human interaction with computers, importance of human characteristics, human consideration, and Human interaction speeds, understanding business functions. Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design	8
3	System Menus	System Menus – Structures of Menus, Functions of Menus, Content of Menus, Kinds of Graphical menus. Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Graphics: Icons, Multimedia, colors, uses problems, choosing colors.	5
4	Controls	CONTROLS: Characteristics of device based controls, Selecting the proper device based controls, Operable controls, Text Entry/Read-only controls, Selection controls, Combination Entry/selection controls, Selecting the proper controls.	5
5	HCI in the software process,	HCI in the software process, The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multimodal interaction	8
6	Software Tools	SOFTWARE TOOLS: Specification methods, Interface, Building tools, Interaction devices, Keyboard and function keys, Pointing devices, Speech recognition digitization and generation, Image and video displays, Drivers.	5

4. Suggested Experiments:

1. To understand the trouble of interacting with machines – Redesign interfaces of home appliances.
2. Design a system based on a user-centered approach.
3. Understand the principles of good screen design.
4. Redesign existing Graphical User Interface with screen complexity
5. Design Web User Interface
6. Implementation of Different Kinds of Menus
7. Implementation of Different Kinds of Windows
8. Design a system with proper guidelines for icons

9. Design website using interface design rules
10. Design mobile app using interface design rules

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 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.

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. The essential guide to user interface design, Wilbert O Galitz, Wiley DreamTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.
3. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004.

B. References:

1. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech,
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Donald A. Norman, “The design of everyday things”, Basic book

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

1. Course Objectives:

The course is aimed to:

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

2. Course Outcomes:

On successful completion of course learner/student 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 the 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.

3. Detailed Theory Syllabus:

Module No	Module	Detailed 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 Co-operation 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 licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board	7
3	Copyright	Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound	6

		recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights	
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

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 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.

7. Books and References:

A. Books:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

B. References:

1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
2. 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 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

1. Course Objectives:

The course is aimed to:

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, viscoelasticity 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

2. Course Outcomes:

On successful completion of course learner/student 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.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	Introduction	Definition of Biomechanics, Selected Historical highlights, The Italian Renaissance, Gait century, Engineering Physiology & Anatomy	6
2	Tissue Biomechanics	Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell & Voight models – anisotropy. Structure and functions of Soft Tissues: Cartilage, Tendon, Ligament, and Muscle	8

3	Joints Biomechanics	Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, hip, knee and ankle.	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	Applications	Application of advanced engineering techniques to the human body, case studies.	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 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.

7. Books and References:

A. Books:

1. Nigg, B.M.and Herzog, W., "BIOMECHANICS of Musculoskeletal system", John Willey & 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. Prof. Ghista,Biomechanics, Private Publication UAF, 2009
5. White &Puyator, Biomechanics, Private publication UAE, 2010

B. References:

1. R. M. Kennedy, A textbook of Biomedical Engineering, GTU, 2010
2. Richard Shalak & ShuChien, Handbook of Bioengineering,
3. Sean P. Flanagan, Flanagan, Biomechanics: A case based Approach, Jones & Bartlett Publishers, 2013
4. Y. C. Fung, Yuan-Cheng Fung, Biomechanics: Mechanical Property of Living Tissue, Springer, 1996.
5. 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	Product Design	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	Product Design	40	40	40	60	--	--	--	100

1. Course Objectives:

The course is aimed to:

1. To familiarize with fundamental product design concepts
2. To acquaint with product design methodologies
3. To understand product design needs and issues in industry

2. Course Outcomes:

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

1. Demonstrate product design and development process.
2. Analyze a product in perspective of aesthetic and ergonomic considerations.
3. Illustrate considerations of Design for Manufacturing and Assembly in product development.
4. Apply appropriate tools and techniques in the design of solutions that are usable and functional for various applications.
5. Design the products as per the customer/industry requirements
6. Apply principles of economy and demonstrate legal and social issues pertaining to product development.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	Introduction	Product definition, specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, Concept generation and evaluation methods, product architecture, Product life cycle Management with case studies, Product analysis. Creativity and Idea generation technique, importance of Quality Dimensions: Performance, Features, aesthetics, Ergonomics, Reliability, Sustainability, Serviceability, Brand value, Value Vs cost, Importance of shape, color, feature & Resemblance.	6
2	Design Factors	Design Factors: Ergonomics, Aesthetics, Anthropometry, Comforts, Economic factors Axiomatic design principles and case studies. Design Thinking, Design by Innovation and collaboration Material and Process selection Methods, Expert systems. Computer Database Approach, performance indices decision matrix, AHP and fuzzy approach, Introduction to material and process selection software.	6
3	Design for Manufacturing, Assembly,	Design for Manufacturing (DFM) and Design for Assembly (DFA) Designs for Maintainability and Reliability and some methods for	8

	Maintainability and Reliability	reliability assessment, Designs for Environment, Design for Robustness: Taguchi Designs & Design of Experiments (DOE).	
4	Product Design Tools and Techniques	Product Design Tools and Techniques: Value Engineering / Value Analysis: definition, methodology-FAST, Benchmarking, Supplier involvement robust design, QFD, Design & process FMEA. Reverse Engineering, Concurrent engineering & Sequential engineering, Case studies.	8
5	Product Development Cycle	Product Development Cycle and Importance of Prototyping. Types of prototypes. Principal and advantages & Different Type of Generative Manufacturing process, Viz. Stereo lithography. FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Consideration. Introduction to Assembly Modeling, Top-Down and Bottom-Up Approaches of AM, Mating Conditions, representation Schemes. Generation of Assembly Sequences. Case studies	6
6	Economics of Product Development	Economics of Product Development: Product costing, Principals of Economy, Engineering Economy and Design Process, Economic Analysis, Inflation, Time Value of Money, Numerical on Internal Rate of Return and Net Present Value (NPV) method. Legal and social issues, Patents and IP acts.	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 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.

7. Books and References:

A. Books:

1. Product Design and Manufacturing by A.K.Chitale, R.C.Gupta, PHI.
2. Product Design and Development by Ulirich Karl T. and Eppinger Steven D, McGraw Hill.
3. Engineering Design by Dieter George E., McGraw Hill.

B. References:

1. Handbook of Product Design for Manufacturing by Bralla, James G, McGraw Hill.
2.Product Design by Kevin Otto & Kristin Wood

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 364	Visual Art	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	Total					
IL 364	Visual Art	10	10	20	40	--	40	--	100

1. Course Objectives:

The course is aimed to:

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.

2. Course Outcomes:

On successful completion of course learner/student 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.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	History of Art and Architecture	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	Introduction and concepts of visual design with special emphasis on the psychological impact of colour	5
3	Introduction to image editing software tools	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	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

5	Creative writing	Creative writing- Movie critique, book reviews, Poems, short plays and skits, Humorous Essays, Autobiography and short stories.	7
6	Creative sculpture	Creative sculpture- Introduction to clay modelling techniques, study of natural and man-made objects in clay, Sculpture with various materials -	7

4. Assessment:

Internal Assessment:

Test 1 : 10 marks (Practical)
Test 2 : 10 marks (Practical)
Total : 20 marks

End Semester Examination:

Theory : 40 marks
Practical : 40 marks

7. Books and References:

A. 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.

B. References:

1. 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.
2. Élisabeth Bonvalot. (2020). Sculpting Book: A Complete Introduction to Modeling the Human Figure

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 366	**Computational 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 366	**Computational Physics**	**40**	**40**	**40**	**60**	**--**	**--**	**--**	**100**

1. Course Objectives:

The course is aimed to:

1. To expose the students to the vast field of computational physics.

2. Course Outcomes:

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

1. To understand various approaches of simulating physical systems on a computer.
2. To choose the correct method to solve a computational problem.

3. Detailed Theory Syllabus:

Module No	Detailed Content	Hrs.
1	Thermodynamics and kinetic theory, specification of state of system, Concept of ensemble, phase space, microcanonical ensemble (NVE), statistical concept of temperature, canonical ensemble (NVT), equipartition theorem, Maxwell-Boltzmann velocity distribution, grand canonical ensemble (μVT), chemical potential	6

2	Molecular Dynamics (MD): Integrating equation of motion of a few variables, role of molecular dynamics (MD), the basic machinery, Lennard-Jones potentials modeling physical system, boundary conditions, time integration algorithm	7
3	Starting a simulation, simulation of microcanonical (NVE) and canonical ensemble (NVT), controlling the system (temperature, pressure), thermostats and barostats, equilibration, running, measuring and analyzing MD simulation data, measurement of statistical quantities, interatomic potentials, force fields.	7
4	Monte Carlo (MC) Method : Random number: Definition, True and Pseudo random number generators (RNG), uniform and non-uniform RNG, Linux RNG, testing a RNG.	6
5	Monte Carlo simulations : Buffon's needles, MC Integration, hit and miss (estimation of pi and e), stochastic processes, sample mean integration, importance sampling, Markov Chain, Metropolis method, master equation, introduction to 2D-Ising model. Random walk: 1-D and 2-D random walk, calculation of rms displacement.	7
6	Introduction to Simulations of quantum systems	3

4. Assessment:

Internal Assessment:
Internal Examination : 20 marks
Internal Term work : 20 marks

End Semester Examination:

Theory : 40 marks
Practical Examination : 20 Marks

5. Books and References:

1. Statistical Physics – Vol. 5 (from the series of Berkeley Physics Course)
2. Introduction to Computational Physics by Tao Pang (Cambridge University Press)
3. An Introduction to Computer Simulation Methods: Applications to Physical Systems by Harvey Gould and
4. Jan Tobochnik, (Pearsom Publications)
5. Understanding Molecular Simulations by Frenkel and Smit (Academic Press)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 368	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 368	Vehicle Safety	40	40	40	60	--	--	--	100

1. Course Objectives:

The course is aimed to:

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

2. Course Outcomes:

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

1. Comprehend Vehicle design from a safety point of view.
2. Apply concepts of accident reconstruction analysis in the 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

3. Detailed Theory Syllabus:

Module No	Module	Detailed Content	Hrs.
1	Introduction to vehicle safety	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	Crash and distracted driver, Human error control, Crash Testing, Use of Dummies, evolution and build 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	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	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	Anti-Lock braking system	Anti-Lock braking system, Electronic Stability Program, Low tire pressure warning system, Collision avoidance systems	5

6	Safety Activity	Basic Vehicle Operations and Road/Helmet Safety Activity	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 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.

7. Books and References:

A. Books:

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.

B. References:

1. Automotive Safety Handbook by Ulrich W. Seiffert and LotharWech, SAE International, 2007
2. Public Safety Standards of the Republic of India

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE 391	Project A	Contact Hours	-	6	-	6
		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 391	Project A	—	—	—	—	50	—	25	75

1. Project A Objectives:
Students will try to:

1. To offer students a glimpse into real world problems and challenges that need IT based solutions
2. To enable students to create very precise specifications of the IT solution to be designed.
3. To introduce students to the vast array of literature available of the various research challenges in the field of IT
4. To create awareness among the students of the characteristics of several domain areas where IT can be effectively used.
5. To enable students to use all concepts of IT in creating a solution for a problem
6. To improve the team building, communication and management skills of the students.

2. Project A Outcomes:
On successful completion of Mini Project learner/student will be able to:

1. Discover potential research areas in the field of IT
2. Conduct a survey of several available literature in the preferred field of study
3. Compare and contrast the several existing solutions for research challenge
4. Demonstrate an ability to work in teams and manage the conduct of the research study.
5. Formulate and propose a plan for creating a solution for the research plan identified
6. To report and present the findings of the study conducted in the preferred domain

3. Guidelines:

1. The project work is to be conducted by a group of three students
2. Each group will be associated with a project mentor/guide. The group should meet with the project mentor/guide periodically and record of the meetings and work discussed must be documented
3. Department has to allocate half a day for project work in VI semester, 1 day in VII semester and 2 day in VIII semester every week.
4. To encourage project based learning in the curriculum students may identify their technical domain area in semester VI and can perform the Mini-project in the VI semester or students may do literature survey
5. Each group along with its guide/mentor shall identify a potential research area/problem domain, on which the study is to be conducted.
6. Each team will do a rigorous literature survey of the problem domain by reading and understanding at least 3-5 research papers from current good quality national/international journals/conferences. (Papers selected must be indexed by Scopus/IEEE/Springer/ACM etc.). The list of papers surveyed must be clearly documented.

7. The project assessment for term work will be done at least two times at department level by giving presentation to panel members which consist of at least three (3) members as Internal examiners (including the project guide/mentor) appointed by the Head of the department of respective Programme.
8. A report is to be prepared summarizing the findings of the literature survey. A comparative evaluation of the different techniques surveyed is also to be done.
9. Teams must analyze all the results obtained by comparing with other standard techniques.
10. Every team must publish their work in national / international conferences/journals (if possible publish in Scopus indexed journals).
11. The team will finally propose a plan for project work to be continued in the final year.
12. Semester VII to carry out the project good quality project and all these project parts.

4. Project Evaluation:

1. Each team has to give a presentation/demo to the Internal Panel and External examiner.
2. Each team will prepare a report that will summarize the results of the literature survey and the project proposal. The list of papers surveyed must be clearly documented.
3. Each group will be jointly evaluated by a team of Internal and External Examiners approved by the University of Mumbai.
4. Oral exams will be conducted on the project done by the students.

5. **Project Assessment:**

Term Work:

1. Term Work shall consist of a full Mini Project on above guidelines/syllabus.
2. Term Work Marks: 50 Marks

Oral Exam:

1. An Oral exam will be held based on the Mini Project and Presentation.
2. Oral Exam Marks: 25 marks

BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING

(Semester VII)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE400TL	Data Science	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					
CE400TL	Data Science	40	40	40	60	25	25	--	150

1. Course Objectives:

The course is aimed to:

1. To understand the foundations of the Data Science process, methods and techniques.
2. To understand management of data and make predictions over the data.
3. To understand the principles of text analytics.
4. To understand why visualization is an important part of data analysis.
5. To understand the ethical responsibilities of data scientists and organizations.
6. To work on various applications of data science.

2. Course Outcomes:

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

1. Learn the fundamentals of data science to enable, reproduce and scalable data from a variety of sources.
2. Generate and process dataset and develop models for prediction
3. Analyze text for common theme and trends
4. Design visualizations and narrate stores based on data
5. Develop data science project ethically
6. Analyze importance and impact of data science in varied applications

3. Detailed Theory Syllabus:

Prerequisite: BDA, ML, DBMS, Python, NLP

Module No	Module	Detailed Contents of Module	Hrs.

1	Introduction to data science	Definition, working, defining goal, benefits and uses of Data Science, Data science vs BI, The data science process, Role of a Data Scientist.	5
2	Data management and Predictive modeling	Data management - Understanding how to create the data set, Data collection methods, Data preparation - importance of data 'cleaning', validity and quality. Data analysis - how format and volume of data limits methods of analysis available Predictive Modeling - Probability and Statistics Basics, Common machine learning models, Feature engineering, Model selection, Performance metrics and hyperparameter optimization, Model Deployment	8
3	Text Analytics	Introduction to text Analytics, Need of Text Analytics, Understanding Text, Cleaning Text Data Sets, Text Classification, Text Clustering, Text mining techniques	5
4	Data visualization and communication	Identifying audience requirements, Data scientist as 'storyteller', Building a narrative, Explaining the technical - how to communicate the role played by ML and/or AI techniques resulting in an informed audience, Introduction to Data Visualization, Visualization Tools(Area Plots, Histograms ,Bar Charts, Pie Charts, Box Plots, Scatter Plots, Waffle Charts, Word Clouds), Visualizing Geospatial Data, visualizing time series data, Importance of data visualization Dashboards	8
5	Ethics of data science	Responsibilities of actuaries around data science and AI, Data Science Ethics, Doing good data science, Owners of the data, Valuing different aspects of privacy, Getting informed consent, The Five Cs, Developing ethical and professional safeguards	5
6	Applications	Healthcare, Banking, Finance, Sports, Advertisement, Transport, Tourism	5

4. Suggested Experiments:

1. Implement using any tools or language the process of dataset creation (Data Acquisition, Data Cleaning, Data Labelling)
2. Perform Exploratory data analysis on the generated dataset
3. Perform Predictive data analytics using open source tools or language
4. Perform Text Analysis Operations(Cleaning, Classification, Clustering using any tools or any open source package on text dataset.
5. Perform Data Visualization by using various Visualization Tools(Area Plots, Histograms ,Bar Charts, Pie Charts, Box Plots, Scatter Plots, Waffle Charts, Word Clouds) and generate data visualization dashboard
6. Case study on Understanding and Implementing Data Science Ethics
7. Case study or Mini project on application of data science in(Healthcare, Banking, Finance, Sports, Advertisement, Transport, Tourism)

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 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.

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:

1. Davy Cielen, Meysman, Mohamed Ali, “Introducing Data Science”, Dreamtech Press
2. Kevin P. Murphy, “Machine Learning a Probabilistic Perspective”, The MIT Press
3. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O’ Reilly, 1st edition, 2018
4. Noel Cressie, Christopher K. Wikle , “Statistics for Spatio-Temporal Data, Wiley
5. Rachel Schutt and Cathy O’Neil, “Doing Data Science”, O’Reilly Media
6. Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly Media
7. EMC Education Services,”Data Science and Big Data Analytics”,Wiley

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE401TL	Information and Cloud 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					
CE401TL	Information and Cloud Security	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. To introduce the concepts of Information Security, Vulnerabilities, Threat and Risk Assessment.
2. To explore the concepts of Unintentional (Non Malicious) Programming, Malicious Code and Malwares.
3. To explore the concepts of Linux/Windows Operating System vulnerabilities and security.
4. To explore the concepts of Database Security.
5. To understand IT Security Management and Risk Assessment and web application security.
6. To explore cloud privacy and Security.

2. Course Outcomes:

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

1. To understand the concepts of Information Security, Vulnerabilities, Threat and Risk Assessment.
2. To understand the concepts of Unintentional (Non Malicious) Programming, Malicious Code and Malwares.
3. To be able to apply the concepts of security in Linux/Windows Operating System to protect against vulnerability.
4. To be able to apply the knowledge of Database Security to protect the Information.
5. Able to understand about IT Security Management and apply the knowledge of security principles to protect web applications.
6. To be able to apply the knowledge of security for cloud data storage and secure server - client configuration.

3. Detailed Theory Syllabus:

Prerequisite: Computer Networks, Operating Systems, Cryptography and Network Security.

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Information Security	Security Goals, Computer Security Concepts (CIA), Attacks and Assets, Vulnerabilities, Threat and Risk Assessment, Types of assessments for Information Security, Authentication, Authorization and Access Control Policies, FIM	6
2	Program and Programming Security	Software Flaws - Unintentional (Non Malicious), Programming - Buffer Overflow, Incomplete Mediation, Race Conditions, Malicious Code—Malware -Malware—Viruses, Trojan Horses, and Worms, Miscellaneous Software Based Attacks - Salami Attacks, Linearization Attacks, Covert Channel, Control Against Program Threats, Countermeasures for Users and Developers	7
3	Operating Systems and Security	OS Security Functions, Security in the Design of Operating, Systems, Memory and address Protection , File Protection, User Authentication Linux and Windows Vulnerabilities, File System Security	7
4	Database Security and Network Security	Introduction to Databases, Security Requirements of Databases, Reliability and Integrity of Databases, Database Disclosure, Threats in Network, Firewall, IDS, Secure E-Mail, Security Information and Event Management (SIEM)	6
5	IT Security Management Web application security	IT Security Management and Risk Assessment, IT Security Controls, Plans, and Procedures , Top 10 OWASP, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks	5
6	Cloud privacy and security Issue	Cloud Security Issues and Threats, Data security and Storage, Cloud Security Risks and Countermeasures, Data Protection in Cloud, Cloud Application Security, Cloud Identity and Access Management, Cloud Security as a Service, SAML, OAuth	8

4. Suggested Experiments:

Software Requirements if any:

1. Exploring Kali Linux and the inbuilt tools for reconnaissance
2. Exploring Authentication and access control using RADIUS, TACACS and TACACS+
3. Configure a local user account on Router and configure authenticate on the console and vty lines using local AAA
4. Exploring Router setting up access lists using Cisco Packet tracer(student edition)
5. Exploring VPN security using Cisco Packet tracer(student edition)
6. Implementation of Buffer overflow attack and its analysis using Splint, Cppcheck etc.
7. Static code analysis using open source tools like RATS, Flawfinder etc.
8. Setting up personal Firewall using Iptables
9. Verify connectivity among devices before firewall configuration
10. Detect SQL injection vulnerabilities in a website database using SQLMap
11. Implementation and analysis of SQL injection Attack
12. Identity Management in Cloud Concept: Simulate identity management in your private cloud. Technology: Open Stack 2
13. Implementation of OAuth for sign up

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 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.

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. Information Security The Complete Reference 2nd Edition Mark Rhodes-Ousley McGraw Hill Education
2. Information Security Principles and Practice 2nd edition by Mark Stamp, Wiley Publications
3. Security in Computing FIFTH EDITION Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Prentice Hall Publications
4. Cloud Security and Privacy, Tim Mather, Subra Kumaraswamy, Shahed Latif , O'Riely

B. References:

1. Computer Security Principles and Practice Third Edition William Stallings, Lawrie Brown Pearson Publications.
2. Computer Security, Dieter Gollman, Third Edition, Wiley
3. Cloud Computing Principles and Paradigms, Rajkumar Buyya Wiley
4. Cloud security, Ronald L. Wiley Publication

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE402TL	Digital Image Processing	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					
CE402TL	Digital Image Processing	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. To learn about sampling and reconstruction
2. To understand spatial domain image enhancement techniques.
3. To apply image transform operations like DFT and DCT
4. To learn about edge detection techniques
5. To understand image compression techniques like Huffman coding
6. To understand binary image processing operations

2. Course Outcomes:

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

1. Sample and Reconstruct a signal.
2. Implement Image Enhancement Techniques.
3. Implement operations like DFT and DCT
4. Implement Edge Detection techniques using first order Derivative Filters.
5. Implement Image Compression Algorithms
6. Perform Binary Image Processing Operations.

3. Detailed Theory Syllabus:

Prerequisite: Computer CGVR

Module No	Module	Detailed Contents of Module	Hrs.
1	Image Fundamentals	Introduction, Origin, Fundamental Steps in Digital Image Processing, Applications of Digital Image Processing, Components of digital image processing system, Image Sampling and Quantization, Pixel connectivity, Distance Transform	5
2	Enhancement in Spatial Domain	Introduction, Point Operation, Zero memory point operations , Histogram Processing, Image smoothening, Sharpening of the Image.	8
3	Image Transforms	Introduction, Need for transform, Fourier Transform, 2D Discrete Fourier Transform, Properties of 2D DFT(without proof), Hadamard Transform, Walsh	8

		Transform, FFT, Discrete Cosine Transform (2D-DCT), Introduction to wavelet transform	
4	Image Segmentation	Introduction, Classification, region based segmentation, Image segmentation based on thresholding- Local and Global, Segmentation based on discontinuities - Edge , line and Point Detection	8
5	Image Compression	Introduction, Redundancy, Fidelity Criteria, Classification of Image Compression Techniques, Run-length Coding, Huffman Coding, Improved Gray Scale Quantization,Vector Quantization	7
6	Binary Image Processing	Introduction, Structuring element, Binary Morphological Operators, Hit-or-Miss Transformation, Boundary Extraction	3

4. Suggested Experiments:

Software Requirements if any:

1. Sampling and Reconstruction
2. To perform Discrete Correlation
3. To perform Discrete Convolution
4. To perform Discrete Fourier Transform
5. To perform Fast Fourier Transform
7. Implementation of Image negative, Gray level Slicing and Thresholding
8. Implementation of Contrast Stretching ,Dynamic range compression & Bit plane Slicing
9. Implementation of Histogram Processing
10. Implementation of Image smoothing/ Image sharpening
11. Implementation of Edge detection using Sobel and Previtt masks

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 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.

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. Rafel C. Gonzalez and Richard E. Woods, 'Digital Image Processing', Pearson Education Asia, Third Edition, 2009,

2. S. Jayaraman, E.Esakkirajan and T.Veerkumar, "Digital Image Processing" Tata McGraw Hill Education Private Ltd, 2009,

3. S. Sridhar, "Digital Image Processing", Oxford University Press, Second Edition, 2012.

4. Anil K. Jain, "Fundamentals and Digital Image Processing", Prentice Hall of India Private Ltd, Third Edition

B. References:

1. B. Chandra and D.Dutta Majumder, "Digital Image Processing and Analysis", Prentice Hall of India Private Ltd, 2011
2. Dwayne Phillps, "Image Processing in C", BPB Publication, 2006
3. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", Prentice Hall of India Private Ltd, Third Edition

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE403TL	Human Computer Interaction	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					
CE403TL	Human Computer Interaction	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. Understand the history of screen designing.
2. Understand the importance of human characteristics, design goals and business functions in interface design.
3. Understand functions of Menus, Windows and importance of graphical user interface.
4. Understand characteristics and selection of device based controls.
5. Understand different types of software tools to design interfaces.
6. Understand various design technologies to meet user requirements..

2. Course Outcomes:

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

1. Describe and apply core theories, models and methodologies from the field of HCI
2. Identify User Interface (UI) design principles.
3. Apply an interactive design process and universal design principles to designing HCI systems.
4. Evaluate interactive software using guidelines from human factor theories.
5. Conduct user and task analysis
6. Implement graphical user interfaces with modern software tools

3. Detailed Theory Syllabus:

Prerequisite: GUI Basics

Module No	Module	Detailed Contents of Module	Hrs.
1	Overview of HCI	Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user	5
2	Design process	Design process: Human interaction with computers, importance of human characteristics, human consideration, and Human interaction speeds, understanding business functions. Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design	8
3	System Menus	System Menus – Structures of Menus, Functions of Menus, Content of Menus, Kinds of Graphical menus. Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Graphics: Icons, Multimedia, colors, uses problems, choosing colors.	5
4	Controls	CONTROLS: Characteristics of device based controls, Selecting the proper device based controls, Operable controls, Text Entry/Read-only controls, Selection controls, Combination Entry/selection controls, Selecting the proper controls.	5
5	HCI in the software process,	HCI in the software process, The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction	8
6	Software Tools	SOFTWARE TOOLS: Specification methods, Interface, Building tools, Interaction devices, Keyboard and function keys, Pointing devices, Speech recognition digitization and generation, Image and video displays, Drivers.	5

4. Suggested Experiments:

1. To understand the trouble of interacting with machines – Redesign interfaces of home appliances.
2. Design a system based on a user-centered approach.
3. Understand the principles of good screen design.
4. Redesign existing Graphical User Interface with screen complexity
5. Design Web User Interface
6. Implementation of Different Kinds of Menus

7. Implementation of Different Kinds of Windows
8. Design a system with proper guidelines for icons
9. Design website using interface design rules
10. Design mobile app using interface design rules

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 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.

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. The essential guide to user interface design, Wilbert O Galitz, Wiley DreamTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann , Pearson Education Asia.
3. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004.

B. References:

1. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech,
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Donald A. Norman, “The design of everyday things”, Basic book

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE404TL	Natural Language Processing	Contact Hours	03	02	-	5
		Credits	03	01	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE404TL	Natural Language Processing	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. To understand natural language processing and to learn how to apply basic algorithms in this field.
2. To understand the basic text processing techniques and significance of morphology.
3. To get acquainted with the basic concepts and algorithmic description of the main language levels: syntax, semantics.
4. To understand language models generation and applications.
5. To recognize the significance of pragmatics and discourse for natural language understanding.
6. To design and implement applications based on natural language processing

2. Course Outcomes:

On successful completion of course learnerstudent:

1. Have a broad understanding of the field of natural language processing.
2. Be able to apply text processing techniques and analysis of morphology of text
3. Be able to model linguistic phenomena with formal grammars and design semantic structure
4. Be able to create language model and apply it for NLP applications
5. Understand the mathematical and linguistic foundations underlying approaches to analyse pragmatic and resolve coreference
6. Be able to apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction...etc.

3. Detailed Theory Syllabus:

Prerequisite: Data structure & Algorithms, Theory of computer science, Probability Theory.

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction	Introduction to Natural Language Processing, History of NLP, Natural Language Generation, Natural Language Understanding, Generic NLP	3

		system, Ambiguity in Natural language, Stages in NLP, Challenges of NLP	
2	Morphology analysisand Language modeling	Text Processing Challenges, Pre-processing of text (tokenization, text filtration, script validation, stop words), Survey of English and Indian Language Morphology, Inflectional morphology & Derivational morphology, Stemming (Porter stemmer), Lemmatization, Regular expression, Morphological parsing with FST, The role of language models, Simple N-gram models, Estimating parameters and smoothing, Evaluating language models. **Self-Learning Topics**: N-gram for spelling correction.	8
3	Syntax analysis	Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank), Rule based POS tagging, Stochastic POS tagging, Introduction to CFG, Parsing with CFG, Statistical parsing and probabilistic CFGs (PCFGs), Sequence labelling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF). **Self-Learning Topics**: Introduction to Indian Language Parsing in Paninian Karaka Theory	8
4	Semantic Analysis	Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses (Homonymy, Polysemy, Synonymy, Hyponymy) WordNet, Vector Space Models of Semantics, Word Sense Disambiguation (WSD), Semantic Role Labelling, Semantic Parsing	6
5	Discourse Context and World Knowledge	Pragmatic analysis and understanding, Discourse: reference resolution, Reference Phenomena, Preferences in Pronoun Interpretation and resolution, Syntactic and Semantic Constraints on Coreference, Coreference Resolution: Coreference, Distinctions in Coreference, Coreference vs. Anaphora, Application **Self-Learning Topics**: Challenges of Coreference Resolution	6
6	Applications of NLP	Machine translation, Information retrieval, Question answers system, categorization, summarization, sentiment analysis, Named Entity Recognition, Topic Modeling, Plagiarism Detection	8

4. Suggested Experiments:

1. Write a program to perform tokenization, filtration and script validation of English and Hindi Text.
2. Write a program to identify stop words, stem and lemma of English and Hindi Text.
3. Write a program to generate n-gram (bigram, trigram, etc) of English and Hindi Text
4. Write a program to generate new words by using inflection and derivational morpheme
5. Write a program to identify word frequency and generate word cloud of English and Hindi Text
6. Write a program to identify Part of Speech of English and Hindi Text
7. Write a program to generate parse tree from text and extract noun and verb phrase of English Text
8. Write a program Get word definition, examples, synonyms, antonyms using English WordNet
9. Write a program to demonstrate use of various text similarity prediction algorithms
10. Write a program to demonstrate coreference resolution.
11. Write a program to generate name entity (NER) from English and Hindi Text
12. Write a program to generate feature vector of text using Bag of Words and TF-IDF
13. Write a program to generate word embedding of the text using Word2Vec

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 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.

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. Sharvari Govilkar, Sagar Kulkarni, Dhiraj Amin ― Natural Language Processing, 2018, StartEDU solutions.
2. Daniel Jurafsky, James H. Martin ―Speech and Language Processing‖ Second Edition, Prentice Hall, 2008.
3. Christopher D.Manning and Hinrich Schutze, ― Foundations of Statistical Natural Language Processing ―, MIT Press, 1999.

B. References:

1. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
2. Daniel M Bikel and ImedZitouni ― Multilingual natural language processing applications Pearson, 2013.
3. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) ― The Handbook of Computational Linguistics and Natural Language Processing
4. Steven Bird, Ewan Klein, Natural Language Processing with Python, O‘Reilly
5. Brian Neil Levine, An Introduction to R Programming
6. Niel J le Roux, Sugnet Lubbe, A step by step tutorial: An introduction into R application and programming.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE405TL	Ethical Hacking and Digital Forensics	Contact Hours	03	02	-	5
		Credits	03	01	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE405TL	Ethical Hacking and Digital Forensics	40	40	40	60	25	25	--	150

1. Course Objectives:
The course is aimed to:

1. To understand underlying principles of Ethical hacking and digital forensic practices.
2. To learn gathering information from various cyber spaces.
3. Perform security scan to test the applications and systems for vulnerability.
4. Understand and deal with the hacking environment and strategies for covering attack tracks.
5. To learn the importance of incident response and evidence handling in digital forensics
6. To apply digital forensic knowledge to use various digital forensic tools for live data collection

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

1. Describe principles of Ethical hacking and digital forensic
2. Gather the information required for Digital forensics and Ethical hacking from various cyber spaces
3. Evaluate testing plan for applications and systems for vulnerability
4. Understand hacking environments and learn hacker hiding techniques
5. Explain the methodology of incident response and various security issues
6. Install and Examine various Digital forensics tools the tools for data collection.

3. Detailed Theory Syllabus:

Prerequisite: Cryptography and Security, Computer Networks, Basics of various operating systems.

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Ethical Hacking and Digital Forensics	Introduction to Ethical hacking: definition, difference between hacking and ethical hacking. Vulnerability, Attack Vector. Five stages of hacking: Reconnaissance, Probing, Actual attack, maintaining presence, Covering attack tracks, Digital Forensic, Rules for Digital Forensic, The Need for Digital Forensics, Types of Digital Forensics, Ethics in Digital Forensics, Digital Evidences: Types and characteristics and challenges for Evidence Handling.	4
2	Information Gathering	**Information gathering:** from social media accounts, extraction of photographs exit data, phone number, vehicle registration number, dumpster dumping, google street view and google history. Social Engineering techniques, Google Dork query, Browser extension to collect information. Principles of Ethical hacking (Legality & Ethics) Introduction to OWAPS, types of OWAPS	6
3	Enumeration and System Hacking	**Scanning & Enumeration**: Port Scanning, Network Scanning, Vulnerability Scanning, NMAP Scanning tool, OS Fingerprinting, Enumeration. **System Hacking**: Password cracking techniques, Keyloggers, Escalating privileges, URL Hiding Files, Sniffers & SQL Injection: Active and passive sniffing, ARP Poisoning, Session Hijacking, DNS Spoofing, Conduct SQL Injection attack, Countermeasures. Study of open-source scanning tools.	7
4	Hacking Environment by Hiding hacker details	Installation and configuration of DVWA environment. Virtual box installation, Installation of Kali Linux within virtual box. Kali Linux penetration testing and ethical hacking tools. What is TOR? How can you use it to protect your anonymity online? Proxy chain for using proxy servers, hiding your IP and obtaining access. What is VPN and how you can stay anonymous with VPN. Mac-changer, use of mac-changer to change your MAC address. Incident Response and Forensic Analysis.	8
5	Incident Response Methodology	Incident Goals of Incident response, Incident Response Methodology, Formulating Response Strategy, IR Process – Initial Response, Investigation, Remediation, Tracking of Significant, Investigative Information, Reporting Pre-Incident Preparation, Incident Detection	6
6	Digital Forensic Tools	Live Data Collection: Live Data Collection on Microsoft Windows Systems: Live Data Collection on Unix-Based Systems Forensic Duplication Forensic Image Formats, Traditional Duplication, Live System Duplication, Forensic Duplication tools Disk and File System Analysis: Media Analysis Concepts, File System Abstraction Model The Sleuth Kit : Installing the Sleuth Kit , Sleuth Kit Tools Partitioning and Disk Layouts : Partition Identification and Recovery, Redundant Array of Inexpensive Disks	8

		Special Containers : Virtual Machine Disk Images, Forensic Containers Hashing, Carving : Foremost , Forensic Imaging : Deleted Data , File Slack , dd , dcfldd , dc3dd Data Analysis Analysis Methodology Investigating Windows systems , Investigating UNIX systems , Investigating Applications, Web Browsers, Email, Malware Handling: Static and Dynamic Analysis, Writing a Report, sample for writing a forensic report	

4. Suggested Experiments:

1. Using Social Engineering/Media to gather personal information about the target person.
2. Using NMAP commands and exploring the features.
3. Configure DVWA web application to simulate and practice OWASP.
4. Study kali linux penetration testing tools.
5. Using Metasploit to extract data from Mobile.
6. Live capture of volatile data from windows and Linux systems.
7. Creation of forensic duplication using forensics tools.
8. Analysis of forensic image and report generation using Autopsy/AccessData FTK.

5. Theory Assessment:

A. **Internal Assessment:** 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 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.

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. Mark Rhodes-Ousley, “Information Security: The Complete Reference”, Second Edition, McGraw-Hill, 2013
2. DafyddStutarf, Marcus Pinto, “Web Application Hackre’s Handbook”, Wiley
3. Skoudis E. Perlman R. “Counter hack: A step by step Guide to Computer Attacks and effective Defense”, Prentice Hall Professional technical Reference, 2001.
4. Jason Luttgens, Matthew Pepe, Kevin Mandia, “Incident Response and computer forensics”,3rd Edition Tata McGraw Hill, 2014.

5. Nilakshi Jain, Dhananjay Kalbande,"Digital Forensic: The fascinating world of Digital Evidences" Wiley India Pvt Ltd 2017.
6. Cory Altheide, Harlan Carvey"Digital forensics with open-source tools "Syngress Publishing, Inc. 2011.

B. References:

1. James S. Tiller, "The Ethical Hack: A Framework for Business Value Penetration Testing", Auerbach Publications, CRC Press
2. EC-Council, "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning
3. Michael Simpson, Kent Backman, James Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning
4. The Hacker Playbook: Practical Guide to Penetration Testing", by Peter Kim, January 1, 2014
5. Clint P Garrison "Digital Forensics for Network, Internet, and Cloud Computing A forensic evidence guide for moving targets and data, Syngress Publishing, Inc. 2010
6. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations" . Cengage Learning, 2014
7. Debra Littlejohn Shinder Michael Cross "Scene of the Cybercrime: Computer Forensics Handbook", 2nd Edition Syngress Publishing, Inc.2008.
8. Marjie T. Britz, Computer Forensics and Cyber Crime, Pearson, Third Edition.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE406TL	Deep Learning	Contact Hours	03	02	-	5
		Credits	03	01	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE406TL	Deep Learning	40	40	40	60	25	--	25	150

1. Course Objectives:
The course is aimed to:

1. To present the mathematical, statistical and computational challenges of building neural networks
2. To apply Deep Learning models to real world problems in an efficient and optimized way.
3. To understand Convolution Neural Networks for solving various computer vision problems.
4. To understand Recurrent Neural Networks basic concepts.
5. To apply RNN for solving various sequence modelling problems.
6. To learn to apply pre-trained models for solving various deep learning problems.

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

1. Understand basics of neural networks
2. Improve Neural Network using various hyperparameter tuning.
3. Design Convolutional Neural Network for various applications
4. Apply Recurrent Neural Network to real life problems
5. Understand and use sequence models
6. Understand transfer learning models

3. Detailed Theory Syllabus:
Prerequisite: Machine Learning, Applied Mathematics

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Deep Learning and Neural Networks basics	What is a neural network? Supervised Learning with Neural Networks, Binary Classification and Logistic Regression, Gradient Descent, Shallow neural networks, Deep Neural Networks	4
2	Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization	Practical Aspects of Deep Learning- Bias / Variance, Regularization, Normalizing inputs, Weight Initialization for Deep Networks, Optimization algorithms- Mini-batch gradient descent, Gradient descent with momentum, RMSprop, Adam optimization algorithm, Hyperparameter tuning- Using an appropriate scale to pick hyperparameters, Normalizing activations in a network, Fitting Batch Norm into a neural network, SoftMax Regression, Batch Normalization and Programming Frameworks	8
3	Convolutional Neural Networks	Edge Detection, Padding, Strided Convolutions, One Layer of a Convolutional Network, Pooling Layers Deep convolutional models- ResNets, Networks in Networks and 1x1 Convolutions, Inception Network, Object Detection-Object Localization, Landmark Detection, Object Detection, Convolutional Implementation of Sliding Windows, Bounding Box Predictions, Intersection Over Union, Non-max Suppression, Anchor Boxes	8
4	Recurrent Neural Networks	Recurrent Neural Network Model, Backpropagation through time, Different types of RNNs, Language model and sequence, generation, Vanishing gradients with RNNs, Gated Recurrent Unit (GRU), Long Short-Term Memory (LSTM), Bidirectional RNN, Deep RNNs	8
5	Sequence models & Attention mechanism	Basic Models, Picking the most likely sentence, Beam Search, Refinements to Beam Search, Error analysis in beam search, Attention Model, Speech recognition, Trigger Word Detection	5
6	Transfer Learning	What is transfer learning? What is a Pre-trained Model? use of pre-trained models, Customize a pretrained model: Feature Extraction, Fine-Tuning, Transfer Learning Implementation using VGG16 Model/ MobileNetV2/YOLO/GloVe/ ResNet50	4

4. Suggested Experiments:

1. Build deep neural network.
2. Analyze deep neural network by using various optimization algorithms.
3. Face Recognition using CNN.
4. Implement Dinosaur Island - Character-Level Language Modeling using RNN.
5. Machine Translation from one language to another with Attention mechanism.
6. Case study on any transfer learning model.

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 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.

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. Neural Networks and Deep Learning: A Textbook, Charu C. Aggarwal, Springer
2. A Guide to Convolutional Neural Networks for Computer Vision, Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, Morgan & Claypool Publishers
3. Recurrent Neural Networks: Design and Applications, Larry Medsker, CRC-Press
4. Natural Language Processing in Action: Understanding, analyzing, and generating text with Python, Hobson Lane, Cole Howard, Hannes Hapke, Manning Publications
5. Transfer Learning, Qiang Yang, Yu Zhang, Wenyuan Dai, SinnoJialin Pan, Cambridge University Press

B. References:

1. Grokking Deep Reinforcement Learning by Miguel Morales, Manning Publications,2020
2. Deep Learning by Josh Patterson, Adam Gibson Released August 2017, O'Reilly Media, Inc.
3. Deep Learning with Python by François Chollet, Manning Publications,2017
4. Practical Deep Learning for Cloud, Mobile and Edge: Real-World AI and Computer Vision Projects Using Python, Keras and TensorFlow by Koul, A. and Ganju, S. and Kasam, M.,O'Reilly Media, Inc.,2019

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE407TL	User Experience Design	Contact Hours	03	02	-	5
		Credits	03	01	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE407TL	User Experience Design	40	40	40	60	25	25	--	150

1. Course Objectives:
The course is aimed to:

1. To study and understand importance of user experience design principles
2. To understand elements of user experience design
3. To encourage students to participate in designing futuristic applications
4. To understand data visualization interaction design.
5. To understand prototype design.
6. To understand usability testing.

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

1. To Apply principles of user experience
2. To apply emerging and established technologies to enhance User Experience design

3. To create an interface for international standards with ethics.
4. To design prototypes.
5. To apply usability tests.
6. To evaluate user experience

3. Detailed Theory Syllabus:

Prerequisite: Web Technologies, Software Engineering, Human Computer Interaction

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction	Introduction to interface design, Understanding and conceptualizing Interface, Understanding User's conceptual cognition.	4
2	Elements of UX Design	Core Elements of User Experience, Working of UX elements	4
3	The UX Design Process – Understanding Users	Defining the UX, Design Process and Methodology, Understanding user requirements and goals, Understanding the Business Requirements/Goals, User research, mental models, wireframes, prototyping, usability testing.	8
4	The UX Design Process- The Structure: Information Architecture and Interaction Design	Visual Design Principles, Information Design and Data Visualization Interaction Design, Information Architecture, Wire framing & Story boarding, UI Elements and Widgets, Screen Design and Layouts	8
5	UX Design Process: Prototype and Test	Testing your Design, Usability Testing, Types of Usability Testing, Usability Testing Process, Preparing and planning for the Usability Tests, Prototype your Design to Test, Introduction of prototyping tools, conducting Usability Test, communicating Usability Test Results	8
6	UX Design Process: Iterate Improve and Deliver	Understanding the Usability Test, findings, Applying the Usability Test, feedback in improving the design. Communication with the implementation team. UXDeliverables to be given to implementation team	4

4. Suggested Experiments:

1. Project Declaration.
2. User Research-Contextual Inquiry and survey.
3. Conveying Research Findings-Personas and Scenarios.
4. Design Sketches and Ideas.
5. Prototypes.
6. Experimental Design and Experience Sampling.
7. Final Report and Presentation.

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 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.

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. Interaction Design, Beyond Human Computer Interaction, Rogers, Sharp, Preece Wiley India Pvt Ltd.
2. The essentials of Interaction Design, Alan Cooper, Robert Reimann, David Cronin.
3. Designing The user Interface by Shneiderman, Plaisant,Cohen,Jacobs Pearson.

B. References:

1. The Elements of User Experience by Jesse James Garrett.
2. Don’t make me think, by Steve Krug.
3. Observing the User Experience: A Practitioner's Guide to User Research by Mike Kuniavsky.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL470T	E-Commerce and E-Business	Contact Hours	03	-	-	3
		Credits	03	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL470T	E-Commerce and E-Business	40	40	40	60	--	--	--	100

1. Course Objectives:

The course is aimed to:

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. Analyze features of existing e-commerce businesses, and propose future directions or innovations for specific businesses.

2. Course Outcomes:

On successful completion of course learner student:

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.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	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, PHS 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

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 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. Books and References:

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, BrahmCanzer, cengage learning
5. Secure e-commerce systems (Kindle edition), Amazon publishing, P S Lokhande, B BMeshram, first edition

IL471T: Business analytics
Syllabus under Construction

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL472T	Biomedical Instrumentation	Contact Hours	03	-	-	3
		Credits	03	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL472T	Biomedical Instrumentation	40	40	40	60	--	--	--	100

1. Course Objectives:

The course is aimed to:

1. To familiarize students with various aspects of measuring electrical parameters from the living body.
2. To introduce students with the characteristics of medical instruments and related errors.
3. To illustrate various types of amplifiers used in biomedical instruments.
4. To familiarize students with biomedical recording devices.
5. To introduce students with patient monitoring systems & their characteristics.

2. Course Outcomes:

On successful completion of course learner student:

1. Safely and effectively use biomechanics instrumentation and equipment to record and assess human and object motion.
2. Describe and characterize the origin of bio-potentials and inspect common biomedical signals by their characteristics features
3. Understand the basic instrumentation system with their limitations & familiarize with pc based medical instrumentation & control of medical devices.
4. Describe and characterize medical instruments as per their specifications, static & dynamic characteristics and understand data acquisition system
5. Describe, analyse, characterize and design bio-potential amplifiers and design various medical recording systems & their components.
6. Understand and describe patient monitoring systems and its necessity in healthcare system.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Medical Instrumentation	Sources of Biomedical Signals, Basic medical Instrumentation system, Performance requirements of medical Instrumentation system, Microprocessors in medical instruments, PC based medical Instruments, General constraints in design of medical Instrumentation system, Regulation of Medical devices.	6
2	Measurement systems	Specifications of instruments, Static & Dynamic characteristics of medical instruments, Classification of errors, Statistical analysis, Reliability, Accuracy, Fidelity, Speed of response, Linearization of technique, Data Acquisition System.	6
3	Bioelectric signals and Bioelectric amplifiers	Origin of bioelectric signals, Electrodes, Electrode Tissue interface, Galvanic Skin Response, BSR, Motion artifacts, Instrumentation amplifiers, Special features of bioelectric amplifiers, Carrier amplifiers, Chopper amplifiers, Phase sensitive detector. ECG, EEG, EMG, ERG, Lead systems and recording methods.	8
4	Biomedical recording systems	Basic Recording systems, General consideration for signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrocardiograph, Phonocardiograph, Electroencephalograph, Electromyography, Digital stethoscope Other biomedical recorders, Biofeedback instrumentation, Electrostatic and Electromagnetic coupling to AC signals, Proper grounding, Patient isolation and accident prevention.	7
5	Patient Monitoring Systems	System concepts, Cardiac monitor, selection of system parameters, Bedside monitors, Central monitors, Heart rate meter, Pulse rate meter, Measurement of respiration rate, Holter monitor and Cardiac stress test, Catheterization Laboratory Instrumentation, Organization and equipment's used in ICCU and ITU.	6
6	Biological sensors	Sensors / receptors in the human body, basic organization of nervous system-neural mechanism, Chemoreceptor: hot and cold receptors, barro receptors, sensors for smell, sound, vision, Ion exchange membrane electrodes, enzyme electrode, glucose sensors, immunosensors, Basic principles of MOSFET biosensors & BIOMEMS, basic idea about Smart sensors.	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 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. Books and References:

1. Joseph Bronzino, "Biomedical Engineering and Instrumentation", PWS Engineering, Boston.
2. Cromwell, Weibell& Pfeiffer, "Biomedical Instrumentation & Measurement", Prentice Hall, India.
3. R. S. Khandpur, "Handbook of Bio-Medical Instrumentation", 2nd Edition, Tata McGraw Hill.
4. J.Webster, "Bioinstrumentation", Wiley & Sons.
5. Joseph D.Bronzino, "The Biomedical Engineering handbook", CRC Press.
6. D. L. Wise, "Applied Bio Sensors", Butterworth, London.
7. J.J.Carr&J.M.Brown, "Introduction to Biomedical Equipment Technology" Pearson Education, Asia.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL473T	Design for Sustainability	Contact Hours	03	-	-	3
		Credits	03	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL473T	Design for Sustainability	40	40	40	60	-	--	-	100

1. Course Objectives:

The course is aimed to:

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

2. Course Outcomes:

On successful completion of course learner student:

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.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	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

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 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. Books and 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, Shefield, 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, Shefield, 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
IL474T	Political Science	Contact Hours	03		-	3
		Credits	03		-	3

Course Code	Course Name	Examination Scheme

		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL474T	Political Science	40	40	40	60		--		100

1. Course Objectives:

The course is aimed to:

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.

2. Course Outcomes:

On successful completion of course learner:

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.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	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. 1. Fundamental Rights and Duties. 2. Directive Principles. 3. Union-State Relations 4. Union Legislature: Rajya Sabha, Lok Sabha 5. Organisation Functions – Law making procedure, Parliamentary procedure, 6. Government in states: Governor, Chief Minister and Council of Ministers: position and functions – State Legislature: composition and functions. 7.Judiciary: Supreme Court and the High Courts: composition and functions – Judicial activism. 8.Constitutional amendment. Major recommendations of National Commission to Review the Working of the Constitution.	6
3	Politics in India	Structures and Processes- Party system: features and trends – major national political parties in India: 1. Ideologies and programmes. Coalition politics in India: nature and trends. 2. Electoral process: Election Commission: composition, functions, role. Electoral reforms. 3. Role of business groups, working class, peasants in Indian politics, Role of (a) religion (b) language (c) caste (d) tribe. 5. Regionalism in Indian	6

		politics. 6. New Social Movements since the 1970s: (a) environmental movements (b) women's movements (c) human rights movements	
4	Indian Political Thought	1 Ancient Indian Political ideas: overview. 2. Kautilya: Saptanga theory, Dandaniti, Diplomacy. 3. Medieval political thought in India: overview (with reference to Barani and Abul Fazal). Legitimacy of kingship. 4. 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. 6. Bankim Chandra Chattopadhyay, Vivekananda and Rabindranath Tagore: views on nationalism. 7. 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: 1. Outline of its evolution as academic discipline. 2. Major theories: (a) Classical Realism and Neo-Realism (b) Dependency (c) World Systems theory. 3. Emergent issues: (a) Development (b) Environment (c) Terrorism (d) Migration. 4. Making of foreign policy. 5. Indian foreign policy: major phases: 1947-1962; 1962-1991; 1991-till date. 6. Sino-Indian relations; Indo-US relations.	7

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 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. Books and 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

IL475T	Research Methodology	Contact Hours	03	02	-	5
		Credits	03	01	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL475T	Research Methodology	40	40	40	60		--		100

1. Course Objectives:
The course is aimed to:
1. To understand Research and Research Process
2. To acquaint students with identifying problems for research and develop research strategies
3. To familiarize students with the techniques of data collection, analysis of data and interpretation.

2. Course Outcomes:
On successful completion of course learner student:
1. Prepare a preliminary research design for projects in their subject matter areas.
2. Accurately collect, analyse and report data.
3. Present complex data or situations clearly.
4. Review and analyse research findings.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction and Basic Research Concepts	1.1 Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Philosophy and validity of research 1.2 Objectives of Research 1.3 Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical 1.4 Need of Research in Business and Social Sciences 1.5 Issues and Problems in Research	8
2	Types of Research	2.1. Pure and Applied Research 2.2. Descriptive and Explanatory Research 2.3. Analytical Research 2.4 Qualitative and Quantitative Approaches 2.5 Literature review 2.6 Developing the objectives.	8
3	Research Design and Sample Design	3.1 Research Design – Meaning, Types and Significance 3.2 Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	7

4	Research Methodology	4.1 Meaning of Research Methodology 4.2. Stages in Scientific Research Process: a. Identification and Selection of Research Problem b. Formulation of Research Problem c. Review of Literature d. Formulation of Hypothesis e. Formulation of research Design f. Sample Design g. Data Collection h. Data Analysis i. Hypothesis testing and Interpretation of Data j. Preparation of Research Report	8
5	Formulating Research Problem	5.1 Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis.	4
6	Outcome of Research	6.1 Preparation of the report on conclusion reached. 6.2 Validity Testing & Ethical Issues 6.3 Suggestions and Recommendation 6.4 Identification of future scope	4

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 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. Books and References:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded),Singapore, Pearson Education

IL476T Maintenance of Mechanical Equipment
Syllabus under Construction

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL477T	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					
IL477T	Cooking and Nutrition	40	40	40	60	-	-	-	100

1. 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

2. 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

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Nutritional terms	**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, sodium, iodide) water Sources and uses of food energy. Sources and functions of dietary fibre.	3
2	Kitchen equipment & Kitchen planning	**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	4

		and equipment for efficient work., Selection, Use and care of: work surfaces, flooring, walls and wall coverings, lighting, ventilation	
3	Meal planning and guidelines	**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	**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	**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 – thin (pouring) and coating, Sweet and savoury yeast products	5
6	Food preservation & Kitchen safety and first aid	**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; Awareness of potential danger areas in the kitchen. Safety precautions. First aid for burns and scalds, cuts, electric shock, fainting, shock.	5

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 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. Books and 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
CE408P	Project B	Contact Hours		12	-	12
		Credits		06	-	06

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE408P	Project B	-	-	-	-	50	25	25	100

1. Course Objectives:

The course is aimed to:

1. To offer students a glimpse into real world problems and challenges that need IT based solutions
2. To enable students to create very precise specifications of the IT solution to be designed.
5. To introduce students to the vast array of literature available of the various research challenges in the field of IT
6. To create awareness among the students of the characteristics of several domain areas where IT can be effectively used.
7. To enable students to use all concepts of IT in creating a solution for a problem
8. To improve the team building, communication and management skills of the students..

2. Course Outcomes:

On successful completion of course learner:

1. Discover potential research areas in the field of IT
2. Conduct a survey of several available literature in the preferred field of study
3. Compare and contrast the several existing solutions for research challenge
4. Demonstrate an ability to work in teams and manage the conduct of the research study.
5. Formulate and propose a plan for creating a solution for the research plan identified
6. To report and present the findings of the study conducted in the preferred domain

3. Detailed Theory Syllabus:

Guidelines

1. The project work is to be conducted by a group of three students
2. Each group will be associated with a project mentor/guide. The group should meet with the project mentor/guide periodically and record of the meetings and work discussed must be documented.
3. Department has to allocate 1 day in VII semester and 2 day in VIII semester every week.

4. Students will do literature survey in Sem VI or Sem VII.
5. Students will do design, implementation and coding in Sem VII.
7. Each group along with its guide/mentor shall identify a potential research area/problem domain, on which the study is to be conducted.
8. Each team will do a rigorous literature survey of the problem domain by reading and understanding at least 3-5 research papers from current good quality national/international journals/conferences. (Papers selected must be indexed by Scopus/IEEE/Springer/ACM etc.). The list of papers surveyed must be clearly documented.
9. The project assessment for term work will be done at least two times at department level by giving presentation to panel members which consist of at least three (3) members as Internal examiners (including the project guide/mentor) appointed by the Head of the department of respective Programme.
10. A report is to be prepared summarizing the findings of the literature survey. A comparative evaluation of the different techniques surveyed is also to be done.
11. Students will do testing and analyse in Sem VIII
12. Teams must analyse all the results obtained by comparing with other standard techniques.
13. Every team must publish their work in national / international conference/journals (if possible publish in Scopus indexed journals).

Evaluation

1. Each team has to give a presentation/demo to the Internal Panel and External examiner.
2. Each team will prepare a report that will summarize the results of the literature survey and implementation and coding as project proposal in SEM VII. The list of papers surveyed must be clearly documented.
3. Each group will be jointly evaluated by a team of Internal and External Examiners approved by the University of Mumbai.
4. Oral exams will be conducted on the project done by the students.

Term Work:

Term Work shall consist of full Project-I on above guidelines/syllabus.
Term Work Marks: 50 Marks (Total marks) = 45 Marks (Project-I) + 5 Marks (Attendance)
Oral Exam: An Oral exam will be held based on the Project-I and Presentation.

BACHELOR OF TECHNOLOGY
IN
COMPUTER ENGINEERING

(Semester VIII)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE409T	Software Project 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					
CE409T	Software Project Management	40	40	40	60	-	-	--	150

1. Course Objectives:

The course is aimed to:

1. To identify key areas of concern over Project Life Cycle (PLC) and use of project management

principles across all the phases of PLC.

2. To make them understand the importance and necessity of project plan.
3. To know how it is helpful for a project manager to monitor and control the various aspects of the project such as schedule, budget, etc.
4. To understand the importance of team and how to work as a team member.
5. To share best project management practices.

2. Course Outcomes:

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

1. Able to articulate similarities and differences between IT projects and other types of projects.
2. Able to Justify an IT project by establishing a business case.
3. Able to develop a project charter.
4. Able to develop a work breakdown structure for an IT project. Demonstrate Team work and team spirit and how to overcome the conflicts.
5. Able to estimate resources (time, cost, human being, etc.) and establish task inter-dependencies. Construct and analyses a network diagram.
6. Identify IT project risks and develop risk mitigation strategies and ensure the quality of the project using various standards.

3. Detailed Theory Syllabus:

Prerequisite: Software Engineering

Module No	Module	Detailed Contents of Module	Hrs.
1	Context of PM and conceptualizing the project.	1.1 Need for Software Project Management. 1.2 Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, (Plans, Methods and Methodologies), 1.3 Ways of Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives, 1.4The Business Case, project selection and approval, project contracting, PMBOK.	5

2	Project Integration &Scope management	2.1 Introduction, project management process, project Integration management 2.2 the project charter, Management planning framework, the contents of a project plan 2.3scope planning, project scope definition 2.4 project scope verification, scope change control 2.5 Work Breakdown Structure (WBS), the linear responsibility chart.	7
3	Project Cost & quality Management	3.1Cost estimating, Cost escalation, Cost estimating and system development cycle 3.2 Cost estimating process, Elements of budgets and estimates, Project cost accounting and MIS 3.3Budgeting using cost accounts, Cost schedules and forecasts. 3.4Quality tools and philosophies, quality systems, the IT project quality plan.	6
4	Project Human Resource management	4.1Introduction, organization and project planning 4.2project team, multidisciplinary teams, the project environment 4.3project leadership, ethics in projects, multicultural projects 4.4 Role of project manager, IT governance and the project office. 4.5Introduction to change, the nature of change, the change management plan, dealing with resistance and conflicts.	5
5	Project schedule and Risk Management	5.1 Introduction to Management Spectrum, 3Ps (people, product and process) 5.2 Different types of Process and Project metrics 5.3 Importance of Timeline Chart and Gnatt Chart, Tracking the Schedule, Earned Value Analysis, Scheduling Techniques – Program Evaluation and Review Technique (PERT), Critical Path Method (CPM), Automated Tools. 5.4 Different Types of Risks 5.5 Concepts of Risks and Risk Management; Risk Management Activities; Effective Risk Management; Risk Categories; Aids for Risk Identification; Potential Risk Treatments; Risk Components and Drivers; Risk Prioritization. 5.6 Derive an RMMM Plan.	8
6	Project communication, Procurement and Project closure	6.1Introduction, monitoring and controlling the project. 6.2project communications plan, project metric, project control, designing the control system, the plan-monitor control cycle 6.3 data collection and reporting, reporting performance and progress, information distribution 6.4Introduction to project procurement management, outsourcing. 6.5project implementation, administrative closure, project evaluation, project audit.	8

4. Theory Assessment:

A. Internal Assessment (IA): Two class tests of 40 mark 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 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. Books and References:

A. Books:

1. Jack T. Marchewka, Information Technology Project Management, 4th edition, Wiley India, 2009.
2. John M. Nicholas, Project Management for Business and Technology, 3rd edition, Pearson Education.

B. References:

1. E-Book - Project Management Body of Knowledge (PMBOK).
2. Claudia M. Baca, Patti M. Jansen, PMP: Project Management Professional Workbook,
3. S. J. Mantel, J. R. Meredith and etal. Project Management 1st edition, Wiley India, 2009.
4. Joel Henry, Software Project Management, A real-world guide to success, Pearson Education, 2008.
5. Gido and Clements, Successful Project Management, 2nd edition, Thomson Learning.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE410TL	Information Retrieval and Social Network Analysis	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					
CE410TL	Information Retrieval and Social Network Analysis	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. To understand basic concepts and techniques in Information Retrieval.
2. To acquire the necessary experience to design, and implement real applications using Information Retrieval systems.
3. To describe models like vector-space, probabilistic models to identify the similarity of query and document.
4. To learn different indexing and searching techniques to retrieve data.
5. To understand the importance of Social Network Analysis.
6. To learn use semantic web technologies for social network analysis.

2. Course Outcomes:

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

1. Gain an understanding of how statistical models of text can be used to solve problems in IR.
2. Understand relevance feedback in vector space model and probabilistic model.
3. Understand the Semantic Web and Social Networks.
4. Understand Electronic sources for network analysis and different ontology languages.
5. Model and aggregate social network data.
6. Design and Analyze social networks using semantic web technologies.

3. Detailed Theory Syllabus:

Prerequisite: DBMS, DWM, Web Technologies, NLP.

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Information Retrieval Systems	Definition of Information Retrieval System - Objectives of Information ,Retrieval Systems - Functional Overview - Relationship to Database Management Systems - Digital Libraries and Data Warehouses ,Information versus Data Retrieval, The Retrieval Process- Ad Hoc and Filtering. Classic Information Retrieval: Basic Concepts.	3

2	Information Retrieval Models	Boolean Model ,Vector Model, Probabilistic Model, Alternative Set Theoretic Models :Fuzzy Set Model, Extended Boolean Model, Alternative Algebraic Models :Generalized Vector Space Model ,Latent Semantic Indexing Model, Brief Comparison of Classic Models	5
3	Searching and Indexing	User Search Techniques**,** Search Capabilities , Browse Capabilities ,Search Statements and Binding , Similarity Measures and Ranking ,Relevance Feedback , Selective Dissemination of Information Search , Weighted Searches of Boolean Systems, Searching the internet and Hypertext , Introduction to Text Search Techniques, Software Text Search Algorithms. Indexing Process, Automatic Indexing, Statistical Indexing, Concept Indexing, Hypertext Linkages-Information Extraction.	10
4	Introduction to Social Network Analysis	What is network analysis, Development of Social Network, Analysis, Key concepts and measures in network analysis.	3
5	Electronic sources for network analysis	Electronic discussion networks, Blogs and online communities Structured Web Documents-XML, Describing web Resources-RDF, RDFSchema, Querying Knowledge Representation on the Semantic Web-SPARQL.	8
6	Modeling and aggregating social network data	Ontologies and their role in the Semantic Web, Ontology languages for the Semantic Web-RDFS, OWL. State-of-the art in network data representation, Ontology Engineering, Semantic Web Knowledge Management Architecture, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data.	10

4. Suggested Experiments:

Software Requirements if any: **(PENDING)**

1.
2.
3.
4.
5.

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 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.

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. Gerald J. Kowalski and Mark.T.Maybury, "Information Storage and Retrieval Systems: Theory and Implementation", Springer/BSP Books, 2nd Edition.
2. D. Grossman and O. Frieder.,Information Retrieval: Algorithms and Heuristics, Kluwer Academic Press.
3. Introduction to Information Retrievalby Christopher D. Manning, Prabhakar Raghavanand HinrichSchütze, Cambridge University Press.
4. Grigoris Antoniou and Frank van Harmelen "Semantic Web Primer" second edition.
5. Peter Mika, "Social Networks and the Semantic Web" , First Edition, springer 2007.
6. Reza Zafarani,Mohammad Ali Abbasi,Huan Liu "Social Media Mining: Introduction",Cambridge University press.
7. Gerald J. Kowalski and Mark.T.Maybury, "Information Storage and Retrieval Systems: Theory and Implementation", Springer/BSP Books, 2nd Edition.

B. References:

1. Introduction to Information Retrieval. C.D. Manning, P. Raghavan, H. Schütze.Cambridge UP 2008.
2. Modern Information Retrieval. R. Baeza-Yates, B. Ribeiro-Neto. Addison - Wesley, 1999.
3. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and Applications", First Edition ,2011.
4. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer 2010.
5. Introduction to Information Retrieval. C.D. Manning, P. Raghavan, H. Schütze.Cambridge UP, 2008.
6. Modern Information Retrieval. R. Baeza-Yates, B. Ribeiro-Neto. Addison - Wesley, 1999.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE411TL	Cyber Security and Laws	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					
CE411TL	Cyber Security and Laws	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. To understand and identify different types cybercrime and cyber law.
2. To recognized Indian IT Act 2008 and its latest amendments.
3. To learn various types of security standards compliances.

2. Course Outcomes:

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

1. Able to understand the concept of cybercrime and its effect on outside world.
2. Able to Interpret and apply IT law in various legal issues.
3. Able to distinguish different aspects of cyber law.
4. Able to develop the various cyber security algorithms.
5. Able to Apply Information Security Standards compliance during software design and development.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Cybercrime	Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes	04

2	Cyber offenses & Cybercrime	How criminal plan the attacks, Social Engineering, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	09
3	Tools and Methods Used in Cyberline	Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	06
4	The Concept of Cyberspace	E-Commerce , The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law , The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law	08
5	Indian IT Act.	Cyber Crime and Criminal Justice : Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments, The Information Technology (Intermediary Guidelines and Digital Media Ethics Code) Rules, 2021.	06
6	Information Security Standard compliances	SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	06

4. Suggested Experiments:

1. To study the steps to protect your personal computer system by creating User Accounts with Passwords and types of User Accounts for safety and security.
2. Study the steps to protect a Microsoft Word Document of different version with different operating system.
3. Study various methods of protecting and securing databases.
4. Study “How to make strong passwords” and “passwords cracking techniques” using ERD Commander, Cain & able.
5. Web browser Security- Browser Security IE(Mozilla Firefox, Google Crome) Add-ons.(Firebug, WOT).
6. Cryptography using PGP and Truecrypt.
7. Steganography using S-Tools and Snow.
8. Email Security (Header Analysis. Email Tracker pro., Read notify).
9. Mobile Security Apps- Smart phone encryption.
10. Ethical Hacking Information Gathering Tool – Samspade (Nslookup , Whois, Tracert,) Scanning Tool(Angry IP Scanner, Nmap).
11. Protection of Information Assets using Recuva.

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 half hour.

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 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.

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

7. Books and References:

A. Books:

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi.
2. The Indian Cyber Law by Suresh T. Vishwanathan, Bharat Law House New Delhi.
3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai.
5. Nina Godbole, Information Systems Security, Wiley India, New Delhi.

A. References:

1. Kennetch J. Knapp, Cyber Security &Global Information Assurance Information Science Publishing.
2. William Stallings, Cryptography and Network Security, Pearson Publication.
3. Websites for more information is available on: The Information Technology ACT, 2008- TIFR: https://www.tifrh.res.in.
4. Website for more information, A Compliance Primer for IT professional: https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals33538

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE412TL	Computer Vision	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					
CE412TL	Computer Vision	40	40	40	60	25	-	25	100

1. Course Objectives:

The course is aimed to:

1. Recognize and describe both the theoretical and practical aspects of computing with images.
2. Describe the foundation of image formation and image analysis.
3. Understand the basics of 2D and 3D Computer Vision.
4. Describe various methods used for registration, alignment, and matching in images.
5. Understand Object, Face and Instance Recognition.
6. Implement computer vision applications.

2. Course Outcomes:

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

1. Implement fundamental image processing techniques required for computer vision.
2. Understand the Image formation process.
3. Extract features from Images and do analysis of Images.
4. Generate 3D models from images.
5. Understand video processing, motion computation and 3D vision and geometry, Camera Calibration.
6. Develop applications using computer vision techniques

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.

1	Introduction to computer vision	What is computer vision? , A brief history of computer vision, Applications of Computer Vision	4
2	Image Formation	Geometric primitives and transformations, Photometric image formation, The digital camera	6
3	Image Preprocessing	Image preprocessing, Image representations (continuous and discrete), Frequency domain filtering	7
4	Feature Detection and Matching	Points and Patches, Edges , Lines, 2D and 3D feature-based alignment , Geometric Intrinsic calibration	7
5	Multiple Views and Motions	Stereo introduction, Camera Calibration, Epipolar Geometry, and Structure from Motion, Dense Stereo Correspondence, Optical Flow	8
6	Recognition	Object Recognition, Face Recognition, Instance Recognition	6

4. Suggested Experiments:

1. Study of computer vision applications.
2. Implement camera calibration methods.
3. i) Implement image preprocessing and Edge detection.
   ii) Implement image filtering using frequency domain filtering techniques.
4. i) Construct 3D model from Stereo pair.
   ii) Construct 3D model from defocus image.
5. i) Construct 3D model from Stereo pair.
   ii) Implement optical flow method.
6. Implement Face detection and Recognition.

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 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.

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. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer,2010.
2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
3. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.

B. References:

1. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
2. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012.
3. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.
4. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE413TL	High Performance Computing	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					
CE413TL	High Performance Computing	40	40	40	60	25	--	25	150

1. Course Objectives:

The course is aimed to:

1. To learn fundamental concepts of parallel processing.
2. To learn utilization of high performance computing resources using programming frameworks.
3. To learn usage of modern processor technology as a high performance computing platform.
4. To learn and appreciate core design issues in parallel computing.
5. To study application of high performance computing to practical problems.
6. To understand factors limiting performance of high performance computing systems.

2. Course Outcomes:

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

1. Memorize and Understand classes of parallel computer architectures.
2. Understand standardized, multi-platform communication methods for parallel programming.
3. Understand usage of graphical processing unit hardware as high performance computing unit.
4. Analyze fundamental issues in parallel computing.
5. Understand parallel computing implementation for a computationally intensive problem.
6. Understand practical limitations of technology for high performance computing.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Parallel Processing Concepts	Levels of parallelism (instruction, transaction, task, thread, memory, function), Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc), Architectures: N-wide superscalar architectures, multi-core, multi-threaded	6
2	Parallel Programming with MPI, OpenMP	Processor Architecture, Interconnect, Communication, Memory Organization, and Programming, building blocks of MPI, Overlapping communication and computation, collective communication operations, OpenMP Threading Building blocks; An Overview of Memory Allocators, Parallel programming model, combining MPI and OpenMP, Shared memory programing	12
3	Parallel Programming using GPU	Models in high performance computing architectures: (Examples: Nvidia Tesla GPU), Memory hierarchy and transaction specific memory design, Thread Organization, An Overview of CUDA, Programming with CUDA	8
4	Fundamental Design Issues in Parallel Computing	Synchronization, Scheduling, Job Allocation, Job Partitioning, Dependency Analysis, Mapping Parallel Algorithms to Parallel Architectures, Performance Analysis of Parallel Algorithms	8
5	Fundamental Limitations Facing Parallel Computing	Bandwidth Limitations, Latency Limitations, Latency Hiding/Tolerating Techniques and their limitations	3
6	Application of HPC	CASE study in HPC	2

4. Suggested Experiments:

1. Study and Write case study on your College network.
2. Write program for matrix multiplication using MPI.
3. Write program for matrix addition using OpenMP.
4. Write program for matrix addition using CUDA.
5. Write program for parallel quicksort algorithm.
6. Write a program to Send message to parallel computers connected through network and find latency.
7. Write a case study on application of HPC.

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 half hour.

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 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.

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

7. Books and References:

1. "Advanced Computer Architecture: Parallelism, Scalability, Programmability", by Kai Hwang, McGraw Hill 1993
2. "Parallel Programming in C with MPI and OpenMP", Michael J. Quinn, McGraw-Hill International Editions, Computer Science Series, 2008.
3. "CUDA by Example – An Introduction to General Purpose GPU Programming",Edward Kandrot and Jason Sanders, Addison-Wesley Professional ©, 2010.
4. NVIDIA TESLA V100 GPU ARCHITECTURE
5. "Introduction to Parallel Computing",AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar , Pearson Education, Second Edition, 2007.
6. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, © 2007.

B. .References:

1. "Case for Energy Proportional Computing", L. Barraso and Holzl, IEEE Computer Dec 2007.
2. "High Performance Computing: Paradigm and Infrastucture", Lawrence Yang, Minyi Guo, Wiley, 2006

IL480T Digital Business Management and Digital Marketing

Syllabus under Construction

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL481T	Medical Image Processing	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					
IL481T	Medical Image Processing	40	40	40	60	--	--	--	100

1. Course Objectives:

The course is aimed to:

1. To introduce the learners the basic theory of digital image processing.
2. To expose learners to various available techniques and possibilities of this field.
3. To prepare learners to formulate solutions to general image processing problems.

2. Course Outcomes:

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

1. Record, extract and analyze key information about teeth, muscles, bones etc.
2. Acquire the fundamental concepts of a digital image processing.
3. Analyze images in the spatial and frequency domain.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.

1	Medical Imaging Systems:	Properties, advantages and disadvantages of X-rays based imaging systems, Magnetic Resonance Imaging (MRI) imaging, Gamma-rays based imaging systems, Positron emission tomography (PET), Single-photon emission computerized tomography (SPECT) scan, Computed Tomography (CT) scan, Ultrasound (sonography), Endoscopy, and Thermography based imaging systems. Difference between different medical imaging systems. Nature of Biomedical images, Objectives of biomedical image analysis, Difficulties in biomedical image acquisition and analysis.	7
2	Medical Imaging Toolkits:	ImageJ (and/or FIJI), ITK-Snap, SimpleITK, MITK, FreeSurfer, SLICER, OsiriX. Image Formats: dicom (.dcm), Nifti (.nii), Minc (.mnc), Analyze (img/hdr), Raw (.raw), MHD (.mhd) and MHA (.mha)	5
3	Medical Image Detection and Recognition:	Medical image parsing, Deep Learning for Medical Image Recognition, Automatic Interpretation of Carotid Intima–Media Using Convolutional Neural Networks, Deep Cascaded Networks for Sparsely Distributed Object Detection, Deep Voting and Structured Regression for Microscopy Image Analysis.	6
4	Medical Image Registration	Intensity-based methods, Cost functions - correlation, least squares, mutual information, robust estimators. Optimization techniques - fixed-point iteration, gradient descent, Nelder-Mead simplex method. MRI motion compensation, Convolutional Neural Network for Robust and Real-Time 2-D Registration.	6
5	Medical Image Segmentation Networks	Comparative study and analysis of U-Net family of segmentation: U-Net, V-Net, 3D U-Net, H-DenseUNet, GP-Unet, UNet++, MDU-Net, DUNet, RA-UNet, nnU-Net, SUNet, IVD-Net, LADDERNET, Attention U-Net, R2U-Net, MultiResUNet, U-NetPlus, CE-Net, CIA-Net, U2-Net, ScleraSegNet, AHCNet, MFP-Unet, ResUNet-a, RAUNet, 3D U2-Net, SegNAS3D, U^2-Net, UNET 3+.	9
6	Deep Learning for Healthcare	Deep learning for different healthcare applications: Diabetic Retinopathy, Knee Osteoarthritis, Histological and Microscopic Elements Detection, Gastrointestinal Diseases Detection, Cardiac Imaging. Lesion detection: Brain tumor detection, prostate lesion detection, Lung nodule detection.	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 half hour.

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 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:

1. W. Birkfellner, Applied Medical Image Processing: A Basic Course, CRC Press , Second Edition, 2014.
2. I. Bankman, Handbook of Medical Image Processing and Analysis, Academic Press , Second Edition, 2008.
3. Rangaraj M. Rangayyan, “Biomedical Image Analysis”, CRC Press, 2000.
4. Zhou et al “Deep learning for Medical image analysis” Elsevier 2018.
5. R. C. Gonzalez, Digital Image Processing, Pearson Education India , Third Edition, 2013.
6. S. Jayaraman, T. Veerakumar, S. Esakkirajan, Digital Image Processing, McGraw Hill Education , 2017.
7. A K Jain, “Fundamental of Digital Image Processing”, Prentice Hall, 2002.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL482T	Technologies for Rural Development	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					
IL482T	Technologies for Rural Development	40	40	40	60	--	--	--	100

1. Course Objectives:
The course is aimed to:
1. To understand the nature and characteristics of rural resources and its importance in Rural.
2. Development. To understand various technologies required for Rural Development.

2. Course Outcomes:
On successful completion of course learner/student will be able to:
1. Understand various natural resources and their importance in rural development.
2. Get exposure to various challenges and problems with regard to availability and use of natural resources.
3. Develop and implement various technologies for rural development.
4. Explore various schemes for rural development.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Nature and Characteristics of Rural Resources: Land Resources. water Resources,	Definition and meaning of Resources, Types of Rural Resources, Natural and Man-made, Characteristics of Resources, Importance of different resources in Rural Development.	8

	Living Resources, Human Resources		
2	Concept of Information and Communication Technologies (ICT's)	Evolution of ICT's, Communication Functions of ICT's, Nature and Scope of ICT's, Information Haves and Information Have Nots in the Rural Areas, Strengths and Weaknesses of ICT's in Rural India, Application of ICT's for Rural Development in India, Management Information System for Rural Development in India, Success Stories relating to ICT's for Rural Development (Andhra Pradesh, Tamil Nadu, Kerala and Karnataka Experiments), Satellite Communication support for Rural Development, Telecommunication support for Rural Development, Computer Communication support for Rural Development	10
3	Crop production technology /Processing Plants	Processing Plants for major cereal crops viz., paddy, wheat, maize, pearl millet, sorghum, etc.; Major varieties, sowing time, method of sowing, spacing, inter culturing, fertilizer and water requirement, time of harvest, maturity index, yield potential, cost of cultivation, income from production, etc. Rural Energy system ,Technologies for Water treatment	8
4	The Role of Rural Technology	Need & importance of rural Technology, appropriate rural Technology, Technology for Rural Women, difficulties in adoption of rural technology.	6
5	Globalization of Rural Economy	Globalization and aims and objectives; Impact of Globalization on rural economy, Contract farming, corporate farming, SEZ's and Agriculture. Agricultural value chain	6
6	Government Schemes	Government Schemes, initiatives and participation of various Stake holders for development and Protection of Rural resources	4

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 half hour.

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 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. References:

1. Rural Development: Principles, Policies and Management, Katar Singh, Sage Publications India Pvt. Ltd., 2009.
2. Development of Land Resources – E-book on Activities Department of Land Resources, Ministry of Rural Development, Government of India, Dec. 2014,
3. Http://dolr.nic.in/downloads/PDFs/DoLR%20Activities.pdf.
4. S.S. Singh., Principles and Practices of Agronomy. 1985. Kalyani Publishers, Ludhiana.
5. Indian Economy by Datt, Rudra & Sundharam, New Delhi: S. Chand, 2008.
6. W.T.O and Indian Economy by Deogirikar, A. B. Jaipur: Shri Niwas Publications, 2004 .

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL483T	Economics	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					
IL483T	Economics	40	40	40	60	--	--	--	100

1. Course Objectives:

The course is aimed to:

1. Provide a good grounding in the basic concepts of Micro and Macroeconomics.
2. Familiarize learners with concept of demand, supply, price, income and equilibrium. Teach students to represent Indifference curve in regular as well as in exceptional cases with respect to consumer behaviour, consumer preferences and Risk Aversion.
3. To inculcate the skills required to understand the concept of Production function with single and two variable inputs.
4. To create an awareness of the different market structures and its impact on the price and output of a product.
5. To prepare the learners in understanding the Keynesian System of Money, Interest and Income and its impact in society with respect to Inflation.

2. Course Outcomes:

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

1. Acquire conceptual and theoretical knowledge of Micro and Macroeconomics and learn to think critically about issues and topics of the subject.
2. Demonstrate the understanding of the concepts of demand, supply, price, income and equilibrium and relate it to the existing scenario in the society.
3. Perform successfully in representing the Indifference curve in relation to the prevalent consumer behaviour and consumer preferences.

4. Illustrate the skills required for maximising output and minimising cost for effective production.
5. Determine the importance of the existence of different market structures and its impact in society.
6. Develop an understanding of the Keynesian System of Money, Interest and Income and formulate anti- inflationary policies.

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Micro and Macro Economics	Introduction to Micro and Macro Economics	5
2	Demand & Supply	Demand & Supply: Concept of demand & supply functions, Price, Income & Cross elasticities of demand, Elasticity of Supply, Market demand functions, Concept of equilibrium, Impact of changes in demand & supply on equilibrium	7
3	Theory of Consumer Behavior	Theory of Consumer Behavior: Concept of cardinal and ordinal utility, consumer's equilibrium, Consumer's preferences, Risk Aversion and Indifference Curve Analysis, & its properties, Shapes of Indifference Curves in exceptional cases	7
4	The Theory of Production	The Theory of Production: Concept of Production function, Production with a single variable input, Production with two variable inputs, Optimal input combination, Constrained output maximization, Cost minimization, Elasticity of substitution	6
5	Theory of Cost	Theory of Cost: Different concept of cost, Short-run and Long- run cost analysis, modern concept. Market Structures a. Perfect Competition Short-run and long-run equilibrium of the firm and Industry, Stability of equilibrium, Concept of imperfect competition; short run and long run price and output decisions of a monopoly firm; concept of a supply curve under monopoly; comparison of perfect competition and monopoly,	4
6	The Keynesian System	The Keynesian System: Money, Interest and Income Money in the Keynesian theory, Interest Rate Determination (Liquidity Preference Theory), Money Market, Bond market and Commodity Market, Monetary policies and fiscal policies, Inflation and Unemployment Inflation, Role and Effects of inflation, Anti- inflationary policies	7

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 half hour.

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 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.

7. Books and References:

1. Dr. Samwel Nyagucha Ores. (2019). Micro and Macro Economics: Understanding the Basics of Economics. New Generation Publishing.
2. Daron Acemoglu and James A. Robinson. (2013). Why Nations Fail: The Origins of Power, Prosperity and Poverty. Profile Books

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL484T	GIS and Remote Sensing	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					
IL484T	GIS and Remote Sensing	40	40	40	60	--	--	--	100

1. Course Objectives:

The course is aimed to:

1. To gain basic understanding of GIS and remote sensing techniques
2. To understand basic software such as QGIS used for GIS analysis
3. To understand various GIS data sources, their processing and interpretation

2. Course Outcomes:

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

1. Know and apply GIS and remote sensing concepts to real world problems
2. Learner will become proficient in using Python and QGIS to conduct geospatial analysis

3. Detailed Theory Syllabus:

Prerequisites: Knowledge of Python or other software programming language

Module No	Module	Detailed Contents of Module	Hrs.
1	**Module 1**	Introduction to GIS Mapping. GIS Data models and modelling, Maps and Databases, GIS data types (vector, raster etc), Geographic coordinate systems,	10
2	**Module 2**	Introduction to QGIS software, GIS data sources, Digitizing data, Georeferencing	10

3	**Module 3**	Spatial Analysis techniques vector and raster analysis and tools.	20
4	**Module 4**	Satellite images, electromagnetic energy and remote sensing, satellites and sensors, arial cameras, surveys using drones, multispectral scanners, LIDAR.	10
5	**Module 5**	Applications of GIS in industry, governments, NGOs etc	10

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 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.

7. Books and References:

1. Principals of Remote Sensing: An Introductory Textbook (https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesremotesensing.pdf)
2. Principals of GIS (https://webapps.itc.utwente.nl/librarywww/papers_2009/general/principlesgis.pdf)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL485T	Physical Education	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					
IL485T	Physical Education	40	40	40	60	--	--	--	100

1. Course Objectives:

The course is aimed to:

1. To understand the components of Physical Fitness.
2. To understand the modern development and social aspects of physical education
3. To understand general troop games, recreational games and the importance of playing to achieve health & wellness.
4. To acquaint students with principles of nutrition and the application of human energy.
5. To understand the role of food in physical performance.
6. To understand the need for wellness & weight management.
7. To understand common sports injuries, first aid & their treatment.
8. To understand the application of Yoga in physical education & sports.
9. To enable the student to understand the basic structure & function of the human body and the effect of exercise on the body as a whole.

2. Course Outcomes:

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

1. Maintain a health-enhancing level of fitness throughout the program as well as be able to collect and analyse personal fitness data.
2. Gain knowledge regarding the application of yoga to Physical Education and Sports
3. Understand the anatomy and Physiology of Asanas and Pranayamas.
4. Acquire the knowledge regarding the effect of exercise on the body as a whole
5. Develop an understanding of the concept of personality, factors affecting personality development
6. To understand proportional body weights and their management
7. To understand nutrition and balance diet

3. Detailed Theory Syllabus:

Module No	Module	Detailed Contents of Module	Hrs.
1	Physical Fitness	**Physical Fitness** 1.1 Concept, definition and meaning of Physical fitness, activity and exercise	8

		1.2 Components of Physical fitness, Benefit of Physical fitness & exercise. 1.3 Principles of physical fitness 1.4 Definition and concept of wellness and factors affecting Physical fitness & wellness 1.5 Concept and importance of physical conditioning, warming up and cooling down of all age groups	
2	Nutrition and Dietary Requirement	**Nutrition and Dietary Requirement** 2.1 Nutrition components and balanced diet 2.2 Meaning and definition of doping and ergogenic aids 2.3 Prevention and first-aid of common injuries during Physical training 2.4 Need of Energy, Carbohydrate and Protein 2.5 Concept training nutrition and competition nutrition	6
3	Wellness, Weight management and Holistic health	**Wellness, Weight management and Holistic health** 3.1 Meaning, concept and components of Wellness 3.2 Manipulation of energy balance to induce weight loss and weight gain 3.3 Methods of weight management 3.4 Concept, types and cause of obesity and its management. 3.5 Waist hip ratio, larger heart, BMI, calculation of Training Heart Rate	6
4	Human body system, function and effect of exercise	**Human body system, function and effect of exercise** 4.1 Meaning and Importance of the study of Human anatomy in physical education & sports 4.2 Classification and functions of bones and joints 4.3 Movements of various joints 4.4 Structural classification of muscle, types of muscle and effect of exercise on the musculoskeletal system. 4.5 Structure and Effect of exercise on the cardiorespiratory system 4.6 Digestion and effect of exercise on the digestive system 4.7 Nervous system and effect of exercise on the nervous system.	6
5	Yoga and meditation	**Yoga and meditation** 5.1 Concept of Yoga and misconception about Yoga 5.2 Comparison of Physical Education exercise and Yogic exercise. 5.3 Meaning, Types and principles of Meditation 5.4 Principles governing various exercises in Yoga(Asana, Pranayam, Bandha, Mudra, Kriya) 5.5 Yoga for stress management and emotional stability 5.6 Application of Yoga in sports & physical education and effect of Yogic exercise on different systems of the human body.	8
6	General & recreational troop games and its method of skill training	**General & recreational troop games and its method of skill training** 6.1 The game soccer and its rules and regulation 6.2 The game Volleyball, Basketball and its rules and regulations 6.3 The Indoor games and their rules and regulations 6.4 Method of sports skill developing training 6.5Recreational games and their importance in day to day life	6

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 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.

7. Books and References:

1. Padmakshan Padmanabhan 'Handbook of Health & Fitness', Indus Source; First edition, Indus Source Books, Wadala Mumbai. 2014.
2. Adams, William.C. 'Foundation of Physical Education Exercises and Sports Sciences', Lea and Febigor, Philadelphia, 1991.
3. Dr. Kamlesh M.L. 'Principles and History of Physical Education and Sports', Friends Publication (India) New Delhi, 2004
4. Bates M.'Health Fitness Management (2nd Ed.) USA : Human Kinetics.2008
5. Fink, H.H., Burgoon,L.A., & Mikesky. Practical Applications in Sports Nutrition. Canada : Jones and Bartlett Publishers. 2006.
6. Worthington, Vivian. History of Yoga. London : Routledge and Kegan Paul Ltd. 1982.
7. Rajan, M. Yoga Stretching and Relaxation for Sportsman. Delhi : Allied publishers. 1985.
8. Crouch James E. – Essential Human Anatomy A Text – Lea & Febriger , Philladalphia
9. Murgesh N. – Anatomy, Physiology and Health Education, Sathya, Chinnalapatti, 1990
10. Giam, C.K. Sport Medicine Exercise and Fitness. Singapore : P.G. Medical Book. 1994.

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
CE414P	**Project C**	Contact Hours	--	12	-	12
		Credits	--	6	-	6

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
CE414P	**Project C**	--	--	--	--	100	--	100	200

1. Course Objectives:

The course is aimed to:

1. To offer students a glimpse into real world problems and challenges that need IT based solutions
2. To enable students to create very precise specifications of the IT solution to be designed.
3. To introduce students to the vast array of literature available of the various research challenges in the field of IT
4. To create awareness among the students of the characteristics of several domain areas where IT can be effectively used.
5. To enable students to use all concepts of IT in creating a solution for a problem
6. To improve the team building, communication and management skills of the students.

2. Course Outcomes:

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

1. Discover potential research areas in the field of IT
2. Conduct a survey of several available literature in the preferred field of study
3. Compare and contrast the several existing solutions for research challenge
4. Demonstrate an ability to work in teams and manage the conduct of the research study.
5. Formulate and propose a plan for creating a solution for the research plan identified
6. To report and present the findings of the study conducted in the preferred domain

3. Guidelines:

1. The project work is to be conducted by a group of three students
2. Each group will be associated with a project mentor/guide. The group should meet with the project mentor/guide periodically and record of the meetings and work discussed must be documented.
3. Department has to allocate 1 day in VII semester and 2 day in VIII semester every week.
4. Students will do literature surveys in Sem VI or Sem VII.

5. Students will do design, implementation and coding in Sem VII.
6. Each group along with its guide/mentor shall identify a potential research area/problem domain, on which the study is to be conducted.
7. Each team will do a rigorous literature survey of the problem domain by reading and understanding at least 3-5 research papers from current good quality national/international journals/conferences. (Papers selected must be indexed by Scopus/IEEE/Springer/ACM etc.). The list of papers surveyed must be clearly documented.
8. The project assessment for term work will be done at least two times at department level by giving presentations to panel members which consist of at least three (3)members as Internal examiners (including the project guide/mentor) appointed by the Head of the department of respective Programme.
9. A report is to be prepared summarizing the findings of the literature survey. A comparative evaluation of the different techniques surveyed is also to be done.
10. Students will do testing and analysis in Sem VIII
11. Teams must analyse all the results obtained by comparing with other standard techniques.
12. Every team must publish their work in national / international conferences/journals (if possible publish in Scopus indexed journals).

4. Evaluation:

1. Each team has to give a presentation/demo to the Internal Panel and External examiner.
2. Each team will prepare a report that will summarize the results of the literature survey and implementation and coding as project proposal in SEM VII. The list of papers surveyed must be clearly documented.
3. Each group will be jointly evaluated by a team of Internal and External Examiners approved by the University of Mumbai.
4. Oral exams will be conducted on the project done by the students.

4. Term Work:

Term Work shall consist of full Project-C on above guidelines/syllabus.
Term Work Marks: 100 Marks (Total marks) = 95 Marks (Project-II) + 5 Marks (Attendance)
Oral Exam: An Oral exam will be held based on the Project-C and Presentation.