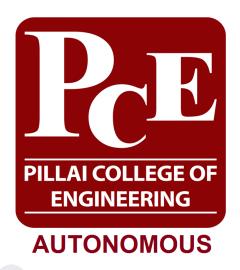Mahatma Education Society's

Pillai College of Engineering

(Autonomous)

Affiliated to University of Mumbai

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

Department of Electronics & Computer Science

Syllabus

of

B.Tech. in Electronics & Computer Science

for

The Admission Batch of AY 2020-21

First Year - Effective from Academic Year **2020-21**

Second Year - Effective from Academic Year **2021-22**

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

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

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 - Syllabus for Undergraduate Programme

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:

$$SGPI = \frac{C_1 G_1 + C_2 G_2 + C_3 G_3 + C_4 G_4 + C_5 G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

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,

$$CGPI = \frac{C_1 G_1 + C_2 G_2 + C_3 G_3 + \dots + C_i * G_i + \dots + C_n G_n}{C_1 + C_2 + C_3 + \dots + C_i + \dots + C_n}$$

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**	22
3	**Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**	29
4	**Professional Core Courses**	58
5	**Professional Elective Courses**	24
6	**Open subjects – Electives from other technical and /or emerging subjects**	9
7	**Project work, seminar and internship in industry or elsewhere**	13
8	**Mandatory Courses** **[Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]**	**(non-credit)**
	Total	164

Semester-wise Credits and Marks

Sr. No.	Semester	Credits Assigned	Marks Assigned
1	I*	18*	675*
2	II*	20*	725*
3	III*	24*	825*
4	IV	23	800
5	V	21	725
6	VI	22	775
7	VII	22	760
8	VIII	14	400
Total Credits & Marks		**164**	**5685**

*First, Second and Third Semester marks and credits are as per MU R2019 Scheme

Department of Electronics & Computer Science - Syllabus for Undergraduate Programme

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 2020-21 from Semester IV onwards. 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
UNIVERSITY OF MUMBAI
Semester I

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
FEC101	Engineering Mathematics-I	3	--	1*	3	--	1	4
FEC102	Engineering Physics-I	2		--	2		--	2
FEC103	Engineering Chemistry-I	2	--	--	2	--	--	2
FEC104	Engineering Mechanics	3	--	--	3	--	--	3
FEC105	Basic Electrical Engineering	3	--	--	3	--	--	3
FEL101	Engineering Physics-I	--	1	--	--	0.5	--	0.5
FEL102	Engineering Chemistry-I	--	1	--	--	0.5	--	0.5
FEL103	Engineering Mechanics	--	2	--	--	1	--	1
FEL104	Basic Electrical Engineering	--	2	--	--	1	--	1
FEL105	Basic Workshop practice-I	--	2	--	--	1	--	1
Total		**13**	**08**	**01**	**13**	**04**	**01**	**18**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
FEC101	Engineering Mathematics-I	20	20	20	80	3	25	--	125
FEC102	Engineering Physics-I	15	15	15	60	2	--	--	75
FEC103	Engineering Chemistry-I	15	15	15	60	2	--	--	75
FEC104	Engineering Mechanics	20	20	20	80	3	--	--	100
FEC105	Basic Electrical Engineering	20	20	20	80	3	--	--	100
FEL101	Engineering Physics-I	--	--	--	--	--	25	--	25
FEL102	Engineering Chemistry-I	--	--	--	--	--	25	--	25
FEL103	Engineering Mechanics	--	--	--	--	--	25	25	50
FEL104	Basic Electrical Engineering	--	--	--	--	--	25	25	50
FEL105	Basic Workshop practice-I	--	--	--	--	--	50	--	50
Total		**--**	**--**	**90**	**360**	**--**	**175**	**50**	**675**

* May be conducted batch-wise

Program Structure for
Bachelor of Technology in Electronics & Computer Science
UNIVERSITY OF MUMBAI
Semester II

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
FEC201	Engineering Mathematics-II	3	--	1*	3	--	1	4
FEC202	Engineering Physics-II	2	--	--	2	--	--	2
FEC203	Engineering Chemistry-II	2	--	--	2	--	--	2
FEC204	Engineering Graphics	2	--	--	2	--	--	2
FEC205	C programming	2	--	--	2	--	--	2
FEC206	Professional Communication and Ethics- I	2	--	--	2	--	--	2
FEL201	Engineering Physics-II	--	1	--	--	0.5	--	0.5
FEL202	Engineering Chemistry-II	--	1	--	--	0.5	--	0.5
FEL203	Engineering Graphics	--	4	--	--	2	--	2
FEL204	C programming	--	2	--	--	1	--	1
FEL205	Professional Communication and Ethics- I	--	2	--	--	1	--	1
FEL206	Basic Workshop practice-II	--	2	--	--	1	--	1
Total		**13**	**12**	**01**	**13**	**06**	**01**	**20**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. /oral	Total
		Internal Assessment			End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
FEC201	Engineering Mathematics-II	20	20	20	80	3	25	--	125
FEC202	Engineering Physics-II	15	15	15	60	2	--	--	75
FEC203	Engineering Chemistry-II	15	15	15	60	2	--	--	75
FEC204	Engineering Graphics	15	15	15	60	3	--	--	75
FEC205	C programming	15	15	15	60	2	--	--	75
FEC206	Professional Communication and Ethics- I	10	10	10	40	2	--	--	50
FEL201	Engineering Physics-II	--	--	--	--	--	25	--	25
FEL202	Engineering Chemistry-II	--	--	--	--	--	25	--	25
FEL203	Engineering Graphics	--	--	--	--	--	25	50	75
FEL204	C programming	--	--	--	--	--	25	25	50
FEL205	Professional Communication and Ethics- I	--	--	--	--	--	25	--	25
FEL206	Basic Workshop practice-II	--	--	--	--	--	50	--	50
Total		**--**	**--**	**90**	**360**	**--**	**200**	**75**	**725**

* May be conducted batch-wise

Program Structure for
Bachelor of Technology in Electronics & Computer Science

UNIVERSITY OF MUMBAI
Semester III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECC 301	Engineering Mathematics - III	3	-	1	3	-	1	4
ECC 302	Electronic Devices	3	-	-	3	-	-	3
ECC 303	Digital Electronics	3	-	-	3	-	-	3
ECC 304	Data Structures and Algorithms	3	-	-	3	-	-	3
ECC 305	Database Management Systems	3	-	-	3	-	-	3
ECL301	Electronic Devices Lab	-	2	-	-	1	-	1
ECL302	Digital Electronics Lab	-	2	-	-	1	-	1
ECL303	Data Structures and Algorithms Lab	-	2	-	-	1	-	1
ECL304	Database Management Systems lab	-	2	-	-	1	-	1
ECL305	Skill-base Lab - OOPM: (C++ and Java)	-	4	-	-	2	-	2
ECM301	Mini-project -1 A	-	4$	-	-	2	-	2
	Total	**15**	**16**	**1**	**15**	**8**	**1**	**24**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Practical /Oral	Total
		Internal Assessment			End Sem. Exam	Exam.Duration (Hrs)			
		Test 1	Test 2	Avg.					
ECC 301	Engineering Mathematics III	20	20	20	80	3	25	-	125
ECC 302	Electronic Devices	20	20	20	80	3	-	-	100
ECC 303	Digital Electronics	20	20	20	80	3	-	-	100
ECC 304	Data Structures and Algorithms	20	20	20	80	3	-	-	100
ECC 305	Database Management Systems	20	20	20	80	3	-	-	100
ECL 301	Electronic Devices Lab	-	-	-	-	-	25	25	50
ECL 302	Digital Electronics Lab	-	-	-	-	-	25	25	50
ECL 303	Data Structures and Algorithms Lab	-	-	--	-	-	25	25	50
ECL 304	Database Management systems lab	-	-	-	-	-	25	25	50
ECL 305	Skill base Lab - OOPM: (C++ and Java)	-	-	-	-	-	50	-	50
ECM 301	Mini Project - 1A						25	25	25
	Total	**-**	**-**	**100**	**400**	**-**	**200**	**125**	**825**

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	Instrumentation & Control System	T	3	-	3	-	3
EC 210	Communication Engineering	TL	2	2	2	1	3
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	Mini Project II (Python Programming)	LPC	-	1#+2	-	1	1
Total			**17**	**12**	**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 208	Engineering Mathematics IV	40	40	40	60	2	25	-	125
EC 209	Instrumentation & Control System	40	40	40	60	2	-	-	100
EC 210	Communication Engineering	40	40	40	60	2	25	-	125
EC 211	Microprocessor and Microcontrollers	40	40	40	60	2	25	-	125
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	Mini Project II (Python 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 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	Computer Organization & Architecture	T	3	-	3	-	3
EC 304	Software Engineering	T	3	-	3	-	3
EC 305	Professional Communication & Ethics II	TC	1	2	1	1	2
EC 3xx	Department Level Optional Course I	TL	3	2	3	1	4
EC 391	Mini Project III (Web Programming)	LPC	-	$1^{\#}+2$	-	1	1
Total			**16**	**10**	**16**	**5**	**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 301	Signals & Systems	40	40	40	60	2	25	-	125
EC 302	Computer Networks	40	40	40	60	2	25	25	150
EC 303	Computer Organization & Architecture	40	40	40	60	2	-	-	100
EC 304	Software Engineering	40	40	40	60	2	-	-	100
EC 305	Professional Communication & Ethics II	-	-	-	-	-	50	-	50
EC 3xx	Department Level Optional Course I	40	40	40	60	2	25	25	150
EC 391	Mini Project III (Web Programming)	-	-	-	-	-	25	25	50
Total									**725**

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

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

Course Code	Department Level Optional Course (DLOC) I	Specializations
EC 306	Computer Graphics & Virtual Reality	AIML
EC 307	Advanced Database Management Systems + DWM	Data Analytics
EC 308	Advanced Operating System	High Performance Computing
EC 309	Basics of VLSI	VLSI Design

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 310	Image Processing & Machine Vision	TLP	3	2	3	1	4
EC 311	Advanced Microprocessor	TL	3	2	3	1	4
EC 3xx	Department Level Optional Course II	TL	3	2	3	1	4
EC 3xx	Department Level Optional Course III	TL	3	2	3	1	4
IL 3xx	Institute Level Optional Course I	T	3	-	3	-	3
EC 312	Skill Lab on R-Programming	L	-	2	-	1	1
EC 392	Project A (Literature Survey & Problem Formulation)	LPC	-	4	-	2	2
Total			**15**	**14**	**15**	**7**	**22**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
EC 310	Image Processing & Machine Vision	40	40	40	60	2	25	25	150
EC 311	Advanced Microprocessors	40	40	40	60	2	25	-	125
EC 3xx	Department Level Optional Course II	40	40	40	60	2	25	25	150
EC 3xx	Department Level Optional Course III	40	40	40	60	2	25	25	150
IL 3xx	Institute Level Optional Course I	40	40	40	60	2	-	-	100
EC 312	Skill Lab on R-Programming	-	-	-	-	-	25	25	50
EC 392	Project A (Literature Survey & Problem Formulation)	-	-	-	-	-	25	25	50
Total									**775**

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

Course Code	Department Level Optional Course (DLOC) II	Specializations
EC 313	Artificial Intelligence & Machine Learning	AIML
EC 314	Big Data Analytics	Data Analytics
EC 315	Parallel Computing Architecture	High Performance Computing
EC 316	Integrated Circuit Technology	VLSI Design
Course Code	Department Level Optional Course (DLOC) III	Specializations
EC 317	Digital Signal Processing	Robotics
EC 318	Advanced Network Theory	System Security
EC 319	Mobile Computing	Cloud Computing
EC 320	Wireless Networks	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 IV	TL	3	2	3	1	4
EC 4xx	Department Level Optional Course V	TL	3	2	3	1	4
EC 4xx	Department Level Optional Course VI	T	3	-	3	-	3
EC415	Human Values and Social Ethics	T	2	-	2	-	2
IL 4xx	Institute Level Optional Course II	T	3	-	3	-	3
EC 491	Project B	LPC	-	8	-	4	4
Total			**16**	**12**	**16**	**6**	**22**

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	1.5 Hrs	-	-	60
EC 4xx	Department Level Optional Course IV	40	40	40	60	2	25	25	150
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	-	-	100
EC 415	Human Values and Social Ethics	-	-	-	-	-	50	-	50
IL 4xx	Institute Level Optional Course II	40	40	40	60	2	-	-	100
EC 491	Project B	-	-	-	-	-	50	100	150
Total									**760**

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

Program Structure for
Bachelor of Technology in Electronics & Computer Science

Course Code	Department Level Optional Course (DLOC) IV	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) V**	**Specializations**
EC 406	Speech Processing	Robotics
EC 407	Cryptography and System Security	System Security
EC 408	Cloud and Distributed Computing	Cloud Computing
EC 409	Embedded System Design & Basics of IOT	IOT
Course Code	**Department Level Optional Course (DLOC) VI**	**Specializations**
EC 410	Robotics & Industrial Applications	Robotics
EC 411	Cyber Security & Digital Forensic	System Security
EC 412	Blockchain Technology	Cloud Computing
EC 413	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
Semester VIII

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract	Theory	Pract	Total
IL 4xx	Institute Level Optional Course III	T	3	-	3	-	3
EC 492	Project C	LPC	-	6	-	3	3
EC 493	Internship	LPC	-	16	-	8	8
Total			**3**	**22**	**3**	**11**	**14**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract/ Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
IL 4xx	Institute Level Optional Course III	40	40	40	60	2	-	-	100
EC 492	Project C	-	-	-	-	-	50	50	100
EC 493	Internship	-	-	-	-	-	100	100	200
Total									**400**

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

Course Code	Institute Level Optional Course (ILOC) III	Specializations
IL 480	Digital Business Management and Digital Marketing	Business and Entrepreneurship
IL 481	Medical Image Processing	Bio-Engineering
IL 482	Technologies for Rural Development	Engineering Design
IL 483	Economics	Art and Humanities
IL 484	GIS and Remote Sensing	Applied Science
IL 485	Physical Education	Life Skills, Repair, Maintenance and Safety
IL 486	Environmental Management	

Curriculum for Sem I , Sem II and Sem III is as per Mumbai University.

MU R 2019 ECS Curriculum for SEM I, SEM II

MU R 2019 ECS Curriculum for SEM III

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.	05
4.	**Graphs and Trees:, Lattice Theory& Recurrence relation**	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 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	11
5.	**Complex 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)	06
6.	**Vector Integration**	Vector integral: Line Integral, Green's theorem in a plane (Without Proof), Stokes' theorem (Without Proof) only evaluation. Gauss' divergence	05

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:

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	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 209	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 analyse 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. Analyse 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.
1.	**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.	07
2.	**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.	07

3.	**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
4.	**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.	06
5.	**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. Cloud based SCADA systems. Introduction to Distributed Control system [D.C.S] and fibre optic instrumentation.	07
6.	**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.	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 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.

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 210	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 210	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 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	--	--	125

Prerequisite: Digital System Design

Course Objectives:
1. To understand the basic concepts of Microcomputer systems.
2. To understand the architecture of the 16-bit Microprocessor 8086.
3. To understand the architecture of 8-bit Microcontroller 8051.
4. To write programs for 8051 Microcontrollers and their applications in Assembly Language.
5. To understand peripheral devices and their interfacing to Microcontrollers.

Course Outcomes:
After successful completion of the course students will be able to
1. Understand the basic concepts of Microcomputer systems.
2. Understand the architecture and aspects of 8086 microprocessor and 8051 microcontroller.
3. Study the in-depth working of the 8051 microcontroller and their Instruction set.
4. Interface various peripheral devices to 8051 Microcontroller.
5. Write programs for 8051 microcontrollers.

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Introduction to Microprocessor System.**	**1.1** Microprocessor based system: CPU, I/O Devices, Clock, Memory, Concept of Address, Data and Control Bus, **1.2** Introduction to 8086 Microprocessor: 8086 architecture & 8086 pin description in detail. **1.3** Major features of 8086 microprocessor.**1.4** pipelined operation **1.5** Programmer's Model & Memory Segmentation. **1.6** Minimum and Maximum mode of 8086. **1.7** Read and Write bus cycle of 8086.	07
2.	**Programming of 8086 Microprocessor**	**2.1** Addressing modes **2.2** Instruction set and assembler directives **2.3** Assembly language programming **2.4** Stack memory, Interrupts and interrupt service routines **2.5** Byte and String Manipulation.	07
3.	**8051 Microcontroller Architecture**	**3.1** Concept of RISC & CISC Architecture, Concept of Harvard & Von Neumann Architecture **3.2** Comparison between	05

		Microprocessor and Microcontroller **3.3** 8051 Features, its architecture and pin configurations **3.4** Memory organization	
4.	**8051 Microcontroller assembly language programming**	**4.1** Addressing modes of 8051. **4.2** Assembler directives of 8051. **4.3** Instruction Set: Data transfer, Arithmetic, Logical, Branching. **4.4** Programs related to: arithmetic, logical, delay, input, output, timer, counters, port, serial communication, and interrupts.	07
5.	**8051 Internal Hardware of 8051 Microcontroller & Programming**	**5.1** I/O port structure and programming.**5.2** Interrupts and programming.**5.3** Timer/Counter and programming. **5.4** Serial port and programming.	08
6.	**8051 Interfacing & Applications**	6.1 Display interfacing: 7-segment LED display, 16x2 generic alphanumeric LCD display.**6.2** Analog devices interfacing: 8-bit ADC/DAC **6.3** Motor interfacing: dc motor, stepper motor and servo motor.	05

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	To write an assembly language program to perform Arithmetic and Logical Operations using 8086 microprocessor.
2	To write an assembly language program to transfer data bytes and string operations using 8086 microprocessor.
3	To write an assembly language & C program to perform Arithmetic and Logical Operations using 8051 microcontroller.
4	To write an assembly language & C program to perform experiments based on General Purpose Input-Output & Timers 8051.
5	An assembly language & C program for Interfacing of LCD with 8051 microcontroller.
6	An assembly language & C program for Interfacing of hex keypad with 8051 microcontroller.
7	An assembly language & C program for Serial communication of 8051 using UART.
8	An assembly language & C program for Interfacing of Stepper Motor / DC motor with 8051 microcontroller.
9	An assembly language & C program for interrupt based application with 8051 microcontroller.
10	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 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:

At Least 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 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.

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.

Back to Scheme

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, Multiplication of 2 polynomials using Fast Fourier Transform 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 Branch-and-bound**	Backtracking: General method, graph coloring Branch and Bound: General method, applications - 0/1 knapsack problem- LC Branch and Bound solution, FIFO Branch and Bound solution.	05
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 Fast Fourier Transform for multiplication of 2 polynomials.
2	Implement Merge and Quick sort algorithms.
3	Implement Bellman-Ford algorithm.
4	Implement Floyd-Warshall algorithm.
5	Implement Dijkstra's algorithm for the single source shortest path problem on a given weighted graph.
6	Implement Prim/Kruskal algorithm for finding a minimum cost spanning tree of a given input graph.
7	Implement a backtracking based algorithm for vertex coloring of a given graph.
8	Implement Johnson's algorithm for shortest paths, for a given graph.
9	Implement a randomized algorithm for searching an element in an unsorted array and derive its expected time complexity.
10	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 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.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 practical's 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.	02

Sr. No.	Topic	Description	Hours
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.	09
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 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:

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.

Back to Scheme

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 292	Mini Project II (Python Programming)	--	1#+2	--	--	01	--	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	Mini Project II (Python Programming)	--	--	--	--	25	25	--	50

Course prerequisite:

Basics of Python Programming, Skill Lab: C++ and Java Programming.

Course Objectives:
  1. Infer the Object-oriented Programming concepts in Python.
  2. Formulate GUI Programming and Database operations in Python.
  3. Explore file and database handling in Python.
  4. Identify problems based on societal /research needs.
  5. Develop applications based on machine learning, deep learning using Python.
  6. Examine methodology in detail about impact of solutions in societal and environmental context for sustainable development.

Course Outcomes:

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

  1. Interpret object-oriented programming in Python
  2. Design GUI Applications in Python.
  3. Handle Database operations in Python .
  4. Identify problems based on societal /research needs , write code using Python and demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
  5. Develop machine learning applications using Python.
  6. Analyze the impact of solutions in societal and environmental context for sustainable development.

DETAILED SYLLABUS:

Module No.	Unit No.	Topics	Hrs.
1.0		**Introduction to Python - a recap**	3
	1.1	Introduction to Python, strings, Lists, Tuples,Strings, Lists, Tuples, Dictionaries, Sets	
	1.2	Functions and file handlings.	
2.0		**Object Oriented Programming**	4
	2.1	**Assertion, decorators**	
	2.2	Generators, Iterators	
3.0		**Basic databases using Python**	5
	3.1	Introduction to Pandas, Pandas data structures – Series and DataFrame , Data wrangling using pandas, Loading a dataset into a dataframe	
	3.2	Selecting Columns from a dataframe, Selecting Rows from a dataframe, Adding new data in a dataframe, Deleting data from a dataframe	
4.0		**GUI in Python**	5
	4.1	Introduction to GUI building libraries, Widgets, Button, Canvas, Checkbutton, Entry, Frame, Label, Listbox, Menubutton, Menu, Message, Radiobutton, Scale, Scrollbar, Text, Toplevel,Spinbox, PanedWindow, LabelFrame	
5.0		**Numpy, Matplotlib, Seaborn, Scipy**	5
	5.1	Introduction to Numpy, Creating and Printing Ndarray, Class and Attributes of Ndarray, Basic operation, Copy and view, Mathematical Functions of Numpy.	
	5.2	Introduction to Matplotlib, Scatter plot, Line plot, Bar chart, Histogram, Introduction to seaborn and scipy	
6.0		**Basic image processing using Python**	**4**
	6.1	Introduction to digital image processing, Basic operations on an image, Crop, Scale, Rotate, Flip, Changing contrast, brightness and color, Edge detection, blur, sharpening	

Text Books:

1. Yashavant Kanetkar, "Let us Python: Python is Future, Embrace it fast", BPB Publications; 1 edition (8 July 2019).
2. Dusty Phillips, "Python 3 object-oriented Programming", Second Edition PACKT Publisher August 2015.
3. John Grayson, "Python and Tkinter Programming", Manning Publications (1 March 1999). 4. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech Press
4. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox publication 6. Introduction to computing and problem solving using python , E Balagurusamy, McGraw Hill Education.
5. Zed A. Shaw, "Learn Python the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code", Addison Wesley; 3 edition (1 October 2013).

Reference Books:

1. Eric Matthes, "Python Crash Course A hands-on, Project Based Introduction to programming" No Starch Press; 1 edition (8 December 2015).
2. Paul Barry, "Head First Python" O′Reilly; 2 edition (16 December 2016)
3. Andreas C. Mueller, "Introduction to Machine Learning with Python", O′Reilly; 1 edition (7 October 2016)
4. David Beazley, Brian K. Jones, "Python Cookbook: Recipes for Mastering Python 3", O'Reilly Media; 3 edition (10 May 2013).
5. Bhaskar Chaudhary, "Tkinter GUI Application Development Blueprints: Master GUI programming in Tkinter as you design, implement, and deliver 10 real world application", Packt Publishing (November 30, 2015)

Software Tools:

1. Python IDE: https://www.python.org/downloads/
2. Anaconda Environment: https://www.anaconda.com/distribution/

Online Repository:

1. Github
2. Python 3 Documentation: https://docs.python.org/3/
3. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/
4. http://spoken-tutorial.org
5. Python 3 Tkinter library Documentation: https://docs.python.org/3/library/tk.html
6. Numpy Documentation: https://numpy.org/doc/
7. Pandas Documentation: https://pandas.pydata.org/docs/
8. Matplotlib Documentation: https://matplotlib.org/3.2.1/contents.html
9. Scipy Documentation : https://www.scipy.org/docs.html
10. Machine Learning Algorithm Documentation: https://scikit-learn.org/stable/
11. https://nptel.ac.in/courses/106/106/106106182/

Suggested list of sample course projects:
1. Human Activity Recognition with Video Classification
2. drowsiness detection
3. Image caption generator
4. Speed typing Test using Python
5. Train announcement system using python

6. Develop classification model using freely available datasets
7. Develop python application for sentiment analysis

Guidelines for Mini Project

1. 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.
2. 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.
3. Students shall submit an implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini projects.
4. 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.
5. Distribution of Term work marks for both semesters shall be as below;
6. Marks awarded by guide/supervisor based on log book : 10
7. Marks awarded by review committee : 10
8. Quality of Project report : 05
9. Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
10. 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:

● Marks awarded by guide/supervisor based on log book : 10
● Marks awarded by review committee : 10
● Quality of Project report : 05

2.Oral/Practical Assessment:

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

Software Requirements:
Python IDE: https://www.python.org/downloads/
https://docs.anaconda.com/anaconda/navigator/

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 operations on the signals- Time Shifting, Time scaling,	07

		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 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 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.

Back to Scheme

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 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 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.

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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.

Back to Scheme

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 303	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 303	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 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.

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

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Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 304	Software Engineering	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 304	Software Engineering	40	40	40	60	--	--	--	100

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 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.

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

Back to Scheme

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 305	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 305	Professional Communication and 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.

Department of Electronics & Computer Science - Syllabus for Undergraduate Programme

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**	5.1 Writing 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.

Back to Scheme

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 306	Computer Graphics and Virtual Reality	03	--	--	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	Computer Graphics and Virtual Reality	40	40	40	60	25	--	25	150

Course Objectives:
1. To introduce the use of the components of a graphics system and become familiar with the building approach of graphics system components and algorithms related to them.
2. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
3. To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.
4. To comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles, and applications.

Course Outcomes: Upon successful completion of the course students will be able to
1. List the basic concepts used in computer graphics.
2. Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
3. Describe the importance of viewing and projections.
4. Define the fundamentals of animation, virtual reality and its related technologies.
5. Understand a typical graphics pipeline
6. Design an application with the principles of virtual reality

Prerequisite: Basic Mathematics (knowledge of Matrices)
DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Introduction to Computer graphics and Output primitives**	Introduction: Display Devices, Bitmap and Vector based graphics, Overview of Coordinate System. Scan Conversion of: point, line using Digital differential analyzer & Bresenham's algorithm, circle using midpoint approach, Curve Generation:	07

		Bezier and B-Spline curves. Introduction to fractals: generation procedure, classification, dimension and Koch Curve.	
2.	**Area Filling, Transformations (2D and 3D)**	Area filling: Inside/Outside Test, Scan line Polygon Fill Algorithm, Boundary Fill and Flood Fill algorithm. Basic Geometrical 2D Transformations: Translation, Rotation, Scaling, Reflection, Shear, their homogeneous Matrix representation and Composite transformation. Three Dimensional transformations: Translation, Scaling, Rotations, Composite.	06
3.	**Viewing (2D and 3D) and Clipping, Projection**	Viewing: Introduction, Viewing Pipeline, View Coordinate reference frame, Window to viewport transformation. Three-Dimensional Viewing: 3D Pipeline, Viewing transformation, Clipping: Point clipping, Line clipping: Cohen Sutherland Algorithm, Liang Barsky algorithms, Polygon clipping: Sutherland Hodgeman polygon clipping and Weiler Atherton. Text Clipping. Projections: Parallel (Oblique and orthographic), perspective (one, two and three Point) with matrix representation.	09
4.	**Introduction To Animation**	Animation: Key Frame Animation, Animation Sequence, Motion Control Methods. Morphing, Warping- Mesh Warping.	06
5.	**Introduction to Virtual Reality**	Virtual Reality: Basic Concepts, Overview and perspective on virtual reality, Human sensation and perception. Classical Components of VR System, Types of VR Systems, Three-Dimensional Position Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces, Input Devices, Graphical Display, Sound displays, and Haptic Feedback. Graphical Rendering Pipeline, Haptic Rendering Pipeline, Open GL rendering pipeline. Applications of Virtual Reality.	06
6.	**VR Modeling and Programming**	Geometric Modeling: Virtual Object Shape, Object Visual Appearance. Kinematics Modeling: Object Position, Transformation Invariants, Object Hierarchies, Physical Modeling: Collision Detection, Surface Deformation, Force Computation. Behavior Modeling. Programming through VRML/X3D: Defining and Using Nodes and Shapes, VRML Browsers, Java 3D, OpenCV for augmented reality.	05

DETAILED LAB SYLLABUS:

Prerequisite: Knowledge of C/C++ programming language

Software Requirements: C compiler.

SN	Detailed Lab Description
1	Implement DDA Line Drawing algorithm
2	Implement midpoint Circle algorithm.
3	Implement Area Filling Algorithm: Boundary Fill, Flood Fill.
4	Implement Curve: Bezier for n control points
5	Character Generation: Bit Map method or Stroke Method

6	Implement 2D Transformations: Translation, Scaling, Rotation
7	Implement Line Clipping Algorithm: Cohen Sutherland
8	Implement polygon clipping algorithm : Sutherland Hodgeman
9	Perform projection of a 3D object on Projection Plane
10	Perform Animation (Use multiple objcts)
11	Create interactive application(games)
12	Design VR system for real time requirement (e.g. car driving simulator for driving learners)

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 Assessments:
1. Term work Assessment:
  ● Term work should consist of 10 experiments.
  ● Journal must include at least 2 assignments
  ● Mini Project to be performed using C /C++/OpenGL/Blender/ any other tool (2/3 students per group). Possible Ideas: Game development with audio, Graphics editor: Like Paint brush, Text editor etc.
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. Donald Hearn and M. Pauline Baker, "Computer Graphics", Pearson Education.
2. R. K Maurya, "Computer Graphics with Virtual Reality", Wiley India.
References:
1. Grigore Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley.
2. Steven Harrington, "Computer Graphics", McGraw Hill.
3. Rogers, "Procedural Elements of Computer Graphics", Tata McGraw Hill.
4. Vince, "Virtual Reality Systems", Pearson Education.

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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

Sr. No.		Topic	Content	Hours
			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 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 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.

Back to Scheme

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

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
		inodes: Structure of file Directories, Path conversion to inode, superblock, inode assignment, allocation of disk blocks	
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 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 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	Basics of VLSI	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	Basics of VLSI	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 design different scaling effects.
4. To design semiconductor memories and its importance.
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 a clear understanding of choice of technology and technology scaling.
2. Understand the design of MOSFET Inverters.
3. Analyze and design MOS based circuits design styles.
4. Understand the design of Semiconductor Memories.
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.	**Technology Comparison, MOSFET Scaling**	Comparison of BJT, NMOS and CMOS technology Types of scaling, Level 1 and Level 2 MOSFET Models, MOSFET capacitances	07
2.	**MOSFET Inverters**	**Circuit Analysis:** Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load and	08

		CMOS inverter, comparison of all types of MOS inverters, design of CMOS inverters **Logic Circuit Design**: Analysis and design of 2-I/P NAND and NOR using equivalent CMOS inverter, W/L ratio, Complex circuits	
3.	**MOS Circuit Design Styles**	**Design Styles:** Static CMOS, pass transistor logic, transmission gate, Pseudo NMOS, Domino, NORA, Zipper, C2MOS, sizing using logical effort **Circuit Realization:** SR Latch, JK FF, D FF, 1 Bit Shift Register, MUX, decoder using above design styles	07
4.	**Semiconductor Memories**	**SRAM:** ROM Array, SRAM (operation, design strategy, leakage currents, read/write circuits), DRAM (Operation 3T, 1T, operation modes, leakage currents, refresh operation), Flash (mechanism, NOR flash, NAND flash) **Peripheral Circuits:** Sense amplifier, decoder	06
5.	**Data Path Design**	**Adder:** Bit adder circuits, ripple carry adder, CLA adder **Multipliers and shifter:** Partial-product generation, partial-product accumulation, final addition, barrel shifter	05
6.	**VLSI Clocking and System Design**	**Clocking:** CMOS clocking styles, Clock generation, stabilization and distribution **Low Power CMOS Circuits:** Various components of power dissipation in CMOS, Limits on low power design, low power design through voltage scaling **IO pads and Power Distribution:** ESD protection, input circuits, output circuits, simultaneous switching noise, power distribution scheme **Interconnect:** Interconnect delay model, interconnect scaling and crosstalk	06

DETAILED LAB SYLLABUS:

Software Requirements: 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 VOH and VOL levels. 2) Comparision 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 VOH and VOL 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.
9	Case Study.
10	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 Assessments:
- Term work should consist of 10 experiments.
- Journal must include at least 2 assignments.
- Mini Project to be performed.
  1. Term work Assessment:
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. 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.

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Department of Electronics & Computer Science - Syllabus for Undergraduate Programme

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 391	Mini Project III (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 391	Mini Project III (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 for practice		
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).

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.

Distribution of Term work marks shall be as below;

● Marks awarded by guide/supervisor based on log book : 10

● Marks awarded by review committee : 10

● Quality of Project report : 05

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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 310	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 310	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 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	Hrs
1.	**Digital Image Fundamentals**	Introduction – Origin – Steps in Digital Image Processing , Components, Elements of Visual Perception – Image Sensing and Acquisition, Image Sampling and Quantization – Relationships between pixels, Transformation: Orthogonal, Euclidean, Affine Color Image Processing: Color Fundamentals Color models.	04

Sr. No.				
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 exams will be based on the entire syllabus.

Text Books:

1. Gonzales and 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.

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Department of Electronics & Computer Science - Syllabus for Undergraduate Programme

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 311	Advanced Microprocessors	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 Microprocessors	40	40	40	60	25	--	--	125

Course Objectives:
1. To understand the basic concepts of microcomputer systems.
2. To understand architecture of 16-bit Microprocessor 80186.
3. To understand architecture of 32-bit Microcontroller ARM Cortex M3.
4. To write programs for ARM Cortex M3 Microcontroller and their applications in C Language.
5. To understand basics of Embedded system.

Course Outcomes: Upon successful completion of this course, the learner will be able to
1. Understand the architecture and aspects of 80386 microprocessor
2. Understand the operating modes, address modes of 80386 microprocessor
3. Understand the architecture and aspects of ARM Cortex M3 microcontroller.
4. Study the in-depth working of the Cortex M3 microcontroller and their Instruction set.
5. Write programs for Cortex M3 microcontroller.
6. Study basics of embedded system.

Prerequisite: Microprocessor & Microcontroller.
DETAILED THEORY SYLLABUS:

Module No.	Unit No.	Details	Hrs
1.		**Introduction to Intel 80386DX Processor**	06
	1.1	Salient Features of 80386.	
	1.2	Architecture of 80386.	
	1.3	Pin Description of 80386.	
	1.4	Programming Model of 80386.	
2.		**Intel 80386DX Processor: - 06 hours**	06
	2.1	Operating Modes (Real mode of 80386, Protected mode of 80386, Virtual 8086 mode).	
	2.2	Address Translation Mechanism in Protected Mode.	
	2.3	Memory Management.	

	2.4	Protection Mechanism.	
3.	**ARM CORTEX-M3 Architecture**		**10**
	3.1	Comparison of CISC & RISC architectures, overview of ARM family.	
	3.2	ARM Cortex-M3 architecture, Programmer's model: Operation Modes and States, registers, special registers, Application Program Status Register- Integer status flags, Q status flag, GE bits.	
	3.3	Memory system: Features and memory map	
	3.4	Exceptions and Interrupts-Nested vectored interrupt controller	
4.	**ARM Instruction Set**		**07**
	4.1	Data Processing Instructions	
	4.1	Conditional and Branching Instructions	
	4.2	ARM-THUMB Interworking	
	4.4	Single-Register Load-Store Instructions	
	4.5	Stack Instructions	
	4.6	Software Interrupt Instructions	
5.	**ARM Programming with Embedded C**		**05**
	5.1	General Purpose Input Output	
	5.2	Timer Mode	
	5.3	Pulse –Width Modulator Configuration	
6.	**Introduction to Embedded Systems.**		**05**
	6.1	Characteristics and Design metrics of Embedded system.	
	6.2	Real time systems: Need for Real-time systems, Hard-Soft Real-time systems.	
	6.3	Challenges in Embedded system Design: Power, Speed and Code density.	

Theory Assessments:

1.Internal Assessment:

Assessment consists of two class tests of 40 marks each. The first class test is to be conducted when approximately 40% syllabus is completed and second class test when additional 40% syllabus is completed. The average marks of both the test will be considered for final Internal Assessment. Duration of each test shall be of one hour.

2.End Semester Examination:

● Question paper will comprise of 5 questions, each carrying 20 marks.
● The students need to solve total 3 questions.
● Question No.1 will be compulsory and based on entire syllabus.
● Remaining question (Q.2 to Q.5) will be selected from all the modules.

Text Books:

1. The 80386DX Microprocessor: Hardware, Software and Interfacing: Walter A Triebel, Prentice Hall.
2. Intel 80386 Datasheets
3. Joseph Yiu,"The Definitive guide to ARM CORTEX-M3 & CORTEX-M4 Processors", Elsevier, 2014, 3rd Edition.
4. Dr. K.V. K. K. Prasad, "Embedded Real Time System: Concepts, Design and Programming", Dreamtech, New Delhi, Edition 2014.
5. Rajkamal, "Embedded Systems: Architecture, Programming and Design", McGraw Hill Education (India) Private Limited, New Delhi, 2015, Edition 3rd.

Reference Books:

1. David Seal, "ARM Architecture", Reference Manual (2nd Edition), Publisher Addison Wesley.
2. Jonathan W. Valvano, "Embedded Microcomputer Systems – Real Time Interfacing", Publisher - Cengage Learning, 2012 Edition 3rd.

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Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 313	Artificial Intelligence and 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 313	Artificial Intelligence and Machine Learning	40	40	40	60	25	--	25	150

Course Objectives:
1. To conceptualize the basic ideas and techniques of AI
2. To distinguish various search techniques and to make student understand knowledge representation and planning
3. To introduce students to the basic concepts and techniques of Machine Learning
4. To become familiar with regression methods, classification methods, clustering methods

Course Outcomes: Upon completion of the course students will be able to
1. Identify the various characteristics of Artificial Intelligence.
2. Choose an appropriate problem solving method for an agent to find a sequence of actions to reach the goal state.
3. Analyze the strength and weakness of AI approaches to knowledge representation, reasoning and planning.
4. Gain knowledge about basic concepts of Machine Learning.
5. Identify machine learning techniques suitable for a given problem.
6. Solve the problems using various machine learning techniques.

Prerequisite:
Prerequisite:
Basic Mathematics, Algorithms, Data Structures, Basic Probability and Statistics

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1.	**Introduction to Artificial Intelligence(AI)**	Introduction and Definition of Artificial Intelligence. Intelligent Agents : Agents and Environments ,Rationality, Nature of Environment, Structure of Agent, types of Agent	05
2.	**Problem Solving**	Problem Solving Agent, Problem formulation, Solving Problems by Searching. Uninformed Search Methods: Depth First Search, Breadth First Search, Depth Limited Search, Informed Search Method: Heuristic Function, Greedy Best First Search, A* Search Local Search: Hill Climbing Search, Optimization: Genetic Algorithm, Game Playing-Adversarial search, mini-max algorithm	08
3.	**Knowledge, Reasoning and Planning**	Knowledge based agents First order logic: syntax and Semantic, Knowledge Engineering in FOL Inference in FOL : Unification, Forward Chaining, Backward Chaining and Resolution in FOPL, Planning Agent, Types of Planning: Partial Order, Hierarchical Order, Conditional Order. Expert Systems, Components of Expert System	07
4.	**Introduction to Machine Learning**	Machine Learning, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing a Machine Learning Application. Basics of Neural Networks: Fundamental concepts, Evolution	06
5.	**Learning with Regression and trees:**	Learning with Regression : Linear Regression, Logistic Regression. Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART),	06
6.	**Learning with Classification and clustering**	Classification: Rule based classification, classification by Bayesian Belief networks, Naive Bay's classifier, Hidden Markov Models. Support Vector Machine: Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions. Clustering: K-means Clustering, Expectation Maximization Algorithm.	07

DETAILED LAB SYLLABUS: .

Software Requirements: The programs can be implemented in either JAVA or Python and prolog.

Hardware Requirements: Any basic computational platform is sufficient.

Sr. No.	Detailed Lab Description
1	Provide the PEAS description and TASK Environment for a given AI problem.
2	Write simple programs using PROLOG as an AI programming Language
3	Start Implementation · Knowledge Representation and Create Knowledge Base
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	To implement Logistic Regression
8	To implement Linear Regression
9	Write a program to demonstrate the working of the decision tree based algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample
10	To implement clustering.
11	Write a program to demonstrate Support Vector Machine
12	For a given set of training data examples stored in a .CSV file, implement and demonstrate the different machine learning algorithms and compare the result

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 Assessments:

Termwork Assessment: At least 8-10 experiments covering the entire syllabus should be set to have well predefined inference and conclusion. The experiments should be student centric and attempts should be made to make experiments more meaningful, interesting. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

1. The distribution of marks for term work shall be as follows:
   ● Lab Performance (Experiments /case studies): 15
   ● Assignments: 05
   ● Attendance (Theory & Practical): 05
2. Oral examination will be based on the entire Artificial intelligence and Machine Learning Syllabus.

Text Books:
1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach ―Second Edition" Pearson Education.
2. Elaine Rich and Kevin Knight ―Artificial Intelligence‖, Third Edition‖, Tata McGraw-Hill Education Pvt. Ltd., 2008.
3. George F Luger ―Artificial Intelligence‖ Low Price Edition, Pearson Education., Fourth edition
4. Peter Harrington ―Machine Learning In Action‖, DreamTech Press
5. Ethem Alpaydın, ―Introduction to Machine Learning‖, MIT Press.
6. Tom M. Mitchell, ―Machine Learning‖ McGraw Hill
7. Stephen Marsland, ―Machine Learning An Algorithmic Perspective‖, CRC Press

References:
1. Elaine Rich and Kevin Knight ―Artificial Intelligence‖ Third Edition, Tata McGraw-Hill Education Pvt. Ltd., 2008.
2. Ivan Bratko, ―PROLOG Programming for Artificial Intelligence‖, Pearson Education, Third Edition.
3. Patrick Henry Winston, ―Artificial Intelligence‖, Addison-Wesley, Third Edition.
4. N. P. Padhy, ―Artificial Intelligence and Intelligent Systems‖, Oxford University Press.
5. Satish Kumar "Neural Networks A Classroom Approach" Tata McGrawHill.
6. Margaret.H.Dunham, ―Data Mining Introductory and Advanced Topics‖, Pearson Education
7. Kevin P. Murphy , Machine Learning ― A Probabilistic Perspective
8. Samir Roy and Chakraborty, ―Introduction to soft computing‖, Pearson Edition.
9. Richard Duda, Peter Hart, David G. Stork, ―Pattern Classification‖, Second Edition, Wiley Publications.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 314	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 314	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

Sr. No.	Detailed Lab Description

(continued)

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 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 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

Back to Scheme

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 315	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 315	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 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 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 316	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 316	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	07

		Silicon Oxidation: Thermal oxidation process, Kinetics of growth, Properties of Silicon Dioxide, Oxide Quality. 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 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 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 317	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 317	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

Sr. No.		Topic	Hours
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 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 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 318	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 318	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

Sr.			
		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=0ahUK
   EwjgwcelodTTAhVJrI8KHTQUC9AQFggqMAA&url=http%3A%2F%2Fscilab.in%2Fte
   xtbook_companion%2Fenerate_book%2F3446&usg=AFQjCNGDs2a6AHGKL93l3_j8R
   a1UN-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 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 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 319	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 319	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	08

		protocol architecture UTRAN , UMTS core network	
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 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 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.

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Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 320	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 320	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=0ahUKEwj
gwcelodTTAhVJrI8KHTQUC9AQFggqMAA&url=http%3A%2F%2Fscilab.in%2Ftextbook
_companion%2Fenerate_book%2F3446&usg=AFQjCNGDs2a6AHGKL93l3_j8Ra1UN-5SQ
Q&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 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 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.

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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

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

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

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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

Theory Assessment:

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

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.

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

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.

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

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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

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.

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

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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 modelling 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:

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

End Semester Examination:

      Theory   : 40 marks
      Practical   : 40 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)

Back to Scheme

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

Internal Assessment:
>   Test 1   : 15 marks
>   Test 2   : 15 marks
>   Total   : 30 marks

End Semester Examination:
>   Theory : 45 marks

Term work:
25 marks (10 marks for assignment, 10 marks for practical and 5 marks for attendance)

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:

       Internal Examination : 20 marks
       Internal Term work   : 20 marks

End Semester Examination:

       Theory   : 40 marks
       Practical Examination : 20 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)

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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

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:**
   - o Question paper will consist of 5 questions, each carrying 20 marks.
   - o Total 3 questions need to be solved.
   - o Q.1 will be compulsory, based on the entire syllabus.
   - o Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

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.

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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

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:**
   o Question paper will consist of 5 questions, each carrying 20 marks.
   o Total 3 questions need to be solved.
   o Q.1 will be compulsory, based on the entire syllabus.
   o Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

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

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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:

Internal Assessment 1 : 20 marks
Internal Assessment 2 : 20 marks
Internal Term work : 30 marks

End Semester Examination:

Practical Examination : 30 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.

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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	--	--	--	--	25	--	25	50

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

10. evaluation of the different techniques surveyed is also to be done.

11. Teams must analyze all the results obtained by comparing with other standard techniques.

12. 10.Every team must publish their work in national / international conference/journals if possible (publish in Scopus indexed journals).

13. 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
3. project proposal. The list of papers surveyed must be clearly documented.
4. Each group will be jointly evaluated by a team of Internal and External Examiners approved by the Department of Electronics and Computer Science Engineering.
5. Oral exam will be conduct 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.

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Bachelor of Technology
In
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(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 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. 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 understand the foundations of the Data Science process, methods and techniques
2. To understand management of data and make prediction over the data
3. To understand the principles of text analytics
4. To understand why visualization is an important part of data analysis
5. To understand ethical responsibilities of data scientist and organization
6. To work on various application of data science

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

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

Prerequisite: BDA. DBMS, Python

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.

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.

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● 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,1stedition.
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	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 406	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 ‖,Pearson Education, 2009.
2.   L R Rabiner, B H Juang, B Yegnanarayana, ―Fundamentals of speech Recognition‖, 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 407	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 407	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, EIGamal 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 Malwares: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits, Spywares, Backdoors, Ransomware, Keyloggers	04

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.

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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 408	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				
		Test1	Test 2	Avg. of 2 Tests					
EC 408	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 Interprocess 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, Mutual Exclusion Algorithms	07
3.	**Process Management**	Introduction to Process management,process migration,threads,code migration.	06
4.	**Introduction of Cloud Computing**	Defining Cloud Computing, Cloud and other similar configurations, Components of Cloud,Cloud types: NIST and Cloud Cube Models,Cloud Deployment Models and Service Models, Cloud computing architecture, Advantages and Disadvantages of cloudComputing.	05
5.	**Virtualization**	Virtualization: Characteristics of virtualized environment, Understanding the importance of Hypervisors, Type I & Type II Hypervisors, Virtualization of CPU, Memory and I/O Devices, Technology Examples: KVM, Xen,Vmware and HyperV	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	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	To implement a multithreaded application.
4	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
5	1. Demonstrate the EC2 using AWS 2. Demonstrate the S3 using AWS
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 409	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				
		Test1	Test 2	Avg. of 2 Tests					
EC 409	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
7.	**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, interrupt latency. Embedded Product development life cycle and hardware software Codesign process	04
8.	**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 communication interfaces (RS-232, RS-485), I2C, CAN, USB (v2.0), Bluetooth, Zigbee.Selection criteria of above interfaces.	08
9.	**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
10.	**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 software and comparison with GPOS, Foreground/Background processes, Interrupt latency, Task, Task states, Multi-tasking, Context switching, Task scheduling, Scheduling algorithms-Rate Monotonic Scheduling, EarliestDeadline First (with numericals), Inter-process communication: Semaphore,Mailbox, Message queues, Event timers, Task synchronization- Shareddata, Priority inversion, Deadlock. Memory Management.Introduction to µCOS II RTOS	08
11.	**IoT Introduction 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
12.	**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:

Department of Electronics & Computer Science - Syllabus for Undergraduate Programme

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)
EC 410	Robotics & Industrial Applications	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 410	Robotics & Industrial Applications	40	40	40	60	-	--	-	100

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

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.

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 411	Cyber Security and Digital Forensics	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 411	Cyber Security and Digital Forensics	40	40	40	60	-	--	-	100

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

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.

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

4. Website for more information, A Compliance Primer for IT professional: https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professional s33538

Course Code	Course Name	Theory (Hrs)	Practical (Hrs)	Tutorial (Hrs)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 412	Blockchain Technology	03	-	--	03	-	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks			Term Work	Practical	Oral	Total	
		Internal assessment		End Sem. Exam					
		1	2	Average					
EC 412	Blockchain Technology	40	40	40	60	-	--	-	100

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

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 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 413	Internet of Everything	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 413	Internet of Everything	40	40	40	60	-	--	-	100

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, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.	10

		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

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.

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	Scheme	Theory	Practical	Tutorial	Total
EC 415	Human Values and Social Ethics	Contact Hours	2	-	-	2
		Credits	2	-	-	2

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
EC 415	Human Values and Social Ethics	-	-	-	-	50	–	-	50

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

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 Lab syllabus:

SN	Details	Hours
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 Professional values and its importance	05

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	05
4	**Ethics in Technical writing** : Documenting sources Presentation of Information Ethics & Plagiarism	06
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	06

Assessment:

Term Work : 50 Marks (Continuous Evaluation)

Reference Books:

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	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

<u>**Assessment Scheme:**</u>

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.

7.

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 　　**i.** Hypothesis testing and Interpretation of Data	8

	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,	3

		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.	
2	Kitchen equipment & Kitchen planning	**Kitchen equipment & Kitchen planning:** Selection, Use and care of: modern cookers, thermostatic control and automatic time-controlled ovens, microwave ovens, slow electric cook pots, refrigerators and freezers, small kitchen equipment, e.g. knives, pans, small electrical kitchen equipment, e.g. food processors, electric kettles, Advantages and disadvantages of microwave ovens, Organisation of cooking area and equipment for efficient work., Selection, Use and care of: work surfaces, flooring, walls and wall coverings, lighting, ventilation	4
3	Meal planning and guidelines	**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;	5

		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.	

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	--	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: 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 presentation and demonstration on the Project- B.

Bachelor of Technology
In
Electronics & Computer Science

(Semester VIII)

Course Code	Course Name	Credits
IL 481	**Medical Image Processing**	**3**

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

Outcomes: Learner will be able to…
1. Record, extract and analyse key information about teeth, muscles, bones etc
2. Acquire the fundamental concepts of a digital image processing
3. Analyze images in the spatial and frequency domain.

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

	U-NetPlus, CE-Net, CIA-Net, U2-Net, ScleraSegNet, AHCNet, MFP-Unet, ResUNet-a, RAUNet, 3D U2-Net, SegNAS3D, U^2-Net, UNET 3+.	
6	**Deep Learning for Healthcare:** Deep learning for different healthcare applications: Diabetic Retinopathy, Knee Osteoarthritis, Histological and Microscopic Elements Detection, Gastrointestinal Diseases Detection, Cardiac Imaging. Lesion detection: Brain tumor detection, prostate lesion detection, Lung nodule detection.	6

Assessment Scheme:

Internal Assessment:

End Semester Examination:

References:

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

Course Code	Course Name	Credits
IL 482	Technologies for Rural Development	3

Objectives:

1. To understand the nature and characteristics of rural resources and its importance in Rural Development.

2. To understand various technologies required for Rural Development

Outcomes: Learner will be able to…

1. Understand various natural resources and their importance in rural development.

2. Get exposure to various challenges and problems with regard to availability and use of natural resources.

3. Develop and implement various technologies for rural development

4. Explore various schemes for rural development

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

| 6 | Government Schemes, initiatives and participation of various Stake holders for development and Protection of Rural resources | 4 |

Assessment Scheme:

Internal Assessment:

End Semester Examination:

References:

1. Rural Development: Principles, Policies and Management, Katar Singh, Sage Publications India Pvt. Ltd., 2009

2. Development of Land Resources – E-book on Activities Department of Land Resources, Ministry of Rural Development, Government of India, Dec. 2014,

3. Http://dolr.nic.in/downloads/PDFs/DoLR%20Activities.pdf

4. S.S. Singh., Principles and Practices of Agronomy. 1985. Kalyani Publishers, Ludhiana

5. Indian Economy by Datt, Rudra & Sundharam, New Delhi: S. Chand, 2008.

6. W.T.O and Indian Economy by Deogirikar, A. B. Jaipur: Shri Niwas Publications, 2004

Course Code	Course Name	Credits
IL 483	Economics	**3**

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

Outcomes: Learner will be able to…
1. Acquire conceptual and theoretical knowledge of Micro and Macroeconomics and learn to think critically about issues and topics of the subject.
2. Demonstrate the understanding of the concepts of demand, supply, price, income and equilibrium and relate it to the existing scenario in the society.
3. Perform successfully in representing the Indifference curve in relation to the prevalent consumer behaviour and consumer preferences.
4. Illustrate the skills required for maximising output and minimising cost for effective production.
5. Determine the importance of the existence of different market structures and its impact in society.
6. Develop an understanding of the Keynesian System of Money, Interest and Income and formulate anti- inflationary policies.

Module	Detailed Contents	Hrs
1	Introduction to Micro and Macro Economics	5
2	Demand & Supply: Concept of demand & supply functions, Price, Income & Cross elasticities of demand, Elasticity of Supply, Market demand functions, Concept of equilibrium, Impact of changes in demand & supply on equilibrium	7
3	Theory of Consumer Behaviour: Concept of cardinal and ordinal utility, consumer's equilibrium, Consumer's preferences, Risk Aversion and Indifference Curve Analysis, & its properties, Shapes of Indifference Curves in exceptional cases	7
4	The Theory of Production: Concept of Production function, Production with a single variable input, Production with two variable inputs, Optimal input combination, Constrained output maximization, Cost minimization, Elasticity of substitution	6
5	Theory of Cost: Different concept of cost, Short-run and Long- run cost analysis, modern concept. Market Structures a. Perfect Competition Short-run and long-run equilibrium of the firm and Industry, Stability of equilibrium, Concept of imperfect competition; short run and long run price and output decisions of a monopoly firm; concept of a supply curve under monopoly; comparison of perfect competition and monopoly,	4

6	The Keynesian System: Money, Interest and Income Money in the Keynesian theory, Interest Rate Determination (Liquidity Preference Theory), Money Market, Bond market and Commodity Market, Monetary policies and fiscal policies, Inflation and Unemployment Inflation, Role and Effects of inflation, Anti- inflationary policies	7

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

Course Code	Course Name	Credits
IL 484	GIS and Remote Sensing	**3**

Objectives:
1. To gain basic understanding of GIS and remote sensing techniques
2. To understand basic software such as QGIS used for GIS analysis
3. To understand various GIS data sources, their processing and interpretation
4.

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

Prerequisites: Knowledge of Python or other software programming language

Module	Detailed Contents	Hrs
1	Introduction to GIS Mapping. GIS Data models and modelling, Maps and Databases, GIS data types (vector, raster etc), Geographic coordinate systems,	10
2	Introduction to QGIS software, GIS data sources, Digitizing data, Georeferencing.	10
3	Spatial Analysis techniques vector and raster analysis and tools.	20
4	Satellite images, electromagnetic energy and remote sensing, satellites and sensors, arial cameras, surveys using drones, multispectral scanners, LIDAR.	10
5	Applications of GIS in industry, governments, NGOs etc	10

Assessment Scheme:

Internal Assessment: Course will have 6 take home assignments worth 10% of the final grade

End Semester Examination: Will have a final exam worth 40% of the final grade
References:

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

Course Code	Course Name	Credits
IL 485	Physical Education, Fitness & Sports	4

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

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

Module	Detailed Contents	Hrs
1	**Physical Fitness** 1.1 Concept, definition and meaning of Physical fitness, activity and exercise 1.2 Component of Physical fitness, Benefit of Physical fitness & exercise. 1.3 Principles of physical fitness 1.4 Definition and concept of wellness and factors affecting Physical fitness & wellness 1.5 Concept and importance of physical conditioning, warming up and cooling down of all age groups	8
2	**Nutrition and Dietary Requirement** 2.1 Nutrition components and balanced diet 2.2 Meaning and definition of doping and ergogenic aids 2.3 Prevention and first-aid of common injuries during Physical training 2.4 Need of Energy, Carbohydrate and Protein 2.5 Concept training nutrition and competition nutrition	6
3	**Wellness, Weight management and Holistic health** 3.1 Meaning, concept and components of Wellness 3.2 Manipulation of energy balance to induce weight loss and weight gain 3.3 Methods of weight management 3.4 Concept, types and cause of obesity and its management.	6

	3.5 Waist hip ratio, larger heart, BMI, calculation of Training Heart Rate		
4	**Human body system, function and effect of exercise** 4.1 Meaning and Importance of the study of Human anatomy in physical education & sports 4.2 Classification and functions of bones and joints 4.3 Movements of various joints 4.4 Structural classification of muscle, types of muscle and effect of exercise on the musculoskeletal system. 4.5 Structure and Effect of exercise on the cardiorespiratory system 4.6 Digestion and effect of exercise on the digestive system 4.7 Nervous system and effect of exercise on the nervous system.	6	
5	**Yoga and meditation** 5.1 Concept of Yoga and misconception about Yoga 5.2 Comparison of Physical Education exercise and Yogic exercise. 5.3 Meaning, Types and principles of Meditation 5.4 Principles governing various exercises in Yoga(Asana, Pranayam, Bandha, Mudra, Kriya) 5.5 Yoga for stress management and emotional stability 5.6 Application of Yoga in sports & physical education and effect of Yogic exercise on different systems of the human body.	8	
6	**General & recreational troop games and its method of skill training** 6.1 The game soccer and its rules and regulation 6.2 The game Volleyball, Basketball and its rules and regulations 6.3 The Indoor games and their rules and regulations 6.4 Method of sports skill developing training 6.5 Recreational games and their importance in day to day life	6	

Assessment Scheme:

1. Term Papers(40 Marks):

Two theory papers will be conducted for 40 marks each with average marks of both papers as the final score. One hour theory paper as per the pattern of the semester-end examination will be conducted.

2.Projects/Assignments(30 Marks):

Project on Nutrition (10 Marks): The learner will be given one project on the calculation of Basel metabolic rate. He /she will submit the report of the same in a prescribed format based on which the learner will be evaluated for 10 marks by the concerned teacher/s

Projects/Assignment on Yoga education (10 Marks): The learner will be given an assignment on yoga education such as gathering/compiling the information about the various aspects of asanas and asking to prepare and submit the report of the same based on which the concerned subject teacher will give marks out of 10.

Assignments on Sports Injuries (10 Marks): The learner will be given two assignments on the specific sports injuries and their remedial aspects based on the report submitted in the prescribed format by him/her as well as observations, the concerned teacher/s will give marks out of 10.

3. Physical Activities(25 Marks):

a. To perform 8 Asanas in a group (10)

b. To perform one Pranayama and one Kriyas(5)

c. To perform any five exercises of Motor Fitness. (5)

d To perform any five exercises of HRPF(5)

4. Trekking/ Hiking (05 Marks)- The learner should be provided experience of participating in the organization and the actual conduct of the co-curricular activities viz. Hiking/Trekking and the assessment of 05 marks should be done based on learners actual participation and involvement in the same.

References:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
EC 492	Project C	--	12	--	--	06	--	06

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	--	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:

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.

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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 an 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.