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 Electronics & Computer Science

Syllabus

of

B.Tech. in Electronics & Computer Science

for

The Admission Batch of AY 2023-24

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

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

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

Fourth Year - Effective from Academic Year **2026-27**

as per Choice Based Credit and Grading System

Mahatma Education Society's

Pillai College of Engineering

Vision

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

Mission

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

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

Department of Electronics & Computer Science

Vision

To produce professionally competent and socially responsible engineers capable of working globally.

Mission

To provide in-depth quality education in Electronics & Computer Science Engineering and prepare the students for lifelong learning.

To develop professional engineers who can critically and creatively apply the knowledge of engineering principles to solve real world problems.

To inculcate entrepreneurship skills and impart ethical and social values.

Program Educational Objectives (PEOs):

I. Graduates will have the ability to apply engineering knowledge and skills to provide solutions to real world technical problems.
II. Graduates will be successful as engineering professionals, innovators or entrepreneurs with a multidisciplinary approach contributing towards research and technological developments.
III. Graduates will have the ability to pursue higher education in Electronics Engineering, Computer Science and allied streams.
IV. Graduates will function in their profession with social awareness and responsibility while maintaining ethical standards.

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 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 of 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 the 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 teamwork: 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 work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognized 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):

Engineering Graduates will be able to

1. Gain knowledge and skills to analyse and design Electronics circuits as well as Computer Programs.
2. Develop hardware and software systems in the areas like Artificial Intelligence & Machine learning, Big Data, Information Security, Automation, Embedded Systems, Signal Processing and Communication Systems.
3. Apply modern Electronics and Computer engineering techniques and tools to find solutions for real life interdisciplinary problems.

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 Electronics & Computer Science offers a B. Tech. programme in Electronics & Computer Science. This is an eight semester course. The complete course is a 163 credit course which comprises core courses and elective courses. The elective courses are distributed over 8 specializations. The specializations are:

1. AIML
2. Robotics
3. Data Analytics
4. System Security
5. High Performance Computing
6. Cloud Computing
7. VLSI Design
8. IOT

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

1. Business and Entrepreneurship
2. Bio Engineering
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 Electronics & Computer Science 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 Electronics & Computer Science is tabulated in Table 1.

Structure of Undergraduate Engineering program

Sr. No.	Category	Breakup of ECS Credits
1	Humanities and Social Sciences including Management courses	9
2	Basic Science courses	25
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	20
4	Professional Core Courses	61
5	Professional Elective Courses	22
6	Open subjects – Electives from other technical and /or emerging subjects	9
7	Project work, seminar and internship in industry or elsewhere	16
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
	Total	162

Semester-wise Credits and Marks

Sr. No.	Semester	Credits Assigned	Marks Assigned
1	I	18	675
2	II	21	775
3	III	23	800
4	IV	25	900
5	V	24	875
6	VI	23	800
7	VII	17	610
8	VIII	11	300
Total Credits & Marks		162	5735

Preface by Board of Studies in Electronics & Computer Science

Dear Students and Teachers, we, the members of Board of Studies Electronics & Computer Science, are very happy to present the B.Tech Electronics & Computer Science syllabus effective from the Academic Year 2023-24 . We are sure you will find this syllabus interesting, challenging, and up to date to fulfill specific needs and expectations.

The Electronics and Computer Science discipline combines two important disciplines of engineering: Electronics and Computer Science. 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 Electronics & Computer Science. Its primary goal is to offer a contemporary and industry-centric education, preparing individuals to effectively meet the global demands of the field.

The syllabus is meticulously crafted to align with the vision and mission of the Electronics & Computer Science Department as well as the standards set by various accreditation agencies. It takes into account technological advancements, innovations, and industry requirements, ensuring that the curriculum remains up-to-date and relevant to the evolving landscape of the field.

The development of this syllabus involves a collaborative brainstorming session, which includes the participation of Heads of Department and senior faculty members from the Department of Electronics & Computer Science.

We express our sincere appreciation and gratitude to the faculty, students, industry experts, and all the stakeholders for their invaluable contributions towards the formulation of this syllabus. Their expertise, insights, and active involvement have been instrumental in shaping and refining the curriculum.

Board of Studies in Electronics & Computer Science

1. Dr. Monika Bhagwat	Coordinator (Chairman)
2. Dr. Rajendrakumar H. Khade	Faculty
3. Prof. Ajit Saraf	Faculty
4. Prof. K.S. Charumathi	Faculty
5. Dr Bhavana Ambudkar	Academic Council Nominee
6. Dr. Seema Shah	Academic Council Nominee
7. Dr. S J Bhosale	Vice Chancellor's Nominee
8. Mr. Sambhaji N. Kadam	Industry Representative relating to placement
9. Mr. Rajat Tyagi	Alumnus Nominee
10. Mr Prashant Kathole	Industry Expert
11. Prof. Ravi Biradar	Other Member of Staff of Same Faculty

Program Structure for
Bachelor of Technology in Electronics & Computer Science

Semester I

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract / Tuts	Theory	Pract /Tuts	Total
EC 101	Engineering Mathematics I	TLP	3	2	3	1	4
EC 102	Engineering Physics I	TL	2	1	2	0.5	2.5
EC 103	Engineering Chemistry I	TL	2	1	2	0.5	2.5
EC 104	C Programming	TLP	3	2	3	1	4
EC 105	Basic Electrical Engineering	TL	3	2	3	1	4
EC 106	Basic Workshop Practice I	L	-	2	-	1	1
Total			**13**	**10**	**13**	**5**	**18**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract /Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
EC 101	Engineering Mathematics I	40	40	40	60	2	25	-	125
EC 102	Engineering Physics I	30	30	30	45	2	25	-	100
EC 103	Engineering Chemistry I	30	30	30	45	2	25	-	100
EC 104	C Programming	40	40	40	60	2	25	25	150
EC 105	Basic Electrical Engineering	40	40	40	60	2	25	25	150
EC 106	Basic Workshop Practice I	-	-	-	-	-	50	-	50
Total									**675**

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

Program Structure for
Bachelor of Technology in Electronics & Computer Science

Semester II

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract/ Tuts	Total
EC 107	Engineering Mathematics II	TLP	3	2	3	1	4
EC 108	Engineering Physics II	TL	2	1	2	0.5	2.5
EC 109	Engineering Chemistry II	TL	2	1	2	0.5	2.5
EC 110	Engineering Mechanics and Graphics	TL	2	4	2	2	4
EC 111	Python Programming	TLP	3	2	3	1	4
EC 112	Professional Communication & Ethics I	TLC	2	2	2	1	3
EC 113	Basic Workshop Practice II	L	-	2	-	1	1
Total			**14**	**14**	**14**	**7**	**21**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
EC 107	Engineering Mathematics II	40	40	40	60	2	25	-	125
EC 108	Engineering Physics II	30	30	30	45	2	25	-	100
EC 109	Engineering Chemistry II	30	30	30	45	2	25	-	100
EC 110	Engineering Mechanics and Graphics	40	40	40	60	3	25	50	175
EC 111	Python Programming	40	40	40	60	2	25	25	150
EC 112	Professional Communication & Ethics I	20	20	20	30	1	25	-	75
EC 113	Basic Workshop Practice II	-	-	-	-	-	50	-	50
Total									**775**

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

Program Structure for
Bachelor of Technology in Electronics & Computer Science

Semester III

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract /Tuts	Theory	Pract /Tuts	Total
EC 201	Engineering Mathematics III	T	3	1	3	1	4
EC 202	Communication Engineering	TL	3	2	3	1	4
EC 203	Analog Electronics Circuits	TL	3	2	3	1	4
EC 204	Digital Circuits & System Design	TL	3	2	3	1	4
EC 205	Data Structures & Algorithms	TLP	3	2	3	1	4
EC 206	Human Values and Social Ethics	T	2	-	2	-	2
EC 291	Programming Lab I (Java Programming)	LPC	-	1#+2	-	1	1
Total			**17+1#**	**11**	**17**	**6**	**23**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract /Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
EC 201	Engineering Mathematics III	40	40	40	60	2	25	-	125
EC 202	Communication Engineering	40	40	40	60	2	25	-	125
EC 203	Analog Electronics Circuits	40	40	40	60	2	25	25	150
EC 204	Digital Circuits & System Design	40	40	40	60	2	25	25	150
EC 205	Data Structures & Algorithms	40	40	40	60	2	25	25	150
EC 206	Human Values and Social Ethics	-	-	-	-	-	50	-	50
EC 291	Programming Lab I (Java Programming)	-	-	-	-	-	25	25	50
Total									**800**

1# to be taken class wise **T- Theory , L- Lab , P-Programming, C- Communication**

Program Structure for
Bachelor of Technology in Electronics & Computer Science

Semester IV

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract/ Tuts	Total
EC 208	Engineering Mathematics IV	T	3	1	3	1	4
EC 209	Basics of VLSI Design	T	3	2	3	1	4
EC 210	Database Management System	TLP	3	2	3	1	4
EC 211	Microprocessor and Microcontrollers	TL	3	2	3	1	4
EC 212	Analysis of Algorithms	TLP	3	2	3	1	4
EC 213	System Software & Operating Systems	TLP	3	2	3	1	4
EC 292	Programming Lab II(Web Programming)	LPC	-	1#+2	-	1	1
Total			**18+1#**	**13**	**18**	**7**	**25**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
EC 208	Engineering Mathematics IV	40	40	40	60	2	25	-	125
EC 209	Basics of VLSI Design	40	40	40	60	2	25	25	150
EC 210	Database Management System	40	40	40	60	2	25	25	150
EC 211	Microprocessor and Microcontrollers	40	40	40	60	2	25	25	150
EC 212	Analysis of Algorithms	40	40	40	60	2	25	25	150
EC 213	System Software & Operating Systems	40	40	40	60	2	25	-	125
EC 292	Programming Lab II (Web Programming)	-	-	-	-	-	25	25	50
Total									**900**

1# to be taken class wise

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

Program Structure for
Bachelor of Technology in Electronics & Computer Science

Semester V

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract/ Tuts	Total
EC 301	Signals & Systems	TL	3	1	3	1	4
EC 302	Computer Networks	TL	3	2	3	1	4
EC 303	Instrumentation & Control System	T	3	-	3	-	3
EC 304	Software Engineering	T	3	2	3	1	4
EC 305	Programming Lab III (R-Programming)	TC	-	1#+2	-	1	1
EC 3xx	Department Level Optional Course I	TL	3	2	3	1	4
EC 3xx	Department Level Optional Course II	TL	3	2	3	1	4
Total			**18+1#**	**11**	**18**	**6**	**24**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
EC 301	Signals & Systems	40	40	40	60	2	25	-	125
EC 302	Computer Networks	40	40	40	60	2	25	25	150
EC 303	Instrumentation & Control System	40	40	40	60	2	-	-	100
EC 304	Software Engineering	40	40	40	60	2	25	25	150
EC 305	Programming Lab III (R-Programming)	-	-	-	-	-	25	25	50
EC 3xx	Department Level Optional Course I	40	40	40	60	2	25	25	150
EC 3xx	Department Level Optional Course II	40	40	40	60	2	25	25	150
Total									**875**

1# to be taken class wise

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

Course Code	Department Level Optional Course (DLOC) I	Specializations
EC 306	Artificial Intelligence	AIML
EC 307	Advanced Database Management Systems + DWM	Data Analytics
EC 308	Advanced Operating System	High Performance Computing
EC 309	Advanced VLSI Design	VLSI Design

Course Code	Department Level Optional Course (DLOC) II	Specializations
EC 310	Digital Signal Processing	Robotics
EC 311	Advanced Network Theory	System Security
EC 312	Mobile Computing	Cloud Computing
EC 313	Wireless Networks	IOT

Program Structure for
Bachelor of Technology in Electronics & Computer Science

Semester VI

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract/ Tuts	Total
EC 314	Image Processing & Machine Vision	TLP	3	2	3	1	4
EC 315	Computer Organization & Architecture	T	3	-	3	-	3
EC 316	Professional Communication & Ethics II	LP	1	2	1	1	2
EC 3xx	Department Level Optional Course III	TL	3	2	3	1	4
EC 3xx	Department Level Optional Course IV	TL	3	2	3	1	4
IL 3xx	Institute Level Optional Course I	T	3	-	3	-	3
EC 392	Project A (Literature Survey & Problem Formulation)	LPC	-	6	-	3	3
Total			**16**	**14**	**16**	**7**	**23**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
EC 314	Image Processing & Machine Vision	40	40	40	60	2	25	25	150
EC 315	Computer Organization & Architecture	40	40	40	60	2	-	-	100
EC 316	Professional Communication & Ethics II	-	-	-	-	-	50	-	50
EC 3xx	Department Level Optional Course III	40	40	40	60	2	25	25	150
EC 3xx	Department Level Optional Course IV	40	40	40	60	2	25	25	150
IL 3xx	Institute Level Optional Course I	40	40	40	60	2	-	-	100
EC 392	Project A (Literature Survey & Problem Formulation)	-	-	-	-	-	50	50	100
Total									**800**

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

Course Code	Department Level Optional Course (DLOC) III	Specializations
EC 317	Machine Learning	AIML
EC 318	Big Data Analytics	Data Analytics
EC 319	Parallel Computing Architecture	High Performance Computing
EC 320	Integrated Circuit Technology	VLSI Design
Course Code	**Department Level Optional Course (DLOC) IV**	**Specializations**
EC 321	Speech Processing	Robotics
EC 322	Cryptography and System Security	System Security
EC 323	Cloud and Distributed Computing	Cloud Computing
EC 324	Embedded System Design & Basics of IOT	IOT
Course Code	**Institute Level Optional Course (ILOC) I**	**Specializations**
IL 360	Entrepreneurship	Business and Entrepreneurship
IL 361	IPR and Patenting	
IL362	Introduction to Bioengineering	Bio-Engineering
IL363	Product Design	Engineering Design
IL 364	Visual Art	Art and Humanities
IL 365	Journalism, Media and Communication Studies	
IL 366	Computational Physics	Applied Science
IL 367	Polymers and Polymeric Materials	
IL 368	Vehicle Safety	Life Skills, Repair, Maintenance and Safety
IL 369	Maintenance of Electronics Equipment	

Program Structure for
Bachelor of Technology in Electronics & Computer Science

Semester VII

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract/Tuts	Total
EC 401	Personal Finance Management	T	2	-	2	-	2
EC 4xx	Department Level Optional Course V	TL	3	2	3	1	4
EC 4xx	Department Level Optional Course VI	TL	3	2	3	1	4
IL 4xx	Institute Level Optional Course II	T	3	-	3	-	3
EC 491	Project B	LPC	-	8	-	4	4
Total			**11**	**12**	**11**	**6**	**17**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
EC 401	Personal Finance Management	20	20	20	40	2	-	-	60
EC 4xx	Department Level Optional Course V	40	40	40	60	2	25	25	150
EC 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
EC 491	Project B	-	-	-	-	-	50	100	150
Total									**610**

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

Course Code	Department Level Optional Course (DLOC) V	Specializations
EC 402	Deep Learning	AIML
EC 403	Data Science	Data Analytics
EC 404	High Performance Computing	High Performance Computing
EC 405	Analog and Mixed Signal VLSI Design	VLSI Design
Course Code	**Department Level Optional Course (DLOC) VI**	**Specializations**
EC 406	Robotics & Industrial Applications	Robotics
EC 407	Cyber Security & Digital Forensic	System Security
EC 408	Blockchain Technology	Cloud Computing
EC 409	Internet of Everything	IOT
Course Code	**Institute Level Optional Course (ILOC) II**	**Specializations**
IL 470	e- Commerce and e-Business	Business and Entrepreneurship
IL 471	Business Analytics	
IL 472	Biomedical Instrumentation	Bio-Engineering
IL 473	Design for Sustainability	Engineering Design
IL 474	Political Science	Art and Humanities
IL 475	Research Methodology	Applied Science
IL 476	Maintenance of Mechanical Equipment	Life Skills, Repair, Maintenance and Safety
IL 477	Cooking and Nutrition	

Program Structure for
Bachelor of Technology in Electronics & Computer Science

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract	Theory	Pract	Total
EC 492	Project C	LPC	-	6	-	3	3
EC 493	Internship	LPC	-	16	-	8	8
Total			**3**	**22**	**-**	**11**	**11**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
EC 492	Project C	-	-	-	-	-	50	50	100
EC 493	Internship	-	-	-	-	-	100	100	200
Total									**300**

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

*** - Six months internship to be undertaken by the student during the semester**

Bachelor of Technology
In
Electronics & Computer Science

(Semester I)

Course Code	Course Name	Credits
EC 101	**Engineering Mathematics I**	**3+1**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical/ Oral	Tutorial	Total credits
EC 101	Engineering Mathematics- I	3	2	-	05	3	1	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg.					
EC 101	Engineering Mathematics- I	40	40	40	60	25	-	-	125

Course Objectives:

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, inverse hyperbolic and logarithmic functions.
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 modeling.

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, Inverse Hyperbolic, and logarithmic functions in engineering problems.
3. Apply the concept of expansion of functions and successive 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.

Syllabus :

Module	Detailed Contents	Hrs.
1	**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 powers of sinθ, cosθ and Expansion of sin^nθ, cos^nθ in terms of sines and cosines of multiples of θ. 1.3. Powers and Roots of complex number.	6
2	**Hyperbolic , Inverse Hyperbolic and Logarithmic functions** 2.1 Introduction to Hyperbolic functions, Inverse Hyperbolic Functions. 2.2 Logarithmic functions, Separation of real and Imaginary parts.	6
3	**Successive Differentiation and Expansion of Function** **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^{x}, sin(x), cos(x), tan(x), sinh(x), cosh(x), tanh(x),log(1+x), $\sin^{-1}(x)$, $\cos^{-1}(x)$,$\tan^{-1}(x)$.	5
4	**Partial Differentiation and Applications of Partial Differentiation.** 4.1 Partial Differentiation: Function of several variables, Partial derivatives of first and higher order. Differentiation of composite function. 4.2.Euler's Theorem on Homogeneous functions with two independent variables (without proof). Deductions from Euler's Theorem. 4.3 Maxima and Minima of a function of two independent variables, Lagrange's method of undetermined multipliers with one constraint. Jacobian of two independent variables.	7
5	**Matrices :-** **Pre-requisite:** Inverse of a matrix, addition, multiplication and transpose of a matrix ,Elementary row and column transformation 5.1. Symmetric, Skew- Symmetric, Hermitian, Skew Hermitian,Unitary, Orthogonal Matrices and properties of Matrices (Without Proof). 5.2 Rank of a Matrix using Echelon forms, reduction to normal form and PAQ form. 5.3.System of homogeneous and non –homogeneous equations, their consistency and solutions.	6
6	**Numerical Methods** 6.1 **Solution of system of linear algebraic equations**, (1) Gauss Elimination, (2)Gauss Jacobi Iteration Method (3) Gauss Seidel Iteration Method, 6.2 **Solutions of Transcendental equations** (1) Bisection Method (2) Secant Method (3) Newton Raphson Method.	6

Assessment

I. Internal Assessment Test:

Assessment consists of two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 90 minutes.

II. End Semester Theory Examination:

1. Question paper will comprise of a total 05 questions, each carrying 20 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus wherein 4 sub-questions of marks each will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of each module will be proportional to number of respective lecture mentioned in the syllabus.

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 .

Engineering Mathematics I Laboratory

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

List of Scilab Programing

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

Term Work:

The distribution of Term Work marks–

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

Course Code	Course Name	Credits
EC 102	Engineering Physics-I	**2 + 0.5**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
EC 102	Engineering Physics-I	2	1	-	03	2	1	-	2.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 102	Engineering Physics-I	30	30	30	45	25	-	-	100

Course Objectives:

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.

Course Outcomes:

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

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

Syllabus:

Module	Details	Hours.
1.	**Lasers**: 1.1 Basic Definitions and explanation of terms: Spontaneous emission and stimulated emission; metastable state, population inversion, types of pumping, resonant cavity, Einstein's Coefficients and their derivation. 1.2. 3-level and 4-level lasing system and need for at least a 3-level system for lasing action. 1.3. Helium Neon laser: Construction, working and Energy level Diagram. 1.4. Nd: YAG laser: Construction, working and Energy level Diagram. 1.5. Application of Lasers: Holography.	4
2.	**Optical Fibres**: 2.1. Working Principle and Structure 2.2. Derivation of expression for Numerical Aperture for step index fibre. Expression for Critical angle; angle of acceptance for a step Index Fibre. 2.3. Classification of optical fibres. 2.4. Expression for V-number and modes of propagation for a step index fibre. 2.5. Applications : Fibre optic communication system	**3**
3.	**Interference in Thin Films:** 3. Interference in Thin Films 3.1. Interference by division of amplitude and by division of wave front. 3.2.Interference in thin films of constant thickness due to reflected light: Conditions for maxima and minima 3.3.Interference in thin films of constant thickness due to transmitted light: Conditions for maxima and minima 3.4.Interference in Wedge shaped film: Conditions for maxima and minima 3.5.Newton's Rings: Diameter of dark and bright rings	4
4.	**Applications of Interference of light:** 4.1: Thin Films of constant thickness: Origin of colours and estimation of absent colours in interference pattern, Conditions for refractive index and thickness for Highly reflecting and Anti-reflecting thin films on glass. 4.2: Wedge Shaped Thin Film: Relation between fringe width and wedge angle, Estimation of film thickness of a thin foil or wire. 4.3: Newton's Rings: Estimation of ring diameter for a particular wavelength and estimation of refractive index of gap medium.	**3**
5.	**Quantum Mechanics**: 5.1. De Broglie wave hypothesis, properties of matter waves: wave packet, Derivation of expressions for phase velocity and group velocity and their relationship. 5.2. Wave Function, its physical interpretation and salient features. 5.3. Heisenberg's Uncertainty principle statements and their interpretation: momentum and position/energy time forms. 5.4. Derivation of Schrodinger's Time Dependent Wave equation and Schrodinger's Time Independent Wave Equation 5.5.Energy Levels and distribution of probabilities of a charged particle bounded in an infinite potential well	**7**

6.	**Superconductivity**: 6.1. Critical temperature, critical magnetic field of a superconductor. 6.2. Meissner Effect, Type I and Type II and high Tc superconductors 6.3. BCS Theory (concept of Cooper pair) 6.4. Applications of superconductors: MAGLEV and qualitative discussion of Josephson effect and SQUID.	**3**

Assessment

I. Internal Assessment Test

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

II.End Semester Examination

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

1. Question paper will comprises 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.

References:

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

Engineering Physics-I Laboratory

List of Experiments:

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

Term work:

Term Work shall consist of a minimum six experiments. The distribution of marks rubric for term work shall be as follows:

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

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

Attendance (Theory and Practical): 05 marks

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

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

Course Code	Course Name	Credits
EC 103	**Engineering Chemistry I**	**2+0.5**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
EC 103	Engineering Chemistry I	2	1	-	03	2	1	-	2.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 103	Engineering Chemistry I	30	30	30	45	25	-	-	100

Course objectives

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

Course outcomes:

Students will be able to:

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

Syllabus:

Module	Detailed Contents	Hrs.
1	**Module 1 - Hardness of water** **Pre - requisites** : Knowledge of sources of water, Possible impurities in water, Characteristics imparted by impurities in water. Hardness in water – Types & its units, Determination of hardness by EDTA method, numerical problems. Effects of Hard water in Industries - Boiler corrosion, Priming and Foaming, Scales and Sludges,, caustic embrittlement, (Causes, methods of prevention), Langlier Index Softening of water- Ion exchange process.	3
2	**Module 2 - Water Treatment** Domestic water treatment : Steps involved in domestic water treatment - screening, sedimentation, filtration, disinfection - chlorination ,treatment with ozone. Desalination of brackish water- Reverse Osmosis, Electrodialysis, Ultrafiltration Sewage water treatment **:** BOD and COD, determination and numerical problems, Steps involved in sewage water treatment- primary, secondary (activated sludge process)	3
3	**Module 3 - Lubricants** **Pre - requisites** : Definition of Lubricants and Lubrication, functions of lubricants Functions of lubricants, Mechanisms of lubrication – Thick film, Thin film and Extreme pressure Classification of lubricants - Solid (MoS_2, graphite), Semi solid (greases), Liquid (animal/vegetable oils, mineral oils, Blended oils) Lubricants for special applications Properties of lubricants and their significance - Viscosity and Viscosity Index, Flash and Fire Points, Cloud and Pour Points, Acid Number, Saponification Number, and related numerical problems.	4
4	**Module 4 - Polymeric materials** **Pre - requisite** : Polymer, Monomer, Polymerization, Degree of polymerisation, Classification of polymers, Mechanism of polymerisation. Molecular weight of polymers: Average molecular weight (weight average and number average) of a polymer, Polydispersity Index, Numerical problems. Polymer crystallinity - glass transition temperature and factors affecting Tg, Viscoelasticity Additives in polymers Commercially important polymers - Polyethylene, Polyvinyl acetate, Polydimethyl Siloxane , Epoxy resins , Polylactic acid (PLA) Conducting polymers - Mechanism of conduction in polymers, Examples and applications.	6
5	**Module 5: Polymer Composites** **Prerequisite** :Definition and basic understanding of composite materials. Constitution of composite materials- Matrix and Dispersed phase Classification of composite materials - Particle reinforced composites, Fibre reinforced composites, structural composites . Advantages and Applications of composite materials	4

6	**Module 6 - Environmental Chemistry** **Pre- requisites:** Definition of Environment and Primary concept of environmental pollution**.** Industrial Pollution- Causes, Effects and solutions, a case study on industrial pollution E-pollution- Causes, concerns and management , Carbon credit Concept of 12 principles of Green chemistry, discussion with examples (synthesis of indigo, adipic acid), numericals on atom economy.	4

Assessment

I.Internal Assessment Test

Assessment consists of two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be 75 minutes.

II.End Semester Examination

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

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

References:

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

Engineering Chemistry-I Laboratory

List of Experiments:

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

Term work:

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

The distribution of marks for term work shall be as follows:
Laboratory work (Experiments and Journal) : 10 marks
Assignments and Viva on modules : 10 marks
Attendance (Theory and Practical) : 05 marks

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

Course Code	Course Name	Credits
EC 104	**C Programming**	**2+2**

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
EC 104	C Programming	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					
EC 104	C Programming	40	40	40	60	25	25	-	150

Course Objectives:

The course is aimed to:

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

Course Outcomes:

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

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

Syllabus:

Module	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 and Strings	4.1 Array Introduction, Declaration, Initialization, Accessing array element, One and Two-dimensional array. 4.2 Strings Introduction, String using char array, String handling functions	7
5	Structures	5.1 Structure Introduction, Declaration, Initialization, operations on structure. 5.2 Nested structure, Array of Structure.	3
6	Pointers	6.1 Pointer :Introduction, Definition, Pointer Variables, Referencing and Dereferencing operator, Pointer Arithmetic, Pointers to Pointers, void Pointer, 6.2 Pointers to Array and Strings, Passing Arrays to Function, Accessing structure using pointers, Array of Pointers, call by value and call by reference. 6.3 Dynamic Memory Allocation using malloc, calloc, realloc, free	6

Assessment:

I.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.

II.End Semester Theory Examination:

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

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

References:

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

C Programming-Laboratory

List of Experiments:

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

Consumption Units	**Rate of charge**
0 - 200	0.50 per unit
201 - 400	Rs. 100 plus 0.65 per unit excess of 200 units
401 - 600	Rs. 230 plus 0.85 per unit excess of 400 units
601 above	Rs. 390 plus 1.00 per unit excess of 600 units.

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

6. Write a program to take input for a character and print the month names starting with that character using a switch case. (Ex: I/P = 'A', O/P = April, August).
7. Write a program to find the result of the series:
   1 - 2^2/3 + 3^2/5……+ n^2/(2n-1)
8. Write a program to print the following pattern : (Take input for the no. of lines 'N').
   *
   * *
   * * *
   * * * *
9. Write a program to print the following pattern : (Take input for the no. of lines 'N').
   1

12A
123BA
1234CBA

10. Write a program to find if the given number is a palindrome number or not.
11. Write a program for the sum of natural numbers using a recursive function.
12. Write a program to illustrate different ways of passing parameters to a function to demonstrate increment/decrement operators.
13. Write a program to cyclically rotate elements of the integer array in the right direction.
14. Write a program to find transpose using the same matrix.
15. Write a program to find the reverse of a string using another string (Define a user defined function to find the length of the string).
16. Write a program using Structure to accept employee name, emp_id, date_of_joining and salary. Display the result in descending order of salary. Store data for N Employees.
17. Write a program to dynamically allocate memory for the user entered size 'N' of an array, accept 'N' integers from the user and find the average of these integers using function and pointer (Pass array to the function using pointer).

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)

1.

Course Code	Course Name	Credits
EC 105	**Basic Electrical Engineering**	**4**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
EC 105	Basic Electrical Engineering	3	2	-	5	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 105	Basic Electrical Engineering	40	40	40	60	25	-	25	150

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

Course Objectives:

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

Course Outcomes:

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

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

Syllabus

Module	Detailed Contents	Hrs.
1	**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** Linear and Nonlinear Circuit, Active and passive network, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, (Source transformation not allowed for Superposition theorem).	8
3	**AC fundamentals** 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** 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**.**	10
5	**Three Phase AC Circuits** Three phase voltage and current generation, star and delta connections (balanced load only), relationship between phase and line currents and voltages, Phasor diagrams, Basic principle of wattmeter, measurement of power by two wattmeter method .	6
6	**Electrical Machines** Working principle of single-phase transformer, EMF equation of a transformer, Transformation Ratio, Transformer Rating. Losses in transformer.	3

Assessment:

I. Internal Assessment Test:

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

II. End Semester Examination:

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

References:

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

5. D P Kothari and I J Nagrath “Theory and Problems of Basic Electrical Engineering”, PHI 13th edition 2011.

Basic Electrical Engineering Laboratory

Hardware Requirements: Hardware Kits, Three phase power supply.

List of Experiments:

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

Lab Assessment:

I.Term work Assessment:

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

The distribution of Term Work marks will be as follows:

Attendance (Theory, Practicals) : 5 marks

Assignment on entire syllabus : 10 marks

Practicals : 10 marks

II. Oral/Viva Assessment:

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

Course Code	Course Name	Credits
EC 106	**Basic Workshop Practice I**	**1.5**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pract.	Total
EC 106	Basic Workshop Practice-I	--	2	--	--	--	1.5	1.5

Course Code	Course Name	Examination Scheme						
		Theory						
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)	Term Work	Pract./oral	Total
		Test1	Test 2	Avg.				
EC 106	Basic Workshop Practice-I	--	--	--	--	--	50	--	50

Course Objectives:

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.

Course Outcomes: Learners will be able to…

1. Develop the necessary skill required to handle/use different fitting tools.
2. Develop skills required for hardware maintenance.
3. Able to install an operating system and system drives.
4. Able to identify the network components and perform basic networking and crimping.
5. Able to prepare the edges of jobs and do simple arc welding.
6. Develop the necessary skill required to handle/use different plumbing tools.
7. Demonstrate the turning operation with the help of a simple job.

Trade	Detailed Content	Hrs.

Note: Trade 1 and 2 are compulsory. Select any one trade topic out of the topic at 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. Students Can** select any one trade topics out of the topic at trade 3 to 5. Demonstrations and hands on experience to be provided during the periods allotted for the same.

Trade-1	**Fitting (Compulsory):** Use and setting of fitting tools for chipping, cutting, filing, marking, center punching, drilling. Term work to include one job involving following operations : filing to size, one simple male- female joint & drilling.	**08**
Trade-2	**Hardware and Networking: (Compulsory)** 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. · Installation of Operating System (Any one) and Device drivers, Boot-up sequence. Installation of application software (at least one) · 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.	**08**
Trade-3	***Welding:** Edge preparation for welding jobs. Arc welding for different jobs like, Lap welding of two plates, butt welding of plates with simple cover, arc welding to join plates at right angles.	**04**
Trade- 4	***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.	**04**
Trade-5	***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.	**04**

Total Hours = 8+8+4=20.* One Optional trade can be chosen out of 3,4 and 5

Workshop Assessment

Internal Assessment: 50

Marks Term Work:

1. All the jobs mentioned above.

2. Complete Work-Shop Book giving details of drawing of the job and time sheet. The distribution of marks for Term work shall be as follows:

Job Work: 30 Marks
Workshop book: 10 marks
Attendance: 10 marks

Bachelor of Technology
In
Electronics & Computer Science

(Semester II)

Course Code	Course Name	Credits
EC 107	**Engineering Mathematics II**	**3+1**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
EC 107	Engineering Mathematics - II	3	2	-	05	3	1	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
EC 107	Engineering Mathematics-II	40	40	40	60	25	-	-	125

Course Objectives:

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 modeling.
3. To acquaint the students with the Beta and Gamma functions
4. To learn different techniques to solve double integrations.
5. To learn the applications of integration in solving complex engineering problems.
6. To provide knowledge of numerical techniques using SCILAB software to handle Mathematical modeling.

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 LDE with constant coefficient in mathematical modeling to solve real life problems.
3. Apply the basic concepts of beta and gamma functions 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 areas.
6. Apply the concept of differentiation and integration numerically for solving the engineering problems with the help of SCILAB software.

Syllabus:

Module	Detailed Contents	Hrs.
1	**Differential Equations of First Order and First Degree:** 1.1 Exact Differential Equations, Equations reducible to exact form by using integrating factors. 1.2 Linear differential equations, Equations reducible to linear form.	6
2	**Linear Differential Equations With Constant Coefficients and Variable coefficients of higher order:** 2.1. Linear Differential Equation with constant coefficient- complementary function, particular integrals of differential equation of the type f(D)y = X where X is e^{ax} , sin($ax + b$) , cos ($ax + b$), x^n, $e^{ax}V$, xV. 2.2. Cauchy Differential equation, 2.3Method of variation of parameters two variables	8
3	**Beta and Gamma Function,** 3.1 Gamma Functions and its properties. 3.2 Beta Functions and its properties.	4
4	**Double Integration:** **Prerequisite**: Tracing of curves 4.1. Double integration- Evaluation of Double Integrals.(Cartesian & Polar),Change of order of Integration and evaluation 4.2. Evaluation of integrals over the given region.(Cartesian & Polar) 4.3. Evaluation of double integrals by changing to polar coordinates.	8
5	**Applications of integration** :- 5.1. Application of double integrals to compute Area 5.2. Triple integration**:** Evaluation only (Cartesian, cylindrical and spherical polar coordinates)	4
6	**Numerical Techniques:-** 6.1. **Numerical solution of ordinary differential equation** (a) Euler's method (b) Modified Euler method, (c)Runge-Kutta fourth order method 6.2. **Numerical integration**- (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule	6

Assessment

I. Internal Assessment Test:

Assessment consists of two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 90 minutes.

II. End Semester Theory Examination:

1. Question paper will comprise of a total 05 questions, each carrying 20 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus wherein 4sub-questions of 5 marks each will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of each module will be proportional to number of respective lecture mentioned in the syllabus.

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. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill .

Engineering Mathematics II Laboratory

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

List of Scilab Programing

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

Term Work:

The distribution of Term Work marks–

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

Course Code	Course Name	Credits
EC 108	**Engineering Physics-II**	**2+0.5**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
EC 108	Engineering Physics-II	2	1	-	03	2	1	-	2.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 108	Engineering Physics-II	30	30	30	45	25	-	-	100

Course Objectives:

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.

Course Outcomes:

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

1. Comprehend the basic concepts of semiconductor physics and apply the same to electronic devices.
2. Apply the concepts of electromagnetism in focusing systems and CRO.
3. Interpret and explore basic sensing techniques for physical measurements in modern instrumentations.
4. Comprehend the concepts of electrodynamics and Maxwell's equations and their use in telecommunication systems.
5. Comprehend the various material characterisation techniques.
6. Comprehend the knowledge of Piezoelectric and Magnetostriction effect for production of ultrasonic waves and its application in various fields.

Syllabus:

Module	Details	Hours.
1.	**1.Semiconductors**: 1.1 Relation between Conductivity, Mobility, Current density; relation between conductivity, charge concentration, and mobility for metals and semiconductors 1.2 Splitting of energy levels for band formation in semiconductors; classification of semiconductors(doping): Intrinsic and Extrinsic; classification of semiconductors(band gap): Direct and Indirect band gap, Classification of semiconductors (composition):elemental and compound 1.3 Fermi Dirac distribution function: Calculation of energy from probability of occupancy, Fermi level in intrinsic and extrinsic semiconductors; Qualitative discussion on effect of temperature and charge concentration on the fermi levels of n-type and p-type semiconductors, Proof of position of Fermi level in midway of bandgap for an intrinsic semiconductors. 1.4 Energy level diagrams for unbiased and biased P-N junction. 1.5 Hall Effect: Derivation of expression for Hall Voltage and Hall coefficient. 1.6 Semiconductor Devices: I-V curves and mechanism for Solar Cell, LED and Zener Diode	7
2.	**Electron Optics and CRO**: 2.1. Bethe's law 2.2 Electrostatic and Magnetic focussing 2.3 Cathode Ray Tube and its applications. 2.4. Block diagram of a CRO: CRT, Sawtooth Sweep Generator, Synchronisation and power supply 2.5. Applications of CRO: Measurement of : DC and AC voltages, frequency value and phase difference	**4**
3.	**Physics of Sensors**: 3.1.Temperature Sensor 3.2.Pressure Transducer: Capacitive and Inductive types 3.3.Photodiode: IV characteristics and use in measurement of light intensity 3.4.Moisture sensor	4
4.	**Electrodynamics:** 4.1.Scalar and Vector fields, gradient, curl and divergence 4.2.Determination of Maxwell's equations for static and varying fields 4.3.Significance of Maxwell's equations and their application in Antenna design and waveguide. 4.4.Numerical Problems	**5**
5.	**Material Characterisation Techniques** 5.1 X-Ray Diffraction: Bragg's law and its application in measuring crystal lattice parameter. 5.2 STM and AFM, SEM and TEM: Principle of operation and working using schematic diagram.	**3**
6.	**Ultrasonics** : 6.1. Ultrasonic Wave generation; Magnetostriction Oscillator; Piezoelectric Oscillator; 6.2. Applications of ultrasonic: Echo sounding; NDT; ultrasonic cleaning(cavitation); ultrasonic sensors; 6.3.Industrial applications of ultrasonic(soldering, welding, cutting, drilling)	**2**

Assessment

I.Internal Assessment Test

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

II.End Semester Examination

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

1. Question paper will comprises 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.

References:

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

Engineering Physics-II Laboratory

List of Experiments:

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

Term work:

Term Work shall consist of a minimum six experiments.

Overall Rubric for the distribution of term work marks:
Laboratory work (Experiments and Journal) : 10/20 marks

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

Attendance (Theory and Practical) : 05 marks

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

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

Course Code	Course Name	Credits
EC 109	**Engineering Chemistry II**	**2+0.5**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
EC 109	Engineering Chemistry II	2	1	-	03	2	1	-	2.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 109	Engineering Chemistry II	30	30	30	45	25	-	-	100

Course objectives:

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

Course outcomes

Students will be able to:

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

Syllabus:

Module	Detailed Contents	Hrs.

1	**Module -1 - Fuels and combustion** **Pre- requisites** : What are fuels, Types of fuels, Characteristics of fuels. Calorific value of a fuel - HCV and LCV, Units of Calorific value, Theoretical determination of calorific value of fuel by Dulong's formula, Numerical problems Solid fuels : Coal (Definition and Ranking) Analysis of coal - Proximate and Ultimate analysis, Numerical problems Liquid fuels: Petroleum -Composition, classification (Mining, Refining - Various fractions , their boiling points, composition and uses), Fuels for Internal Combustion Engines - Knocking, Octane number, Anti Knocking agents,Cetane number. Gaseous Fuels: Natural gas, CNG and LNG, (Composition, Properties and uses) Combustion of fuels – Numerical problems for calculating the amount of air needed for the complete combustion of solid and gaseous fuels. Green fuels - Biodiesel	6
2	**Module 2- Engineering Electrochemistry** **Pre -requisite :** redox reaction, cell reaction, electrode and its type, salt bridge Electrode potential, electrode reaction, derivation of Nernst equation for single electrode potential, numerical problems. Electrochemical cells, Concentration cells. Reference electrodes -Types of reference electrodes, Construction, working of SHE, Calomel electrode	3
3	**Module 3- Battery Technology** Battery- classification – primary, secondary and reserve batteries. Characteristics – Capacity, Electricity storage density, energy efficiency, cycle life and shelf life. Construction, working, applications and limitations of Lead acid storage battery, Modern Batteries - Lithium and Lithium ion batteries Fuel Cells: Introduction, classification of fuel cells, limitations & advantages of fuel cells, Construction of Hydrogen oxygen alkaline fuel cells.	3
4	**Module -4- Corrosion and its Control** **Pre- requisites** : corrosion , corrosion product, corrosive and non corrosive metals. Galvanic series and electrochemical series. Mechanism of corrosion - Chemical and Electrochemical corrosion. Types of corrosion : Galvanic corrosion, Differential aeration corrosion, Pitting corrosion, Intergranular corrosion, Waterline corrosion, Stress corrosion. Factors Affecting Corrosion Rate : - (i) Nature of metal, (ii) Nature of environment. Methods of Corrosion Control : Material selection, Design, Cathodic protection Protective Coatings: Metallic coatings - anodic coating (galvanizing) and cathodic coating (Tinning) Methods of Applying Metallic Coatings - Hot dipping, Metal Spraying, Electroplating and Diffusion coating Organic coatings – Paints	6

5	**Module 5- Spectroscopic techniques** **Pre-requisites :** Electromagnetic radiation, characteristics of electromagnetic radiation, electromagnetic spectrum. Spectroscopy - Principle, Interaction of radiation with matter, Selection rules. Classification of spectroscopy - Based on atomic or molecular level, absorption or emission, electronic or magnetic level Types of spectroscopy - IR and NMR Spectroscopy Fluorescence and its applications	3
6	**Module 6 -Nanomaterials** **Prerequisites:** Concept of nano scale, definition of nanoparticles Types of nanomaterials - Fullerenes, Carbon Nanotubes, Properties of nanomaterials – Optical properties, magnetic properties, electrical properties Preparation of Nanomaterials - Top down and Bottom up approach Synthesis of Nanomaterials -Chemical vapour deposition (CVD) method and Laser Ablation Method Applications of nano materials	3

Assessment

I.Internal Assessment Test

Assessment consists of two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be 75 minutes.

II.End Semester Examination

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

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

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. Instrumental methods of Chemical Analysis - B.K.Sharma, Goel Publishing House
5. Fundamentals of Molecular Spectroscopy - C.N. Banwell, Tata Mc Graw Hill.

Engineering Chemistry-II Laboratory

List of Experiments:

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

Term work:

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

The distribution of marks for term work shall be as follows:
Laboratory work (Experiments and Journal) : 10 marks
Assignments and Viva on modules : 10 marks
Attendance (Theory and Practical) : 05 marks

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

Course Code	Course Name	Credits
EC 110	**Engineering Mechanics and Graphics**	**2+2**

Course Code	Course Name	Theory	Practical	Tutorial	Total Contact Hours	Theory	Practical/ Oral	Tutorial	Total Credit
EC 110	Engineering Mechanics and Graphics	2	4	-	6	2	2	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
EC 110	Engineering Mechanics and Graphics	40	40	40	60	25	50	-	175

Course Objectives:

The course is aimed

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

Course Outcomes:

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

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

Syllabus:

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

	Principles of Isometric projection – Isometric Scale, Isometric Views, Conversion of Orthographic Views to Isometric Views (Excluding Sphere). **6.2 @ Drawing of Isometric projections using Autocad.**	

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

Assessment:

I.Internal Assessment Test (Entirely on Engineering Mechanics):
Assessment consists of two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 90 minutes.

II.End Semester Theory Examination (Entirely on Engineering Mechanics):

1. Question paper will comprise of a total 05 questions, each carrying 20 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus **(Module 1-4)** wherein 4 sub-questions of 5 marks each will be asked.
4. Remaining questions will be randomly selected from all the modules **(Module 1-4)**.
5. Weightage of each module will be proportional to the number of respective lectures mentioned in the syllabus.

References:

1. Engineering Mechanics by Beer &Johnston, Tata McGrawHill
2. Engineering Mechanics (Statics) by Meriam and Kraige, Wiley Books
3. Engineering Mechanics (Dynamics) by Meriam and Kraige, Wiley Books
4. Engineering Mechanics by F. L. Singer, Harper& Raw Publication
5. Engineering Mechanics by Shaum Series
6. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing HousePvt. Ltd.
7. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.
8. M.B Shah & B.C Rana, “Engineering Drawing”, Pearson Publications.
9. P.J. Shah, “Engineering Graphics”, S Chand Publications.
10. Dhananjay A Jolhe, “Engineering Drawing” Tata McGraw Hill.
11. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, “(CAD Soft Technologies) : AutoCAD 2012 (For engineers and Designers)”, Dreamtech Press NewDelhi.

Engineering Mechanics & Graphics Laboratory

Term Work:

Component-1 Engineering Mechanics Practical (Any Four)

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. (Collision of bodies)
5. Kinematics of particles. (Projectile motion)

Component -2 Engineering Graphics Practical
One A-3 size sketch book consisting of:-

1. Simple Orthographic Projections.(4 problems)
2. Sectional Orthographic Projections. (4 problems)
3. Isometric projections. (4 problems)

Component-3 AutoCAD Practical
Printouts of each from:

1. Orthographic Projections with Section – 3 problems.
2. Isometric projections – 4 problems.
3. Reading of Orthographic Projections – 1 problem.

Note:- 2 hrs /week Auto CAD Practical is essential for completing the Auto CAD Drawings and taking required printouts.

Note: Satisfactory submission of all 3 components is mandatory to fulfill the Term.

End Semester Practical Examination (Auto CAD) (2 hours/ 50 Marks.)

1. Isometric drawing. (1 problem) (20 Marks)
2. Orthographic Projection (With Section) (1 problem). (30 Marks)

Course Code	Course Name	Credits
EC 111	**Python Programming**	**3+1**

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
EC 111	Python Programming	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
EC 111	Python Programming	40	40	40	60	25	25	-	150

Course Objectives:

1. Basics of python including data types, operator, conditional statements, looping statements, input andoutput functions in Python.
2. List, tuple, set, dictionary, string, array and functions
3. Object Oriented Programming concepts in python
4. Concepts of modules, packages, multithreading and exception handling
5. File handling

Course Outcomes:

Upon completion of the course students will be able

1. To understand the structure, syntax of the Python language.
2. To interpret varied data types in python.
3. To implement arrays and functions.
4. To illustrate the concepts of object-oriented programming as used in Python.
5. To create Python applications using modules, packages, multithreading and exception handling.
6. To gain proficiency in writing File Handling programs.

Syllabus:

	Module	Description	Hrs
	Prerequisite	Python IDE installation and environment setup.	
	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, Decorators, Iterators and Generators.	06
	Advanced data types & Functions	Lists: a) Defining lists, accessing values in list, deleting values in list, updating lists b) Basic list operations c) Built-in list functions Tuples: a) Accessing values in Tuples, deleting values in Tuples, and updating Tuples b) Basic Tuple operations c) Built-in Tuple functions Dictionaries: a) Accessing values in Dictionary, deleting values in Dictionary, and updating Dictionary b) Basic Dictionary operations c) Built-in Dictionary functions Sets: a) Accessing values in Set, deleting values in Set, updating Sets b) Basic Set operations, c) Built-in Set functions Strings: a) String initialization, Indexing, Slicing, Concatenation, Membership & Immutability b) Built-in String functions.	
	Array and 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 Functions: a) Built-in functions in python b) Defining function, calling function, returning values, passing parameters c) Nested and Recursive functions d) Anonymous Functions (Lambda, Map, Reduce, Filter)	
	Object Oriented Programming	Overview of Object-oriented programming, Creating Classes and Objects, Self-Variable, Constructors, Inner class, Static method. Inheritance: Types of Inheritance (Single, Multiple, Multi-level, Hierarchical), super() method, Constructors in inheritance, Method overloading, Method overriding, Abstract class, Abstract method	
	Modules and Packages	Modules: Writing modules, importing objects from modules, Pythonbuilt-in modules (e.g. Numeric and Mathematical module, Functional Programming module, Regular Expression module), Namespace and Scoping. Packages: creating user defined packages and importing packages. Multi-threading: process vs thread, use of threads, types of threads, creating threads in python, thread synchronization, deadlock of threads. Exception handling: Compile time errors, Runtime errors, exceptions, types of exception, try statement, except block, raise statement, Assert statement, User-Defined Exceptions.	

	File handling	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, Pickle in Python.	

Assessment:

I.Internal Assessment Test:

Assessment consists of 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.

II.End Semester Theory Examination:

1. Question paper will comprise of total 05 questions, each carrying 20 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus wherein 4/5 sub-questions of 5/4 marks each will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of each module will be proportional to the number of respective lectures mentioned in the syllabus.

References:

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

Web resources:

1. https://docs.scipy.org/doc/numpy/user/quickstart.html
2. https://matplotlib.org/tutorials/
3. https://pandas.pydata.org/docs/getting_started/
4. https://www.geeksforgeeks.org/python-build-a-rest-api-using-flask/ Back to Scheme

Python Programming Laboratory

Minimum Hardware Requirements	Software Requirements	Other Requirements
PC With following Configuration 1. Intel Dual core Processor or higher 2. Minimum 2 GB RAM 3. Minimum 40 GB Hard disk 4. Network interface card	1. Windows or Linux Desktop OS 2. Python 3.6 or higher 3. Notepad ++ 4. Python IDEs like IDLE, Pycharm, Pydev, Netbeans or Eclipse 5. Mysql	1.Internet Connection for installing additional packages

List of suggested Experiments:

1. Write python programs to understand
   a) Basic data types, Operators, expressions and Input Output Statements
   b) Control flow statements: Conditional statements (if, if…else, nested if)
   c) Looping in Python (while loop, for loop, nested loops)
2. Write python programs to understand
   a) Different List and Tuple operations using Built-in functions
   b) Built-in Set and String functions
3. Write python programs to understand
   c) Basic Array operations on 1-D and Multidimensional arrays
   d) Implementing User defined and Anonymous Functions
4. Write python programs to understand
   a) Classes, Objects, Constructors and Static method
   b) Different types of Inheritance
   c) Method overloading, Method overriding, Abstract class and Abstract method
5. Write python programs to understand
   a) Creating User-defined modules/packages and import them in a program
   b) Creating user defined multithreaded application to demonstrate simultaneous execution of multiple threads
   c) Creating a menu driven applications which should cover the built-in exceptions in python
6. Write python programs to understand
   a) Different File Handling operations in Python

Lab Assessments:

1. Term work Assessment:

The Term work shall consist of at least 15 practical's 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.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments/tutorial/write up) + 5 Marks (Attendance)

2. Oral/Viva Assessment:

An Oral & Practical exam will be held based on the above syllabus.

Course Code	Course Name	Credits
EC 112	**Professional Communication and Ethics-I**	**3**

Subject Code	Subject Name	Theory (Hrs)	Practical (Hrs)	Tutorial (Hrs)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 112	Professional Communication and Ethics-I	2	02	--	2	01	--	03

Subject Code	Subject Name	Examination Scheme (tentative)							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 112	Professional Communication and Ethics-I	-20-	-20-	-20-	30--	25	--		75

Course Objectives:

The course is aimed

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.

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.

Syllabus:

Module	Detailed Contents	Hrs.
1	**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 -Comprehend meaning of audio text-graded on the basis of vocabulary, sentence construction and theme. -potential barriers	**5 Hrs**
2	**Developing Speaking Skills** 2.1 Intensive Speaking- on the spot topics 2.2 Responsive speaking-answering a question 2.3 Interactive speaking-conversations 2.4 Extensive speaking-speech, oral presentations-specific emphasis on plagiarism check and generating the report	**6 Hrs**
3	**Strategies and Techniques to build Reading Skil** 3.1 Develop the process of reading- a) predicting content from the given title, b) anticipating content from the given sentence, c) skimming for understanding the theme of the passage, d) scanning for specific information, e) guessing the meaning of unfamiliar words from the context, that is, the careful analysis of structural words f) inferring from the content- conclusion reached on the basis of evidence and reasoning g) deduction- logical conclusions based on the information given in a text Special emphasis on reading comprehension exercises and summarisation	**5 Hrs**

4	**Developing Professional Writing Skills** 4.1 Effective introduction with emphasis on general statement, opposing statement and thesis statement 4.2 Critical response to a text with special reference to purpose, evaluation of the content, theme and style of a text 4.3 Organization of ideas, sentence construction and word choice, grammar and usage 4.4 Explanation and support of ideas (special reference to writing paragraphs and business letters- Sales and Claim letters}	**6 Hrs**
5	**Etiquette and Grooming for Personality Development** 5.1 Social Etiquette 5.2 Corporate etiquette 5.3 Confidence building and Personality development	**1 Hr**
6	**Vocabulary and Grammar** 6.1 Contextual vocabulary Development- Word Maps 6.2 Identifying errors in a sentence.	**1 Hr**

Assessment:

I.Internal Assessment Test:
Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 60 minutes**.(Note: Summarization should be a compulsory question in Test II and not in the End Semester Theory Examination)**

II. End Semester Theory Examination:
Total marks 30, duration 1 and half hours.

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

References:

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

Professional Communication and Ethics-I Laboratory

Lab Prerequisite: Basic language skills

Syllabus:

Sr. No.	Level 1. Basic 2. Design 3. Advanced 4. Project/Case Study/Seminar	Detailed Lab/Tutorial Description	LO Mapping
1	Assignment 1	Written record of listening activities-Listening practice tasks of 3 types (through audio recordings of (1) Monologues (2) Dialogues (3) Formal/Expert Talk or Lecture)	LO1
2	Assignment 2	Transcription of the public speech along with a plagiarism report-Practice public speech	LO2
3	Assignment 3	Summarization through graphic organisers (1. Text to graphic organizer 2. Graphic organizer to text)	LO3
4	Assignment 4	1. Case studies on critical thinking 2. 2 business letters in complete block format.	LO4
5	Assignment 5	Documentation of case studies/Role play based on Module 5	LO5
6	Assignment 6	1. Contextual Vocabulary Development 2. Aptitude Test	LO6

Term work:

Term Work shall consist of 6 Assignments .

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

1.Assignments : **10 marks**

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

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

Course Code	Course Name	Credits
EC 113	**Basic Workshop Practice II**	**1**

Course Code	Course Name	Teaching Scheme(Contact Hours)			CreditsAssigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pract.	Total
EC 113	Basic Workshop Practice-II	--	2	--	--	--	1	1

Course Code	CourseName	ExaminationScheme							
		Theory					TermWork	Pract./ oral	Total
		InternalAssessment			End SemExam.	Exam.Duration(in Hrs)			
		Test 1	Test 2	Avg.					
EC 113	BasicWork Workshop Practice-II	--	--	--	--	--	50	--	50

Course Objectives

1. To Impart Training Help the students develop engineering skills sets.
2. Toinculcaterespectforphysicalworkandhard labor.
3. To Get Exposure To Interdisciplinary Engineering Domain.

Course Outcomes:

Learner will be able to…

1. Develop The Necessary Skill required to handle/use different carpentry tools.
2. Identify and understand the safe practices to adopt in the electrical environment.
3. Demonstrate Thewiringpracticesforthe connectionof simpleelectricalload/equipment.
4. Design, fabricateandassemblePCB.
5. Develop Thenecessaryskill Required to handle/use different measuring tools.
6. Develop The Necessary Skill required to use different sheet metal tools.
7. Able To demonstrate the operation,forgingwiththehelpof asimplejob.

Trade	Detailed Content	Hrs.
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. Report on the demonstration including suitable sketches is also to be included in the term work Trade evaluation is to be done according to the opted Trades in addition to Compulsory Trades.		
Trade-1	**Carpentry (Compulsory)** 6. 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. 7.Termworktoincludeonecarpentryjobinvolvingajointandreportondemonstrationofa job involving wood turning	**08**
Trade-2	**Basic Electrical workshop:(Compulsory):** 8. Single phase and three phase wiring. Familiarization. of protection switch-gears and their ratings (fuse, MCB, ELCB). Wiring standards, Electrical safety in the workplace, safe work practices. Protective equipment. 9. Layout drawing, layout transfer to PCB, etching and drilling and soldering technique	**08**
Trade-3	**Measurement*** 10. Vernier Height gauge, wire gauge, Dial gauge. Use of the listed gauges and precaution.	**04**
Trade 4	**Sheet metal working*** 11.Use of sheet metal, working hand tools, cutting, bending, spot welding operation.	**04**
Trade-5	**Forging (Smithy):*** 12.AtleastoneforgingjobtobedemonstratedandasimplejobtobemadeforTerm Work in a group of 4 students.	**04**

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

Total hours= 8+8+4=20 hours

2. Complete Work-Shop Book giving details of drawing of the job and time sheet The distribution of marks for Term work shall be as follows:

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

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

Bachelor of Technology
In
Electronics & Computer Science

(Semester III)

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 201	Engineering Mathematics III	03	-	01	03	-	01	04

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

Prerequisite: Engineering Mathematics-I and Engineering Mathematics-2

Course Objectives:

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

Course Outcomes:

After successful completion of the course students will be able to

1. Apply the concept of Laplace transform and its application to solve the real integrals 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 Eigen values 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.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	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.	07

2.	**Fourier Series , Fourier Transform**	Dirichlet's conditions, Fourier series of periodic functions with period 2π and 2L, Fourier series for even and odd functions, Half range sine and cosine Fourier series, Orthogonal and Ortho-normal functions, Fourier Integral Representation, Fourier Transform and Inverse Fourier transform of constant and exponential function.	06
3.	**Linear Algebra Matrix Theory, Quadratic Forms**	Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Quadratic forms over real field, Linear Transformation of Quadratic form, Reduction of Quadratic form to diagonal form using congruent transformation. Rank, Index and Signature of quadratic form, Sylvester's law of inertia, Value- class of a quadratic form-Definite, Semidefinite and Indefinite. Reduction of Quadratic form to a canonical form using congruent transformations.	07
4.	**Complex Variables and conformal mappings**	Function f(z)of complex variable, Introduction to Limit, Continuity and Differentiability of (z), 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) or its combination (u+v / u-v) is given, Conformal mapping, Linear and Bilinear mappings, cross ratio	06
5.	**Relation and Function**	Partition of A Set, Relation, Diagram of A Relation, Matrix of A Relation, Digraph of A Relation, Types of Relation, Number of Binary Relations, Number of Reflexive Relations, Equivalance Relation, Relation of the Path, Operations on Relations, Closures, Warshall's Algorithm,	07
6.	**Algebraic Structures, coding theory**	Properties of Binary Operations, Semi-Group. Monoid, Group, Ring, Isomorphism, Homomorphism, Group Code, Decoding and Error Correction, Maximum Likelihood Technique	06

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 4 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 number of hours assigned to each module.

Lab Assessment:

1. Term work Assessment:

Term work should consist of all the work done in tutorials and assignments. The final certification and acceptance of term work ensures satisfactory performance throughout in all the assigned work.

Text Books & References:

1. Complex Variables and Applications, Brown and Churchill, McGraw-Hill education.
2. Advanced engineering mathematics H.K. Das, S . Chand, Publications.
3. Higher Engineering Mathematics B. V. Ramana, Tata Mc-Graw Hill Publication
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication
5. Advanced Engineering Mathematics Wylie and Barret, Tata Mc-Graw Hill.
6. Beginning Linear Algebra Seymour Lipschutz Schaum's outline series, Mc-Graw Hill Publication
7. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication
8. Discrete Mathematical Structures Bernard Kolman, Robert C. Busby ,Sharon Cutler Ross, Nadeem-ur-Rehman, " Pearson Education".
9. Discrete Mathematical Structures: Theory and Applications, D.S. Malik and M.K. Sen: Cengage Learning, 2004.
10. Discrete Mathematics with Applications, Thomas Koshy: Elsevier, 2005, Reprint 2008.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 202	Communication Engineering	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 202	Communication Engineering	40	40	40	60	25	--	--	125

Prerequisite: Basic Electrical Engineering

Course Objectives:

1. Gain the core idea of electromagnetic Spectrum.
2. To introduce students to various Communication Methods and Introduction to Noise and its effect on the Communication System.
3. To analyze different parameters of analog communication techniques.
4. Study the Sampling theorem and Pulse Analog and digital modulation techniques.
5. Learn the concept of multiplexing and digital bandpass modulation techniques.
6. To understand the fundamental concepts of electronic communication and their use in computer applications.

Course Outcomes:

After successful completion of the course students will be able to

1. Use different modulation and demodulation techniques used in analog communication
2. Identify and solve basic communication problems
3. Analyze transmitter and receiver circuits
4. Compare and contrast design issues, advantages, disadvantages and limitations of analog communication systems
5. To understand the fundamental concepts of electronic communication
6. To study basic concepts of information theory.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Basics of Communication System**	Block diagram, electromagnetic spectrum, signal bandwidth and power, types of communication channels, Introduction to time and frequency domain. Types of noise, signal to noise ratio, noise figure and noise temperature, Friss transmission formula.	06
2.	**Communication Fundamentals: Analog Communication (Amplitude Modulation)**	Block diagram and elements of analog communication systems, Theory of amplitude modulation, mathematical Derivation Of AM and types of AM. Block diagram of AM transmitter (HLM and LLM). Generation of DSB-SC using diode Ring balanced modulator. Generation of SSB using phase shift method. **AM Receivers:** Receiver Characteristics (Selectivity, Sensitivity, Fedility) TRF Receiver and its disadvantages Superheterodyne Receiver. (Numerical's on Transmitter and Receiver).	09

3.	**Communication Fundamentals: Angle Modulation**	Frequency modulation (FM): Basic concept, mathematical analysis, spectrum of FM wave, sensitivity, phase deviation and modulation index, deviation ratio, narrowband FM and wideband FM. Varactor diode modulator, Direct FM transmitter, indirect FM Transmitter, pre-emphasis and de-emphasis. **FM demodulation:** Balance slope detector, Foster-Seely discriminator, ratio detector, comparison between AM, FM and PM Applications of AM, FM and PM	08
4.	**Pulse Modulation Techniques**	Statement of Sampling Theorem, Generation and detection of PAM, PWM, PPM, PCM, DM and ADM. Quantization process, Pulse code modulation, Delta modulation, Adaptive delta modulation. Introduction to Line Codes and ISI.	06
5.	**Multiplexing Techniques**	Principles of FDM. FDM Hierarchy. FDM Transmitter and Receiver. Principles of TDM. TDM Transmitter and Receiver. TDM – PCM system. TDM –PAM system. (Numericals)	06
6.	**Communication Fundamentals**: **Information theory**	Amount of information, average information, information rate, Statement of Shannon's theorem, channel capacity (Numericals)	04

DETAILED LAB SYLLABUS:
Hardware Requirements: Demonstrative kits

Sr. No.	Detailed Lab/Tutorial Description
1	Study of Electronic Component and measuring instruments
2	Modulation and Demodulation of AM.
3	Modulation and demodulation of FM
4	Study of super heterodyne receiver
5	Modulation and Demodulation PAM.
6	Modulation and Demodulation PWM.
7	Modulation and Demodulation PPM.
8	Modulation and Demodulation PCM.
9	FDM
10	TDM

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 4 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 number of hours assigned to each module.

Lab Assessment:
1. Term work Assessment :
Minimum 8 experiments to be performed based on the entire syllabus. Term work of 25 Marks will be based on the assessment on the overall performance of the student in every experiment and assignments graded from time to time.

Books:

1. George Kennedy, Bernard Davis, SRM Prasanna, Electronic Communication Systems, Tata McGraw Hill, 5th Ed
2. Simon Haykin, Michael Moher, Introduction to Analog & Digital Communications, Wiley India Pvt. Ltd., 2nd Ed.
3. Wireless Communication and Networking, Vijay Garg

References:

1. Wayne Tomasi, Electronic Communications Systems, Pearson Publication, 5th Ed.
2. B P Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University
3. Herbert Taub, Donald L Schilling, Goutam Saha, Principles of Communication Systems, Tata McGraw Hill, 3rdEd.
4. K Sam Shanmugam, Digital and Analog Communication Systems, Wiley India Pvt. Ltd, 1st Ed.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 203	Analog Electronics Circuits	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 203	Analog Electronics Circuits	40	40	40	60	25	25	--	150

Prerequisite: Basic Electrical Engineering

Course Objectives:

1. To enhance comprehension capabilities of students through understanding of electronic circuits.
2. To perform DC and AC analysis of BJT and MOSFET amplifier circuits.
3. To teach fundamental principles of operational amplifiers.
4. To develop an overall approach for students from selection of integrated circuit, specification, functionality and applications.

Course Outcomes:

After successful completion of the course students will be able to

1. Understand construction, characteristics and working of semiconductor devices such as BJT, MOSFET.
2. Derive expressions for performance parameters of BJT and MOSFET based Electronic circuits
3. Select and Design electronic circuits (using BJT and MOSFET) for given specifications
4. Derive and determine various performances-based parameters and their significance for Op-Amp.
5. Analyze and identify the closed loop stability considerations, linear and nonlinear applications of operational amplifiers.
6. Design an application with the use of integrated circuits.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Semiconductor devices**	1.1Bipolar Junction Transistor - BJT operations, voltages and current equations, BJT characteristics (CE, CB, CC configurations), early effect. 1.2 Field Effect Devices- JFET: Construction, operation and characteristics. MOSFET: Construction, operation and characteristics of D-MOSFET and EMOSFET.	06

2.	**Biasing Circuits of BJTs and MOSFETs**	2.1 Concept of DC load line, Q point and regions of operations, Analysis and design of biasing circuits for BJT (Voltage divider Bias ONLY) 2.2 DC load line and region of operation for MOSFETs. Analysis and design of biasing circuits for E-MOSFET (voltage divider bias ONLY).	06
3.	**Small Signal Amplifiers**	3.1Concept of AC load line and Amplification, Small signal analysis (Zi, Zo, Av and Ai) of CE amplifiers using hybrid pi model ONLY. 3.2 Small signal analysis (Zi, Zo, Av) of CS (for EMOSFET) amplifiers. Introduction to multistage amplifiers. Cascade and cascode only.(Concept, advantages & disadvantages)	07
4.	**Operational Amplifiers**	4.1The ideal operational amplifier (op-amp), internal block diagram of op-amp, characteristics of op-amp, ideal & practical op-amp parameters / specifications (no detailed description or any analysis), mathematical model of op-amp, IC 741 op-amp with pin diagram & description 4.2 Operational amplifier open loop & closed loop configurations (theoretical description only), the concept of virtual ground & virtual short	06
5.	**Applications of Operational Amplifier**	5.1 The op-amp inverting amplifier & op-amp non-inverting amplifier (mathematical analysis for derivation of output voltage only,numerical examples & designing) 5.2 Adder, summing amplifier, averaging circuit, subtractor, integrator (ideal), differentiator (ideal), op-amp instrumentation amplifier (only mathematical analysis for derivation of output voltage)	07
6.	**Special Purpose Integrated Circuits**	6.1 IC 555 timer internal block diagram & pin configuration, operation in astable & monostable multivibrator with mathematical analysis & numerical examples, design problems on astable & monostable multivibrator, applications in astable & monostable configuration 6.2 Functional block diagram, working and design of general purpose IC 723 (HVLC and HVHC).(theoretical description only). working of the switching regulator. (theoretical description only)	07

DETAILED LAB SYLLABUS:

Hardware Requirements: Breadboard, Transistors, Resistors, Diodes, Connecting wires,Op-amp IC 741, timer IC555

Software Requirements: LTSpice

Sr. No.	Detailed Lab/Tutorial Description
1	To study input and output characteristics of CE configuration
2	Analyze Integrator using op-amp IC 741
3	Design Monostable Multivibrator using IC 555.
4	To study EMOSFET biasing circuits..
5	To study BJT as CE amplifier.and calculate its voltage gain
6	To study frequency response of a multistage amplifier.
7	Design inverting, non-inverting amplifier and buffer using IC 741
8	Design Wein bridge and RC phase shift Oscillator using op-amp IC 741
9	Simulation experiment on drain and transfer characteristics of JFET
10	Simulation experiment on multistage amplifier.
11	Design High Voltage High Current voltage regulator using IC 723.

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 4 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.

Lab Assessment:

1. **Term work Assessment :**

At least 8 experiments covering the entire syllabus of AEC should be set to have well predefined inference and conclusion. Simulation experiments are also encouraged. Minimum 3 Simulation Experiments covering the entire syllabus must be performed during the "Laboratory session batch wise". The experiments should be student centric and attempt to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment and assignments are graded from time to time.

2. Oral/Viva Assessment:

The oral examination will be based on the entire syllabus.(10 marks for performance and 15 marks for oral)

Books:

1. Donald A. Neamen, "Electronic Circuit Analysis and Design", TATA McGraw Hill, 2nd Edition.
2. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson Prentice Hall, 4th Edition.

References:

1. Robert Boylestad," Electronic Devices and Circuit Theory", Pearson.
2. George Clayton and Steve Winder, "Operational Amplifiers", NewnesBali, "Linear Integrated Circuits", Mc Graw Hill
3. Gray, Hurst, Lewise, Meyer, "Analysis & Design of Analog Integrated Circuits, Wiley Publications.
4. K. R. Botkar, "Integrated Circuits", Khanna Publishers (2004)
5. S. Salivahanan, N. Suresh Kumar,"Electronic Devices and Circuits", Tata McGraw Hill.
6. D. Roy Choudhury and S. B. Jain, "Linear Integrated Circuits", New Age International Publishers, 4th Edition.
7. Sergio Franco, "Design with operational amplifiers &analog integrated circuits", Tata McGraw Hill, 3rd edition
8. William D. Stanley, "Operational Amplifiers with Linear Integrated Circuits", Pearson, 4th Edition

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 204	Digital Circuits & System Design	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 204	Digital Circuits & System Design	40	40	40	60	25	--	25	150

Prerequisite: Physics of Std 11th, 12th and FE - Basic Electrical & Electronics Engineering

Course Objectives:

1. To understand various number systems & codes and to introduce students to various logic gates, SOP, POS form and their minimization techniques.
2. To teach the working of combinational circuits, their applications and implementation of combinational logic circuits using MSI chips.
3. To teach the elements of sequential logic design, analysis and design of sequential circuits.
4. To understand various counters and shift registers and its design using MSI chips.
5. To explain and describe various logic families, their interfacing and Programmable Logic Devices.
6. To train students in writing programs with VHDL hardware description languages.

Course Outcomes:

After successful completion of the course students will be able to

1. Perform code conversion and able to apply Boolean algebra for the implementation and minimization of logic functions.
2. Analyze, design and implement Combinational logic circuits.
3. Analyze, design and implement Sequential logic circuits.
4. Design and implement various counter using flip flops and MSI chips.
5. Understand TTL & CMOS logic families, PLDs, CPLD and FPGA.
6. Understand basics of VHDL Hardware Description Language and its programming with combinational and sequential logic circuits.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Logic Gates and Boolean Algebra**	Digital logic gates, Realization using NAND, NOR gates, Boolean Algebra, De Morgan's Theorem, SOP and POS representation, K Map up to four variables.	04
2.	**Combinational Circuits using basic gates as well as MSI devices**	Arithmetic Circuits: Half adder, Full adder, Ripple carry adder, Carry Look ahead adder, Half Subtractor, Full Subtractor, multiplexer, cascading of Multiplexer, demultiplexer, decoder, Comparator (Multiplexer and demultiplexer gate level upto 4:1). MSI devices: IC7483, IC74151, IC74138, IC7485.	07

3.	**Elements of Sequential Logic Design**	Sequential Logic: Latches and Flip-Flops. RS, JK, Master slave flip flops, T & D flip flops with various triggering methods, Conversion of flip flops Counters: Asynchronous, Synchronous Counters, Up Down Counters, Mod Counters, Ring Counter, Twisted ring counter, Shift Registers, Universal Shift Register.	07
4.	**Sequential Logic Design**	Sequential Logic Design: Mealy and Moore Machines, Clocked synchronous state machine analysis, State reduction techniques (inspection, partition and implication chart method) and state assignment, sequence detector, Clocked synchronous state machine design. Sequential logic design practices: MSI counters (7490, 7492, 7493,74163, 74169) and applications, MSI Shift registers (74194) and their applications.	07
5.	**Logic Families and Programmable Logic Devices**	Logic Families: Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in), transfer characteristics of TTL NAND (Operation of TTL NAND gate),CMOS Logic: CMOS inverter, CMOS NAND and CMOS NOR, Interfacing CMOS to TTL and TTL to CMOS. Programmable Logic Devices: Concepts of PAL and PLA. Simple logic implementation using PAL and PLA, Introduction to CPLD and FPGA architectures.	07
6.	**Introduction to VHDL**	Design of Combinational circuits using VHDL: Introduction to Hardware Description Language, Core features of VHDL, data types, concurrent and sequential statements, data flow, behavioral, structural architectures, subprograms, Examples like Adder, subtractor, Multiplexers, De-multiplexers, decoder. Design of Sequential circuits using VHDL: VHDL code for flip flop, counters.	07

DETAILED LAB SYLLABUS:

Hardware Requirements: Hardware Kits

Software Requirements: VHDL simulation software

Sr. No.	Detailed Lab/Tutorial Description
1	Implementation of Asynchronous counter using MSI counter IC and flip flops
2	Implementation of synchronous counter using MSI counter IC and flip flops
3	Conversion of Flip flops.
4	Application of Universal Shift Register.
5	Design and implement Mealy machine
6	Design and implement Moore machine
7	Design sequence detector using Flip Flop
8	VHDL program for Combinational circuits
9	VHDL program for sequential circuits
10	VHDL program for Mealy and Moore machines.

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 4 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.

Lab Assessment:

1.Term work Assessment:

At least 6 experiments covering the entire syllabus of DCSD should be set to have well predefined inference and conclusion. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting. Simulation experiments are also encouraged. Experiments must be graded from time to time. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2.Oral/Viva Assessment:

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

Books:

1. R. P. Jain, Modern Digital Electronics, Tata McGraw Hill Education, Third Edition 2003.
2. Morris Mano, Digital Design, Pearson Education, Asia 2002.
3. J Bhaskar, VHDL Primer, Prentice Hall, Third Edition (1999).

References:

1. Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2006
2. John F. Warkerly, Digital Design Principles and Practices, Pearson Education, Fourth Edition, 2008.
3. Stephen Brown and Zvonko Vranesic, Fundamentals of digital logic design with VHDL, McGraw Hill, 2nd Edition.
4. Volnei A. Pedroni, “Circuit Design with VHDL” MIT Press (2004)
5. Digital Circuits and Logic Design – Samuel C. Lee , PHI
6. William I.Flectcher, “An Engineering Approach to Digital Design”, Prentice Hall of India.
7. Parag K Lala, “Digital System design using PLD”, BS Publications, 2003.
8. Charles H. Roth Jr., “Fundamentals of Logic design”, Thomson Learning, 2004.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 205	Data Structures and Algorithms	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 205	Data Structures and Algorithms	40	40	40	60	25	--	25	150

Prerequisite: C Programming

Course Objectives:

1. To teach concept and implementation of linear and nonlinear data structures.
2. To analyze various data structures and select the appropriate one to solve a specific real-world problem.
3. To introduce various techniques for representation of the data in the real world.

Course Outcomes:

After successful completion of the course students 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 analyze and Implement appropriate sorting and searching techniques for a given problem.
6. Students will be able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
	Introduction to Data Structures	Introduction to Data Structures, Types of Data Structures – Linear and Nonlinear, Operations on Data Structures, Concept of array, Static arrays vs Dynamic Arrays, structures, Array Data Type:- Single and Multidimensional Arrays. Introduction to Analysis of Algorithms, characteristics of algorithms, Time and Space complexities, Asymptotic notations.	04
	Stack and Queue	**Stack:** Basic Stack Operations, Representation of a Stack using Array, Applications of Stack – Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation.	07

		Queue: Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Dequeue, queue-Round Robin Algorithm, Applications of Queue:- Interrupt handling	
	Linked List	Representation of Linked List, Linked List v*/s* Array, Types of Linked List - Singly Linked List (SLL), Doubly Linked List, Circular Linked List, Operations on Singly Linked List: Insertion, Deletion, reversal of SLL, Print SLL. Implementation of Stack and Queue using Singly Linked List. Singly Linked List Application-Documenting a sequence of heterogeneous records.	08
	Tree	Tree Terminologies, Binary Tree, Types of Binary Tree, Binary Tree Representation: Array and Linked Representation of Binary trees, Binary Tree Traversals algorithms: In-order, Pre-order, Post-order, Binary Search Tree Operations on Binary Search Tree, Applications of Binary Tree - Expression Tree, Huffman Encoding.	07
	Graph	Graph Terminologies, Representation of graph (Adjacency matrix and adjacency list), Graph Traversals – Depth First Search (DFS) and Breadth First Search (BFS), Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal's algorithm, Application of Graph – Topological Sorting.	06
	Sorting and Searching	**Searching:** Linear search, Random search, Binary search, Hashing, Applications:- Finding a root of a general quadratic polynomial over a finite interval. **Sorting:** Bubble, Insertion, selection, Quick Sort, Merge Sort, Two Way Merge Sort, Counting sort, Comparison of sorting Techniques based on their complexity, A few practical considerations for in-memory sorting	07

DETAILED LAB SYLLABUS:

Software Requirements: Turbo C/Code Blocks, Windows/Linux

Sr. No.	Detailed Lab/Tutorial Description
1	Program to reverse a list of given numbers using stack ADT.
2	Program to Check whether parentheses are balanced or not.
3	Convert an Infix expression to Postfix expression using stack ADT.
4	Program to evaluate Postfix Expression using Stack ADT.
4	Program to implement Linear Queue ADT using array.
5	Program to implement Stack/Queue using linked list.
6	Program to implement Circular Queue ADT using array.
7	Program to implement Priority Queue ADT using array.
8	Program to implement Binary Search Tree ADT using Linked List.
9	Program to implement searching algorithms -Linear search, Binary search.
10	Implement Depth First Search and Breadth First Search Graph Traversal technique.
11	Program to implement sorting algorithms (any 2)- bubble, selection, insertion, merge, quick.
12	Implementation of Prim's and Kruskal's algorithms for finding out Minimum Cost Spanning Tree of a given input graph. For eg. Finding out electricity distribution cable network with minimum overall cable length.

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 4 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 number of hours assigned to each module.

Lab Assessment:

1. Term work Assessment :

The experiments should be student centric and attempt to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment and assignments are graded from time to time.

2. Oral/Viva Assessment:

The oral examination will be based on the entire syllabus.

Text Books:

1. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", Pearson Publication.
2. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications", McGraw-Hill Higher Education
3. Thomas H. Cormen, Charles E. Leiserson, Ronald Rivest, Clifford Stein, "Introduction to Algorithms", PHI Learning Pvt. Ltd. (Originally MIT Press); Third edition, 2010
4. Mark A.Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education India; 2nd edition, 2002.
5. Data Structures using C and C++, Rajesh K Shukla, Wiley - India
6. Data Structures Using C, Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, Pearson.
7. Data Structures: A Pseudocode Approach with C, Richard F. Gilberg & Behrouz A., Forouzan, Second Edition, CENGAGE Learning.
8. Introduction to Data Structure and Its Applications, Jean Paul Tremblay, P. G. Sorenson.

Reference Books:

1. C & Data Structures, Prof. P.S. Deshpande, Prof. O.G. Kakde, 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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 206	Human Values and Social Ethics	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 206	Human Values and Social Ethics	--	--	--	--	50	--	--	50

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

Course Objectives:

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

Course Outcomes:

After successful completion of the course students 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.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Ethics and Values**	Meaning & Concept of Ethics Difference between Ethics and Values Ethical code of conduct	03
2.	**Professional Ethics**	Professional Ethics vs Personal ethics Components of professional ethics	05

		Professional values and its importance	
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	04
4.	**Ethics in Technical writing**	Documenting sources Presentation of Information Ethics & Plagiarism	07
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	07

Assessments:

Termwork : 50 marks (Continuous evaluation)

Books/References:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 291	Programming Lab I (Java Programming)		$1^{\#}$+2	--	-	1	--	1

$1^{\#}$ to be taken class wise

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment (Review)			End Sem. Exam				
		1(10)	2(10)	Average					
EC 291	Programming Lab I (Java Programming)	-	-	-	-	25	–	25	50

Course Objectives:

1. To write programs using abstract classes.
2. To write programs for solving real world problems using the java collection framework.
3. To write Exception Handling & multithreaded programs.
4. To write GUI programs using swing controls in Java.
5. To introduce java compiler and eclipse platform.
6. To impart hands-on experience with java programming

Course Outcomes:

After successful completion of the course students will be able to

1. Understand Java Programming.
2. Develop a program that efficiently implements the features and packaging concept of java.
3. Implement Exception handling and Applets using Java.
4. Identify problems based on societal /research needs , write code using java and demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
5. Analyse the impact of solutions in societal and environmental context for sustainable development.
6. Use standard norms of engineering practices

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Lab/Tutorial Description	No of Hours
1	Introduction to Java	Java History, Java Features, Java Virtual Machine, Data Types and Size (Signed vs. Unsigned, User Defined vs. Primitive Data Types, Explicit Pointer type)Installing Java, Java Program Development, Java Source File Structure, Compilation, Executions.	3
2	Object-Oriented Programming	Class Fundamentals, Object & Object reference, Creating and Operating Objects, Constructor &	5

		initialization code block, Access Control, Modifiers, Abstract Class & Interfaces Defining Methods, Argument Passing Mechanism.	
3	Classes, and Inheritance	Use and Benefits of Inheritance in OOP, Types of Inheritance in Java, Inheriting Data members and Methods, Role of Constructors in inheritance	5
4	Package	Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, Classpath, Setting for Packages, Making JAR Files for Library Packages Import and Static Import Naming Convention For Packages.	4
5	Exception Handling & Multithreading	The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow In Exceptions, JVM reaction to Exceptions, Use of try, catch, finally, throw, throws in Exception Handling, In-built and User Defined Exceptions. Multithreaded programming, Create thread, Life cycle, Thread methodsThread exception,	5
6	Applet and Graphics Programming	Applet: Applet Fundamental, Applet Architecture, Applet Life-Cycle, Applet Skeleton, Applet, and Application Program.Graphics Programming, Graphics classes, Functions and methods	4

DETAILED LAB SYLLABUS:

Software Requirements: Netbeans:https://netbeans.org/downloads/ J-Edit/J-Editor/Blue J

Sr. No.	Detailed Lab/Tutorial Description
1	Introduction to Java programming language.
2	Creating Classes and their Objects in Java.
3	Using constructors to create objects.
4	To understand the inheritance in Java
4	Learning of abstraction through Interface.
5	Learning of Encapsulation through Package.
6	Handling Exceptions in Java
7	Understanding Life cycle of a Thread
8	Develop an applet in Java that displays a simple message
9	Mini Project

Guidelines for Mini Project

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do surveys and identify needs, which shall be converted into problem statements for mini projects in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students shall submit an implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini projects.
- A log book to be prepared by each group, wherein the group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand the problem effectively, propose multiple solutions and select the best possible solution in consultation with the guide/ supervisor. Students shall convert the best solution into a working model using various components of their domain areas and demonstrate. The solution to be validated with proper justification and report to be compiled in standard format.

Lab Assessment:

1.Term work Assessment:

For performance experiments	: 15 Marks
Attendance	: 05 Marks
Quality of Project report	: 05 Marks

2.Oral/Practical Assessment:

Practical and Oral exam will be based on the experiments and project implemented in the semester.

Bachelor of Technology
In
Electronics & Computer Science

(Semester IV)

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 208	Engineering Mathematics IV	03	--	01	03	--	01	04

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

Prerequisite: Engineering Mathematics I, Engineering Mathematics II and Engineering Mathematics III.

Course Objectives:

1. Understand the basic techniques of statistics like correlation, regression, and curve fitting for data analysis, Machine learning, and AI.
2. Acquaint 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.
4. Introduce students to equivalence relations, recurrence relations, Introduce students to graphs, and trees.
5. Understand the concepts of complex integration.
6. Use concepts of vector calculus to analyze and model engineering problems.

Course Outcomes:

After successful completion of the course students 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.
4. Express recursive functions of other subjects like Data Structures as recurrence relation, Ability to understand use of functions, graphs and trees in programming applications.
5. Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals
6. Apply the concepts of vector calculus in real life problems.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Correlation, Regression and Curve Fitting,**	Karl Pearson's Coefficient of correlation (r),Spearman's Rank correlation coefficient (R) ,Lines of regression ,Fitting of first and second degree curves.	06
2.	**Probability, Probability Distributions**	Conditional probability, Total Probability and Baye's Theorem, Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expectation, Variance, Binomial distribution ,Poisson distribution, Normal distribution	06
3.	**Linear Algebra : Vector Spaces**	Vectors in n-dimensional vector space, norm, dot product, The Cauchy Schwarz inequality, Unit vector ; Linear combinations, linear Dependence and Independence, QR decomposition ; Orthogonal projection, Orthonormal basis, Gram-Schmidt process for vectors ; Vector spaces over real field, subspaces.	06
4.	**Graphs and Trees**	Types of Graphs, Homomorphism And Isomorphism Of Graphs, Subgraphs, Types of Graphs, Complement of Graph, Connected Graphs, Eulerian And Hamiltonian Graphs, Trees, Binary Trees, Minimum Spanning Tree, Kruskal's Algorithm	08
5.	**Lattice Theory & Recurrence relation**	Poset, Hasse Digram, Isomorphism, Extremal Elements of Posets, Lattices, Special Types of Lattices, Solving Recurrence relation, Linear Homogenous Recurrence relation with constant coefficients, Non-Homogenous Recurrence relation	06
6.	**Complex Integration and Vector Integration**	Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof). Taylor's and Laurent's series (without proof). Definition of Singularity, Zeroes, poles of f(z), Residues, Cauchy's Residue Theorem (without proof) Vector integral: Line Integral, Green's theorem in a plane (Without Proof), Stokes' theorem (Without Proof) only evaluation. Gauss' divergence	07

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 4 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.

Lab Assessment:

Term work Assessment:

Term work should consist of all the work done in tutorials and assignments. The final certification and acceptance of term work ensures satisfactory performance throughout in all the assigned work.

Books/References:

1. Probability, Statistics and Random Processes, T. Veerarajan, Mc. Graw Hill education.
2. Vector Analysis, Murray R. Spiegel, Schaum Series.
3. Beginning Linear Algebra Seymour Lipschutz Schaum's outline series, Mc-Graw Hill Publication.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication.
5. Discrete Mathematical Structures"Bernard Kolman, Robert C. Busby ,Sharon Cutler Ross, Nadeem-ur-Rehman, " Pearson Education.
6. Discrete Mathematical Structures: Theory and Applications, D.S. Malik and M.K. Sen: Cengage Learning, 2004.
7. Higher Engineering Mathematics B. V. Ramana, Tata Mc-Graw Hill Publication.
8. Advanced Engineering Mathematics Wylie and Barret, Tata Mc-Graw Hill.
9. Advanced engineering mathematics H.K. Das, S . Chand, Publications.
10. Discrete Mathematics with Applications, Thomas Koshy, Elsevier, 2005, Reprint 2008.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 209	Basics of VLSI Design	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 209	Basics of VLSI Design	40	40	40	60	25	--	25	150

Course Objectives:

1. To teach fundamental principles of VLSI circuit design and layout techniques.
2. To highlight the circuit design issues in the context of VLSI technology
3. To explain different scaling effects.
4. To study CMOS gates and effect of W/L ratio.
5. To study dynamic gates and circuit realization using pass transistors.
6. To design semiconductor memories and its importance.

Course Outcomes: Upon successful completion of the course students will be able to

1. Apply the knowledge to demonstrate a clear understanding of choice of technology and technology scaling.
2. Explain the design of MOSFET Inverters.
3. Analyze and design MOS based circuits design styles.
4. Understand CMOS gates and effect of W/L ratio.
5. Understand dynamic gates and circuit realization using pass transistors.
6. Understand the design of Semiconductor Memories.

Prerequisite: Analog Electronics Circuits, Digital Circuits and System Design(DCSD)

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Technology Comparison, MOSFET Scaling**	Comparison of BJT, NMOS and CMOS technology Types of scaling, MOSFET Models, MOSFET capacitances	05

2.	**MOSFET Inverters**	**Circuit Analysis:** Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load, E mode MOSFET load, D mode MOSFET load inverter and CMOS inverter, comparison of all types of MOS inverters, design of CMOS inverters	07
3.	**Universal gates, Complex circuits using MOSFETs**	**Logic Circuit Design**: Analysis and design of 2-I/P NAND and NOR using equivalent CMOS inverter, W/L ratio, Complex circuits.	07
4.	**MOS Circuit Design Styles**	**Design Styles:** Static CMOS, pass transistor logic, transmission gate, Pseudo NMOS, Domino, NORA, Zipper, C2MOS, sizing using logical effort	08
5.	**Circuit Realization using MOSFETs**	**Circuit Realization:** SR Latch, JK FF, D FF, 1 Bit Shift Register, MUX, decoder using above design styles	06
6.	**Semiconductor Memories**	**SRAM:** ROM Array, SRAM (operation, design strategy, leakage currents, read/write circuits), DRAM (Operation, leakage currents, refresh operation), Flash memory- NOR flash, NAND flash.	06

DETAILED LAB SYLLABUS:

Software Requirements: TINA**,** NGSpice, Microwind

Sr. No.	Detailed Lab Description
1	Effect of parasitic capacitance and threshold voltage on output of NMOS inverter with resistive load.
2	Circuit characteristics and performance estimation of NMOS inverter with resistive load. 1) Verification of V_{OH} level for different values of load resistance. 2) Find rise time for different values of load resistance.
3	Circuit characteristics and performance estimation of NMOS inverter with Enhancement mode MOSFET load.
4	Circuit characteristics and performance estimation of NMOS inverter with Depletion mode N channel MOSFET as a load.
5	Circuit characteristics and performance estimation of CMOS inverter. 1) Verification of V_{OH} and V_{OL} levels. 2) Comparison of rise and fall times for different values of W/L ratio of pull up and pull down devices.
6	Circuit characteristics and performance estimation of CMOS Dynamic 2 Input NAND Gate. 1) Verification of V_{OH} and V_{OL} levels for various input possibilities. 2) Verification of precharge and evaluate condition for different inputs. 3) Verification of charge leakage problem.

7	Design of 4:1 MUX using pass transistor logic and transmission gates.
8	Design of 6T SRAM using Microwind dsch3.1.

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 4 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 number of hours assigned to each module.

Lab Assessments:

- Term work should consist of 8 experiments.
- Journal must include at least 3 assignments.

1. **Term work Assessment:**

Total 25 Marks (Experiments: 10-marks, Assignments: 10-marks, Attendance Theory & Practical: 05-marks)

2. **Oral/Viva Assessment**:

Based on the above contents and entire syllabus.

Text Books:

1. Sung-Mo Kang and Yusuf Leblebici, “CMOS Digital Integrated Circuits Analysis and Design”, Tata McGraw Hill, 3rd Edition.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, “Digital Integrated Circuits: A Design Perspective”, Pearson Education, 2nd Edition.

References:

1. Etienne Sicard and Sonia Delmas Bendhia, “Basics of CMOS Cell Design”, Tata McGraw Hill, First Edition. 2. Neil H. E. Weste, David Harris and Ayan Banerjee, “CMOS VLSI Design: A Circuits and Systems Perspective”, Pearson Education, 3rd Edition.
2. Debaprasad Das, “VLSI Design”, Oxford, 1st Edition. 6. Kaushik Roy and Sharat C. Prasad, “Low-Power CMOS VLSI Circuit Design”, Wiley, Student Edition.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 210	Database Management System	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 210	Database Management System	40	40	40	60	25	25	--	150

Prerequisite: Data Structures

Course Objectives:

1. Develop entity relationship data model and its mapping to relational model
2. Learn relational algebra and Formulate SQL queries
3. Apply normalization techniques to normalize the database
4. Understand the concept of transaction, concurrency control and recovery techniques.

Course Outcomes:

After successful completion of the course students will be able to

1. Recognize the need of database management system
2. Design ER and EER diagram for real life applications
3. Construct relational models and write relational algebra queries.
4. Formulate SQL queries.
5. Apply the concept of normalization to relational database design.
6. Describe the concept of transaction, concurrency and recovery.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Introduction Database Concepts**	Introduction, Characteristics of databases, File system v/s Database system, Data abstraction and data Independence, DBMS system architecture, Database Administrator	04
2.	**Entity–Relationship Data Model**	The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Relationship constraints: Cardinality and Participation,	06
3.	**Relational Model and relational Algebra**	Introduction to the Relational Model, relational schema and concept of keys. Relational Algebra-operators, Relational Algebra Queries.	07
4.	**Structured Query Language (SQL)**	Overview of SQL, Data Definition Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity , check constraints, Data Manipulation commands, Data Control commands, Set and string operations, aggregate	08

		functions, group by, having, Views in SQL, joins, Nested and complex queries, Triggers.	
5.	**Relational-Database Design**	Concept of normalization, Function Dependencies, First Normal Form, 2NF, 3NF, BCNF.	06
6.	**Transactions Management and Concurrency and Recovery**	Transaction concept, Transaction states, ACID properties, Transaction Control Commands, Concurrent Executions, Serializability-Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols, Recovery System: Log based recovery, Deadlock handling.	07

DETAILED LAB SYLLABUS:

Hardware Requirements: 2GB RAM

Software Requirements: SQL server (Oracle/MySQL/PostGreSQL)

Sr. No.	Detailed Lab/Tutorial Description
1	Identify the case study and detail 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 Views and Join operations.
7	Perform Nested and Complex queries
8	Perform DCL and TCL commands.
9	Implement function and trigger.
10	Demonstrate Database connectivity
11	Implementation and demonstration of Transaction and Concurrency control techniques using locks.

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 4 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 number of hours assigned to each module.

Lab Assessment:

1.Term work Assessment:

Term work should have min. 8 experiments. Journal must include at least 2 assignments on content of theory and practical of "Database Management System". The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks).

2.Oral/ Practical Assessment:

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

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.

References:

1. Microsoft SQL Server Black Book By Patrick Dalton.
2. https://www.w3schools.com/sql/
3. https://www.postgresqltutorial.com/

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 211	Microprocessor & Microcontrollers	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 211	Microprocessor & Microcontrollers	40	40	40	60	25	25	--	150

Prerequisite: Digital System Design

Course Objectives:

1. To understand the basic concepts of Microprocessor based systems.
2. To understand the architecture and instruction set of 8-bit Microcontroller 8051.
3. To write assembly / C programs for 8051 Microcontroller.
4. To understand peripheral devices and their interfacing with 8051 Microcontroller.
5. To understand various applications of 8051microcontroller.
6. To understand architecture of 32-bit Microcontroller ARM Cortex M3.

Course Outcomes:

After successful completion of the course students will be able to

1. Identify the features of microcontrollers (8051 & ARM Cortex M3)
2. Understand the architecture and aspects of 8051& Cortex M3 microcontroller.
3. Interface microcontroller with hardware for given application
4. Write and execute assembly or C language programs for given application.
5. Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051
6. Develop small microcontroller based applications.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
	Introduction to Microprocessor System.	1.1 Microprocessor based system: CPU, I/O Devices, Clock, Memory, Concept of Address, Data and Control Bus. 1.2 Features of 8086 Microprocessor. 1.3 Comparison between Microprocessor and Microcontroller. 1.4 Concept of Harvard & Von Neumann Architecture. 1.5 pipelined operation.	04

2	**8051 Microcontroller Architecture**	2.1 8051 Features & its architecture (ALU, PC, DPTR, PSW, Internal RAM, Internal ROM, Latch, SFRs, General purpose registers, Timer/Counter, Interrupt, Ports). 2.2 Pin configuration of 8051 Microcontroller. 2.3 Memory organization (Program and Data memory Map)	04
3.	**8051 Microcontroller assembly language programming**	3.1 Addressing modes of 8051. 3.2 Assembler directives of 8051. 3.3 Instruction Set: Data transfer, Arithmetic, Logical, Branching. 3.4 Programming concepts: Looping , Counting, sorting and Indexing, Data manipulation, Masking. 3.5 Programs related to: arithmetic, logical, Branch & delay.	08
4.	**Internal Hardware of 8051 Microcontroller & Programming**	4.1 I/O port structure and programming. 4.2 Timer/Counter and programming.. 4.3 Serial port and programming. 4.4 Interrupts and programming. 4.5 Power saving modes of 8051: Power down and idle mode.	08
5.	**8051 Interfacing & Applications**	6.1 Display interfacing: 7-segment LED display, 16x2 generic alphanumeric LCD display. 6.2 Analog devices interfacing: 8-bit ADC and DAC 6.3 Motor interfacing: Dc motor & Stepper motor. 6.4 Waveform (Ramp, triangular & Sine wave) generation program using DAC.	08
6.	**Advanced Microcontroller Architecture (ARM CORTEX-M3)**	6.1 Comparison of CISC & RISC architectures. 6.2 Overview of ARM family. 6.3 ARM Cortex-M3 architecture,. 6.4 Programmer's model: Operation Modes and States, registers, special registers, Application Program Status Register- Integer status flags, Q status flag, GE bits. 6.5 Memory system: Features and memory map 6.6 Exceptions and Interrupts - Nested vectored interrupt controller.	07

DETAILED LAB SYLLABUS:
Lab Prerequisite: Digital System Design
Hardware Requirements: Experiments can be conducted on Assembler, Emulator
Software Requirements: Hardware kits

Sr. No.	Detailed Lab/Tutorial Description
1	Introduction to 8086 microprocessor kit and assembler.
2	To write an assembly language program to perform Arithmetic and Logical Operations using 8051 microcontroller.
3	To write an assembly language program to transfer of data bytes between Internal and External Memory using 8051 microcontroller.
4	To write an assembly language program to perform experiments based on General Purpose Input-Output & Timers.
5	Program for Serial communication of 8051 using UART.

6	Programs for Interfacing of Stepper Motor/DC motor with 8051 microcontroller.
7	Programs for generating waveform (Square, Triangular, Sine wave) with 8051 microcontroller.
8	Programs for Interfacing of LCD with 8051
9	Mini project based on any application related to 8051 microcontroller.

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 4 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.

Lab Assessment:

1. Term work Assessment:

08 Experiments covering the entire syllabus must be given during the "Laboratory session batch wise". Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempts should be made to make experiments more meaningful, interesting and innovative. Application oriented one mini-project can be conducted for a maximum batch of at least 04 students.

Text Books:

1. Microprocessor and Interfacing: By Douglas Hall (TMH Publication)
2. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, "The 8051 Microcontroller & Embedded systems", Pearson Publications, Second Edition 2006.
3. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C' ", Cengage Learning, Edition 2010.
4. Joseph Yiu,"The Definitive Guide to ARM CORTEX-M3 & CORTEX-M4 Processors", Elsevier, 2014, 3rd Edition.

Reference Books:

1. 8086 Microprocessor Programming and Interfacing the PC: By Kenneth Ayala (West Publication).
2. Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: By Liu & Gibson (PHI Publication).
3. Satish Shah, "The 8051 Microcontrollers", Oxford publication first edition 2010.
4. "MCS@51 Microcontroller, Family users Manual" Intel.
5. David Seal, "ARM Architecture", Reference Manual (2nd Edition), Publisher Addison Wesley.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 212	Analysis of Algorithms	03	02	-	03	01	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 212	Analysis of Algorithms	40	40	40	60	25	25	--	150

Prerequisite: Data Structure

Course Objectives:

1. To conceptualize learners with mathematical models for analysis of algorithm
2. To understand and solve problems using various algorithmic design strategies
3. To apply algorithm strategies to real life problems

Course Outcomes:

After successful completion of the course students will be able to

1. Analyse space and time complexity of various algorithms
2. Describe, Apply and Analyse design strategy and complexity for optimization problems
3. Describe, Apply and Analyse design and complexity of Backtracking
4. Describe, Apply and Analyse design and complexity of Branch and Bound
5. Describe, Apply and Analyse divide and conquer approach
6. Define and give examples complexity classes P and NP

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Introduction to algorithms and analysis of algorithm**	Notion of an Algorithm, Brief introduction:-algorithm design paradigms, Algorithm analysis :- Asymptotic notations $O, \Omega, \theta, \omega, o$ $O, \Omega, \theta, \omega, o$ and their properties, notions of time and space complexity, best case, worst case and average case analysis of algorithms, Brief introduction:- randomized algorithms and notion of expected time complexity	07
2.	**Divide and Conquer Approach**	Recurrence equations, Solution of recurrence equations:-Recurrence Tree method, Master Theorem, General structure of a Divide and Conquer algorithm, Finding closest pair of points in 2D plane, Merge/Quick sort.	06
3.	**Dynamic Programming Approach**	General method, applications-Matrix chain multiplication, Optimal binary search trees, Single Source Shortest Path:- Bellman-Ford algorithm, All pairs shortest path problem:-Floyd-Warshall, Travelling salesperson problem.	08
4.	**Greedy Method Approach**	General method, Applications-Job sequencing with deadlines, fractional knapsack problem, Minimum cost spanning trees, Single source shortest path problem:- Dijkstra's algorithm	08
5.	**Backtracking and**	Backtracking: General method, graph coloring	05

	Branch-and-bound	Branch and Bound: General method, applications - 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution.	
6.	**Selected algorithms and Non-deterministic polynomial time algorithms**	Number Theoretic:- Euclid's algorithm for GCD and it's time complexity analysis, Graph Theoretic:- Johnson's algorithm for All pair Shortest Path problem Computational Complexity classification of problem: Brief introduction:- non deterministic algorithms, Complexity classes:- P, NP.	05

DETAILED LAB SYLLABUS:

Lab Prerequisite:

Hardware Requirements:

Software Requirements: C/Python/C++

Sr. No.	Detailed Lab/Tutorial Description
1	Implement Merge and Quick sort algorithms.
2	Implement Bellman-Ford algorithm.
3	Implement Floyd-Warshall algorithm.
4	Implement Dijkstra's algorithm for the single source shortest path problem on a given weighted graph.
5	Implement Prim/Kruskal algorithm for finding a minimum cost spanning tree of a given input graph.
6	Implement a backtracking based algorithm for vertex coloring of a given graph.
7	Implement Johnson's algorithm for shortest paths, for a given graph.
8	Implement a randomized algorithm for searching an element in an unsorted array and derive its expected time complexity.
9	Implement Euclid's algorithm to calculate GCD of a given set of n>2 natural numbers.

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 4 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 number of hours assigned to each module.

Lab Assessment:

1.Termwork Assessment:

Term work should consist of all the work done in tutorials and assignments. The final certification and acceptance of term work ensures satisfactory performance throughout all the assigned work.

2. Oral/Practical Assessment: Practical & Oral Exams should be conducted based on syllabus and practicals conducted.

Text Books:

1. Ellis Horowitz,Satraj Sahni and Rajasekharam, Fundamentals of Computer Algorithms, Galgotia publications pvt. Ltd.
2. Parag Himanshu Dave, Himanshu Bhalchandra Dave, Design and Analysis Algorithms - Publisher: Pearson

Reference Books:

1. T.H.Cormen, C.E.Leiserson, R.L.Rivest, C. Stein, Introduction to Algorithms, 2nd edition, Prentice-Hall India, 2001.
2. J. Kleinberg and E. Tardos, Algorithm Design, Pearson International Edition, 2005.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 213	System Software & Operating Systems	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 213	System Software & Operating Systems	40	40	40	60	25	--	--	125

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

Course Objectives:

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 loaders, linkers and Compilers.
4. To introduce basic concepts and functions of operating systems.
5. To understand the concepts and implementation of Process Management, IPC, memory management policies, File and I/O Management.

Course Outcomes:

After successful completion of the course students will be able to

1. Identify the relevance of different system programs.
2. Identify the need of assembler and macro processor design.
3. Understand the functions of linkers, loaders and compilers.
4. Understand the role of Operating System in terms of process, memory, file and I/O management.
5. Apply and analyse the concept of a process,process scheduling and synchronization
6. Apply and analyze different techniques of memory management, file and I/O management.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Introduction to System Software**	Concept of System Software, Introduction to various system programs such as Assembler, Macro processor, Loader, Linker, Compiler, Interpreter, Device Drivers, Operating system, Editors, Debuggers.	03

2.	**Assemblers and Macro Processors**	Elements of Assembly Language programming, Assembler Design: Introduction to single pass Assembler Design for Hypothetical machines, data structures used. Macro definition and call, parameterized, conditional Macro, Design of Two pass macro processor for Hypothetical machines, data structures used.	08
3.	**Linkers, Loaders and Compilers**	Functions of loaders, Absolute loader/Compile and Go loader, Phases of compilers: Lexical Analysis, Syntax analysis, SR Parser, Introduction to semantic analysis, Intermediate Code Generation: Types of Intermediate codes, Code optimization techniques, Introduction to Code Generation.	08
4.	**Overview of operating System**	Introduction, Objectives, Functions and Types of Operating System, Operating System Services and Interface; Operating system structures: Layered, Monolithic and Microkernel.	04
5.	**Process Management**	Concept of a Process, Process States, Operation on Process Uniprocessor Scheduling-Types: Preemptive and Non-preemptive, scheduling algorithms Threads: Definition and Types, Concept of Multithreading, Inter-Process Communication, Process Synchronization, Mutual Exclusion: ,Semaphores, Producer Consumer problem, Principles of Deadlock: Conditions Deadlock Handling Mechanism.	08
6.	**Memory Management and I/O Management**	Basic Concepts of Memory Management; Memory Allocation Techniques, Paging, TLB, Segmentation, Virtual Memory; Demand Paging, Page Replacement Algorithms, I/O Devices, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C- LOOK, Linux I/O.	08

DETAILED LAB SYLLABUS:

Lab Prerequisite: Any programming language, Knowledge on Operating system principles

Hardware Requirements: 2GB RAM,PC i3 processor and above

Software Requirements: C, IDE/Compiler (Geany). Linux Operating System

Sr. No.	Detailed Lab/Tutorial Description
1	Implementation of File handling program to check whether entered input is Mnemonic or Pseudo opcode or symbol.
2	Design and Development of Simple Macro Processor
3	Implementation of Lexical analysis phase of compilers
4	Implementation of Intermediate code generation phase of compilers
5	Implementation of code generation phase of compilers
6	Explore usage of basic and advanced Linux Commands
7	Explore the file and process management system calls.
8	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 call.
9	Write a program to demonstrate the concept of non-preemptive and preemptive scheduling algorithms.
10	Write a program in C demonstrate the concept of page replacement policies

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 4 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.

Lab Assessment:

1.Term work Assessment:

Term work should consist of 10 experiments. Journal must include at least 2 assignments on content of theory and practical of "System Software & Operating Systems".The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks).

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

References:

1. Compiler construction : principles and practices , Kenneth C.Louden ,CENGAGE Learning.
2. System software : An introduction to system programming , Leland L. Beck, Pearson.
3. Principles of Operating Systems, Naresh Chauhan, First Edition , Oxford university press.
4. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rd Edition.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 292	Programming Lab II(Web Programming)	-	1#+2	--	-	--	--	01

1# to be taken class wise

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment (Review)			End Sem. Exam				
		1(10)	2(10)	Average					
EC 292	Programming Lab II(Web Programming)	-	-	-	-	25	--	25	50

Course Objectives:

1. To make students familiar with Web Fundamentals, Programming Languages for the Web.
2. To make students familiar with HTML Basics, the working environment.
3. To develop the ability to logically plan and develop web pages.
4. To learn to write, test, and debug web pages using HTML and JavaScript.

Course Outcomes: Upon successful completion of the course students will be able to

1. Understand Basics of JavaScript.
2. Support the development of web pages.
3. Programming the browser and forms with JavaScript.
4. Create forms and check for data accuracy.
5. Use JavaScript system objects.
6. Analyse the impact of solutions in societal and environmental context for sustainable development.
7. Use standard norms of engineering practices.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
I	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.	8

		Formatting and Fonts, Anchors, images, lists, tables, frames and forms. Introduction to CSS: Evolution of CSS, Syntax of CSS, Exploring CSS Selectors, Inserting CSS in an HTML Document, Defining Inheritance in CSS. Introduction to JavaScript: JavaScript language constructs, Objects in JavaScript- Built in, Browser objects and DOM objects, event handling, form validation and cookies.	
II	Responsive Web Design with CSS3	Native Audio and Video, Geo-location, CSS3 and Responsive Web Design: Media Queries, Selectors, Typography and color Modes, CSS3 Transitions, Transformations and Animations.	4
III	Rich Internet Application (RIA)	Characteristics of RIA, 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
IV	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: Laravel.	5
V	Python Web Framework: Flask	Introduction, Web Frameworks, Introduction to Flask, Creating flask application, “Hello World” Application.	2
VI	Web Extensions	Introduction to XML, Introducing XSL, XSLT.	3

Text 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 Cookbook, By Christopher Schmitt, Kyle Simpson, O'Reilly Media

Web Links:

HTML ● https://www.w3schools.com/html/default.asp ● https://developer.mozilla.org/en-US/docs/Learn/HTML
CSS ● https://www.w3schools.com/css/default.asp ● https://developer.mozilla.org/en-US/docs/Learn/CSS

JavaScript
- https://www.w3schools.com/js/default.asp
- https://developer.mozilla.org/en-US/docs/Web/JavaScript

Detailed Lab Syllabus:
Prerequisite: Basic programming skills.

Hardware Requirements:
PC With following Configuration
1. Intel Core i3/i5/i7 Processor
2. 4 GB RAM
3. 500 GB Hard Disk

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

Suggested list of Experiments		
I	HTML	Write five HTML programs showing use of: Links, images, table, lists, forms.
II	CSS and JavaScript	Create a HTML document and style it using three ways of applying CSS. Create a HTML document applying following CSS styles: color, background, border, margins, padding, text alignment, font, Write a program for form validation using JavaScript.
III	Responsive web design and RIA	Create a HTML document to display audio and video files. Create a HTML showing use of canvas. Create a HTML showing use of media queries. Write a program using geolocation api. Write a program showing use of AJAX.
IV	PHP	Write five PHP programs showing use of: server side form validation, session tracking, MySQL connection.
V	Flask	Any two programs creating basic flask applications.
VI	XML	Write a program to create any XML document. Write a program to display a XML document using XSLT.

Text Books:

1. Responsive Web Design by Example Beginner's Guide by Thoriq Firdaus, PACKT
2. Responsive Web Design with HTML5 and CSS3 PACKT
3. Professional Rich Internet Application : AJAX and Beyond WROX press

References:

1. Laravel: Up and Running, By Matt Stauffer O'Reilly Media.
2. Advanced Internet Technologies (includes practicals) ,Deven Shah ,Dreamtech publication
3. Flask Web Development: Developing Web Applications with Python, O′Reilly; 2nd edition (16 March 2018).

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 08 experiments based on the above list.The term work Journal must include Mini Project based on the content of the syllabus (Group of 3-4 students).

Distribution of Term work marks shall be as below:

● Term Work Marks - Total 25-Marks: Experiments: 10 Marks, Attendance: 05 Marks, Mini Project: 10 Marks

Bachelor of Technology
In
Electronics & Computer Science

(Semester V)

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 301	Signals and Systems	03	--	01	03	--	01	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 301	Signals and Systems	40	40	40	60	25	--	--	125

Course Objectives:

1. To identify, classify and analyze various types of signals and systems.
2. To analyze time Domain analysis of continuous and discrete time signals and systems.
3. To Analyze the continuous and discrete time LTI signals and systems in frequency domain using Fourier Transform.
4. To analyze, formulate and solve problems on frequency domain analysis of continuous time systems using Laplace Transform.
5. To analyze, formulate and solve problems on frequency domain analysis of discrete time systems using Z- Transform.
6. To provide foundation of signal and system concepts to areas like communication, control and comprehend applications of signal processing in communication systems.

Course Outcomes: Upon successful completion students will be able to

1. Classify and analyze various types of signals and systems.
2. Determine convolution integral and convolution sum.
3. Analyze the continuous and discrete time signals and systems in frequency domain using Fourier Transform.
4. Analyze, formulate and solve problems on frequency domain analysis of continuous time systems using Laplace Transform.
5. Analyze, formulate and solve problems on frequency domain analysis of discrete time systems using Z- Transform.
6. Understand the concept of FIR and IIR system.

Prerequisite: Engineering Mathematics III

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Introduction of Continuous and Discrete Time Signals and systems:**	Introduction to Signals: Definition of Signals , Representation of continuous time signals and discrete time signals, Sampling theorem, sampling of continuous time signals Basic Elementary signals , Arithmetic	07

		operations on the signals- Time Shifting, Time scaling, Time Reversal of signals Classification of Continuous time signals and Discrete time signal Introduction to Systems: Definition of Systems , Classification of Continuous time systems and Discrete time systems, Applications of Signals and Systems	
2.	**Time domain analysis of continuous time and discrete time systems**	Linear Time Invariant (LTI) systems; impulse response, step response, Convolution integral and Convolution sum for analysis of LTI systems, properties of convolution integral/sum, Correlation of Signals: Auto-correlation and Cross correlation of Continuous time signals (Numericals not expected) and Discrete time signal.	06
3.	**Fourier Analysis of Continuous and Discrete Time Signals and Systems**	Fourier transform of periodic and non-periodic functions, Properties of Fourier Transform, Inverse Fourier Transform, Frequency Response: computation of Magnitude and Phase Response, Limitations of Fourier Transform	07
4.	**Frequency domain analysis of continuous time system using Laplace transform**	Definition of Laplace Transform (LT), Region of Convergence (ROC), Properties of Laplace transform, Inverse Laplace transform. Analysis of continuous time LTI systems using Laplace Transform: Causality and stability of systems in s-domain, Total Response of the system, Relation between LT and FT	07
5.	**Frequency domain analysis of discrete time system using Z-transform**	Definition of unilateral and bilateral Z Transform, Region of Convergence (ROC),Properties of Z-Transform, Inverse Z-Transform. Analysis and characterization of the LTI system using Z transform: Transfer Function and difference equation, plotting Poles and Zeros of a transfer function, impulse and step response, causality, stability, Total response of a system. Relation between Laplace Transform and Z–Transform, Relation between ZT and FT	08
6.	**FIR and IIR systems**	Concept of finite impulse response systems and infinite impulse response systems, Linear Phase FIR systems. IIR Realization structures of LTI Discrete time system: Direct form –I and direct form II.	04

SR NO	List of Tutorials
01	Tutorial No 1 : Mathematical Operations on Continuous and Discrete time signals
02	Tutorial No 2 : Classifications of Continuous and Discrete time signals and systems
03	Tutorial No 3 : Convolution and Correlation of Continuous and Discrete time signals
04	Tutorial No 4 : Sums on properties of Continuous time and Discrete time Fourier Transform
05	Tutorial No 5 : Magnitude and Phase Response Sums of Fourier transform
06	Tutorial No 6 : ROC , properties of Laplace transform

07	Tutorial No 7 : Inverse Laplace transform and total response
08	Tutorial No 8 : ROC and properties of Z transform
09	Tutorial No 9 : Inverse Z transform and total response
10	Tutorial No 10 : FIR Realization structures 1. Direct form –I 2. Direct form II

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 4 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 number of hours assigned to each module.

Lab Assessments:

Term Work Assessment:

- At least 08 tutorials covering the entire syllabus must be conducted.
- The tutorials should include easy, medium and high level thinking questions. Term work assessment must be based on the overall performance of the student with every tutorial graded from time to time. The grades should be converted into marks as per the Credit and Grading System manual and should be added and averaged. The grading and term work assessment should be done based on this scheme.

Text Books:

1. NagoorKani, “Signals and Systems”, Tata McGraw Hill, Third Edition, 2011.
2. Tarun Kumar Rawat, “Signals and Systems”, Oxford University Press 2016.
3. Simon Haykin and Barry Van Veen, “Signals and Systems”, John Wiley and Sons, Second Edition, 2004.

References:

1. Hwei. P Hsu, “Signals and Systems”, Tata McGraw Hill, Third edition, 2010
2. Rodger E Ziemer, William H. Tranter and D. Ronald Fannin, “Signals and Systems”, Pearson Education, Fourth Edition 2009.
3. Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, “Signals and Systems”, Prentice-Hall of India, Second Edition, 2002.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 302	Computer Networks	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 302	Computer Networks	40	40	40	60	25	--	25	150

Course Objectives:

1. To introduce networking architecture and protocols.
2. To understand the various layers and protocols in the TCP/IP model.
3. To recognize different addressing schemes, connecting devices and routing protocols.
4. To select the required protocol from the application layer protocols.

Course Outcomes: Upon successful completion students will be able to

1. Demonstrate understanding of networking concepts and required protocols.
2. Analyze the various layers and protocols of the layered architecture.
3. Evaluate different addressing schemes, connecting devices and routing protocols.
4. Appreciate the application layer protocols.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Introduction to Network Architectures, Protocol Layers, and Service models**	Uses of computer networks. Topologies, LAN, MAN, WAN, Network topologies, Addressing : Physical / Logical /Port addressing, Protocols and Standards. Protocol Architecture: Need of layered protocol architecture, Layers details of OSI, , Protocol Layers and Their Service Models TCP/IP Model: Protocol suite, Comparison of OSI and TCP/IP	06

2.	**Physical Layer**	Transmission Media: Guided media like Coaxial, fiber, twisted pair, and Wireless media, Transmission Impairments. Interconnecting Devices: Hub, Bridges, Switches, Router, Gateway Data communication model : DTE, DCE, RS-232D Interface , Null Modem , Multiplexing : FDM , Synchronous TDM , Statistical TDM, ADSL , xDSL, Cable modem	09
3.	**Data Link Control**	Data link services: Framing, Flow control, Error control, ARQ methods, Piggybacking High Level Data Link Control (HDLC): HDLC configurations, Frame formats, Typical frame exchanges. Medium Access Control Protocols: ALOHA, Slotted ALOHA, CSMA, CSMA/CD	08
4.	**Network Layer**	Switching: Switched Communication networks, Circuit switching Networks, , Circuit switching Concepts, Packet switching Principles: Virtual circuit switching and Datagram switching Routing in Packet Switching Networks: Characteristics, Routing strategies, Link state Routing versus Distance vector Routing. Least-Cost Routing Algorithms: Dijkstra's Algorithm, Bellman Ford Algorithm. Internet Protocol: Principles of Internetworking: Requirements, Connectionless Operation Internet Protocol Operation: IP packet, IP addressing, subnet addressing , IPv4, ICMP, ARP, RARP IPv6 (IPv6 Datagram format, comparison with IPv4, and transition from IPv4 to IPv6)	04
5.	**Transport Layer**	Connection –oriented Transport Protocol Mechanisms: Transmission Control Protocol (TCP): TCP Services, TCP Header format, TCP three way handshake, TCP state transition diagram. User datagram Protocol (UDP) Congestion: Effects of congestion, Congestion control methods, Traffic management, Congestion control in Packet switching Networks	08
6.	**Application Layer**	Application layer Protocols : HTTP, FTP, DNS,SMTP, SSH	04

DETAILED LAB SYLLABUS:

Hardware Requirements: Switches Routers, Cables Crimping Tools

Software Requirements: Cisco PacketTRacer, NS 2

Sr. No.	Detailed Lab Description
1	To study basic networking commands.
2	To perform crimping and set up a LAN connection.
3	To configure a network using Distance Vector Routing Protocol-RIP using Cisco Packet Tracer.
4	Configure a network using Path Vector Routing Protocol- BGP using Cisco Packet Tracer
5	To perform subnetting using Cisco Packet Tracer.
6	To study about NS2 simulator in detail.
7	Creating two nodes and set up a LAN connection using NSG 2.1
8	To Simulate and to study stop and Wait protocol using NS 2.1
9	To Simulate Sliding Window protocol using NS 2.1

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 4 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 number of hours assigned to each module.

Lab Assessments:

1. Term Work Assessment:

- At least 08 experiments covering entire syllabus and one mini project should be set to have well predefined inference and conclusion.
- The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment graded from time to time. The grades should be converted into marks as per the Credit and Grading System manual and should be added and averaged. The grading and term work assessment should be done based on this scheme.

2. Oral/Viva Assessment:

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus. Students are encouraged to share their experiments/mini project codes on online repository.

Text Books:

1. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition TMH,2006.
2. Computer Networks -Andrew S Tanenbaum, 4th Edition, Pearson Education..
3. Alberto Leon Garcia, “Communication Networks” , McGraw Hill Education, Second Edition.
4. J. F. Kurose and K. W. Ross ,”Computer Networking: A Top-Down Approach”, Addison Wesley, 5th Edition

References:

1. An Engineering Approach to Computer Networks-S.Keshav,2nd Edition, Pearson Education.
2. Understanding communications and Networks,3rd Edition, W. A. Shay, Cengage Learning T L Singal “wireless communications”, Mc Graw Hill Education
3. Computer and Communication Networks, Nader F. Mir, Pearson Education.
4. Computer Networking: A Top-Down Approach Featuring the Internet, James F.Kurose,K.W.Ross,3rd Edition, Pearson Education.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 303	Instrumentation & Control System	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 303	Instrumentation & Control System	40	40	40	60	--	---	----	100

Prerequisite: Applied Mathematics(Laplace Transform, Ordinary differential equations), Applied Physics, Basic Electrical Engineering

Course Objectives:

1. To develop the ability to model control systems and determine their time response and frequency response.
2. To develop the ability to analyze stability of control systems.
3. To develop the ability to understand various types of sensors, transducers and data acquisition systems.

Course Outcomes: After successful completion of the course students will be able to

1. Derive the transfer functions for any given control systems.
2. Analyze the performance of control systems based on the time domain and frequency domain specifications.
3. Evaluate the stability of the control systems in time domain and frequency domain.
4. Understand the working principle of sensors and transducers.
5. Explain various parameters of data acquisition systems.
6. Describe instrument communication standards.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
	Introduction to Control System	Examples of control systems; open and closed loop systems; Servomechanism. Mathematical modeling of Electrical & Mechanical Systems; Transfer function model. Block diagram and Signal Flow Graph (SFG) representation of control systems; Block diagram reductions; Mason's gain formula.	**08**
	Time Response Analysis	Standard test input signals; time response of first and second order systems for standard test inputs; Transient response specification for second order system; Error constants and type of the system. Concept of stability; Routh-Hurwitz Criteria; Relative stability analysis; Root-Locus technique and construction of root-loci.	**08**

	Frequency Response Analysis	Introduction to frequency response; Frequency response plots: Polar plot and Bode plot; Stability margins in frequency domain, Nyquist stability criterion and stability analysis using Nyquist plot (Numericals not expected).	**06**
	Sensor and Transducers	Introduction to sensors and transducers. Various types of sensors. Various types of transducers and their principle of operation. Selection criteria of transducers. Displacement and pressure transducers: potentiometers, pressure gauges, Linear variable differential transducer (LVDT), strain gauges. Temperature transducers: working principle, ranges and applications of resistance temperature detectors (RTD), thermocouple and thermistor temperature transducers.	**07**
	Signal conditioning DAS and SCADA	Introduction to instrumentation systems, data acquisition system (DAS), use of DAS in Intelligent instrumentation system. Data logger, its types and applications. SCADA communication architecture, types, applications, open SCADA protocols. Introduction to Distributed Control system [D.C.S] and fibre optic instrumentation.	**06**
	Telemetry and Instrument communication standards	Introduction to telemetry, landline telemetry, radio telemetry and types of multiplexing. Instrument interfacing, Current loop, RS232/485, Field bus, Modbus GPIB, USB Protocol, and HART communication Protocol.	**04**

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 4 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.

Books:

1. K. Ogata, “Modern Control Engineering”, PHI, New Delhi
2. I. J. Nagrath, M. Gopal, “Control System Engineering”, 5th edition, New Age International Publishers
3. A.K. Sawhney, “Electrical & Electronic Measurement & Instrumentation” – DRS. India
4. D. Patranabis, “Principle of Industrial Instrumentation”, Tata McGraw Hill.
5. H.S.Kalsi, “Electronic Instrumentation”-TMH, 2nd Edition.

References:

1. Kuo B.C., Automatic Control Systems, Prentice Hall of India Ltd., New Delhi, 1995.
2. Norman S. Nise, “Control System Engineering”, John Wiley and Sons
3. C. S. Rangan, G. R. Sharma and V. S. Mani, ‘Instrumentation Devices and Systems’, Tata McGraw-Hill Publishing Company Ltd.
4. Helfrick& Cooper, “Modern Electronic Instrumentation & Measuring Techniques” – PHI

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 304	Software Engineering	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 304	Software Engineering	40	40	40	60	25	--	25	150

Course Objectives:

1. To demonstrate and evaluate real time projects with respect to software engineering principles.
2. To provide the knowledge of software engineering discipline.
3. To apply analysis, design and testing principles to software project development.
4. To design and develop different software projects.
5. To provide knowledge about gathering requirements, analysing them and to develop prototypes.

Course Outcomes: Upon successful completion of the course students will be able to

1. Understand and demonstrate basic knowledge in software engineering.
2. Identify requirements, analyze and prepare models.
3. Plan, schedule and track the progress of the projects.
4. Design & develop the software projects.
5. Identify risks, manage the change to assure quality in software projects.
6. Apply testing principles on software project and understand the maintenance concepts.

Prerequisite:

1. Concepts of Object Oriented Programming & Methodology
2. Knowledge of developing applications with front end & back end connectivity.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Introduction to software Engineering process paradigms and Agile methodology**	● "Generic view of Process, Software Process, Capability Maturity Model (CMM)" ● Prescriptive Models: Waterfall Model, Incremental-RAD Model ● "Evolutionary Process Model Prototyping, Spiral and Concurrent Development Model"	06

		• Specialized Models: Component based, Aspect Oriented Development • Agile Methodology, Agility Principles, Scrum and Extreme Programming & Kanban model	
2.	**Requirement Elicitation and Software Project 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 • Management Spectrum, 4Ps (people, product and process), Process &Project metrics.	08
3.	**Project Scheduling ,Monitoring & Risk Management**	• Project scheduling: Defining a Task Set for the Software Project • Timeline charts, Tracking the Schedule, Earned Value Analysis • Risk Identification, Risk Assessment, • Risk Projection, RMMM	06
4.	**Software Analysis and design**	• "Introduction of Analysis elements, Scenario based, Flow based, • behavior and class based Design Concepts" • Classification of UML • Developing UML Diagrams • Requirement Model – Scenario-based model, Class-based model, Behavioral model. • Principles, Architecture Design, .Coupling vs. Cohesion • Post Development models- Component Level Design, System Level Design, • Types of User Interface Design & develop an UI Design	07
5.	**Software Configuration management and quality Assurance**	• SCM Process • Version control management • Re- engineering & Reverse Engineering • SCM repositories • Software Quality Assurance Task and Plan, • Software Reliability, Formal Technical Review (FTR), Walkthrough • McCall's Quality Factor	05
6.	**Software testing and Web Engineering**	• Purpose of STLC • Strategic Approach of Testing , White-Box, Grey-Box and Black Box testing and their types, Boundary-value Analusis, Path Testing- Calculate Cyclomatic Complexity, Equivalence class partitioning	07

		• Types of Software Testing – Manual Testing, Automated Testing, Object-oriented Testing approach, Derive a Test case • Importance of Web Engineering • Web project planning and management • Web-based System ,Major Differences between Web Applications and Conventional Software • Elements of Web Site Construction	

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 4 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 number of hours assigned to each module.

Text Books:

1. Roger Pressman, ―Software Engineering: A Practitioner‘s Approach", McGraw-Hill Publications (7th edition)
2. Ian Sommerville, ―Software Engineering‖, Pearson Education (9th edition)
3. Ali Behfrooz and Fredeick J. Hudson, "Software Engineering Fundamentals", Oxford University Press

References:

1. Pankaj Jalote, "An integrated approach to Software Engineering", Springer/Narosa
2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India
3. Ugrasen Suman, ―Software Engineering – Concepts and Practices‖, Cengage Learning
4. Jibitesh Mishra and Ashok Mohanty, ―Software Engineering‖, Pearson

DETAILED LAB SYLLABUS:

Lab Prerequisite: Object Oriented Programming with Java , Python Programming

Suggested List of Experiments - Assign the case study/project as detail statement of problem to a group of two/three students. Laboratory work will be based on course syllabus with minimum 08 experiments. Open source computer-aided software engineering (CASE) tools can be used for performing the experiment.

Sr. No.	Title of Experiment
1	Application of at least two traditional process models.
2	Application of the Agile process models.
3	Preparation of software requirement specification (SRS) document in IEEE format.

4	Structured data flow analysis.
5	Use of metrics to estimate the cost.
6	Scheduling & tracking of the project.
7	Write test cases for black box testing.
8	Write test cases for white box testing.
9	Preparation of Risk Mitigation, Monitoring and Management Plan (RMMM).
10	Version controlling of the project.

Term Work:

1.Term work should consist of 08 experiments.

2.Journal must include at least 2 assignments on content of theory and practical of "Software Engineering".

3.The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.

Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks)

Oral/Viva Assessment:**:-** Oral Exams should be conducted based on syllabus and practicals conducted.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 305	Programming Lab III (R-Programming)	--	02	--	--	01	--	01

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 305	Programming Lab III (R-Programming)	--	--	--	--	25	--	25	50

Lab Prerequisite:
Basic statistics

Lab Objectives:
1. To provide an overview of a new language R used for data science.
2. To introduce students to the R programming environment and related ecosystem and thus provide them with an in-demand skill-set, in both the research and business environments.
3. To introduce the extended R ecosystem of libraries and packages
4. To demonstrate usage of as standard Programming Language.
5. To familiarize students with how various statistics like mean median etc. can be collected for data exploration in R
6. To enable students to use R to conduct analytics on large real

Lab Outcomes:
1: Install and use R for simple programming tasks.
2. Extend the functionality of R by using add-on packages
3. Extract data from files and other sources and perform various data manipulation tasks on them.
4. Code statistical functions in R.
5. Use R Graphics and Tables to visualize results of various statistical operations on data .
6. Apply the knowledge of R gained to data Analytics for real life applications.

SN	Detailed Lab/Tutorial Description	Hrs.
1	Introduction: Installing R on personal machines. installing R and RStudio. The basic functionality of R will be demonstrated , Variable types in R. Numeric variables, strings and factors.,Accessing the help system. Retrieving R packages.,Basic data types and operations: numbers, characters and composites.Data entry and exporting dat	3
2	Data structures: vectors, matrices, lists and data frames	4
3	R as a programming language: Grouping, loops and conditional execution, Functions Exploratory data analysisRange, summary, mean, variance, median, standard deviation, histogram, box plot, scatterplot	5
4	Graphics in R: Graphics and tables Working with larger datasets Introduction to ggplot2 graphics	5
5	Regression and correlation: Simple regression and correlation,Multiple regression ,Tabular data and analysis of Categorical data	5
6	R for Data Science (Mini Project) Implementing a mini project using any data mining or big data analytics algorithm in R Extracting data from a large Dataset,Exploratory analysis,Visualizations and interpretation of results	4

Laboratory Assessment:

Term Work:

Term Work shall consist of experiments on above guidelines/syllabus. Also Term work Journal
must include at least 2 assignments.
25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5Marks (Attendance)

End Semester Practical/Oral Examination:

Pair of Internal and External Examiner should conduct practical/viva based on contents.
Distribution of marks for practical/viva examination shall be as follows:
Practical Examination: 15 Marks Oral Examination: 10 Mark

Text Books:

1. URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf (Online Resources)
2. R Cookbook Paperback – 2011 by Teetor Paul O Reilly Publications
3. Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications
4. R Programming For Dummies by Joris Meys Andrie De Vries, Wiley Publications

References:

1. Hands-On Programming with R by Grolemund, O Reilly Publications
2. R for Everyone: Advanced Analytics and Graphics, 1e by Lander, Pearson Ltd.
3. R for Data Science Learning Dan Toomey December 2014 Pack

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 306	Artificial Intelligence	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 306	Artificial Intelligence	40	40	40	60	25	--	25	150

Course Objectives:

1. To gain perspective of AI and its foundations.
2. To study different agent architectures and properties of the environment.
3. To understand the basic principles of AI towards problem solving, inference, perception, knowledge representation, and learning.
4. To investigate probabilistic reasoning under uncertain and incomplete information.
5. To explore the current scope, potential, limitations, and implications of intelligent systems.

Course Outcomes: Upon successful completion of the course students will be able to:

1. Identify the characteristics of the environment and differentiate between various agent architectures.
2. Apply the most suitable search strategy to design problem solving agents.
3. Represent a natural language description of statements in logic and apply the inference rules to design Knowledge Based agents.
4. Apply a probabilistic model for reasoning under uncertainty.
5. Comprehend various learning techniques.
6. Ability to design and develop AI applications in real world scenarios.

Prerequisite: Discrete Mathematics, Data Structures

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Introduction to Artificial Intelligence**	1.1: Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System,	4

		Components of AI Program, Foundations of AI, Sub-areas of AI, Applications of AI, Current trends in AI.	
2.	**Intelligent Agents**	2.1: Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent. 2.2: Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems.	4
3.	**Problem solving**	3.1: Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID), Informed Search Methods: Greedy best first Search, A* Search, Memory bounded heuristic Search. 3.2: Local Search Algorithms and Optimization Problems: Hill climbing search Simulated annealing, Genetic algorithms. 3.3: Adversarial Search: Game Playing, Min-Max Search, Alpha Beta Pruning	10
4.	**Knowledge and Reasoning**	4.1: Knowledge based Agents, Brief Overview of propositional logic, First Order Logic: Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining. 4.2: Knowledge Engineering in First-Order Logic, Unification, Resolution 4.3: Uncertain Knowledge and Reasoning: Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief network, Simple Inference in belief network	12
5.	**Planning and Learning**	5.1: The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning. 5.2: Learning: Forms of Learning, Theory of Learning, PAC learning. Introduction to statistical learning (Introduction only) Introduction to reinforcement learning: Learning from Rewards, Passive Reinforcement Learning, Active reinforcement Learning	5
6.	**Applications of AI**	A. Introduction to NLP- Language models, Grammars, Parsing B. Robotics - Robots, Robot hardware C. AI applications in Healthcare, Retail, Banking	4

DETAILED LAB SYLLABUS:

Lab Prerequisite: Discrete Mathematics, Data Structure
Suggested List of Experiments:

Sr. No.	Title of the experiment
1	Provide the PEAS description and TASK Environment for a given AI problem.
2	Identify suitable Agent Architecture for the problem

3	Write simple programs using PROLOG as an AI programming Language
4	Implement any one of the Uninformed search techniques
5	Implement any one of the Informed search techniques e.g. A-Star algorithm for 8 puzzle problem
6	Implement adversarial search using min-max algorithm.
7	Implement any one of the Local Search techniques. e.g. Hill Climbing, Simulated Annealing, Genetic algorithm
8	Prove the goal sentence from the following set of statements in FOPL by applying forward, backward and resolution inference algorithms.
9	Create a Bayesian Network for the given Problem Statement and draw inferences from it. (You can use any Belief and Decision Networks Tool for modeling Bayesian Networks)
10	Implement a Planning Agent
11	Design a prototype of an expert system
12	Case study of any existing successful AI system

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 4 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 number of hours assigned to each module.

Lab Assessment:

1. **Termwork Assessment:** Term Work shall consist of at least 8 to 10 experiments 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). The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

Text Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition" Pearson Education, 2020.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, First edition, 2011
3. George F Luger, "Artificial Intelligence" Low Price Edition, Fourth edition, Pearson Education.,2005

References:

1. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.
4. Elaine Rich and Kevin Knight, "Artificial Intelligence", Third Edition, McGraw Hill Education,2017.
5. Ivan Bratko, ―PROLOG Programming for Artificial Intelligence‖, Pearson Education, Third Edition.
6. D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall.

Useful Links :

1. https://nptel.ac.in/courses/106105078
2. https://nptel.ac.in/courses/106105079

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 307	Advance Database Management System + Data Warehousing & Mining	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 307	Advance Database Management System + Data Warehousing & Mining	40	40	40	60	25	--	25	150

Course Objectives:

1. To provide insights into distributed database designing.
2. To specify the various approaches used for using XML and JSON technologies.
3. To apply the concepts behind the various types of NoSQL databases and utilize it for Mongodb.
4. To identify the significance of Data Warehousing and Mining.
5. To develop research interest towards advances in data mining.

Course Outcomes: Upon successful completion students will be able to

1. Design distributed database using the various techniques for query processing.
2. Organize the data using XML and JSON database for better interoperability.
3. Compare different types of NoSQL databases.
4. Formulate NoSQL queries using Mongodb.
5. Understand data warehouse fundamentals and design data warehouse with dimensional modelling and apply OLAP operations.
6. Understand data mining principles and perform Data preprocessing and Visualization.

Prerequisite: Database Management System (DBMS)

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Distributed Databases**	Introduction, Distributed DBMS Architecture, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Distributed Transaction Management – Definition, properties, types, architecture. Distributed Query Processing - Characterization of Query Processors, Layers/ phases of query processing. Distributed Concurrency Control- Taxonomy, Locking based, Basic TO	08

		algorithm, Recovery in Distributed Databases: Failures in distributed database, 2PC and 3PC protocol.	
2.	**Data interoperability – XML and JSON**	XML Databases: Document Type Definition, XML Schema, Querying and Transformation: XPath and XQuery. Basic JSON syntax, (Java Script Object Notation),JSON data types, Stringifying and parsing the JSON for sending & receiving, JSON Object retrieval using key-value pair and JQuery, XML Vs JSON.	05
3.	**NoSQL Distribution Model**	NoSQL database concepts: NoSQL data modeling, Benefits of NoSQL, comparison between SQL and NoSQL database system. Replication and sharding, Distribution Models Consistency in distributed data, CAP theorem, Notion of ACID Vs BASE, handling Transactions, consistency and eventual consistency. Types of NoSQL databases: Key-value data store, Document database and Column Family Data store, Comparison of NoSQL databases w.r.t CAP theorem and ACID properties.	07
4.	**NoSQL using MongoDB**	NoSQL using MongoDB: Introduction to MongoDB Shell, Running the MongoDB shell, MongoDB client, Basic operations with MongoDB shell, Basic Data Types, Arrays, Embedded Documents. Querying MongoDB using find() functions, advanced queries using logical operators and sorting, simple aggregate functions, saving and updating document. MongoDB Distributed environment: Concepts of replication and horizontal scaling through sharding in MongoDB.	05
5.	**Data Warehousing Fundamentals**	Introduction to Data Warehouse, Data warehouse architecture, Data warehouse versus Data Marts, E-R Modeling versus Dimensional Modeling, Information Package Diagram, Data Warehouse Schemas; Star Schema, Snowflake Schema, Factless Fact Table, Fact Constellation Schema. Update to the dimension tables. Major steps in ETL process, OLTP versus OLAP, OLAP operations: Slice, Dice, Rollup, Drilldown and Pivot.	07
6.	**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 and Concept hierarchy generation.	07

DETAILED LAB SYLLABUS:

Software Requirements: SQL, Java/Python, WEKA

Sr. No.	Detailed Lab Description
1	Design of a distributed database for a real life application - Fragmentation, Query Processing.
2	Simulation of Recovery methods in distributed DB.
3	Design XML schema for real life application and write queries using XPath & XQuery.
4	Implement data transfer using JSON.
5	Design a database using NoSQL model and query it.

6	Implement different operations in MongoDB.
7	One case study on building Data warehouse/Data Mart -Write Detailed Problem statement and design dimensional modelling (creation of star and snowflake schema).
8	Implementation of all dimension table and fact table based on the case study.
9	Implementation of OLAP operations: Slice, Dice, Rollup, Drilldown and Pivot based on the case study.
10	Perform data Pre-processing task and demonstrate Classification, Clustering, Association algorithm on data sets using data mining tool (WEKA/R tool).

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 4 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 number of hours assigned to each module.

Lab Assessments:

1.Term work Assessment:

Term work should consist of minimum 8-10 experiments. Journal must include at least 2 assignments on content of theory and practical. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Total 25 Marks (Experiments: 15-marks, Attendance (Theory & Practical): 05-marks, Assignments: 05-marks).

2. Oral/Viva Assessment: Oral exam to be conducted by Internal & External examiners.

Text Books:

1. Korth, Siberchatz,Sudarshan, “Database System Concepts”, 6thEdition, McGraw Hill.
2. Elmasri and Navathe, “Fundamentals of Database Systems”, 5thEdition, Pearson Education.
3. Ozsu, M. Tamer, Valduriez, Patrick, “Principles of distributed database systems”,3rd Edition, Pearson Education, Inc.
4. PramodSadalge, Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison Wesely/ Pearson.
5. Jeff Friesen , Java XML and JSON,Second Edition, 2019, après Inc.
6. Paulraj Ponniah, “ Data Warehousing: Fundamentals for IT Professionals”, Wiley India.
7. Han, Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann 2nd edition.

References:

1. Peter Rob and Carlos Coronel,Database Systems Design, Implementation and Management, Thomson Learning, 5thEdition.
2. Adam Fowler, NoSQL for dummies, John Wiley & Sons, Inc.
3. Shashank Tiwari, Professional NOSQL, John Willy & Sons. Inc
4. MongoDB Manual : https://docs.mongodb.com/manual.
5. Reema Theraja, "Data warehousing", Oxford University Press 2009.
6. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Publisher 2nd edition.
7. Ian H. Witten, Eibe Frank and Mark A. Hall, "Data Mining", Morgan Kaufmann 3rd edition.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 308	Advanced Operating System	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 308	Advanced Operating System	40	40	40	60	25	--	25	150

Course Objectives:

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

Course Outcomes: Upon successful completion of the course students will be able to

1. Apply the principles and concepts in analyzing and designing Advance Operating System.
2. To be able to learn the Unix Operating System.
3. Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
4. To understand a comprehensive knowledge of Real time operating system.
5. To be able to learn knowledge of database operating systems
6. Analyze the performance and reliability of different Advanced Operating Systems.

Prerequisite: Knowledge of Operating System

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Introduction to Advanced operating System**	Functions of operating systems, Design approaches: layered, kernel based and virtual machine approach, types of advanced operating systems (NOS, DOS, Multiprocessor OS, Mobile OS,RTOS, Cloud OS)	07
2.	**Unix Kernel and File Management**	System Structure, User Perspective, Architecture of Unix Operating System, Buffer cache: Header, Buffer Pool, Retrieving, Reading and Writing Buffer, File Representation:	07

		inodes: Structure of file Directories, Path conversion to inode, superblock, inode assignment, allocation of disk blocks	
3.	**Distributed Operating system concepts**	Goals, Distributed Computing Models, Hardware Concepts, Software Concepts, Architecture of DOS. Design Issues: Transparency, Flexibility, Scalability, Reliability, Performance, fault tolerance, Distributed Mutual Exclusion: Introduction, Classification of Mutual Exclusion algorithms, Mutual Exclusion Algorithms, Distributed Deadlock: Introduction, deadlock handling strategies, Deadlock detection: Issues and resolution	07
4.	**Real Time Operating Systems and Mobile OS**	Characteristics of Real Time operating Systems, Classification of Real Time Operating Systems, Scheduling in RTOS: Clock driven: cyclic, Event driven: EDF and rate monotonic scheduling, Resource Handling: Resource Sharing, Priority Inversion, PIP, PCP, HLP. Scheduling real time tasks in distributed systems	08
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 : asic synchronization Algorithms, Lock based, Timestamp based and Optimistic Algorithms, Concurrency Control Algorithms : Data Replication	06
6.	**Mobile OS**	Architecture, Android OS, iOS, Virtual OS, Cloud OS and their design issues	04

DETAILED LAB SYLLABUS:

Software Requirements: Windows/linux

Sr. No.	Detailed Lab Description
1	Design and developed shell script that support Following Command ls, date, time, echo, cat, pwd, cp,
2	Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class
3	Implement the program for EDF
4	Implement the Program for Rate Monotonic algorithm
5	Implement a distributed share list among a group of mobile device users which is similar to Google document.
6	IOs, Android OS, Cloud OS

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 4 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 number of hours assigned to each module.

Lab Assessments:

- Term work should consist of 10 experiments.
- Journal must include at least 2 assignments.
  1. **Term work Assessment:** Total 25 Marks (Experiments: 10-marks, Attendance Theory& Practical: 05-marks, Assignments: 10-marks)
  2. **Oral/Viva Assessment**:
     Based on the above contents and entire syllabus.

Text Books:

1. Mukesh Singhal and 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.

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	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 309	Advanced VLSI Design	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 309	Advanced VLSI Design	40	40	40	60	25	--	25	150

Course Objectives:

1. To teach various CMOS adders circuits.
2. To highlight the CMOS multiplier and shift registers design
3. To study low power CMOS circuits.
4. To teach various clocking techniques .
5. To teach different clocking techniques and data paths.
6. To highlight different interconnects and delay models.

Course Outcomes: Upon successful completion of the course students will be able to

1. Apply the knowledge to demonstrate various CMOS adder circuits.
2. Understand the CMOS multiplier and shift registers design.
3. Analyze and design Low power CMOS circuits.
4. Understand various clocking techniques..
5. Develop different Data path design
6. Demonstrate a clear understanding of system level design issues such as protection, timing and power dissipation

Prerequisite: Analog Electronics Circuits, Digital Circuits and System Design(DCSD)

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Data Path Design**	**Adder:** Bit adder circuits, ripple carry adder, CLA adder, CMOS implementation of CLA adder, MODL Manchester carry chain adder, Manchester dynamic networks, carry skip adder, carry select adder, carry save adder.	08

2.	**Multipliers and shifter**	**Multipliers and shifter:** Partial-product generation, partial-product accumulation, final addition, Booth algorithm, barrel shifter	06
3.	**Low power design**	**Low power design:** Introduction to low power VLSI design-Need for low power-Charging and Discharging Capacitance-Short Circuit Current in CMOS Circuit-CMOS leakage current-static current-Basic principles of low power design Various components of power dissipation in CMOS, Limits on low power design, low power design through voltage scaling	06
4.	**IO pads and Power Distribution:**	**IO pads and Power Distribution:** ESD protection, input circuits, output circuits, simultaneous switching noise, power distribution scheme.	05
5.	**VLSI Clocking and System Design**	**Clocking:** CMOS clocking styles, Clock generation (single phase, two phase, four phase clocking), stabilization and distribution, Multiphase clock, H tree, Clock skew, Clock jitter	07
6.	**VLSI interconnect design**	**Interconnect:** Interconnect delay model, interconnect scaling and crosstalk, Floor planning & routing, pin ordering - network restructuring and reorganization, Power supply droop and ground bounce.	07

DETAILED LAB SYLLABUS: Students will have to perform experiments or write assignments on following topics.

Software Requirements: TINA**,** NGSpice, Microwind

Sr. No.	Detailed Lab Description
1	Design of CMOS adder circuits.
2	Design of multiplier circuits.
3	Design of barrel shifter circuits.
4	ESD protection, input circuits, output circuits,
5	Switching noise, voltage droop effect in CMOS Ics.
6	Switching noise, ground bounce effect in CMOS Ics.
7	Clock generation (single phase, two phase, four phase clocking),
8	interconnect scaling and crosstalk,

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 4 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 number of hours assigned to each module.

Lab Assessments:

- Term work should consist of 8 experiments.
- Journal must include at least 3 assignments.

1. **Term work Assessment:**

Total 25 Marks (Experiments: 10-marks, Assignments: 10-marks, Attendance Theory & Practical: 05-marks)

2. **Oral/Viva Assessment**:

Based on the above contents and entire syllabus.

Text Books:

1. Sung-Mo Kang and Yusuf Leblebici, “CMOS Digital Integrated Circuits Analysis and Design”, Tata McGraw Hill, 3rd Edition.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, “Digital Integrated Circuits: A Design Perspective”, Pearson Education, 2nd Edition.
3. John P. Uyemura, Introduction to VLSI circuits and systems, John Wiley & sons.

References:

1. Etienne Sicard and Sonia Delmas Bendhia, “Basics of CMOS Cell Design”, Tata McGraw Hill, First Edition. 2. Neil H. E. Weste, David Harris and Ayan Banerjee, “CMOS VLSI Design: A Circuits and Systems Perspective”, Pearson Education, 3rd Edition.
2. Debaprasad Das, “VLSI Design”, Oxford, 1st Edition. 6. Kaushik Roy and Sharat C. Prasad, “Low-Power CMOS VLSI Circuit Design”, Wiley, Student Edition.
3. Neil H. E. Weste , Kamran Eshraghian, Principle of CMOS VLSI Design: A system perspective, Addison Wesley publication.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 310	Digital Signal Processing	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 310	Digital Signal Processing	40	40	40	60	25	--	25	150

Course Objectives:

1. To introduce students with Discrete fourier transform and Fast fourier transforms for analysis of Discrete time signals and systems.
2. To use and design techniques for implementation of IIR digital filters.
3. To use and design techniques for implementation of FIR digital filters.
4. To introduce Finite Word Length effects in Digital Filters.
5. To introduce the students to digital signal processors and its applications.
6. To use and understand multirate digital signal processing.

Course Outcomes: Upon successful completion of the course students will be able to

1. Analyze the discrete time signals and system using different transform domain techniques.
2. Apply the knowledge of design of IIR digital filters to meet arbitrary specifications.
3. Apply the knowledge of design of FIR digital filters to meet arbitrary specifications.
4. Understand the effect of hardware limitations on performance of digital filters.
5. Develop different signal processing applications using DSP processors.
6. Analyze discrete-time filter banks and multirate signal processing.

Prerequisite: Signals and systems

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Discrete Fourier Transform and Fast Fourier Transform**	Definition and Properties of DFT, IDFT, Circular convolution, Computation of linear convolution using circular convolution, Filtering of long data sequences: Overlap-Save and Overlap-Add Method FFT: Fast Fourier Transforms (FFT), Radix-2 decimation in time and decimation in frequency FFT algorithms, inverse FFT	08

2.	**IIR Digital Filters**	Analog filter design -Butterworth filters, Chebyshev Type I filters, Elliptic ,Mapping of S-plane to Z-plane, IIR filter design by impulse invariance method and Bilinear transformation method, Design of IIR digital Butterworth filters and Chebyshev Type I filters. Analog and Digital frequency transformations with design examples	07
3.	**FIR Digital Filters**	Introduction of FIR digital filters, Minimum Phase, Maximum Phase, Mixed Phase and linear phase FIR filters,location of the zeros of linear phase FIR filters, Gibbs phenomenon, Design of FIR filters using Window techniques (Rectangular, Hamming, Hanning, Blackmann, Kaiser), Design of FIR filters using Frequency Sampling technique,Comparison of FIR & IIR	07
4.	**Finite Word Length effects in Digital Filters**	Quantization, truncation and rounding,Input quantization error, Product quantization error, Coefficient quantization error, Zero-input limit cycle oscillations, Overflow limit cycle oscillations, Scaling. Quantization in Floating Point realization of IIR digital filters, Finite word length effects in FIR digital filters	06
5.	**DSP Processors**	Introduction to General Purpose and Special Purpose DSP processors, fixed point and floating point DSP processor, digital signal processor architecture , Pipelining, multiplier and accumulator (MAC) ,Very long instruction word Architecture (VLIW) Architecture of TMS320C6X fixed and floating DSP processors. Applications of digital signal processing-Speech processing,Radar Signal Processing, Biomedical Applications in DSP	06
6.	**Multirate DSP and Filter Bank**	Introduction and concept of Multirate Processing, Decimator and Interpolator, Decimation and Interpolation by Integer numbers, Multistage Approach to Sampling rate converters Sample rate conversion using Polyphase filter structure, Polyphase Decomposition,Filter Banks	05

DETAILED LAB SYLLABUS:

Hardware Requirements: DSP Processor Kit

Software Requirements: Scilab, Matlab

Sr. No.	Detailed Lab Description
1	To perform DFT and IDFT of the discrete time sequence and sketch the magnitude and phase spectrum.
2	To perform circular convolution of discrete time sequences using DFT and IDFT method and compute linear convolution using circular convolution.
3	To Design an analog low pass Butterworth and Chebyshev filter

4	To Design IIR butterworth low pass filter using impulse in-variance method .
5	To Design IIR butterworth low pass filter using bilinear transformation method .
6	To Design IIR Chebyshev low pass filter using bilinear transformation method.
7	To Design FIR low pass, high pass filter using various windowing methods and plot their frequency response.
8	To plot magnitude and phase response of low pass ,high pass & all Pass filter
9	To plot magnitude and phase response of comb filter & notch filter.
10	To perform interpolation and decimation on a given discrete signal.
11	To perform the Circular Convolution of two given discrete sequences using TMS320C6745 Kit.
12	To perform the Linear Convolution of two given discrete sequences using TMS320C6745 Kit.
13	One Course Project

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 4 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 number of hours assigned to each module.

Lab Assessments:

1.Term work Assessment:

At least 08 Experiments and 3 Assignments based on the entire syllabus and **one course project/seminar** must be submitted by a maximum batch of 2 to 3 students. Term work assessment must be based on the overall performance of the student with every experiment and Course-project is graded from time to time.

2.Oral/Viva Assessment: Based on the above contents and entire syllabus.

Text Books:

1. Tarun Kumar Rawat, " Digital Signal Processing", Oxford University Press, 2015
2. Nagoor Kani, " Digital Signal Processing", Tata McGraw Hill Education Private Limited.
3. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing", A Practical Approach by, Pearson Education
4. S. Salivahanan, C. Gnanpriya, ― Digital Signal processing‖, McGraw Hill
5. Ramesh Babu, " Digital Signal Processing", Scientech Publication (India) Private Limited

References:

1. Proakis J., Manolakis D. , "Digital Signal Processing", 4th Edition, Pearson Education.
2. B. Venkata Ramani and M. Bhaskar, “Digital Signal Processors, Architecture, Programming and Applications”, Tata McGraw Hill, 2004.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete Time Signal Processing", Pearson, 8th Indian Reprint, 2004.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 311	Advanced Network Theory	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 311	Advanced Network Theory	40	40	40	60	25	--	25	150

Course Objectives:

1. To get familiar with emerging wireless technologies.
2. To understand basic concept of optical networking.
3. To study various WAN technologies like Frame relay and ATM.
4. To explore basics of network design.
5. To study basic fundamental of network security.
6. To discuss about network management and control.

Course Outcomes: Upon successful completion of the course students will be able to

1. Get familiar with emerging wireless technologies.
2. Understand basic concept of optical networking.
3. Study various WAN technologies like Frame relay and ATM.
4. Explore basics of network design.
5. Study basic fundamental of network security.
6. Discuss about network management and control

Prerequisite: Computer Networks

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Emerging Wireless Technologies**	**Wireless Personal Area Network –** Bluetooth Bluetooth (IEEE 802.15.1),Definitions of the Terms Used in Bluetooth, Bluetooth Protocol Stack, Bluetooth Link Types, Bluetooth Security, Network Connection Establishment in Bluetooth, Network Topology in Bluetooth, Bluetooth Usage Models Bluetooth Applications, WAP and Bluetooth Wireless Personal Area Networks (WPAN):Low Rate (LR) and High Rate (HR)Wireless Sensor Network, Usage of Wireless Sensor Networks, Wireless Sensor Network Model, Sensor Network	05

		Protocol Stack, ZigBee Technology, IEEE 802.15.4 LR-WPAN Device Architecture, IEEE 802.15.3a Ultra WideBand, Radio Frequency Identification.	
2.	**Optical Networking**	SONET/SDH Standards, devices, DWDM, frame format, DWDM, Performance and design considerations	09
3.	**WAN Technologies**	**Frame:** FR concept, FR specifications, FR design and VoFR and Performance and design considerations **ATM:** The WAN Protocol: Faces of ATM, ATM Protocol operations. (ATM cell and Transmission) ATM Networking basics, Theory of Operations, B-ISDN reference model, PHY layer, ATM Layer (Protocol model), ATM layer and cell Traffic Descriptor and parameters, Traffic Congestion control defined, AAL Protocol model, Traffic contract and QoS, User Plane overview, Control Plane AAL, Management Plane, Sub S3 ATM,ATM public services	08
4.	**Network Design**	Network layer design, access layer design, access network capacity, network topology and Hardware and completing the access network design	04
5.	**Network Security**	Security threats, safeguards and design for network security Enterprise Network Security: DMZ, NAT, SNAT, DNAT, Port Forwarding, Proxy, Transparent Proxy, Packet Filtering and Layer 7 Filtering	09
6.	**Network Management and Control**	Network management definitions, functional areas (FCAPS), SNMP, RMON, Designing a network management solutions, Monitoring and control of network activity and network project management	04

DETAILED LAB SYLLABUS:

Software Requirements:

1. Cisco PacketTRacer, ns 2
2. Ns-2: http://www.isi.edu/nsnam/ns/
3. Virtual Lab : http://vlab.amrita.edu/index.php?sub=78&brch=256
4. Scilab Experiments Book: https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwjgwcelodTTAhVJrI8KHTQUC9AQFggqMAA&url=http%3A%2F%2Fscilab.in%2Ftextbook_companion%2Fenerate_book%2F3446&usg=AFQjCNGDs2a6AHGKL93l3_j8Ra1UN-5SQQ&sig2=yT9ep5_ZlhfRDVsv-GmsWw&cad=rja

Online Repository Sites:

1. Google Drive
2. GitHub
3. Code Guru

Sr. No.	Detailed Lab Description
1	Study of Hardware and Software aspects of Wireless Network.
2	Study, discussion and installation of different network simulation tools such as NS2/NS3, Netstumbler, Wireshark etc.
3	Analysis of Zigbee Network to compute the energy efficiency of the network.
4	Simulation of Wireless Sensor Network (IEEE802.15.4)in NS2 or any other simulator.
5	To analyze the performance of DWDM.

6	To study the performance of SONET.
7	To study the performance of Frame relay.
8	To analyze the performance of ATM.
9	To configure a Network topology using packet tracer software.
10	To study Eavesdropping Attacks and its prevention using SSH.

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 4 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 number of hours assigned to each module.

Lab Assessments:

- At least 08 experiments covering entire syllabus and one mini project should be set to have well predefined inference and conclusion.
- The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative.

1.Term work assessment:

- Term work must be based on the overall performance of the student with every experiment graded from time to time. The grades should be converted into marks as per the Credit and Grading System manual and should be added and averaged. The grading and term work assessment should be done based on this scheme.
- The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.
- Students are encouraged to share their experiments/mini project codes on online repository.

2.Oral/Viva Assessment:

Based on the above contents and entire syllabus.

Text Books:

1. Vijay K. Garg, "Wireless Communication and Networking", Morgan -Kaufmann
2. Series in Networking—Elsevier
3. ATM and IP Internetworking: Khalid Ahmed, John Wiley and Sons Publication.
4. Network Security and Management: Brijendra Singh, Third Edition, PHI Publication.
5. Optical network design and planning: Jane Simmons (IInd Edition), Springer Publication

References:

1. Theodore S. Rappaport "wireless communications - principles and practice", PEARSON Second edition.
2. Dr SunilkumarS. Manvi, Mahabaleshwar S. Kakkasageri, "Wireless and Mobile Networks Concepts and Protocol"Wiley India Pvt Ltd.
3. T L Singal "wireless communications", Mc Graw Hill Education
4. Kazem Sohraby, Daniel Minoli, and Taieb Znati, "Wireless Sensor Networks:
5. Technology, Protocols, and Applications", Wiley Student Edition.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 312	Mobile Computing	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 312	Mobile Computing	40	40	40	60	25	--	25	150

Course Objectives:

1. To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications
2. To explore both theoretical and practical issues of mobile computing.
3. To provide an opportunity for students to understand the key components and technologies
   involved and to gain hands-on experiences in building mobile applications.
4. To understand different mobility management concepts.
5. To equip students with skills to analyze and design mobile applications.
6. To study emerging technologies like the long term evolution of 3GPP .

Course Outcomes: Upon successful completion of the course students will be able to

1. To identify basic concepts and principles in mobile communication & computing, cellular architecture.
2. To describe the components and functioning of mobile networking.
3. To classify a variety of security techniques in mobile networks.
4. To apply the concepts of WLAN for local as well as remote applications.
5. To describe and apply the concepts of mobility management .
6. To describe Long Term Evolution (LTE) architecture and its interfaces.

Prerequisite: Computer Networks

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Introduction to Mobile Computing**	Introduction to Mobile Computing, Telecommunication Generations, Electromagnetic Spectrum, Antenna ,Signal Propagation, Signal Characteristics, , Multiplexing, Spread Spectrum: DSSS & FHSS	06

2.	**GSM Mobile Services**	GSM Mobile services, System Architecture, Protocols , Localization and Calling, Handover GPRS system and protocol architecture UTRAN , UMTS core network	08
3.	**Mobile Networking**	Mobile IP, IP Packet Delivery, Agent Advertisement and Discovery, Registration, Tunneling and Encapsulation, Optimization, Reverse Tunneling, Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing, Selective Retransmission.	06
4.	**Wireless Local Area Networks**	**Wireless Local Area Networks :** Introduction, Infrastructure and ad-hoc network **IEEE 802.11:**System architecture , Protocol architecture , Physical layer, Medium access control layer, MAC management, 802.11a, 802.11b Bluetooth: Introduction, User Scenario, Architecture, protocol stack HiperLAN 1 & HiperLAN 2	10
5.	**Mobility Management**	Mobility Management : Introduction, IP Mobility, Optimization, IPv6Macro Mobility : MIPv6 Micro Mobility: Cellular IP	05
6.	**Long-Term Evolution(LTE) of 3GPP**	LTE System Overview,Voice over LTE (VoLTE)	04

DETAILED LAB SYLLABUS:

Software Requirements: J2ME, Android Studio, NS2

Sr. No.	Detailed Lab Description
1	1) Study of NS2 installation in ubuntu. 2) Mobile node creation in NS2. 3) Implementation of packet transfer using TCP in mobile nodes.
2	1) Explore and install J2ME 2) Implementation of basic calculator/EMI calculator in J2ME. 3) To implement Mobile node discovery using J2ME.
3	1) To implement OBEX protocol using bluetooth.
4	1) Explore and install Android studio 2) Develop an application that uses GUI components in Android. 3) Write an application that draws basic graphical primitives on the screen in Android
5	1) To understand the cellular frequency reuse concept fulfilling the following objectives: a) Finding the co-channel cells for a particular cell. b) Finding the cell clusters within a certain geographic area. 2) To understand the handover concept in mobile communication.
6	MINI PROJECT Develop an android application for social needs.

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 4 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 number of hours assigned to each module.

Lab Assessments:

1.Term work Assessment:

At least 08 Experiments and 2 Assignments based on the entire syllabus and **one mini project** must be submitted by a maximum batch of 3 to 4 students. Term work assessment must be based on the overall performance of the student with every experiment and mini project is graded from time to time.The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

2.Oral/Viva Assessment: Based on the above contents and entire syllabus.

Text Books:

1. Jochen Schilller,‖Mobile Communication ―, Addision wisely,Pearson Education, 2nd Edition.
2. Wireless Communications & Networks,‖ By William Stallings, Second Edition, Pearson Education .
3. Raj Kamal, Mobile Computing, 2/e , Oxford University Press-New Delhi

References:

1. LTE Self-Organizing Networks (SON): Network Management Automation for Operational
   Efficiency, Seppo Hamalainen, Henning Sanneck , Cinzia Sartori, Wiley publications .
2. Christopher Cox, ―An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications,‖ Wiley publications .
3. Mobility Protocols and Handover Optimization: Design, Evaluation and Application By Ashutosh Dutta, Henning Schulzrinne, IEEE Press, Wiley Publication.
4. Michael Gregg, ―Build your own security lab,‖ Wiley India edition .
5. Emerging Wireless Technologies and the Future Mobile Internet, Dipankar Raychaudhuri, Mario Gerla, Cambridge.
6. Andreas F.Molisch, ―Wireless Communications,‖ Second Edition, Wiley Publications.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 313	Wireless Networks	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test2	Avg.					
EC 313	Wireless Networks	40	40	40	60	25	--	25	150

Course Objectives:

1. To get familiar with basic of wireless system.
2. To understand planning and design of various mobile and wireless networks.
3. To study various WPAN technologies like Bluetooth, Zigbee etc.
4. To explore basics of WAP.
5. To study basic fundamental of WLAN technologies.
6. To discuss introduction of 5G technology.

Course Outcomes: Upon successful completion of the course students will be able to

1. Get familiar with basic of wireless system.
2. Understand planning and design of various mobile and wireless networks.
3. Study various WPAN technologies like Bluetooth, Zigbee etc..
4. Explore basics of WAP.
5. Study basic fundamental of WLAN technologies.
6. Discuss introduction of 5G technology

Prerequisite: Wireless and mobile communication.

Detailed Theory Syllabus:

Sr. No.	Module	Detailed Content	Hours
1	**Overview of Wireless System**	Advantages, limitations and application wireless media, Infrared Modulation Techniques, DSSS and FHSS, Frequency Spectrum: Radio and Infrared, Wireless generations: 1G: Cellular,2G: Mobile Radio, 3G: UMTS- Security related Encryption Algorithm	05
2	**Planning and design of WWANs**	Basics of fundamental of WWANs, Planning and design of wireless networks, Receiver sensitivity and link budget, Pole capacity of CDMA cell, Uplink and downlink radio link budget for CDMA system	09

3	**WPANs (Low rate and high rate)**	Introduction to wireless PAN, Need of Wireless PAN, Bluetooth Technology: History & Applications, Technical Overview, Bluetooth Specifications, Piconet Synchronization, master-slave switch, Bluetooth security, Enhancements to Bluetooth: Bluetooth Interface issues, Intra & Inter Piconet Scheduling, Scatternet Formation, QoS Assignment, IEEE 802.15 Working group for WPAN, IEEE 802.15.3 & IEEE 802.15.4, Comparison between WPAN System & Comparison between WLAN & WPAN	08
4	**Basics of WAP**	Introduction to WAP, WML basics, Forms and user input, Data base driven WAP	04
5	**Fundamentals of WLANs**	Introduction to wireless LAN, Transmission Techniques, Medium Access Control Protocol Issues: Hidden Terminal Problem, Reliability, Collision Avoidance, Congestion Avoidance, Congestion Control, Energy Efficiency, IEEE 802.11 Standard for Wireless LAN: Network Architecture, Physical Layer, MAC Layer, Security, System design and considerations, Enhancements to IEEE 802.11 MAC: Power Control, Spatial Reusability & QoS Provisioning	09
6	**Introduction to 5G**	Salient features of 5G , 5G technology, 5G Architecture, Advantages and disadvantages, Applications, 5G Advancements, 5G Challenges, 5G future scope	04

DETAILED LAB SYLLABUS:

Software Requirements:

1. Ns-2: http://www.isi.edu/nsnam/ns/
2. Virtual Lab : http://vlab.amrita.edu/index.php?sub=78&brch=256
3. Scilab Experiments Book:
https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwjgwcelodTTAhVJrI8KHTQUC9AQFggqMAA&url=http%3A%2F%2Fscilab.in%2Ftextbook_companion%2Fenerate_book%2F3446&usg=AFQjCNGDs2a6AHGKL93l3_j8Ra1UN-5SQQ&sig2=yT9ep5_ZlhfRDVsv-GmsWw&cad=rja

Online Repository Sites:

1. Google Drive
2. GitHub
3. Code Guru

Sr. No.	Detailed Lab Description
1	Study of Hardware and Software aspects of Wireless Network.
2	Study, discussion and installation of different network simulation tools such as NS2/NS3,Netstumbler, Wireshark etc.
3	Analysis of Zigbee Network to compute the energy efficiency of the network.
4	Simulation of a simple wireless network (IEEE802.11) using NS2 or any other simulator.
5	Configuration of WPAN using Xbee S2 series modules and XCTU software.
6	Use of wireshark to capture WiFi or Bluetooth packets.
7	Configuration of WLAN.

8	Analysis of WiFi network to compute average end to end delay and packet delivery ratio.
9	Link budget analysis of a GSM Network using Scilab / Matlab.
10	Link budget analysis of a WCDMA Network using Scilab / Matlab.
11	Simulation of Wireless Sensor Network (IEEE802.15.4)in NS2 or any other simulator.

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 4 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 number of hours assigned to each module

Lab Assessments:

1.Term work Assessment:

- Term work should consist of 10 experiments.
- Journal must include at least 2 assignments

Total 25 Marks (Experiments: 10-marks, Attendance Theory& Practical: 05-marks, Assignments: 10-marks)

2.Oral/Viva Assessment:

Based on the above contents and entire syllabus.

Text Books:

1. Vijay K. Garg, "Wireless Communication and Networking", Morgan -Kaufmann
2. Series in Networking—Elsevier
3. Theodore S. Rappaport, "wireless communications - principles and practice", PEARSON, Second edition.
4. T L Singal ,"Wireless Communications", Mc Graw Hill Education.
5. Fundamentals of 5G Mobile Networks: Jonathan Rodriguez (Ist Edition), Wiley Publication

References:

1. WAP Development with WML and WML Script: Ben Forta and Keith
2. Dr SunilkumarS. Manvi, Mahabaleshwar S. Kakkasageri, "Wireless and Mobile
3. Networks Concepts and Protocol", Wiley India Pvt Ltd.
4. Raj Kamal, "Internet of Things Architecture & Design Principles" Mcgraw Hill
5. Kazem Sohraby, Daniel Minoli, and Taieb Znati, "Wireless Sensor Networks:
6. Technology, Protocols, and Applications", Wiley Student Edition.

Bachelor of Technology
In
Electronics & Computer Science

(Semester VI)

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 314	Image Processing & Machine Vision	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 314	Image Processing & Machine Vision	40	40	40	60	25	--	25	150

Course Objectives:

1. To cover the fundamentals and mathematical models in digital image processing and Machine Vision
2. To understand basic image segmentation techniques.
3. To develop time and frequency domain techniques for image enhancement.
4. To expose the students to classification techniques in Machine Vision
5. To develop Applications using image processing and Machine Vision

Course Outcomes: Upon successful completion of the course students will be able to

1. Understand theory and models in image processing.
2. Interpret and analyze 2D signals in Spatial and frequency domain through image transforms.
3. Apply quantitative models of image processing for segmentation and restoration for various applications
4. Find shape using various representation techniques and classify the object using different classification methods
5. Develop innovative design for practical applications in various fields.

Prerequisite:

- Signals and Systems
- Discrete Time Signal Processing

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	**Digital Image Fundamentals**	Introduction – Origin – Steps in Digital Image Processing , Components, Elements of Visual Perception – Image Sensing and Acquisition, Image	04

		Sampling and Quantization – Relationships between pixels, Transformation: Orthogonal, Euclidean, Affine Color Image Processing: Color Fundamentals Color models.	
2	**Image Transforms**	1-D DFT, 2-D Discrete Fourier Transform and Its Inverse, Some Properties of 2D DFT ,Walsh –Hadamard Transform, Discrete Cosine Transform, Haar Transform	04
3	**Image Enhancement**	Digital Negative, contrast stretching, thresholding, graylevel slicing, bit plane slicing, log transform and power law transform. Histogram equalization and Histogram Specification Spatial Domain: Averaging filters, order statistics filters, high pass filters and high boost filters Frequency Domain: The Basics of Filtering in the Frequency Domain, Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Laplacian, Unsharp Masking and Homomorphic filters	08
4	**Image Segmentation and Representation**	Detection of Discontinuities, Edge Linking using Hough Transform, Thresholding, Region based Segmentation, Split and Merge Technique, Image Representation and Description, Chain Code, Polygonal, Representation, Shape Number, Moments.	06
5	**Morphology & Image Restoration**	Morphology: Erosion and Dilation, Opening and Closing, The Hit- or-Miss Transformation. Restoration: Degradation model, noise models, estimation of degradation function by modeling, restoration using Weiner filters and Inverse filters	08
6	**Boundary Description & Object Recognition**	Texture: Statistical Texture Description Methods-Methods based on spatial frequencies, co-occurrence matrices, edge frequency, primitive length, Law‘s texture energy measures Object Recognition Knowledge representation, Classification Principles, Classifier setting, Classifier Learning, Support vector machine, cluster analysis	09

DETAILED LAB SYLLABUS:

Sr. No.	Detailed Lab/Tutorial Description
1	Point Processing Methods - Negative, Log, Power law, Contrast stretching, Bit plane slicing
2	Histogram calculation and equalization

3	Spatial Domain Filtering: 1. Smoothening filters 2. Sharpening with Laplacian 3. Unsharp masking & high boost filtering 4. Edge detection using 1st and 2nd order derivatives
4	Frequency Domain Filtering : Ideal, Butterworth and Gaussian
5	Image segmentation using global Thresholding Algorithm
6	Canny edge detection
7	Shape representation using chain code
8	Morphological operation – Erosion, dilation, opening, closing, hit-miss transform, Boundary extraction
9	Feature extraction using co-occurrence matrix
10	Classification using k-means algorithm
11	Classification using Basiyan classifier
12	Basic binary classification of any data or pattern using Support Vector Machine.
13	Case Study : 1. Face recognition 2. Finger print identification 3. License plate recognition

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 4 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 number of hours assigned to each module.

Lab Assessment:

1. Term work Assessment:

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2. Oral/Viva Assessment:

Practical and Oral exam will be based on the entire syllabus.

Text Books:

1. Gonzalesand Woods, ―Digital Image Processing‖, Pearson Education, India, Third Edition,
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, ―Image Processing, Analysis, and Machine Vision‖, Cengage Engineering, 3rd Edition, 2013

References:

1. AnilK.Jain,―FundamentalsofImageProcessing‖,PrenticeHallofIndia,FirstEdition, 1989.
2. W Pratt, ―Digital Image Processing‖, Wiley Publication, 3rdEdition, 2002
3. S. Jayaraman, E.Esakkirajan and T.Veerkumar, "Digital Image Processing" TataMcGraw Hill Education Private Ltd, 2009.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 315	Computer Organization & Architecture	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 315	Computer Organization & Architecture	40	40	40	60	--	--	--	100

Course Objectives:

1. To conceptualize the basics of organizational and architectural issues of a digital computer.
2. To analyze performance issues in processor and memory design of a digital computer.
3. To understand various data transfer techniques in digital computers.
4. To analyze processor performance improvement using instruction level parallelism

Course Outcomes: Upon successful completion of the course students will be able to

1. Explain the basic structure of a computer.
2. Do computer arithmetic operations.
3. Elaborate control unit operations.
4. Able to perform the concept of cache mapping techniques.
5. Explain the concept of I/O organization and conceptualize instruction level parallelism.
6. Able to explain the advance computer architectures

Prerequisite: Microprocessor and Microcontroller

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Introduction to Computer Organization**	1.1 Introduction to Computer Organization & Architecture, Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit. 1.2 Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. 1.3 Evolution of computers, Von Neumann model, 1.4 Performance measure of computer architecture.	06

2.	**Data presentation and Arithmetic algorithm**	2.1 Signed number representation, fixed and floating point representations, character representation. 2.2 Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder. 2.3 Multiplication - shift-and-add, Booth multiplier, carry save multiplier. 2.4 Division - non-restoring and restoring techniques. 2.5 Floating point arithmetic : Addition, Subtraction	08
3.	**Processor Organization and Architecture**	3.1 CPU Architecture, register organization, instruction formats, basic instruction cycle, instruction interpretation and sequencing 3.2 Control unit: soft wired (micro-programmed) and hardwired control unit design methods 3.3 Introduction to RISC and CISC architectures	06
4.	**Memory Organization**	4.1 Semiconductor memory technologies : SRAM,DRAM. Interleaved and associative memory, 4.2 Cache memory concept, mapping techniques, cache coherency, cache performance. 4.3 Virtual memory concept, segmentation and paging-	08
5.	**Input / Output Organization**	5.1 IO fundamentals: handshaking, buffering, programmed controlled IO, interrupt driven IO; Interrupt handling mechanism, 5.2 Buses: protocols, arbitration, direct memory access (DMA).	04
6.	**Fundamentals of Advanced Computer Architecture**	6.1 Parallel Architecture: Classification of Parallel Systems, Flynn's Taxonomy, Array Processors, Clusters, and NUMA Computers. 6.2 Multiprocessor Systems : Structure & interconnection Networks 6.3 Multi-Core Computers: Introduction,Organization and Performance.	07

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 4 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 number of hours assigned to each module.

Text Books:

1. Computer Organization and Design, 5th Ed., D. A. Patterson and J. L. Hennessy
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw-Hill.
3. John P. Hayes, "Computer Architecture and Organization", Third Edition

References:

1. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Eighth Edition, Pearson.
2. Govindarajulu, “Computer Architecture and Organization: Design Principles and Applications”, Second Edition, Tata McGraw-Hill.
3. Dr. M. Usha and T. S. Srikanth, “Computer System Architecture and Organization”, First Edition, Wiley-India.
4. Ramesh Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”, Fifth Edition, Penram.
5. Microprocessor Architecture, Jean Loup Baer

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 316	Professional Communication & Ethics II	01	--	02	01	--	01	02

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 316	Professional Communication & Ethics II	--	--	--	--	50	--	--	50

Course Objectives:

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. Train learners in effective presentation, research, organisational, creative and critical thinking skills necessary for global and industrial set up.
4. To promote the importance of having an impressive personality that will enhance self-esteem, build self-confidence and sensitize the learners in appropriate behaviour.
5. To prepare the learners for campus placement, employability and competitive examination required for lifelong learning.
6. Fostering skills in technology-mediated social and professional communications and collaborative learning.

Course Outcomes: Upon successful completion of the course students 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. Illustrate effective presentation, research, organisational, creative and critical skills necessary for lifelong learning.
6. Acquire the skills necessary to communicate using blogs, LinkedIn, You Tube, Facebook and Twitter.

Prerequisite: Possess the necessary language skills.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	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 analyse 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 labelling 1.5 How and why to write discussion 1.6 Citing and referencing- IEEE format 1.7 Writing an abstract	06
2.	**Practicing Critical Thinking**	2.1 Framing the situation 2.2 Gathering information from different sources and comparing them 2.3 Create/write an autonomous research paper	04
3.	**Oral Skills for Employability**	3.1 Group Discussion- with special reference to leadership qualities, assertiveness, analysing 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.	06
4.	**Personality Development And Social Etiquettes**	4.1. Personality Development ● Improving self-awareness- analysing our own experiences, looking at ourselves through the eyes of others ● Knowing and Building our own identity ● Discovering and Developing our talents ● Teamwork/collaboration 4.2. Social Etiquettes ● Formal Dining Etiquettes ● Cubicle Etiquettes ● Learning Accountability and Accepting Criticism ● Demonstrating Flexibility and Cooperation ● Selecting Effective Communication Channels	03
5.	**Content writing**	5.1Writing Resume and statement of purpose 5.2 Research Skills 5.3 Organisational skills 5.4 Creative Writing- Blog posts, Web pages etc.	04
6.	**Communication through Social Media**	6.1 Introduction to Social Media and its relevance in communication 6.2 Benefits of social media in communication	03

		6.3 Impact of social media in human communication (positive and negative) 6.4 Responsibility in Using Social Media Showing Empathy and Respect	

DETAILED LAB SYLLABUS:

Sr. No.	Details of Assignments	Details of Activities	Hrs
I	Written assignment on Literature Review 20 page report on technical topic-(to be included as part of term work)	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.	4
II	Written assignment on summarizing a technical proposal 4 page technical proposal (to be included as part of term work)	Example of summarizing techniques to be demonstrated.	4
III	Oral Skills for Employability to be included in term work.	Role play and mock interviews Mock group discussion Mock presentation	2 2 2
IV	Written Assignment on Documentation of Business Meeting	Mock meetings	2
V	Written Assignment on Resume writing/Statement of Purpose.	NA	2
VI	Written Assignment on Blog Posts	NA	2

Term work Assessment:

Term work will consist of-

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 mark
8. The final certification and acceptance of term work ensures that satisfactory performance in class activities and assignments is met by the student.

Text Books:

1. Virendra Singh Nirban, Krishna Mohan, RC Sharma, Business Correspondence and Report
   Writing.
2. Raman Meenakshi & Sharma Sangeeta, Technical Communication Principles and Practice,
   Second edition, Oxford University Press.
3. Ann Handley Everybody Writes: Your Go-To Guide to Creating Ridiculously Good Content, Wiley.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 317	Machine Learning	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 317	Machine Learning	40	40	40	60	25	--	25	150

Course Objectives:

1. To introduce the basic concepts and techniques of Machine Learning.
2. To acquire in depth understanding of various supervised and unsupervised algorithms
3. To be able to apply various ensemble techniques for combining ML models.
4. To demonstrate dimensionality reduction techniques.

Course Outcomes: Upon successful completion of the course students will be able to:

1. Acquire fundamental knowledge of developing machine learning models.
2. Comprehend regression, classification that are used in machine learning.
3. To demonstrate ensemble techniques to combine predictions from different models.
4. Identify and apply classification models to real world problems.
5. Apply different clustering methods that are used in machine learning.
6. To demonstrate the dimensionality reduction techniques.

Prerequisite: Data Structures, Algorithms, Linear algebra, multivariate calculus, and probability theory

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Introduction to Machine Learning**	1.1: Machine Learning, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing a Machine Learning Application. 1.2: Training Error, Generalization error, Overfitting, Underfitting, BiasVariance trade-off.	04
2.	**Learning with Regression and Trees**	2.1: Learning with Regression: Linear Regression, Multivariate Linear Regression, Logistic Regression. 2.2: Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index (Regression), Classification and Regression Trees (CART) 2.3: Performance Metrics: Confusion Matrix, [Kappa Statistics], Sensitivity, Specificity, Precision, Recall, F-measure, ROC curve	09
3.	**Ensemble Learning**	3.1: Understanding Ensembles, K-fold cross validation, Boosting, Stumping, XGBoost 3.2: Bagging, Subagging, Random Forest, Comparison with Boosting, Different ways to combine classifiers	06
4.	**Learning with Classification**	4.1: Support Vector Machine Constrained Optimization, Optimal decision boundary, Margins and support vectors, SVM as constrained optimization problem, Quadratic Programming, SVM for linear and nonlinear classification, Basics of Kernel trick. 4.2: Support Vector Regression, Multiclass Classification	08
5.	**Learning with Clustering**	5.1: Introduction to clustering with overview of distance metrics and major clustering approaches. 5.2: Graph Based Clustering: Clustering with minimal spanning tree Model based Clustering: Expectation Maximization Algorithm, Density Based Clustering: DBSCAN	07
6.	**Dimensionality Reduction**	6.1: Dimensionality Reduction Techniques, Principal Component Analysis, Linear Discriminant Analysis, Singular Value Decomposition.	05

DETAILED LAB SYLLABUS:

Lab Prerequisite: Data Structures, Analysis of Algorithms
Suggested List of Experiments:

Sr. No	Title of Experiment
1	To implement Linear Regression.
2	To implement Logistic Regression
3	To implement Ensemble learning (bagging/boosting)
4	To implement multivariate Linear Regression.
5	To implement Naive Bayes Classifier with sample dataset and evaluate it using various performance measure
6	To implement CART.
7	To implement K-Means clustering using sample dataset
8	To implement agglomerative clustering using sample dataset
9	To implement SVM.
10	To implement PCA/SVD/LDA.
11	To implement Graph Based Clustering.
12	To implement DB Scan.
13	To implement LDA.

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 4 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 number of hours assigned to each module.

Lab Assessment:

1. **Termwork Assessment:** Term Work shall consist of at least 8 to 10 experiments 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). The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

Text Books:

1. Peter Harrington, ―Machine Learning n Action‖, DreamTech Press
2. Ethem Alpaydın, ―Introduction to Machine Learning‖, MIT Press
3. Tom M. Mitchell, ―Machine Learning‖ McGraw Hill
4. Stephen Marsland, ―Machine Learning An Algorithmic Perspective‖, CRC Press

References:

1. Han Kamber, ―Data Mining Concepts and Techniques‖, Morgan Kaufmann Publishers
2. Margaret. H. Dunham, ―Data Mining Introductory and Advanced Topics, Pearson Education
3. Kevin P. Murphy , Machine Learning ― A Probabilistic Perspective‖
4. Samir Roy and Chakraborty, ―Introduction to soft computing‖, Pearson Edition.
5. Richard Duda, Peter Hart, David G. Stork, ―Pattern Classification‖, Second Edition, Wiley Publications.

Useful Digital Links :

1. Data sets for Machine Learning algorithms: https://www.kaggle.com/datasets
2. Machine Learning repository- https://archive.ics.uci.edu/ml/index.php
3. Machine Learning from Coursera
4. https://towardsdatascience.com/machine-learning/home
5. Introduction to Machine Learning - IITKGP - Course (nptel.ac.in)

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 318	Big Data Analytics	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
EC 318	Big Data Analytics	40	40	40	60	25	--	25	150

Course Objectives:

1. To provide an overview of an exciting growing field of Big Data analytics.
2. To discuss the challenges traditional data mining algorithms face when analyzing Big Data.
3. To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
4. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5. To introduce to the students several types of big data like social media, web graphs and data streams.
6. To enable students to have skills that will help them to solve complex real-world problems in decision support.

Course Outcomes: Upon successful completion of the course students will be able to

1. Explain the motivation for big data systems and identify the main sources of Big Data in the real world.
2. Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store, retrieve and process Big Data for Analytics.
3. Implement several Data Intensive tasks using the Map Reduce Paradigm
4. Apply several newer algorithms for Clustering Classifying and finding associations in Big Data
5. Design algorithms to analyze Big data like streams, Web Graphs and Social Media data.
6. Design and implement successful Recommendation engines for enterprises.

Prerequisite: Database Management System.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Introduction to Big Data**	Data 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	03
2.	**Introduction to Big Data Frameworks: Hadoop, NOSQL**	What is Hadoop? Core Hadoop Components; Hadoop Ecosystem; Overview of : Apache Spark, Pig, Hive, Hbase, Sqoop What is NoSQL? NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, MongoDB	07
3.	**MapReduce Paradigm**	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, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step . Illustrating use of MapReduce with use of real life databases and applications.	06
4.	**Mining Big Data Streams**	The Stream Data Model: A DataStream-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-IndykMotwani Algorithm, Query	06
5.	**Big Data Mining Algorithms**	Frequent Pattern Mining : Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce Classification Algorithms: Parallel Decision trees, Overview SVM classifiers, Parallel SVM, KNearest Neighbor classifications for Big Data, One Nearest Neighbour.	08
6.	**Big Data Analytics Applications**	Link Analysis : PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank: PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm. Mining Social- Network Graphs : Social Networks as Graphs, Types , Clustering of	09

		Social Network Graphs, Direct Discovery of Communities, Counting triangles using Map-Reduce. Recommendation Engines: A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering.	

DETAILED LAB SYLLABUS:

Software Requirements: Virtual Machine, Hadoop Frame work, NOSQL and MongoDb Compilers

Hardware Requirements: PC i3 or above, 8 GB RAM

Sr. No.	Detailed Lab Description
1	Assignment on Study of Hadoop ecosystem
2	Programming exercises on Hadoop Using Hive, Pig, Hbase Sqoop NOSQL, MongoDB
3	Implementing simple algorithms in MapReduce Matrix multiplication, Aggregates, joins, sorting, searching etc.
4	● Implementing Algorithms using MapReduce (Any 2) ● Implementing Frequent Item set Mining Implementing Clustering algorithms Implementing Classification Algorithms
5	Big Data Applications (Any 2) ● Implementing Analytics on data streams ● Implementing Social Network Analysis Algorithms Implementing Web Graph Algorithms Implementing recommendation Engines
6	Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web) a) Twitter data analysis b) Fraud Detection c) Text Mining d) Recommendation Engines (list of datsets also given in the text book)

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 4 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 number of hours assigned to each module.

Lab Assessments:

1. **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. Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks

(Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance) Oral Examination will be based on the above syllabus.

2. **Oral/Viva Assessment**: An oral exam will be held based on the above syllabus.

Text Books:

1. Radha Shankarmani, M Vijayalakshmi, ”Big Data Analytics”, Wiley Publications
2. Anand Rajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press.
3. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press.
4. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press.
5. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf, O'Reilly Publications.

References:

1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens , WILEY Big Data Series.
2. Big Data Analytics with R and Hadoop by Vignesh Prajapati Paperback, Packt Publishing Limited
3. Hadoop: The Definitive Guide by Tom White, O'Reilly Publications
4. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services
5. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence by Pramod J. Sadalage, Addison Wesley

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 319	Parallel Computing Architecture	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 319	Parallel Computing Architecture	40	40	40	60	25	--	25	150

Course Objectives:

1. To understand the principles of parallel computer architecture.
2. To understand the design of parallel computer systems including modern parallel architectures.
3. To assess the communication and computing possibilities of parallel system architecture and to predict the performance of parallel applications.

Course Outcomes: Upon successful completion of the course students will be able to

1. Students get accustomed with the representation of data, addressing modes, and instruction sets.
2. Students are able to understand parallelism both in terms of a single processor and multiple processors.
3. Technical knowhow of parallel hardware constructs to include instruction-level parallelism for multi core processor design.

Prerequisite: Computer Organization & Architecture

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Fundamentals of Computer Design**	Defining Computer Architecture – Trends in Technology – Trends in Power in Integrated Circuits – Trends in Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design – Basic and Intermediate concepts of pipelining – Pipeline Hazards.	04
2.	**Introduction to Parallel Processing**	Parallel computing structure, scope of parallel computing, architectures classification schemes, applications of parallel processing.	06

3.	**Memory and Input output subsystems**	Memory structure Hierarchy, Addressing scheme for main memory, Virtual Memory systems, Memory allocation and management strategies, Virtual Memory, Cache Memory, Management and Design criteria, I/O subsystems, Interrupt mechanisms, Vector processing requirements.	08
4.	**Pipelining**	Principles of pipelining, vector processing: Pipelining, Instruction and Arithmetic pipelines, principles of designing pipelined processors, vector processing requirements Pipeline computers and Vectorization methods: Vectorization and Optimization methods.	07
5.	**SIMD and MIMD**	SIMD computers and Performance enhancement: Study of SIMD array processor and associative processor, Scientific attached processor. MIMD: Architecture and memory organization of MIMD and Interconnection N/W. Data Driven computing, Data Flow Computer Architecture.	08
6.	**Parallel Software Environment**	Parallel Algorithm, features of Parallel Languages, Parallel compiler and OS.	06

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 4 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 number of hours assigned to each module.

Lab Assessments:

1. The distribution of marks for term work shall be as follows:
   - Lab Performance (Experiments /case studies): 15
   - Assignment 05
   - Attendance (Theory & Practical) 05

2. Oral/Viva Assessment: Based on the above contents and entire syllabus.

Text Books:

1. David.A.Patterson, John L.Hennessy, "Computer Architecture: A Quantitative approach", Elsevier, 5th Edition 2012.
2. K.Hwang, Naresh Jotwani, “Advanced Computer Architecture, Parallelism, Scalability, Programmability”, Tata McGraw Hill, 2nd Edition 2010
3. D.Culler and J. Singh, Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann, 1999.

4. J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach. Morgan-Kaufmann publishers.
5. A.Grama, A. Gupta, G. Karypis, and V. Kumar, Introduction to Parallel Computing, 2nd Edition, Pearson: Addison-Wesley, 2003. Errata is available by John Kirk.
6. P.Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann, 2011.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 320	Integrated Circuit Technology	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 320	Integrated Circuit Technology	40	40	40	60	25	--	25	150

Course Objectives:

1. To provide knowledge of Wafer preparation and fabrication for VLSI Technology
2. To provide knowledge of IC fabrication processes and advanced IC technologies.
3. To provide knowledge of IC fabrication processes and design rules.
4. To disseminate knowledge about novel semiconductor measurement.
5. To provide knowledge about different VLSI Technology.
6. To disseminate knowledge about novel VLSI devices and materials.

Course Outcomes: Upon successful completion of the course students will be able to

1. Analyze and demonstrate a clear understanding of various MOS fabrication processes & CMOS fabrication flow.
2. Analyze and design layout of MOS based Circuits.
3. Demonstrate a clear understanding of Semiconductor Measurements & Testing.
4. Analyze SOI and GaAs technology.
5. Develop different fabrication process.
6. Understand advanced technologies, Novel Devices and materials in Modern VLSI Technology.

Prerequisite: Electronic Devices and Circuits I, Digital Circuit Design, VLSI Design

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Crystal Growth, Wafer preparation and fabrication for VLSI Technology**	Semiconductor Manufacturing: Semiconductor technology trend, Clean rooms, Wafer cleaning and Gettering. Semiconductor Substrate: Crystal structure, Crystal defects, Czochralski growth, Float Zone growth, Bridgman growth of GaAs, Wafer Preparation and specifications	08
2.	**Fabrication Processes Part 1**	Epitaxy: Classification, Molecular Beam Epitaxy Silicon Oxidation: Thermal oxidation process, Kinetics of growth, Properties of Silicon Dioxide, Oxide Quality.	07

		Device Isolation: LOCOS, Shallow Trench Isolation (STI). Deposition: Physical Vapor Deposition-Evaporation and Sputtering, Chemical Vapor Deposition: APCVD, LPCVD,PECVD Diffusion: Nature of diffusion, Diffusion in a concentration gradient, diffusion Equation, diffusion systems, problems in diffusion. Ion Implantation: Penetration range-Nuclear& Electronic stopping and Range, implantation damage, Annealing-Rapid thermal annealing, ion implantation systems.	
3.	**Fabrication Process Part 2**	Etching & Lithography: Etching: Basic concepts and Classification Lithography: Introduction to Lithography process, Types of Photoresist, Types of Lithography: Electron beam, Ion beam and X-ray lithography. Metallization and Contacts: Introduction to Metallization, Schottky contacts and Ohmic contacts. CMOS Process Flow: N well, P-well and Twin tub, CMOS Latch Up Design rules, Layout of MOS based circuits (gates and combinational logic), Buried and Butting Contact.	07
4.	**Measurement and Testing**	Semiconductor Measurements: Conductivity type, Resistivity, Hall Effect Measurements, Drift Mobility. Testing: Technology trends affecting testing, VLSI testing process and test equipment, test economics and product quality.	06
5.	**VLSI Technologies**	SOI Technology: SOI fabrication using SIMOX, Bonded SOI and Smart Cut ,PD ,SOI and FD SOI Device structure and their features. Advanced Technologies: low κ and high κ, BiCMOS, HκMG Stack, Strained Silicon. GaAs Technologies: MESFET Technology, MMIC technologies, MODFET	06
6.	**Novel Devices and Materials**	Multigate Devices:Various multigate device configurations-double gate, triple gate (FinFET) and Gate All Around (Nanowire). Nanowire: Concept, VLS method of fabrication, Nanowire FET, Types: Horizontal and Vertical Nanowires, III-V compound Materials in Nanowires. 2-D Materials and FET:Graphene& CNT FET, MOS2 and Black Phosphorous.	05

DETAILED LAB SYLLABUS:

Software Requirements: NANOHUB, MICROWIND

Sr. No.	Detailed Lab Description
1	To study the CZ process for Silicon Crystallization.
2	Implement NMOS inverter with resistive load using NANOHUB and study its characteristics.
3	Various effects of Temperature on Thermal Oxidation using NANOHUB.
4	Design of CMOS Inverter using Microwind.
5	Design of CMOS NAND using Microwind.
6	Design of CMOS NOR using Microwind.
7	Design of CMOS EXOR using Microwind.
8	To implement the given function Y=A+BC using Microwind.
9	Design of 6T SRAM using Microwind.
10	Case Study IEEE paper.

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 4 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 number of hours assigned to each module.

Lab Assessments:

1.Term work Assessment:

- Term work should consist of 10 experiments.
- Journal must include at least 2 assignments
- Mini Project to be performed

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

2.Oral/Viva Assessment:

Based on the above contents and entire syllabus.

Text Books:

1. James D. Plummer, Michael D. Deal and Peter B. Griffin, “Silicon VLSI Technology”, Pearson, Indian Edition.
2. Stephen A. Campbell, “The Science and Engineering of Microelectronic Fabrication”, Oxford University Press, 2nd Edition.
3. Sorab K. Gandhi, “VLSI Fabrication Principles”, Wiley, Student Edition.
4. G. S. May and S. M. Sze, “Fundamentals of Semiconductor Fabrication”, Wiley, First Edition.
5. Kerry Bernstein and N. J. Rohrer, “SOI Circuit Design Concepts”, Kluwer Academic Publishers, 1st edition.

References:

1. Jean-Pierre Colinge, “FinFETs and Other Multigate Transistors”, Springer, 1st edition
2. M. S. Tyagi, “Introduction to Semiconductor Materials and Devices”, John Wiley and Sons,1st edition.
3. James E. Morris and KrzysztolIniewski, “Nanoelectronic Device ApplicationsHandbook”, CRC Press.
4. Glenn R. Blackwell, “The electronic packaging”, CRC Press.
5. Michael L. Bushnell and Vishwani D. Agrawal, “Essentials of Electronic Testing for digital, memory and mixed-signal VLSI circuits”, Springer.
6. G.S.May and S. M. Sze, “Fundamentals of Semiconductor Fabrication”, Wiley, First Edition.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 321	Speech Processing	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 321	Speech Processing	40	40	40	60	25	--	25	150

Course Objectives:

1. To understand basic concepts and methodologies for the analysis and modeling of speech signal.
2. To characterize the speech signal as generated by a speech production model.
3. To understand the mechanism of speech and audio perception.
4. To understand the digital representation of the speech waveform.
5. To perform the analysis of speech signal using STFT.
6. To extract the information of the speech or audio signals.
7. To provide a foundation for developing application in this field.

Course Outcomes:

1. Demonstrate advanced Knowledge in Digital model representation of speech signal.
2. Design and implement algorithms for processing speech and audio signals considering the properties of acoustic signals and human hearing.
3. Analyze speech signal to extract the characteristic of vocal tract (formants) and vocal cords (pitch).
4. Formulate and design a system for speech recognition and speaker recognition.
5. Acquired knowledge about audio and speech signal estimation and detection.

Prerequisite: Signal System

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Introduction**	Review of digital signal and systems, Transforms representations of signal and systems, Sampling Theorem, Goertzel algorithm, Chirp algorithm.	04
2.	**Digital Models for Speech signals**	Speech production and acoustic tube modeling, acoustic phonetics, anatomy, and physiology of the vocal tract and ear, hearing and perception.	05
3.	**Digital Representations of the Speech Waveform**	Sampling speech signals, Instantaneous quantization, Adaptive quantization, Differential quantization, Delta Modulation, Differential PCM, Comparison of systems, Direct digital code conversion.	06
4.	**Time Domain Models for Speech Processing**	Time dependent processing of speech, Short time energy and average magnitude, Short time average zero crossing rate, Speech V/S silence discrimination using energy & Zero crossings, Pitch period estimation, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function, Median smoothing.	10
5.	**Short time Fourier Transform**	Introduction- Definition and Properties, Fourier Transform Interpretation ,Linear Filtering Interpretation ,Sampling rates of Xn (ejw)in Time and Frequency ,Filter Bank Summation Method of Short -Time Synthesis ,Overlap Addition Method for Short -Time Synthesis.	08
6.	**Speech and Audio Processing**	Vocoder- Voice excited channel vocoder, Voice excited and error signal excited LPC vocoders. Adaptive predictive coding of speech, Auditory Modeling. Audio signal processing for Music applications. Speech recognition pattern comparison techniques, Artificial Neural Network.	06

DETAILED LAB SYLLABUS:

Sr. No.	Detailed Lab/Tutorial Description
1	Manual Speech Signal-to-Symbol Transformation
2	Sampling Frequency and Bit Resolution for Speech Signal Processing
3	To study the time-varying nature of the speech signal in the time domain as well as frequency domain.
4	To study the effects of sampling (aliasing) and quantization on speech signals by playing them at different sampling rates and bits per sample
5	Short Term Time Domain Processing of Speech
6	To estimate pitch of speech using short term autocorrelation.

7	To compute the excitation parameters like pitch by LP analysis.
8	To compute LP coefficients and LP residual of a given speech signal.
9	To study the characteristics of speech using linear prediction (LP) analysis.
10	To study the effect of order of LP analysis (normalized error), autocorrelation of signal and LP residual for voiced and unvoiced segments.
11	To study the glottal pulse characteristics.
12	Case study- 1.To study different sound units present in majority of Indian languages. 2.To understand significance of telephone bandwidth 3.Estimation of Pitch From Speech Signals

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 number of hours assigned to each module.

Lab Assessment:

1. **Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

2. **Oral/Viva Assessment:**

Practical and Oral exam will be based on the entire syllabus.

Text Books:

1. L.R. Rabiner and S.W. Schafer-Digital processing of speech signals ǁ,Pearson Education, 2009.
2. L R Rabiner, B H Juang, B Yegnanarayana, ―Fundamentals of speech Recognitionǁ, Pearson Education,1993.

References:

1. Thomas F Quateri, ―Discrete Time Speech Signal Processing―Pearson Edition,2006.
2. Ben Gold and Nelson Morgan, ―Speech &Audio Signal Processing‖, wiley, 2007.
3. Douglas O Shaughnessy, ―Speech Communications‖, 2ndEdition, Oxford university
Press,2000.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 322	Cryptography and System Security	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 322	Cryptography and System Security	40	40	40	60	25	--	25	150

Course Objectives:

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.

Course Outcomes: Upon successful completion of the course students 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.

Prerequisite: Computer Networks, ISO OSI Layered Protocols, TCP/IP protocol suite.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Introduction and Number Theory**	Security Goals, Services, Security Mechanisms and attacks, The OSI security architecture, Network Security Model, Classical Encryption Techniques, Symmetric cipher model, mono-alphabetic and poly-alphabetic substitution techniques: Vigenere cipher, playfair cipher, Hill cipher, transposition techniques: keyed and keyless transposition ciphers, steganography. Modular Arithmetic and Number Theory:- Euclid‘s algorithm, Prime numbers, Fermat‘s & Euler‘s theorem - Testing for primality, The Chinese remainder theorem and its application, Discrete logarithms.	09
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 and trusted third party. Diffie Hellman Key exchange algorithm.	08
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, Digital Certificate types and applications, PKI	04
4.	**Authentication Protocols & Digital signature schemes**	Authentication Requirement and Functions, Types of Authentication, User Authentication and Entity Authentication, One-way and mutual authentication schemes, Needham Schroeder Authentication protocol, Kerberos Authentication protocol. Importance of Digital Signature, Digital Signature Schemes – RSA, ElGamal signature schemes	05
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	09
6.	**System Security**	Software Vulnerabilities: Buffer Overflow, Format string, cross-site scripting, SQL injection	04

		Malwares: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits, Spywares, Backdoors, Ransomware, Keyloggers	

DETAILED LAB SYLLABUS:

Hardware Requirements: PC With following Configuration

1. Intel Core i3/i5/i7 Processor
2. 4 GB RAM
3. 500 GB Hard Disk

Software Requirements:

1. Windows / Linux Desktop OS / Kali Linux
2. wireshark
3. ARPWATCH
4. Cppcheck
5. Hping, hping3

Sr. No.	Detailed Lab/Tutorial Description
1	Design and Implementation of a product cipher using Substitution and Transposition ciphers
2	Implementation and analysis of RSA cryptosystem and Digital signature scheme using RSA. Implementation of Diffie Hellman Key exchange algorithm. For varying message sizes, test integrity of message using MD-5, SHA-1, and analyse the performance of the two protocols.
3	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
4	Study of packet sniffer tools :wireshark, : 1. Download and install wireshark and capture icmp, tcp, and http packets in promiscuous mode. 2. Explore how the 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, xmas scan etc. 4. Detect ARP spoofing using nmap and/or open source tool ARPWATCH and wireshark.
5	Setting up personal Firewall using iptables. Explore the GPG tool of linux to implement email security. Set up Snort and study the logs.
6	Simulate buffer overflow attack using Ollydbg, Splint, Cppcheck etc. Simulate DOS attack using Hping, hping3.

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 number of hours assigned to each module.

Lab Assessment:

1. **Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

2. **Oral/Viva Assessment:**

Practical and Oral exam will be based on the entire syllabus.

Text 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.

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 323	Cloud and Distributed Computing	03	02	--	03	01	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
EC 323	Cloud and Distributed Computing	40	40	40	60	25	--	25	150

Course Objectives:

1. To introduce basic concepts,goals,issues of distributed systems.
2. To understand the concept of Inter process communications ,Message oriented
3. communication,stream oriented communications.
4. To provide master skills to measure the performance of distributed synchronization algorithms.
5. Basics of cloud computing.
6. Key concepts of virtualization.
7. Key components of Amazon Web Services.

Course Outcomes:

1. Understand the basic elements and concepts related to distributed systems and illustrate the middleware technologies that supports distributed applications such as RPC,RMI and object based middleware.
2. Analyze various techniques used for clock synchronization, election of coordinators and distributed mutual exclusion.
3. Demonstrate the concepts of resource and process management.
4. Define Cloud Computing and mem orize the different Cloud service and deployment models
5. Describe the importance of virtualization along with their technologies..
6. Describe the key components of Amazon web Service

Prerequisite: Operating system

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Introduction to Distributed Systems and Communication**	Characterization of Distributed Systems: Issues, Goals, and Types of distributed systems, Distributed System Models Introduction to message passing, Remote communication: Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI)	08
2.	**Synchronization**	Clock Synchronization, Physical clock synchronization algorithm,Logical (lamport) Clock, Election Algorithms,	07
3.	**Process Management**	Introduction to Process management,process migration,threads,code migration.	06
4.	**Introduction of Cloud Computing**	Introduction to cloud computing: Definition, Goles, Characteristics, Applications. Cloud types: Cloud Deployment Models and Service Models (NIST, Cloud cube model), Cloud computing architecture, Advantages and Disadvantages of cloudComputing.	05
5.	**Virtualization**	Virtualization: Characteristics of virtualized environment, Understanding the importance of Hypervisors, Virtualization of CPU, Memory and I/O Devices, Technology Examples: KVM, Xen,	06
6.	**Exploring the Components of Amazon Web Services**	Introduction to AWS cloud computing Platform, Various services available on AWS Cloud Platform like EC2, EBS, VPC, ELB, S3.	07

DETAILED LAB SYLLABUS:

Sr. No.	Detailed Lab/Tutorial Description
1	To implement Remote Procedure Call/Remote Method Invocation.
2	To implement deadlock management in distributed systems. To implement Logical Clock Synchronization algorithm(Lamport clock) To implement an election algorithm. To implement a mutual exclusion algorithm.
3	1.Creating and running virtual machines on Hosted Hypervisors like KVM Type 1,Vmware Workstation,Oracle Virtualbox 2. Creating and running virtual machines on Bare-Metal Hypervisors Type 0 like Xen,Vmware ESXI or HyperV

4	1. Demonstrate the EC2 using AWS 2. Demonstrate the S3 using AWS.
5	1. Management of VPC and Load Balancer 2. Auto Scaling
6	1. To study and implement Identity and Access Management (IAM) practices on AWS/Azure cloud. 2. To study and Implement Security as a Service on AWS/Azure

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.

Lab Assessment:

1. Term work Assessment:

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2. Oral/Viva Assessment:

Practical and Oral exam will be based on the entire syllabus.

Text 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.
3. Barrie Sosinsky ,"Cloud Computing Bible",Wiley Publication.
4. Kailash Jayaswal, Jagannath Kallalurchi, Donald J. Houde, Dr. Deven Shah, "Cloud Computing Black Book", Dreamtech Press.

References:

- A. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
- M. L. Liu, ―Distributed Computing Principles and Applications‖, Pearson Addison
  Wesley, 2004.
- Pradeep K Sinha, "Distributed Operating Systems: Concepts and design", IEEE computer society press.
- Ajay D. Kshemkalyani,Mukesh Singhal "Distributed Computing Principles, Algorithms, and Systems".
- Thomas Erl,Robert Cope,Amin naserpour, "Cloud Computing Design Patterns",Pearson Publication.
- Judith Hurwitz ,"Cloud Computing for Dummies" , Wiley Publication.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 324	Embedded System Design and basics of IOT	03	02	---	03	01	---	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
EC 324	Embedded System Design and basics of IOT	40	40	40	60	25	--	25	150

Course Objectives:

1. To develop background knowledge Embedded Systems.
2. To understand communication techniques.·
3. To write programs for embedded systems and real time operating systems
4. To understand fundamentals of IoT / M2M
5. To learn real world application scenarios of IoT along with its social and economic impact using case studies

Course Outcomes:

1. Identify and describe various characteristic features and applications of embedded systems. Analyse and identify hardware for embedded systems implementation
2. Understand the detailed processor design techniques and methods of communication protocols.
3. Detail understanding of low power embedded processor
4. Study the in-depth program modelling concepts as well as study the concepts of Real time operating systems and write programs.
5. Understand IoT and its related issues
6. Design embedded system applications using RTOS . Study basic applications of IoT development.

.**Prerequisite:** Basics of microprocessor and micro controller.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Introduction**	Definition of Embedded System, Embedded Systems Vs GeneralComputing Systems, Classification, Major Application Areas Characteristics and quality attributes (Design Metric) of embedded systems. Real time system‘s requirements, real time issues, interruptlatency. Embedded Product development life cycle and hardware software Codesign process	04
2.	**Embedded Hardware**	Embedded cores, Types of memories, Sensors (Optical encoders,Resistive) and Actuators (Solenoid valves, Relay/switch, Opto-couplers),Power supply considerations in Embedded systems: Low power featuresIdle& Power down mode, Sleep mode, Brown-out detection. Communication Interfaces: Comparative study of serial communicationinterfaces (RS-232, RS-485), I2C, CAN, USB (v2.0), Bluetooth, Zig-Bee.Selection criteria of above interfaces.	08
3.	**ARM CORTEX-M3 Architecture**	Comparison of CISC & RISC architectures, overview of ARM family. ARM Cortex-M3 architecture, Programmer’s model: Operation Modes and States, registers, special registers, Application Program Status RegisterInteger status flags, Q status flag, GE bits. Memory system: Features and memory map Exceptions and Interrupts-Nested vectored interrupt controller.	08
4.	**Embedded C-programming concepts**	Program Modelling concepts: DFG,FSM,UML Embedded C-programming concepts (from Embedded system point of view): Data types, Modifiers, Qualifiers, Functions, Macros, Interrupt service routine, Device drivers. Real-time Operating system: Need of RTOS in Embedded system softwareand comparison with GPOS, Foreground/Background processes, Interrupt latency, Task, Task states, Multi-tasking, Context switching, Task scheduling, Schedulingalgorithms-Rate Monotonic Scheduling, EarliestDeadline First (with numericals), Inter-process communication: Semaphore,Mailbox, Message queues, Event timers, Task synchronisation- Shareddata, Priority inversion, Deadlock. Memory Management.Introduction to µCOS II RTOS	08
5.	**IoT Introducton and Architecture**	History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis The Architecture The Layering concepts , IoT Communication Pattern, IoT protocol Architecture, Application Protocols MQTT, REST/HTTP, CoAP and 6LoWPAN in IoT.	06
6.	**Case Study & advanced IoT Applications**	Hard Real-time: Car Cruise-Control using µCOS II RTOS-Requirements study, specification study using UML, Hardware architecture, Software Architecture, Automatic Chocolate Vending Machine IoT	05

DETAILED LAB SYLLABUS:

Software Requirements:

Keil 5, Raspbian

Hardware Requirements:

ARM 7 kit, RPi, peripherals

Sr. No.	List of Experiments
1	Two or three programs for GPIO programming with ARM 7
2	Two Interfacing of communication protocols(I2C,CAN,SPI,zigbee etc) with ARM 7
3	Simulation of multitasking with ARM 7 using RTOS
4	Inter process communication using semaphore with ARM 7 in RTOS
5	Minimum two Experiments using any hardware platform (Arduino/Raspberry i/BeagleBone/Galileo) for data handling and storage.
6	Minimum three experiments using any hardware platform (Arduino/Raspberry Pi/BeagleBone/Galileo) for interfacing various sensors and communicating data using Internet using various Protocols.

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 number of hours assigned to each module.

Lab Assessment:

1. **Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2. **Oral/Viva Assessment:**

Practical and Oral exam will be based on the entire syllabus.

Text Books:

1. Raj Kamal,‖ Embedded Systems Architecture, Programming and design‖, Tata MCgrawHill Publication.
2. Shibu K.V,‖ Introduction to Embedded Systems‖, Mc Graw Hill, 2nd edition.
3. Raj Kamal, "Internet of Things Architecture & Design Principles" Mcgraw Hill
4. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.

References:

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers.
2. David Simon, ―Embedded systems software primer', Pearson
3. K.V.K.K. Prasad, ―Embedded Real Time Systems: Concepts, Design & Programming‖,Dreamtech Publication.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 360	Entrepreneurship	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
IL 360	Entrepreneurship	40	40	40	60	-	-	-	100

Course Objectives:

1. To understand the basic concepts of entrepreneurship.
2. To understand the role of entrepreneurship in economic development
3. To understand the importance of opportunity recognition and internal and external analyses to the success of a business venture
4. To enable the learners to know the factors contributed in failure of the enterprise

Course Outcomes:

1. Analyse the business environment in order to identify business opportunities
2. Identify the elements of success of entrepreneurial ventures
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Interpret their own business plan

Detailed Theory Syllabus:

Module No	Detailed Content	Hours
1	Conceptual definition of entrepreneurs and entrepreneurship, Advantages and Disadvantages of Being an Entrepreneur, Entrepreneurial motivation, Entrepreneurial characteristics	8
2	Recognizing, assessment and Exploiting the Opportunity, Conducting Internal and External Analyses, Determining the Feasibility of the Concept, Selecting a Marketing Strategy	6
3	Entrepreneurial Business Types A. Overview of Franchising and Their Advantages and Disadvantages B. Overview of Buyouts & Their Advantages and Disadvantages C. Overview of Family Businesses and Their Advantages and Disadvantages	6
4	The Overall Business Plan, Purpose of the Business Plan, Components of the Business Plan, Presentation of the Business Plan, Matching the Business Plan to the Needs of the Firm	6

5	The Marketing Plan, conducting a Market Analysis, Understanding the Target Market, Reaching the Target Market through Locale and Engagement	8
6	Entrepreneurial failure, early stage failure, late stage failure	6

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

Books and References:

1. Fundamentals of Entrepreneurship by H. Nandan, PHI
2. Entrepreneurship by Robert Hisrich, Michael Peters, Dean Shepherd, Sabyasachi Sinha, Mc Graw Hill
3. Why startups fail: A new roadmap for entrepreneurial success by Tom Eisenmann

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 361	IPR and Patenting	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
IL 361	IPR and Patenting	40	40	40	60	-	-	-	100

Course Objectives:

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

Course Outcomes:

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.

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 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	6
4	Trademark	Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non-Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademark's registry and appellate board	6
5	Patent Acts	Section 21 of the Indian Patent Act, 1970 (and corresponding Rules and Forms) with specific focus on Definitions, Criteria of Patentability, Non-Patentable Subject Matters, Types of Applications, and Powers of Controllers. Section 25 - Section 66 of the Indian Patent Act, 1970 with specific focus on the Oppositions, Anticipation, Provisions of Secrecy, Revocations, Patent of Addition, and Restoration of Patents. Section 67 - Section 115 of the Indian Patent Act, 1970 with specific focus on Patent Assignments, Compulsory Licensing, Power of Central Government, and Infringement Proceedings. Section 116 - Section 162 of the Indian Patent Act, 1970 with specific focus on Convention/PCT Applications, Functions of Appellate Board and other Provisions. Amendment Rules 2016 with emphasis on important revisions to examination and Hearing procedures; provisions for start-ups and fees	9
6	Indian IP Policy	India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP – IPR.	3

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

Books and References:

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.

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	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 362	Introduction to Bioengineering	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
IL 362	Introduction to Bioengineering	40	40	40	60	-	-	-	100

Course Objectives:

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

Course Outcomes: Upon successful completion of the course students 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.

DETAILED THEORY SYLLABUS:

Module	Detailed Contents	Hrs
1	**Introduction:** Definition of Biomechanics, Selected Historical highlights, The Italian Renaissance, Gait century, Engineering Physiology & Anatomy	06
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	08
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.	07
4	**Biomaterials:** Brief Anatomy, Bone, cartilage, ligament, tendon, Muscles, biofluid their physical properties	06
5	**Implants:** General concepts of Implants, classification of implants, Soft tissues	06
6	Application of advanced engineering techniques to the human body, case studies.	06

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

References:

1. Nigg, B.M.and Herzog, W., "BIOMECHANICS of Musculo skeleton 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
6. R. M. Kennedy, A textbook of Biomedical Engineering, GTU, 2010
7. Richard Shalak & ShuChien, Handbook of Bioengineering,
8. Sean P. Flanagan, Flanagan, Biomechanics: A case based Approach, Jones & Bartlett Publishers, 2013
9. Y. C. Fung, Yuan-Cheng Fung,Biomechanics: mechanical Property of living Tissue, Springer, 1996.
10. Carol A. Oatis, The Mechanics and Pathomechanics of Human Movement, Lippincott Williams & Wilkins, 2010

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 363	Product Design	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
IL 363	Product Design	40	40	40	60	-	-	-	100

Course Objectives:

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

Course Outcomes: Upon successful completion students 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.

DETAILED THEORY SYLLABUS:

Module	Detailed content	Hours
1	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.	06

2	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.	06
3	Design for Manufacturing (DFM) and Design for Assembly (DFA) Designs for Maintainability and Reliability and some methods for reliability assessment, Designs for Environment, Design for Robustness: Taguchi Designs & Design of Experiments (DOE).	08
4	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.	08
5	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	06
6	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.	06

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

References:

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

Back to Scheme

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 364	Visual Arts	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Total of 2 Tests					
IL 364	Visual Arts	10	10	20	40	-	40	-	100

Course Objectives:

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

Course Outcomes: Upon successful completion of the course students 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 modeling and sculpture for industrial use.

DETAILED THEORY SYLLABUS:

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

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

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

References:

1. Gill Martha. (2000). Color Harmony Pastels: A Guidebook for Creating Great Color Combinations. Rockport Publishers.
2. Janson, Anthony F. (1977). History of art, second edition, H.W. Janson. Instructor's manual. Englewood Cliffs, N.J.: Prentice-Hall.
3. Brommer, Gerald F. (1988). *Exploring Drawing*. Worcester, Massachusetts: Davis Publications.
4. Wendy Burt Thomas. (2010). The Everything Creative Writing Book: All you need to know to write novels, plays, short stories, screenplays, poems, articles, or blogs: All You Need ... - Stories, Screenplays, Blogs and More. Fw Media; 2nd edition.
5. Élisabeth Bonvalot. (2020). Sculpting Book: A Complete Introduction to Modeling the Human Figure. (Publisher not mentioned)

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical / Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 365	Journalism, Media and Communication Studies	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Total of 2 Tests					
IL 365	Journalism, Media and Communication Studies	15	15	30	45	25	-	-	100

Course Objectives:

1. Provide a good grounding in the basic concepts of Journalism, Mass communication and Media.
2. Familiarize learners with reporting and editing practices.
3. Teach students to write editorials, feature articles, interviews, reviews, criticism etc.
4. To inculcate the skills required for writing in online newspapers, blogs, email and cell phone.
5. To prepare the learners for understanding the importance of Press laws and Ethics.
6. To train learners in advertising techniques and Public Relation Communication

Course Outcomes: Upon successful completion of the course students will be able to

1. Acquire conceptual and theoretical knowledge of Journalism, Mass Communication and Media Studies and learn to think critically about issues and topics of the subject.
2. Demonstrate the understanding of reporting and editing from Newspaper and the Organization.
3. Perform successfully in writing effective editorials, featured articles reviews etc.
4. Illustrate the skills required for writing in online newspapers, blogs, emails etc.
5. Determine the importance of Press Laws and Ethics.
6. Develop an understanding of the techniques required for advertising and Public Relation Communication.

DETAILED THEORY SYLLABUS:

Module	Detailed Contents	Hrs
1	Introduction to Journalism, Communication, Media and Cultural Studies- Basics of Mass communication, Pioneers of Indian Journalism, Introduction to newspapers, magazines and other publications. Introduction to broadcast journalism with special reference to television	5
2	Reporting and Editing Practices-Reporting different news, stories from Newspaper, and Organization. Principles of editing, rewriting, and translation	7

3	Writing for Print- Newspaper Content Writing Opinion pieces, editorials, feature articles, interviews, profiles, reviews, criticism etc.	7
4	Writing for Media- Introduction to New Media Writing for Online newspapers Blogs Cell phone Communication E-mail	6
5	Press Laws and Ethics- Origin and definition of Law, Law and Morality, Types of Law – Civil and Criminal, Press Legislations, Freedom of the Press Defamation Contempt of Court	4
6	Public Relations and Advertising- Introduction to Public Relations Stages of PR Communication with Public Need and Meaning of Advertising, Advertising strategies and Sales Promotion	7

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

References:

1. Rangaswamy, Parthasaratihi, (1985). *Journalism in India*, Sterling Publication, New Delhi.
2. Jeffrey, Robin, (2009). *India's Newspaper Evolution*, Oxford University Press, Delhi.
3. Singh, Devvrat. (2012). *Indian Television: Content, Issues and Challenges*, HarAnand Publications Delhi.
4. Daryl L. Frazell, George Tuck. (1996). *Principles of Editing: A Comprehensive Guide for Students and Journalists Principles of Editing: A Comprehensive Guide for Students and Journalists.* McGraw-Hill
5. Barry Newman. (2015). *News to Me: Finding and Writing Colorful Feature Stories*. Paperback
6. The Associated Press. (2017). *The Associated Press Stylebook: and Briefing on Media Law*. Revised, Updated Edition. Paperback.
7. Kristina Halvorson. (2012) *Content Strategy for the Web*, 2nd Edition. New Riders

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 366	Computational Physics	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
IL 366	Computational Physics	20	20	20	40	20	20	-	100

Course Objectives:

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

Course Outcomes: Upon successful completion of the course students 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.

DETAILED THEORY SYLLABUS:

Module	Detail Content	Hrs.
1	**Introduction to Statistical Mechanics :** 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.	7

	Random walk: 1-D and 2-D random walk, calculation of rms displacement.	
6	Introduction to Simulations of quantum systems	3

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

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, (Pearson Publications)
5. Understanding Molecular Simulations by Frenkel and Smit (Academic Press)

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 367	Polymers and Polymeric Materials	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
IL 367	Polymers and Polymeric Materials	40	40	40	60	-	-	-	100

Course Objectives:

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

Course Outcomes: Upon successful completion of the course students will be able to

1. To understand and analyze various polymeric materials and to establish the structure property relationship.
2. To select the proper polymeric material for specific industrial applications.
3. To become familiarized with various characterization techniques related to polymeric materials.

DETAILED THEORY SYLLABUS:

Module	Detail Content	Hrs.
1	**Basic understanding of Polymeric aspects:** Monomers, functionality, degree of polymerizations, classification of polymers, glass transition, melting transition, criteria for rubberiness, polymerization methods: addition and condensation; metallocene polymers and other newer techniques of polymerization, copolymerization, monomer reactivity ratios and its significance, different copolymers, random, alternating, azeotropic copolymerization, block and graft copolymers, concept of average molecular weight, determination of number average, weight average	9
2	**Polymer Technology:** Compounding of plastics, Polymer compounding-need and significance, different compounding ingredients for rubber and plastics, crosslinking and vulcanization	5
3	**Polymer Processing:**	6

	Fabrication of plastics by different moulding process, Compression molding, transfer molding, injection molding, blow molding, reaction injection molding, extrusion, pultrusion, calendaring, rotational molding, thermoforming, rubber processing in two-roll mill, internal mixer	
4	**Polymer blends:** Thermo- dynamical aspects of polymer blends and its miscibility, Role of compatibilizer, Composition based structure (dispersed and co-continuous), properties and its application, choice of polymers for blending, thermodynamics, phase morphology, polymer alloys, polymer eutectics, plastic-plastic, rubber-plastic and rubber-rubber blends	6
5	**Polymer composites:** Fundamentals of polymer composites, Advanced polymer nanocomposites, Fillers used for polymer composites, Effect of processing condition and composition, Polymer composites structure, characterisation and design, physical and chemical modification of polymer composites. 1-D and 2-D random walk, calculation of rms displacement.	6
6	**Testing of Polymeric Materials:** Samples preparation, Mechanical-static and dynamic tensile, flexural, compressive, abrasion, endurance, fatigue, hardness, tear, resilience, impact, toughness. Conductivity-thermal and electrical, dielectric constant, dissipation factor, power factor, electric resistance, surface resistivity, volume resistivity, swelling, aging resistance, establishment of structure property relationship	7

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

References:

1. “Fundamentals of Polymer Engineering” by Anil Kumar and Rakesh Gupta.
2. “ Principles of Polymer Systems” by F Rodriguez.
3. “ Polymer Science” by V R Gorwankar.
4. “ Textbook of Polymer Science” by F W Billmeyer. 5. “ Polymer Chemistry” by P C Heimenz.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 368	Vehicle Safety	03	-	-	03	-	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
IL 368	Vehicle Safety	40	40	40	60	-	-	-	100

Course Objectives:

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

Course Outcomes: Upon successful completion of the course students will be able to

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

DETAILED THEORY SYLLABUS:

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

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

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

References:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
IL 369	Maintenance of Electronics Equipment	-	-	-	-	3	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
IL 369	Maintenance of Electronics Equipment	20	20	40	-	30	30	-	100

Lab Objectives:

1. To demonstrate use of different types of hand tools
2. To understand testing of different active and passive components mounted on PCB
3. To understand functionality TTL and CMOS digital IC tester
4. To demonstrate computer assembling, troubleshooting and software installation
5. To understand/demonstrate concept of circuit diagram of LED/LCD TV, DTH and mobile phone troubleshooting
6. To understand concept of medical equipments

Lab Outcomes:

1. Demonstrate use of different types of hand tools
2. Understand testing of different active and passive components mounted on PCB
3. Understand functionality TTL and CMOS digital IC tester
4. Demonstrate computer assembling, troubleshooting and software installation
5. Understand/demonstrate concept of circuit diagram of LED/LCD TV, DTH and mobile phone troubleshooting
6. Understand concept of medical equipments

SN	Detailed Lab/Tutorial Description	Hrs.
1	Demonstrate use of various hand held tools.	2
2	Test the performance of different passive electronic components (fixed/variable)	2
3	Test the performance of active electronic components like general purpose transistor/FET/MOSFET/SCR/ DIAC/TRIAC with DMM and CRO OR Components Tester	4
4	Verify the functionality of TTL and CMOS Digital IC's using IC tester	4
5	Explore a datasheet of minimum any five electronics components and analog/ Digital IC's.	2
6	Draw the given regulated power supply circuit/ SMPS (from any television/fridge/ computer system/ laboratory etc)	2
7	Identify basic sections of a personal computer/Laptop	2
8	Demonstrate Assembling of Personal Computer/Laptop	4

9	Troubleshoot the booting process of computer system and install different hardware associated with computer (HDD, LAN Card, Audio System etc)	4
10	Study Installation of Software and Configure Internet	4
11	Explore circuit diagram of LED/LCD TV.	2
12	Demonstrate Installation of DTH system	4
13	Demonstrate installation Solar power system	4
14	Practice steps for mobile troubleshooting	4
15	Visit to Medical Equipment Industry/Laboratory	8

Assessment:
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

Books/References:

1. Troubleshooting and Maintenance of Electronics Equipment, Singh K. Sudeep, Katson Book ,New Delhi ,II edition , Reprint 2014
2. Mobile repairing Books, Manohar Lotia, BPB Publication, New Delhi , latest edition
3. Troubleshooting Electronic Equipment: Includes Repair and Maintenance, Second Edition, Khandpur R. S. , Tata McGraw-Hill Education, New Delhi ,India , latest edition.
4. Data Books, National semiconductor.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 392	Project-A	--	04	--	--	02	--	02

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 392	Project-A	--	--	--	--	50	--	50	100

Lab Objectives:

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

Lab Outcomes: Student will be able to:

1. Discover potential research areas in the field of Electronics and Computer Science Engineering.
2. Conduct a survey of several available literatures 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

Guidelines:

1. The project work is to be conducted by a group of two to four 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 day for the project work in VI semester.
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.
7. (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 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.
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. Teams must analyze all the results obtained by comparing with other standard techniques.
11. Every team must publish their work in national / international conference/journals if possible (publish in Scopus indexed journals).
12. The team will finally propose a plan for project work to be continued in the final year.

Project Assessment:

1.Evaluation:

1. Each team has to give 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 Department of Electronics and Computer Science Engineering.
4. Oral exam will be conducted on the project done by the students.

2.Term Work:

Term Work shall consist of full Literature survey/ Mini-project and Presentation on above guidelines/syllabus.

3.Oral Exam:

An Oral exam will be held based on the Literature survey/ Mini-project and Presentation.

Bachelor of Technology
In
Electronics & Computer Science

(Semester VII)

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
EC 401	Personal Finance Management	Contact Hours	2	-	-	2
		Credits	2	-	-	1

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
EC 401	Personal Finance Management	20	20	20	40	-	-	--	60

Course Objectives: The course or instructor aims

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 .

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

1. To know 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 .

Detailed Theory Syllabus:

SN	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 of 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

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.

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	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 402	Deep Learning	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 402	Deep Learning	40	40	40	60	25	--	25	150

Course Objectives:

1. To learn the fundamentals of Neural Network.
2. To gain an insight into optimization and regularization of Deep Neural Networks
3. To acquire knowledge of advanced concepts of Convolution Neural Networks, Recurrent Neural Networks and Autoencoders.
4. To understand the applications of DL algorithms in image classification, image captioning, image generation, text summarization and video to Text operation.

Course Outcomes: Upon successful completion of the course students will be able to:

1. Understand fundamentals concepts of Neural Network and Deep Networks.
2. Gain an in-depth understanding of training, optimization and regularization of Deep Neural Networks
3. Understand and apply concepts of Convolutional Neural Networks for supervised learning applications
4. Understand and apply concepts of Recurrent Neural Network for supervised learning applications
5. Understand and apply concepts of Autoencoder for unsupervised learning applications
6. Gain familiarity with recent trends and applications of Deep Learning.

Prerequisite: Probability and Basic Biological Concepts

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Introduction**	**1.1: Introduction to NN** Biological Neuron. McCulloch Pitts NN, Linear Separability, Learning Rule: Perceptron, Delta. **1.2: Introduction to Deep Learning** ML vs DL approach, Types of DL Algorithms, Hyperparameters, Loss functions, Data augmentation, Activation functions: Sigmoid, Tanh, ReLU, Softmax.	05
2.	**Optimization and Regularization**	**2.1: Optimization** Learning with backpropagation, Learning Parameters: Gradient Descent (GD), Stochastic and Mini Batch GD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, Adam, RMSProp **2.2: Regularization** Overview of Overfitting, Types of biases, Bias Variance Tradeoff Regularization Methods: L1, L2 regularization, Parameter sharing, Dropout, Weight Decay, Batch normalization, Early stopping, Data Augmentation, Adding noise to input and output	08
3.	**Supervised Deep Learning: Convolutional Neural Networks**	**3.1: Introduction** Edge Detection Filters, Filter Size, Convolutions, Padding, Stride, Compare CNN and ANN, Limitations of CNN. **3.2: Architecture** CNN architecture, Layers: Pooling, Convolutions. Transfer learning, DL architecture: LeNET and AlexNET.	07
4.	**Supervised Deep Learning: Recurrent Neural Networks**	**4.1: Introduction** Recurrent neuron, RNN model, RNN types, Gradients in RNN, Back propagation, Compare CNN and RNN. **4.2: Long Short Term Memory** Selective Read, Selective write, Selective Forget, Gated Recurrent Unit	07
5.	**Unsupervised Deep Learning: Autoencoders**	**5.1:** Introduction, Linear Autoencoder, Undercomplete Autoencoder, Overcomplete Autoencoders, Regularization in Autoencoders. **5.2:** Denoising Autoencoders, Sparse Autoencoders, Contractive Autoencoders.	07
6.	**Applications**	**6.1:** Application of Autoencoders: Image Compression **6.2:** Image classification, Image Captioning, Image generation, Text summarization, Video to Text using LSTM.	05

DETAILED LAB SYLLABUS:

Lab Prerequisite: Knowledge of Machine learning algorithms beneficial, Python Programming.

Suggested List of Experiments:

- Implementation of Linear Regression
- Implementation of MNIST Sampler
- Implementation of MNIST Classifier
- Implementation of CNN MNIST Classifier
- Implementation of CNN MNIST Classifier using Functional API
- Implementation of RNN MNIST Classifier
- Implementation of LSTM MNIST Classifier
- Implementation of Transformer MNIST Classifier
- Implementation of MLP on MNIST with L2
- Implementation of MLP on MNIST with Data Augmentation
- Implementation of AutoEncoder and Colorization AutoEncoder
- Implementation of VAE MLP
- Implementation of VAE CNN
- Implementation of CVAE

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 4 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 number of hours assigned to each module.

Lab Assessment:

1. **Termwork Assessment:** Term Work shall consist of at least 8 to 10experiments 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). The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

Text Books:

1. Satish Kumar, "Neural Networks: A Classroom Approach", McGraw Hill Education; 2ed, 2017.
1. Jacek M. Zurada, "Introduction to Artificial Neural Systems", West Publishing Company, 1092.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press Ltd, 2016
3. Li Deng and Dong Yu, "Deep Learning Methods and Applications", Now Publishers Inc., 2014.
4. Mykel J. Kochenderfer and Tim A. Wheeler, "Algorithms for Optimization", The MIT Press, Cambridge, Massachusetts London.

References:

1. Simon Haykin, "Neural Network - A Comprehensive Foundation", 2ed, Pearson Education, 2005.
2. S.N. Sivanandam and S.N. Deepa, "Principles of soft computing", Wiley India
3. François Chollet, "Deep learning with Python," New York: Manning, Vol. 361. 2018.
4. Douwe Osinga, "Deep Learning Cookbook", O′Reilly; 1st edition, 2018, SPD Publishers.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 403	Data Science	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 403	Data Science	40	40	40	60	25	--	25	150

Course Objectives:

1. To gain perspective of Big Data, Data Science and its Applications.
2. To learn basic concepts of statistics, probability.
3. To understand different stages in the Data Science Process.
4. To learn the basic data preprocessing, data cleaning and data transformation techniques.
5. To understand various algorithms and learning techniques used in data science.
6. To investigate the current scope, potential, limitations, and implications of data science and its applications across multiple domains

Course Outcomes:

After successful completion of the course students will be able to:
1. Translate business challenge into data science challenge.
2. Apply structured lifecycle approach to data science projects.
3. Analyze the data, create statistical models, and identify insights that can lead to actionable results.
4. Apply various data analysis and visualization techniques.
5. Apply various algorithms and develop models for data science projects.
6. To Provide data science solutions for solving real business problems.

Prerequisite: BDA. ML , DBMS, Python, NLP

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
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.	04
2.	**Data management and Predictive modeling**	Data management - Create the data set, Data collection methods, Data preparation - importance of data 'cleaning', validity and quality. Data analysis Predictive Modeling - Probability and Statistics Basics, Common machine learning models(Machine Learning Algorithms: Linear Regression, Logistic Regression, Multinomial Logistic Regression, Decision Trees, Naive Bays, SVM, Clustering)	09
3.	**Feature Extraction and Text Analytics**	Feature engineering, Model selection, Performance metrics and hyperparameter optimization, Confusion Matrix, Model Deployment. Introduction to text Analytics, Need of Text Analytics, Understanding Text, Cleaning Text Data Sets	07
4.	**Data visualization and Tools**	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. Data Visualization using R, Python and Tableau.	08
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	06
6.	**Data Science Applications**	1. Case Study on Healthcare/Banking/Finance 2. Case Study on Advertisement,/sports/Tourism	05

Text Books:

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, ―Introducing Data Science‖, Manning Publication.
2. Sanjeev Wagh, Manisha S. Bhende And Anuradha D. Thakare, ―Fundamentals ofData Science‖, Thakare, Taylor and Francis Group, CRC Publication.
3. Kevin P. Murphy, "Machine Learning a Probabilistic Perspective", The MIT Press
4. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition,
   2018

References:

1. Noel Cressie, Christopher K. Wikle , "Statistics for Spatio-Temporal Data, Wiley
2. Rachel Schutt and Cathy O'Neil, ―Doing Data Science‖, O'Reilly Media
3. Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly Media
4. Practical Tableau by Ryan Sleeper, O'Reilly Media, Inc., April 2018

DETAILED LAB SYLLABUS:

Suggested List of Experiments:

- Python based data preprocessing (02 - 03 experiments)
- ML algorithm based experiments (02 - 03 experiments)
- SQL based programming (02 - 03 experiments)
- Data visualization based experiments (02 - 03 experiments)
- Implementation of case study [Presentation by individual student]

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 4 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 number of hours assigned to each module.

Lab Assessment:

1. **Termwork Assessment:** Term Work shall consist of at least 8 to 10 experiments based on the above list. Individual student should identify specific application of Data science and implement it and presentation of the same. 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). The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

Lab Assessment:

1. Term work Assessment:

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

2. Oral/Viva Assessment:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 404	High Performance Computing	03	02	-	03	01	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 404	High Performance Computing	40	40	40	60	25	-	25	150

Course Objectives:

1. To learn fundamental concepts of parallel processing
2. To learn utilization of high performance computing resources using programming Frameworks.

Course Outcomes: Upon successful completion students 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
4. Understand parallel computing implementation for a computationally intensive problem
5. Understand practical limitations of technology for high performance computing
6. Understand Power aware techniques

Prerequisite: Computer organization and Architectures, Parallel computing

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
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	06
2.	**Parallel Programming with CUDA**	Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architectures: (Examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Microarchitecture and Intel Nehalem microarchitecture), Memory hierarchy and transaction specific memory design, Thread Organization	10
3.	**Fundamental Design Issues in Parallel Computing**	Synchronization, Scheduling, Job Allocation,JobPartitioning,Dependency Analysis, Mapping Parallel Algorithms on Parallel Architectures,Performance Analysis of Parallel Algorithms	06
4.	**Fundamental Limitations Facing Parallel Computing**	Bandwidth Limitations,Latency Limitations, Latency Hiding/Tolerating Techniques and their limitations	05
5.	**Power-Aware Computing and Communication**	Power-aware Processing Techniques, Power-aware Memory Design, Power-aware Interconnect Design, Software Power Management	06
6.	**Advanced Topics**	Petascale Computing, Optics in Parallel Computing, Quantum Computers, Recent developments in Nanotechnology and its impact on HPC	06

DETAILED LAB SYLLABUS:

Software Requirements:

Windows/Linux, Python, Matlab, Tensorflow

High performance Systems

Sr. No.	Detailed Lab/Tutorial Description
1	Study and Write case study on your College network
2	Write program for matrix multiplication using MPI Write program for matrix addition using OpenMP
3	Write program for matrix addition using CUDA
4	Write program for parallel quicksort algorithm
5	Write a program to Send message to parallel computers connected through network and find latency

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 number of hours assigned to each module.

Lab Assessment:

1. **Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

2. **Oral/Viva Assessment:**

Oral exam will be based on the entire syllabus.

Text Books:

1. "Highly Parallel Computing", by George S. Almasi and Alan Gottlieb
2. "Advanced Computer Architecture: Parallelism, Scalability, Programmability", by Kai Hwang, McGraw Hill 1993
3. "Parallel Computer Architecture: A hardware/Software Approach", by David Culler Jaswinder Pal Singh, Morgan Kaufmann, 1999.
4. "Scalable Parallel Computing", by Kai Hwang, McGraw Hill 1998.
5. "Introduction to Parallel Computing", Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, © 2003.
6. "Petascale Computing: Algorithms and Applications", David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, © 2007.

References:

1. GPU Gems 3 --- by Hubert Nguyen (Chapter 29 to Chapter 41)
2. "Principles and Practices on Interconnection Networks", by William James Dally and Brian Towles, Morgan Kauffman 2004.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 405	Analog and Mixed Signal VLSI Design	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 405	Analog and Mixed Signal VLSI Design	40	40	40	60	25	--	25	150

Course Objectives:

1. To teach analysis and design of building blocks of CMOS Analog VLSI Circuits.
2. To highlight the issues associated with the CMOS analog VLSI circuit design.
3. To emphasize upon the issues related to MOS Amplifier.
4. To emphasize upon the issues related to oscillators and PLL.
5. To emphasize upon the issues related to mixed signal layout design.
6. To highlight the issues associated with data Converter

Course Outcomes: Upon successful completion of the course students will be able to

1. Discuss tradeoffs involved in analog VLSI Circuits.
2. Analyze amplifier fundamentals.
3. Discuss various MOS operational amplifier.
4. Analyze building blocks of CMOS analog VLSI circuits.
5. Design building blocks of CMOS analog VLSI circuits
6. Carry out verifications of issues involved in analog and mixed signal circuits.

Prerequisite: Electronic Devices and Circuits I, Digital Circuit Design, Electronic Devices and Circuits II, Design With Linear Integrated Circuits, VLSI Design, VLSI Design

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1.	**Analog building blocks**	Need for CMOS analog and mixed signal designs, MOS Transistor assampling switch, active resistances, current source and sinks,current mirror. Voltage References: Band Gap References, General Considerations, Supply-independent biasing, Temperature independent references, PTAT, current generation and Constant Gm biasing.	08
2.	**Amplifier Fundamentals**	Single Stage Amplifiers: Basic concepts, Gain Bandwidth (GBW), Common-source stage (with resistive load, diode connected load, current- source load, triode load, source degeneration), source follower, common-gate stage, cascode stage, folded cascade stage. Differential Amplifiers: Single ended and differential operation, Basic differential pair, large signal and small signal behaviours, Common-mode response, Differential pair with MOS loads. Noise: Statistical Characteristics of Noise, Types of Noise, Representation of Noise in circuits, Noise in Single stage amplifiers (CS, CD, CG stages), noise in differential pairs, noise bandwidth, noise figure, noise temperature.	07
3.	**MOS Operational Amplifiers**	Stability and Frequency Compensation: General Considerations, Multipole systems, Phase margin, Frequency compensation, compensation of two stage op-amps. Op-amp Design: General Considerations, performance parameters, One- stage op- amps, Two-stage op-amps, Gain Boosting, Common-mode feedback, Input range limitations(ICMR), Slew Rate, Power supply rejection, Noise in op-amps. Design of single ended and double ended two stage Op-amps.	07
4.	**Mixed Signal Circuits**	Basic Concepts: AMS design flow, ASIC, Full custom design, Semi- custom design, System on Chip, System in package, Hardware software co-design, and mixed signal layout issues. Oscillators: General considerations, Ring oscillators, LC oscillators, VCO. Phase-Locked Loop: Simple PLL, Charge pump PLL, Non-ideal effects in PLL, Delay locked loops and applications of PLL in integrated circuits.	06
5.	**Data Converter Fundamentals**	Switch Capacitor Circuits: MOSFETs as switches, Speed considerations, Precision Considerations, Charge injection cancellation,	06

		Unity gain buffer, Non- inverting amplifier and integrator. Basic CMOS comparator Design, Adaptive biasing, Analog multipliers.	
6.	**Data Converter Fundamentals and Architectures**	Fundamentals: Analog versus discrete time signals, converting analog signals to data signals, sample and hold characteristics. DAC specifications, ADC specifications. DAC architectures: Digital input code, resistors string, R-2R ladder networks, current steering, charge scaling DACs, Cyclic DAC, pipeline DAC ADC architectures: Flash, Two Step Flash, Pipeline ADC, Integrating ADCs, Successiveapproximation ADCs.	05

DETAILED LAB SYLLABUS:

Software Requirements: LT Spice

Sr. No.	Detailed Lab/Tutorial Description
1	Design and Simulate NMOS Inverter with Resistive load. Plot Drain current and Trans conductance.
2	Design and simulate NMOS current Mirror and plot Iref.
3	Design and simulate CS amplifier. With and without source degeneration .
4	Design and simulate Cascode Current Mirror Circuit.
5	Design and simulate basic Differential Amplifier Circuit.
6	Design and simulate one stage Op-Amp circuit.
7	Design and simulate Sample and Hold circuit.
8	To design of simulate 3 stage ring oscillator.
9	Case study of IEEE papers.
10	Case study of IEEE papers.

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 number of hours assigned to each module.

Lab Assessment:

1. Term work Assessment:

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

2. Oral/Viva Assessment:

Practical and Oral exam will be based on the entire syllabus.

Text Books:

1. B Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 1st Edition.
2. R. Jacaob Baker, Harry W. Li, David E. Boyce, "CMOS Circuit Design, Layout, and Simulation", Wiley, Student Edition
3. P. E. Allen and D. R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 3rd Edition.
4. Gray, Meyer, Lewis, Hurst, "Analysis and design of Analog Integrated Circuits", Willey, 5th Edition.

References:

1. Jean-Pierre Colinge, "FinFETs and Other Multigate Transistors", Springer, 1st edition
2. M. S. Tyagi, "Introduction to Semiconductor Materials and Devices", John Wiley and Sons,1st edition.
3. James E. Morris and KrzysztolIniewski, "Nanoelectronic Device ApplicationsHandbook", CRCPress.
4. Glenn R. Blackwell, "The electronic packaging", CRC Press.
5. Michael L. Bushnell and Vishwani D. Agrawal, "Essentials of Electronic Testing fordigital, memory and mixed-signal VLSI circuits", Springer.

Course Code	Course Name	Theory (Hrs)	Practical (Hrs)	Tutorial (Hrs)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 406	Robotics & Industrial Applications	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 406	Robotics & Industrial Applications	40	40	40	60	25	--	25	150

Course Objectives:

1. To study different types of Robots and understand the fundamentals of robotics.
2. To study the concepts of Direct Kinematics & Inverse Kinematics.
3. To analyze the Velocity Kinematics and Dynamics.
4. To familiarize students with Trajectory planning of robots.
5. To familiarize students with robot vision.
6. To familiarize students with task planning of robots.

Course Outcomes: Upon successful completion students will be able to

1. Understand the basic concepts of robotics.
2. Perform the kinematic analysis of robots.
3. Ability to analyze the Velocity Kinematics and Dynamics.
4. Perform trajectory planning of robots
5. Describe importance of visionary system in robotic manipulation
6. Perform task planning of robots

Prerequisite: Applied Mathematics, Linear Control Systems.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	**Fundamentals of Robotics**	Robot Classification, Robot Components, Robot Specification, Joints, Coordinates, Coordinate frames, Workspace, Languages, Applications.	06
2	**Kinematics of Robots**	Homogeneous transformation matrices, Inverse transformation matrices, Forward and inverse kinematic equations – position and orientation Denavit-Hartenberg representation of forward kinematics, Forward and inverse kinematic solutions of three and four axis robot	08
3	**Velocity Kinematics & Dynamics**	Differential motions and velocities: Differential relationship, Jacobian, Differential motion of a frame and robot, Inverse Jacobian, Singularities. Dynamic Analysis of Forces : Lagrangian mechanics, Newton Euler formulation, Dynamic equations of two axis robot	08
4	**Trajectory planning**	Basics of Trajectory planning , Joint-space trajectory planning, Cartesian-space trajectories	06
5	**Robot Vision**	Image representation, Template matching, Polyhedral objects, Shape analysis, Segmentation, Iterative processing, Perspective transform, Camera Calibration	06
6	**Task Planning**	Task level programming, Uncertainty, Configuration Space, Gross motion Planning; Grasp planning, Fine-motion Planning, Simulation of Planer motion, Source and goal scenes, Task planner simulation.	06

DETAILED LAB SYLLABUS:

Software Requirements: Matlab / Scilab

Sr. No.	List of Experiments
1	Forward kinematics
2	Inverse kinematic
3	Dynamic analysis
4	Space trajectory
5	Cartesian-space trajectory
6	Template matching

7	Iterative Processing
8	Segmentation

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 number of hours assigned to each module.

Lab Assessment:

1. Term work Assessment:

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2.Oral/Viva Assessment: Practical and Oral exam will be based on the entire syllabus.

Text Books:

1. Robert Shilling, "Fundamentals of Robotics - Analysis and control", Prentice Hall of India, 2009
2. Saeed Benjamin Niku, "Introduction to Robotics – Analysis, Control, Applications", Wiley India Pvt. Ltd., Second Edition, 2011

References:

1. John J. Craig, "Introduction to Robotics – Mechanics & Control", Third Edition, Pearson Education, India, 2009
2. Mark W. Spong , Seth Hutchinson, M. Vidyasagar, "Robot Modeling & Control ", Wiley India Pvt. Ltd., 2006
3. Mikell P. Groover et.al, "Industrial Robots-Technology, Programming & applications", McGraw Hill , New York, 2008

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 407	Cyber Security and Digital Forensics	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 407	Cyber Security and Digital Forensics	40	40	40	60	25	--	25	150

Course Objectives:

1.To understand and identify different types of cybercrime and cyber law.
2.To recognize Indian IT Act 2008 and its latest amendments.
3.To learn various types of security standards compliances
4. To discuss the need and process of digital forensics and Incident Response Methodology.
5. To explore the procedures for identification, preservation, and acquisition of digital evidence.
6. To explore techniques and tools used in digital forensics for Operating system and malware investigation

Course Outcomes: Upon successful completion of the course students 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 understand the need and process of digital forensics and Incident Response Methodology.
5. Able to understand the procedures for identification, preservation, and acquisition of digital evidence.
6. Able to understand the techniques and tools used in digital forensics for Operating system and malware investigation

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
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.	**Introduction to Digital Forensics**	Digital Forensics Definition, Digital Forensics Goals, Digital Forensics Categories - Computer Forensics, Mobile Forensics, Network Forensics, Database Forensics Introduction to Incident - Computer Security Incident, Goals of Incident Response, CSIRT, Incident Response Methodology, Phase after detection of an incident	08
5.	**Digital Evidence, Forensics Duplication and Digital Evidence Acquisition**	Digital evidence, Types of Digital Evidence, Challenges in acquiring Digital evidence, Admissibility of evidence, Challenges in evidence handling, Chain of Custody, Necessity of forensic duplication, Forensic image formats, Forensic duplication techniques, Acquiring Digital Evidence - Forensic Image File Format, Acquiring Volatile Memory (Live Acquisition), Acquiring Nonvolatile Memory (Static Acquisition)	06
6.	**Forensics Investigation**	Analyzing Hard Drive Forensic Images, Analyzing RAM Forensic Image, Investigating Routers Malware Analysis - Malware, Viruses, Worms, Essential skills and tools for Malware Analysis, List of Malware Analysis Tools and Techniques, Investigating logs from Unix and windows systems, Investigating Windows Registry.	06

DETAILED LAB SYLLABUS:

Hardware Requirements:

Standalone desktops

Software Requirements:

C++

Java or equivalent compiler

Sr. No.	Detailed Lab/Tutorial Description
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.
12	Analysis of forensic images using open source tools. ● FTK Imager ● Autopsy
13	Explore forensics tools in kali linux for acquiring, analyzing and duplicating data. ● dd ● dcfldd
14	Data Carving using open source tools ● Foremost ● Scalpel ● Jpegcarver
15	Performing penetration testing using Metasploit - kali Linux.

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 number of hours assigned to each module.

Lab Assessment:

1. Term work Assessment:

At least 6 experiments covering the entire syllabus of DCSD should be set to have well predefined inference and conclusion. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting. Simulation experiments are also encouraged. Experiments must be graded from time to time. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2. Oral/Viva Assessment:

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

Text Books:

1. Nina Godbole, SunitBelapure, 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

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

Course Code	Course Name	Theory (Hrs)	Practical (Hrs)	Tutorial (Hrs)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 408	Blockchain Technology	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
EC 408	Blockchain Technology	40	40	40	60	25	--	25	150

Course Objectives:

1. To understand basics of Blockchain technology
2. To understand concept of cryptocurrency and Bitcoin
3. To understand concepts of Ethereum Blockchain
4. To learn the concepts of Hyperledger
5. To understand solidity programming language and concepts of smart contracts
6. To learn and develop various applications of Blockchain

Course Outcomes: Upon successful completion of the course students will be able to

1. Have an understanding and working knowledge of the emerging blockchain technology.
2. Discuss concept of cryptocurrency and Bitcoin
3. Apply the knowledge of Ethereum Blockchain
4. Understand and analyze the working of Hyperledger
5. Explore basics of solidity programming language and smart contracts
6. Develop various applications of Blockchain

Prerequisite: Data Structure and Algorithm, Computer Networks

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	**Introduction of Cryptography and Blockchain**	What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions And Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain	**07**
2	**Bitcoin and Cryptocurrency**	What is Bitcoin, Bitcoin Network, Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Hot and Cold Storage, Decentralization and Hard Forks, Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency	**08**
3	**Introduction to Ethereum Blockchain**	Introduction to Ethereum, Ethereum Structure,Ethereum Operations, Ethereum Virtual Machine (EVM), Incentive Model, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Initial Coin Offering(ICO)	**07**
4	**Introduction to Hyperledger**	What is Hyperledger? , Distributed Ledger Technology & its Challenges,Hyperledger: Distributed Ledger Frameworks and Domain Specific Blockchains, Hyperledger Fabric, Hyperledger Fabric Architecture, Hyperledger Composer.	**05**
5	**Solidity Programming Language**	Solidity -Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real, String, Bytes, Arrays, Mapping, Decision making, Structs ,Ether units, Enum, address, special variables), Solidity Functions , Solidity patterns (pattern withdrawal and restricted access)	**08**
6	**Blockchain Applications**	Blockchain Applications: Internet of Things, Medical Record Management System, Do-main Name Service and future of Blockchain	**04**

DETAILED LAB SYLLABUS:

Software Requirements: Remix Browser - online compiler

Sr. No.	Detailed Lab Description
1	Understanding the concept of Hash in Blockchain
2	Working of Bitcoin mining and how blocks are added in the Blockchain.
3	Setting up bitcoin wallet
4	Creating and Building Up Crypto Token
5	Setting up Metamask and MIST Wallet
6	Set up Hyperledger Fabric Blockchain using Hyperledger Composer locally
7	Create a smart contract for Hotel Room
8	Create a smart contract for voting system
9	Create a smart contract that implements the simplest form of a cryptocurrency. The contract allows only its creator to create new coins (different issuance schemes are possible). Anyone can send coins to each other without a need for registering with a username and password, all you need is an Ethereum keypair
10	Simple Open Auction Smart Contract The general idea of the following simple auction contract is that everyone can send their bids during a bidding period. The bids already include sending money / Ether in order to bind the bidders to their bid. If the highest bid is raised, the previous highest bidder gets their money back. After the end of the bidding period, the contract has to be called manually for the beneficiary to receive their money - contracts cannot activate themselves.
11	Practical use cases of Blockchain - Case study

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 number of hours assigned to each module.

Lab Assessment:

1. **Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2. **Oral/Viva Assessment:** Practical and Oral exam will be based on the entire syllabus.

Text Book

1.Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2.Arshdeep Bahga, Vijay Madisetti, Blockchain Applications: A Hands-On Approach Paperback, VPT; 1st edition (31 January 2017)
3.Baset, Salman A., Blockchain Development with Hyperledger,Packt, 2019
4. Parikshit Jain, A Practical Guide To Blockchain And Its Applications, Bloomsbury India,1st Edition,February 2019

Reference Books

1.Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2.Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3.DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4.Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts
5.Jitendra Chittoda, Mastering Blockchain Programming with Solidity: Write production-ready smart contracts for Ethereum blockchain with Solidity,Packt Publishing; 1st edition (2 August 2019).

Course Code	Course Name	Theory (Hrs)	Practical (Hrs)	Tutorial (Hrs)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 409	Internet of Everything	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 409	Internet of Everything	40	40	40	60	25	--	25	150

Course Objectives:

1. Introduce evolution of internet technology and need for IoT.

2. Discuss on IoT reference layers and various protocols and software.

3. To provide in depth knowledge in physical principles applied in sensing, measurement and a comprehensive understanding on how measurement systems are designed, calibrated, characterized, and analyzed.

4. To introduce the students to sources and detectors of various Optical sensing mechanisms and provide in-depth understanding of the principle of the basic laws and phenomena on which operation of sensor transformation of energy is based, measurement and theory of instruments and sensors.

5. Train the students to build IoT systems using sensors, single board computers and open source IoT platforms.

6. Make the students apply IoT data for business solutions in various domains in a secure manner.

Course Outcomes: Upon successful completion of the course students will be able to

1. Identify the IoT networking components with respect to the OSI layer.
2. Build schematic for IoT solutions .
3. Design and develop IoT based sensor systems.
4. Select IoT protocols and software.
5. Evaluate the wireless technologies for IoT.
6. Appreciate the need for IoT Trust and variants of IoT and compete in the design, construction, and execution of systems for measuring physical quantities

Prerequisite:

Electronics Devices and Circuits(EDC), Microprocessor and Microcontroller (MPC)

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
1	**Introduction to Internet of Things**	Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Trends in the Adoption of IoT, Societal Benefits of IoT, Risks, Privacy, and Security. Exemplary Device Boards, Arduino, Linux on Raspberry, Interface and Programming & IOT Device. Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases	06
2	**Sensing and Actuation**	Sensor fundamentals and characteristics, Optical Sources and Detectors, Intensity Polarization and Interferometric Sensors, Strain, Force, Torque and Pressure sensors, Position, Direction, Displacement and Level sensors, Velocity and Acceleration sensors, Flow, Temperature and Acoustic sensors.	07
3	**Networking and the Internet of Things**	IoT and Machine to Machine Communications, IoT protocols, Network configurations, Network Operator Requirements, SNMP, NETCONF, YANG, Interoperability in IoT. SDN	08
4	**Sensor Networks and IoT**	Characteristic and challenges, WSN vs Adhoc Networks, Sensor node architecture, Physical layer and transceiver design considerations in WSNs, Energy usage profile,	10

		Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations. Sensor Network Architecture: Data Dissemination, Flooding and Gossiping-Data gathering Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles for WSNs- Gateway Concepts, Need for gateway, WSN and Internet Communication, WSN Tunneling, Amplifiers and Sensor Noise, Importance and Adoption of Smart Sensors, Architecture of Smart Sensors	
5	**Cloud Computing**	Interfacing and data logging with cloud, Evolution of Cloud Computation, Commercial clouds and their features, open source IoT platforms, cloud dashboards, Fog Computing, Introduction to big data analytics and Hadoop.	08

DETAILED LAB SYLLABUS:

Software Requirements:

Arduino IDE, Noobs, Keil and energia, CCStudio

Hardware Requirements:

Arduino, Raspberry Pi, ARM7 Board, MSP430, Inductive transducer, Hall Effect sensor, Thermocouple, Thermistor, Temperature sensor, LCD Display, Zigbee Chip, Motors, Miscellaneous

Sr. No.	Detailed Lab/Tutorial Description
1	IoT systems Working with Raspberry pi using Python. Arduino platform Working with open source clouds
2	Python Programming for IoT Systems: Basic operations, String manipulation, Dictionary, Signal plotting, processing and graphics on cloud
3	Develop a displacement measurement system with the following sensors: i. Inductive transducer (LVDT) ii. Hall effect sensor
4	After studying the characteristics of temperature sensors listed below, develop a temperature measurement system for a particular application using the suitable sensor. i. Thermocouple principles ii. Thermistor and linearization of NTC Thermistor iii. Resistance Temperature Detector iv. Semiconductor Temperature sensor OA79 v. Current output absolute temperature sensor Based on sensing experiments carried out suggest a noncontact method and try to complete its proof of concept.
5	Embedded Programming and IoT: C programming, Declarations and Expressions, Arrays, Pointers, Constructs, Data structures and Linked list, Embedded C (Keil).
6	Working with ARM (Keil and energia) Sub Task 1: Peripheral programming of ARM7 board Sub Task 2: PWM generation Sub Task 3:Configuring CC3200, wifi configuration ,HTTP and MQTT Protocol
7	Working with MSP430 (CCStudio) Sub Task 1: Port programming of MSP430 microcontrollers Sub Task 2: Analog to Digital Conversion using MSP430 microcontroller Sub Task 3: LCD display of characters and numbers. Sub Task 4: Timer
8	Low power wireless transmission using Zigbee Sub Task 1 : Interfacing Zigbee controller with MSP 430 microcontroller using SPI/UART. Sub Task 2: Programming sleep and wake up mode of MSP 430.
9	Speed regulation measurement of DC motor using armature control system
10	Consider a real time data available in college campus and develop a data analytic system to determine the average, trend and prediction
11	Mini Project

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 number of hours assigned to each module.

Lab Assessment:

1.Term work Assessment:

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2.Oral/Viva Assessment:

Practical and Oral exam will be based on the entire syllabus.

Text Books:

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016

2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.

3. Jacob Fraden, "HandBook of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.

4. Jon. S. Wilson, "Sensor Technology HandBook", 2011, 1st edition, Elsevier, Netherland.

References:

1. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga & Vijay Madisetti, 2014

2. LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March,2008.

3. RonaldL. Krutz, Russell Dean Vines,Cloud Security: A Comprehensive Guide to Secure Cloud Computing,Wiley-India, 2010.

4. John G Webster, "Measurement, Instrumentation and sensor Handbook", 2017, 2nd edition, CRC Press, Florida.
5. Bahaa E. A. Saleh and Malvin Carl Teich, "Fundamentals of photonics", 2012, 1st edition, John Wiley, New York.

Course Code	Course Name	Credits
IL 470	**e-commerce and e-business**	**3+1**

Objectives:

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

Outcomes: Learner will be able to…

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

Module	Detailed Contents	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

Assessment Scheme:

Internal Assessment: Two tests of 20 marks

End Semester Examination:

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, Brahm Canzer, cengage learning
5) Secure e-commerce systems (Kindle edition), Amazon publishing, P S Lokhande, B B Meshram, first edition

Course Code	Course Name	Credits
IL 472	**Biomedical Instrumentation**	**3**

Objectives:

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.

Outcomes: Learner will be able to…

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, analyze, 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.

Module	Detailed Contents	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 equipments 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

Assessment Scheme:

Internal Assessment:

End Semester Examination:

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	Credits
IL 473	**Design for sustainability**	**3**

Objectives:

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

Outcomes: Learner will be able to…

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

Module	**Detailed Contents**	**Hrs**
1	Introduction - Need, Evolution of sustainability within Design, environmental - economic sustainability concept, Challenges for sustainable development, Environmental agreement & protocols	6
2	Product Life Cycle Design – Life Cycle Assessment, Methods & Strategies, Software Tools	6
3	Sustainable Product - Service System Design, Definition, Types & Examples ,Transition Path and Challenges, Methods and Tools, Design thinking and design process for sustainable development	8
4	Design for Sustainability – Engineering Design Criteria and Guidelines	6
5	Design for Sustainability – Architecture, Agriculture, Cities & Communities, Carbon Footprint	6
6	Green Building Technologies - Necessity, Principles, low energy materials, effective systems	6

Assessment Scheme:

Internal Assessment:

End Semester Examination:

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	Credits
IL 474	Political Science	**3**

Objectives:

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

Outcomes: Learner will be able to…

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

7.

Module	Detailed Contents	Hrs
1	Understanding Political Theory- Evolution of State, Nation, Sovereignty, Types and Linkages between Power and Authority; Interrelationships between Law. Liberty, Equality, Rights; Justice and Freedom, Democracy vs Authoritarianism	4
2	Constitutional Government in India -Evolution of the Indian Constitution, . Fundamental Rights and Duties. Directive Principles. Union-State Relations, Union Legislature: Rajya Sabha, Lok Sabha: Organisation, Functions – Law making procedure, Parliamentary procedure, 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: ideologies and programmes. Coalition politics in India: nature and trends. 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 politics. 6. New Social Movements since the 1970s: (a) environmental movements (b) women's movements (c) human rights movements.	6

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: 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

Assessment Scheme:

Internal Assessment: Test 1-10 marks
Test 2-10 marks
Average- 10 marks

End Semester Examination: Theory- 40 marks
Term work- 25 marks (10 marks for assignment, 10 marks for practical (in the form of debates) and 5 marks for attendance)

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	Credits
IL 475	**Research Methodology**	**3**

Objectives:

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

Outcomes: At the end of the course **l**earner will be able to…

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.

Module	Detailed Contents	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	8

	i. Hypothesis testing and Interpretation of Data **j.** Preparation of Research Report	
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

Assessment Scheme:

Internal:

Assessment consists of two tests out of which; one should be compulsory class test and the other is either.
a class test or at least 3assignment on complete syllabus or course project.

End Semester Examination:

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question.
papers of end semester examination. **In question paper weightage of each module will be proportional**
to number of respective lecture hours as mentioned in the syllabus.
1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

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

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 477	Cooking and Nutrition	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 477	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 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	4

	Kitchen planning	freezers, small kitchen equipment, e.g. knives, pans, small electrical kitchen equipment, e.g. food processors, electric kettles, Advantages and disadvantages of microwave ovens, Organisation of cooking area and equipment for efficient work., Selection, Use and care of: work surfaces, flooring, walls and wall coverings, lighting, ventilation	
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 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	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 491	Project-B	--	08	--	--	04	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
EC 491	Project-B	--	--	--	--	50	--	100	150

Course Objectives:

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

Course Outcomes: Upon successful completion of the course students will be able to

1. Discover potential research areas in the field of Electronics and Computer Science Engineering.
2. Conduct a survey of several available literatures 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.

Guidelines:

1. **Project Topic:**
   - To proceed with the project work it is very important to select a right topic. Project can be undertaken on any domain of Electronics and Computer Science Engineering programme. Research and development projects on problems of practical and theoretical interest should be encouraged.
   - Project work must be carried out by the group of at least two students and maximum four and must be original.
   - Students can certainly take ideas from anywhere, but be sure that they should evolve them in the unique way to suit their project requirements.
   - The project work can be undertaken in a research institute or organization/company/any business establishment.
   - Student must consult internal guide along with external guide (if any) in selection of topic.
   - Head of department and senior staff in the department will take decision regarding selection of projects.
   - Student has to submit weekly progress report to the internal guide and whereas internal guide has to keep track on the progress of the project and also has to maintain attendance report. This progress report can be used for awarding the term work marks.
   - In case of industry projects, visit by internal guide will be preferred.

2. Project Report Format:

At the end of semester a project report should preferably contain at least following details:-

- Abstract
- Introduction
- Literature Survey
  a) Survey Existing system
  b) Limitation of the Existing system or research gap
  c) Problem Statement and Objective
  d) Scope
- Proposed System
  a) Analysis/Framework/ Algorithm
  b) Details of Hardware & Software
  c) Design details
  d) Methodology (your approach to solve the problem)
- Implementation Plan for next semester
- Conclusion
- References

3. Term Work:

Distribution of marks for term work shall be as follows:

a) Weekly Attendance on Project Day
b) Contribution in the Project work
c) Project Report (Spiral Bound)
d) Term End Presentation (Internal)

The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

4. Oral Exam:

Oral examination of Project-B should be conducted by Internal and External Examiners. Students have to give a presentation and demonstration on Project- B.

Bachelor of Technology
In
Electronics & Computer Science

(Semester VIII)

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 492	Project C	--	6	--	--	3	--	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Average					
EC 492	Project C	--	--	--	--	50	--	50	100

Course Objectives:

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

Course Outcomes:

1. Discover potential research areas in the field of Electronics and Computer Science Engineering.
2. Conduct a survey of several available literatures 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

Lab Assessment:

Guidelines:
1. Project Report Format:

At the end of the semester the student needs to prepare a project report which should be prepared as per the guidelines issued by the ECS Department. Along with the project report a CD containing: project documentation, Implementation code, required utilities, Software‘s and user Manuals need to be attached.

2. Term Work:

Students have to submit a weekly progress report to the internal guide and the internal guide has to keep a track on the progress of the project and also has to maintain the attendance report. This progress report can be used for awarding the term work marks. In case of industry projects, visits by internal guide will be preferred to get the status of the project. Distribution of marks for term work shall be as follows:

a) Weekly Attendance on Project Day
b) Project work contributions as per objective
c) Project Report (Hard Bound)
d) Term End Presentation (Internal)

The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

3. Oral Exam:

Oral examination of Project-C should be conducted by Internal and External Examiners. Students have to give a presentation and demonstration on the Project- C.