Mahatma Education Society's

Pillai College of Engineering

(Autonomous)

Affiliated to University of Mumbai

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

PCE
PILLAI COLLEGE OF ENGINEERING
AUTONOMOUS

Department of Electronics & Computer Science

Syllabus

Of

B.Tech. in Electronics & Computer Science

for

The Admission Batch of AY 2024-25

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

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

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

Fourth Year - Effective from Academic Year **2027-28**

as per Choice Based Credit and Grading System

Mahatma Education Society's

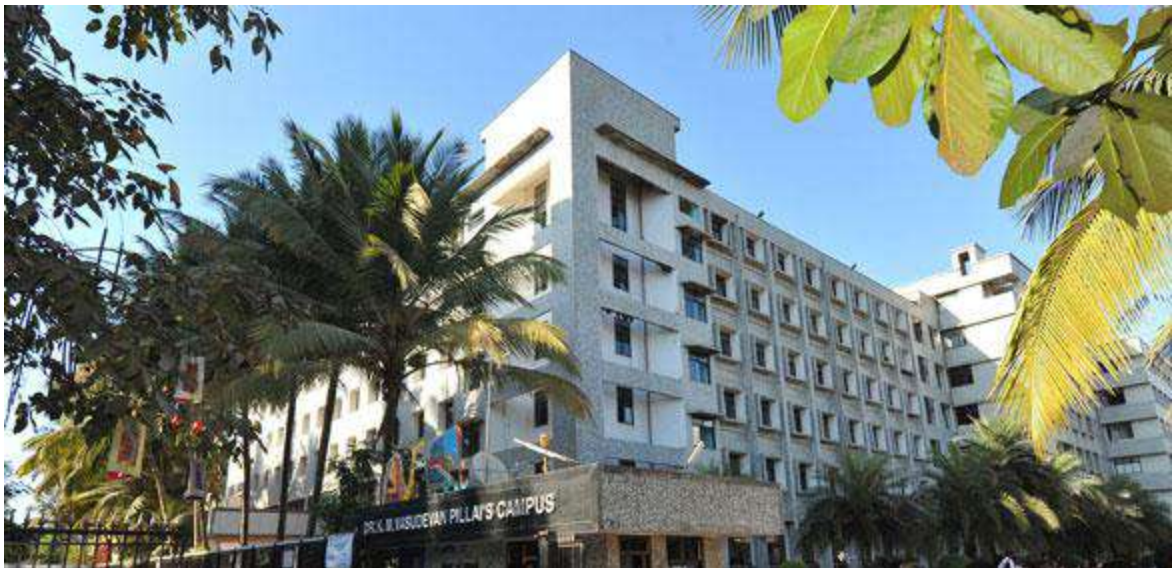
Pillai College of Engineering

Vision

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

Mission

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



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

Department of Electronics & Computer Science

Vision

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

Mission

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

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

To inculcate entrepreneurship skills and impart ethical and social values.

Program Educational Objectives (PEOs):

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

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet

identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs):

Engineering Graduates will be able to

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

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

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

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

The performance of a learner in a semester is indicated by a number called Semester Grade Performance Index (SGPI). The SGPI is the weighted average of the grade points obtained in all the courses by the learner during the semester. For example, if a learner passes five courses (Theory/labs./Projects/ Seminar etc.) in a semester with credits C1, C2, C3, C4 and C5 and learners grade points in these courses are G1, G2, G3, G4 and G5 respectively, then learners SGPI is equal to:

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

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

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

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

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

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

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

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 department level specialization, a minimum of three courses under that specialization has to be completed.

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 2024-25 . 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. Uttam Kolekar	Vice Chancellor's Nominee
3. Dr. Vaishali Ingle	Academic Council Nominee
4. Dr. Shweta Chawhane	Academic Council Nominee
5. Mr. Vijay Raut	Industry Representative
6. Mr.Saurabh Bhopi	Alumnus Nominee
7. Dr. Parikshi Sahatiya	Experts from outside the Autonomous College
8. All faculty members of the Department.	

Semester I

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract /Tuts	Total
MATH101	Engineering Mathematics I	BSC	3	2	3	1	4
PHY102	Engineering Physics I	BSC	2	1	2	0.5	2.5
CHEM103	Engineering Chemistry I	BSC	2	1	2	0.5	2.5
CE104	C Programming	ESC	3	2	3	1	4
ENGG105	Basic Electrical Engineering	ESC	3	2	3	1	4
ENGG111	Basic Workshop-I	SKILL	-	2	-	2	1
HUM113	Ancient Indian Engineering(IKS)	*IKS*	1	2+2#	1	1	2
ENGG114	Co Curricular Course I	*CC*	-	4	-	2	2
Total			**14**	**16**	**14**	**8**	**22**

Course Code	Course Name	Category	Examination Scheme							
			Theory					Term Work	Pract /Oral	Total
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
			1	2	Avg					
MATH101	Engineering Mathematics I	BSC	40	40	40	60	2	25	-	125
PHY102	Engineering Physics I	BSC	30	30	30	45	2	25	-	100
CHEM103	Engineering Chemistry I	BSC	30	30	30	45	2	25	-	100
CE104	C Programming	ESC	40	40	40	60	2	25	25	150
ENGG105	Basic Electrical Engineering	ESC	40	40	40	60	2	25	25	150
ENGG111	Basic Workshop-I	*VSEC*	-	-	-	-	-	50	-	50
HUM113	Ancient Indian Engineering(IKS)	*IKS*	-	-	-	-	-	50	-	50
ENGG114	Co Curricular Course I	*CC*	-	-	-	-	-	50	-	50
Total										**775**

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

Semester II

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract/Tuts	Total
MATH115	Engineering Mathematics II	BSC	3	2	2	1	4
PHY116	Engineering Physics II	BSC	2	1	2	0.5	2.5
CHEM117	Engineering Chemistry II	BSC	2	1	2	0.5	2.5
MECH107	Engineering Mechanics and Graphics	ESC	2	4	2	2	4
CE119	Python Programming	Program Courses	3	2	2	1	4
ENGG123	Basic Workshop -II	SKILL	-	4	-	2	1
COMM121	Professional Communication and Ethics I	AEC	1	2	1	1	2
ENGG125	Co Curricular Course II	*Liberal Learning*	-	4	-	2	2
Total			**12**	**20**	**12**	**10**	**22**

Course Code	Course Name	Category	Examination Scheme							
			Theory					Term Work	Pract/ Oral	Total
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
			1	2	Avg					
MATH115	Engineering Mathematics II	BSC	40	40	40	60	2	25	-	125
PHY116	Engineering Physics II	BSC	30	30	30	45	2	25	-	100
CHEM117	Engineering Chemistry II	BSC	30	30	30	45	2	25	-	100
MECH107	Engineering Mechanics and Graphics	ESC	40	40	40	60	2	25	50	175
CE119	Python Programming	Program Courses	40	40	40	60	2	25	25	150
ENGG123	Basic Workshop -II	*VSEC*	-	-	-	-	-	50	-	50
COMM121	Professional Communication and Ethics I	AEC	-	-	-	-	-	50	-	50
ENGG125	Co Curricular Course II	Liberal Learning	-	-	-	-	-	50	-	50
Total										**775**

Semester III

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract /Tuts	Total
MATH 201E	Mathematics for Electronics and Computer Science III	ESC	2+1*	2	2	1	3
ECS 202	Analog Electronics Circuits	PCC	3	-	3	-	3
ECS 203	Digital Circuits and System Design	PCC	3	-	3	-	3
ECS 204	Data Structures and Algorithms	MDM	3	2	3	1	4
ECS 205	Database Management System	PCC	3	2	3	1	4
ECS 206	Analog and Digital Electronics Lab	PCC	-	2	-	1	1
MGMT 290	Personal Finance Management	HSSM	2	-	2	-	2
HUM 201	Human Values and Social Ethics	VEC	2	-	2	-	2
			18	**8**	**18**	**4**	**22**

Course Code	Course Name	Category	Examination Scheme							
			Theory					Term Work	Pract /Oral	Total
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
			1	2	Avg					
MATH 201E	Mathematics for Electronics and Computer Science III	ESC	40	40	40	60	2	25	-	125
ECS 202	Analog Electronics Circuits	PCC	40	40	40	60	2	-	-	100
ECS 203	Digital Circuits and System Design	PCC	40	40	40	60	2	-	-	100
ECS 204	Data Structures and Algorithms	MDM	40	40	40	60	2	25	25	150
ECS 205	Database Management System	PCC	40	40	40	60	2	25	25	150
ECS 206	Analog and Digital Electronics Lab	PCC	-	-	-	-	-	25	25	50
MGMT 290	Personal Finance Management	HSSM	20	20	20	40	2	-	-	60
HUM 201	Human Values and Social Ethics	VEC	-	-	-	-	-	50	-	50
										785

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

Semester IV

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract/ Tuts	Total
MATH 209E	Mathematics for Electronics & Computer Science IV	ESC	2	1+1*	2	1	3
ECS 210	Analysis of Algorithms	PCC	3	2	3	1	4
ECS 211	Basics of VLSI	PCC	3	2	3	1	4
ECS 212	System Software and Operating Systems	MDM	3	-	3	-	3
ECS 213	Microprocessor and Microcontroller	PCC	3	2	3	1	4
ECS 214	System Software and Operating Systems Lab	Skill courses	-	2	-	1	1
ECS 291	Programming Lab I (Java Programming)	VSEC	-	2	-	1	1
ENGG 201	Entrepreneurship	HSSM	2	-	2	-	2
Total			**17**	**12**	**16**	**6**	**22**

Course Code	Course Name	Category	Examination Scheme							
			Theory					Term Work	Pract/ Oral	Total
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
			1	2	Avg					
MATH 209E	Mathematics for Electronics & Computer Science IV	ESC	40	40	40	60	2	25	-	125
ECS 210	Analysis of Algorithms	PCC	40	40	40	60	2	25	25	150
ECS 211	Basics of VLSI	PCC	40	40	40	60	2	25	25	150
ECS 212	System Software and Operating Systems	MDM	40	40	40	60	2	-	-	100
ECS 213	Microprocessor and Microcontroller	PCC	40	40	40	60	2	25	25	150
ECS 214	System Software and Operating Systems Lab	Skill courses	-	-	-	-	-	25	25	50
ECS 291	Programming Lab I (Java Programming)	VSEC	-	-	-	-	-	25	25	50
ENGG 201	Entrepreneurship	HSSM	20	20	20	40	2	-	-	60
Total										**835**

*classwise lecture

Semester V

Course Code	Course Name	Category	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
				Theory	Pract/ Tuts	Theory	Pract / Tuts	Total
ECS 301	Signals & Systems	PCC	TL	3	1	3	1	4
ECS 302	Computer Networks	PCC	TL	3	2	3	1	4
ECS 303	Software Engineering	MDM	T	3	-	3	-	3
ECS 3xx	Department Level Optional Course I	PEC	TL	3	2	3	1	4
IL 3xx	Institute Level Optional Course I	Open Elective (OEC)	T	3	-	3	-	3
COMM 202	Professional Communication and Ethics II	AEC	LC	1	2	1	1	2
ECS 391	Programming Lab II(Web Programming)	Skill Courses	LPC	1	2	1	1	2
Total				**17**	**9**	**17**	**5**	**22**

Course Code	Course Name	Category	Examination Scheme							
			Theory					Term Work	Pract / Oral	Total
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
			1	2	Avg					
ECS 301	Signals & Systems	PCC	40	40	40	60	2	25	-	125
ECS 302	Computer Networks	PCC	40	40	40	60	2	25	25	150
ECS 303	Software Engineering	MDM	40	40	40	60	2	-	-	100
ECS 3xx	Department Level Optional Course I	PEC	40	40	40	60	2	25	25	150
IL 3xx	Institute Level Optional Course I	Open Elective Courses (OEC)	40	40	40	60	2	-	-	100
COMM 202	Professional Communication and Ethics II	AEC	-	-	-	-	-	50	-	50
ECS 391	Programming Lab II(Web Programming)	Skill Courses	-	-	-	-	-	25	25	50
Total										**725**

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

Course Code	Department Level Optional Course (DLOC) I	Specializations
ECS 304	Artificial Intelligence	AIML
ECS 305	Advanced Database Management Systems + DWM	Data Analytics
ECS 306	Advanced Operating System	High Performance Computing
ECS 307	Embedded System Design & Basics of IOT	IOT

Course Code	Institute Level Optional Course (ILOC) I	Specializations
ENGG 380	IPR and Patenting	IP Management and Digital Business
MGMT 380	E- Commerce and E-Business	Business Management
ENGG 381	Introduction to Bioengineering	Bioengineering
ENGG 382	Biomedical Instrumentation	Bio Instrumentation
DES 380	Design of Experiments	Engineering Design
DES 381	Design for Sustainability	Sustainable Technologies
ECON 380	Political Science	Contemporary Studies
VART 380	Visual Arts	Art and Journalism
PHY 380	Modern Day Sensor Physics	Applied Science
ENGG 383	Energy Audit and Management	Green Technologies
ENGG 384	Maintenance of Electronics Equipment	Maintenance Engineering
HMC 380	Cooking and Nutrition	Life Skills
EVS 380	Environmental Management	Environment and Safety

Semester VI

Course Code	Course Name	Category	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
				Theory	Pract/ Tuts	Theory	Pract/ Tuts	Total
ECS 308	Instrumentation and Control System	PCC	TLP	3	2	3	1	4
ECS 309	Computer Organization & Architecture	PCC	T	2	-	2	-	2
ECS 310	Software Testing & Quality Assurance	MDM	T	3	-	3	-	3
ECS 3xx	Department Level Optional Course II	PEC	TL	3	2	3	1	4
ECS 3xx	Department Level Optional Course III	PEC	TL	3	2	3	1	4
IL 3xx	Institute Level Optional Course II	Open Elective (OE)	T	3	-	3	-	3
ECS 392	Project A (Literature Survey & Problem Formulation)	Experiential Learning Courses	LPC	-	4	-	2	2
Total				**17**	**10**	**17**	**5**	**22**

Course Code	Course Name	Category	Examination Scheme							
			Theory					Term Work	Pract/ Oral	Total
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
			1	2	Avg					
ECS 308	Instrumentation and Control System	PCC	40	40	40	60	2	25	25	150
ECS 309	Computer Organization & Architecture	PCC	40	40	40	60	2	-	-	100
ECS 310	Software Testing & Quality Assurance	MDM	40	40	40	60	2	-	-	100
ECS 3xx	Department Level Optional Course II	PEC	40	40	40	60	2	25	25	150
ECS 3xx	Department Level Optional Course III	PEC	40	40	40	60	2	25	25	150
IL 3xx	Institute Level Optional Course II	Open Elective Courses(OEC)	40	40	40	60	2	-	-	100
ECS 392	Project A (Literature Survey & Problem Formulation)	CEP/Field Project	-	-	-	-	-	25	25	50
Total										**800**

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

Course Code	Department Level Optional Course (DLOC) II	Specializations
EC 312	Foundations of Robotics	Robotics
EC 313	Cryptography and System Security	System Security
EC 314	Mobile & Distributed Computing	Cloud Computing
EC 315	Integrated Circuit Technology	VLSI Design

Course Code	Department Level Optional Course (DLOC) III	Specializations
EC 316	Machine Learning	AIML
EC 317	Big Data Analytics	Data Analytics
EC 318	Parallel Computing Architecture	High Performance Computing
EC 319	Wireless Networks	IOT

Course Code	Institute Level Optional Course (ILOC) II	Specializations
MKT 380	Digital Business Management and Digital Marketing	IP Management and Digital Business
ENGG 385	Business Analytics	Business Management
ENGG 386	Bio Mechanics	Bio Engineering
ENGG 387	Medical Image Processing	Bio Instrumentation
DES 382	Product Design	Engineering Design
DES 383	Technologies for Rural Development	Sustainable Technologies
ECON 381	Economics	Contemporary Studies
MMC 380	Journalism, Media and Communication studies	Art and Journalism
ENGG 388	Operation Research	Applied Science
ENGG 389	Climate Informatics	Green Technologies
ENGG 390	Maintenance of Mechanical Equipment	Maintenance Engineering
PE 380	Physical Education	Life Skills
ENGG 391	Vehicle Safety	Environment and Safety

Semester VII

Course Code	Course Name	Category	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
				Theory	Pract/ Tuts	Theory	Pract/Tuts	Total
ECS 401	Image Processing & Machine Vision	PCC	T	3	2	3	1	4
ECS 4xx	Department Level Optional Course IV	PEC	TL	3	2	3	1	4
ECS 4xx	Department Level Optional Course V	PEC	TL	3	2	3	1	4
ENGG 470	Multidisciplinary Minor Project	MDM	T	-	4	-	2	2
ECS 491	Project B	Experiential Learning Courses	LPC	-	8	-	4	4
Total				**9**	**18**	**9**	**9**	**18**

Course Code	Course Name	Category	Examination Scheme							
			Theory					Term Work	Pract/ Oral	Total
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
			1	2	Avg					
ECS 401	Image Processing & Machine Vision	PCC	40	40	40	60	2	25	25	150
ECS 4xx	Department Level Optional Course IV	PEC	40	40	40	60	2	25	25	150
ECS 4xx	Department Level Optional Course V	PEC	40	40	40	60	2	25	25	150
ENGG 470	Multidisciplinary Minor Course	MDM	-	-	-	-	-	25	25	50
ECS 491	Project B	Experiential Learning Courses	-	-	-	-	-	50	50	100
Total										**600**

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

Course Code	Department Level Optional Course (DLOC) IV	Specializations
ECS 402	Advanced Robotics	Robotics
ECS 403	Advanced Network Theory	System Security
ECS 404	Cloud Computing	Cloud Computing
ECS 405	Advanced VLSI Design	VLSI Design

Course Code	Department Level Optional Course (DLOC) V	Specializations
ECS 406	Deep Learning	AIML
ECS 407	Data Science	Data Analytics
ECS 408	High Performance Computing	High Performance Computing
ECS 409	Internet of Everything	IOT

Semester VIII

Course Code	Course Name	Category	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
				Theory	Pract	Theory	Pract	Total
ENGG 401	Research Methodology	Experiential Learning Courses	T	2	-	2	-	2
ECS 4xx	Department Level Optional Course VI	PEC	TL	3	2	3	1	4
ECS 492	Project C	Experiential Learning Courses	LPC	-	6	-	3	3
ECS 493	Internship/ OJT	Experiential Learning Courses	LPC	-	16	-	8	8
Total				**5**	**24**	**5**	**12**	**17**

Course Code	Course Name	Category	Examination Scheme							
			Theory							
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)	Term Work	Pract/Oral	Total
			1	2	Avg					
ENGG 401	Research Methodology	Experiential Learning Courses	30	30	30	45	2	-	-	75
EC 4xx	Department Level Optional Course VI	PEC	40	40	40	60	2	25	25	150
EC 492	Project C	Experiential Learning Courses	-	-	-	-	-	50	50	100
EC 493	Internship/ OJT	Experiential Learning Courses	50	50	50	-	-	50	100	200
Total										**525**

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

Course Code	Department Level Optional Course (DLOC) VI	Specializations
ECS 410	Intelligent Robotics	Robotics
ECS 411	Cyber Security & Digital Forensic	System Security
ECS 412	Blockchain Technology	Cloud Computing
ECS 413	Analog and Mixed Signal VLSI Design	VLSI Design

Semester III

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract /Tuts	Total
MATH 201E	Mathematics for Electronics and Computer Science III	ESC	2+1*	2	2	1	3
ECS 202	Analog Electronics Circuits	PCC	3	-	3	-	3
ECS 203	Digital Circuits and System Design	PCC	3	-	3	-	3
ECS 204	Data Structures and Algorithms	MDM	3	2	3	1	4
ECS 205	Database Management System	PCC	3	2	3	1	4
ECS 206	Analog and Digital Electronics Lab	PCC	-	2	-	1	1
MGMT 290	Personal Finance Management	HSSM	2	-	2	-	2
HUM 201	Human Values and Social Ethics	VEC	2	-	2	-	2
			18	**8**	**18**	**4**	**22**

Course Code	Course Name	Category	Examination Scheme							
			Theory					Term Work	Pract /Oral	Total
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
			1	2	Avg					
MATH 201E	Mathematics for Electronics & Computer Science III	ESC	40	40	40	60	2	25	-	125
ECS 202	Analog Electronics Circuits	PCC	40	40	40	60	2	-	-	100
ECS 203	Digital Circuits and System Design	PCC	40	40	40	60	2	-	-	100
ECS 204	Data Structures and Algorithms	MDM	40	40	40	60	2	25	25	150
ECS 205	Database Management System	PCC	40	40	40	60	2	25	25	150
ECS 206	Analog and Digital Electronics Lab	PCC	-	-	-	-	-	25	25	50
MGMT 290	Personal Finance Management	HSSM	20	20	20	40	2	-	-	60
HUM 201	Human Values and Social Ethics	VEC	-	-	-	-	-	50	-	50
										785

*additional lecture class wise

Semester IV

Course Code	Course Name	Category	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract/ Tuts	Theory	Pract/ Tuts	Total
MATH 209E	Mathematics for Electronics and Computer Science IV	ESC	2	1+1*	2	1	3
ECS 210	Analysis of Algorithms	PCC	3	2	3	1	4
ECS 211	Basics of VLSI	PCC	3	2	3	1	4
ECS 212	System Software and Operating Systems	MDM	3	-	3	-	3
ECS 213	Microprocessor and Microcontroller	PCC	3	2	3	1	4
ECS 214	System Software and Operating Systems Lab	Skill courses	-	2	-	1	1
ECS 291	Programming Lab I (Java Programming)	VSEC	-	2	-	1	1
ENGG 201	Entrepreneurship	HSSM	2	-	2	-	2
Total			**17**	**12**	**16**	**6**	**22**

Course Code	Course Name	Category	Examination Scheme							
			Theory					Term Work	Pract/ Oral	Total
			Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
			1	2	Avg					
MATH 209E	Mathematics for Electronics and Computer Science IV	ESC	40	40	40	60	2	25	-	125
ECS 210	Analysis of Algorithms	PCC	40	40	40	60	2	25	25	150
ECS 211	Basics of VLSI	PCC	40	40	40	60	2	25	25	150
ECS 212	System Software and Operating Systems	MDM	40	40	40	60	2	-	-	100
ECS 213	Microprocessor and Microcontroller	PCC	40	40	40	60	2	25	25	150
ECS 214	System Software and Operating Systems Lab	Skill courses	-	-	-	-	-	25	25	50
ECS 291	Programming Lab I (Java Programming)	VSEC	-	-	-	-	-	25	25	50
ENGG 201	Entrepreneurship	HSSM	20	20	20	40	2	-	-	60
Total										**835**

*additional lecture class wise

Bachelor of Technology
In
Electronics & Computer Science

(Semester III)

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
MATH 201E	Mathematics for Electronics and Computer Science III	02+1*	02	-	02	01	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
MATH 201E	Mathematics for Electronics and Computer Science III	40	40	40	60	25	-	-	125

Prerequisite: Engineering Mathematics-I and Engineering Mathematics-2

Course Objectives:

1. Learn the Laplace Transform, Inverse Laplace Transform of various functions, its applications.
2. Understand the concept of Fourier Series, its complex form and enhance the problem solving skills.
3. Understand Matrix algebra for engineering problems.
4. Understand the concepts of complex integration and analyze the Engineering problem
5. Understand the concept of Relation and function.
6. Understand the concept of coding theory

Course Outcomes:

After successful completion of the course students will be able to

1. Apply the concept of Laplace transform and its application to solve the real integrals in engineering problems.
2. Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems.
3. Apply the concepts of Eigen values and eigenvectors in engineering problems.
4. Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
5. Apply the concept of relation and function.
6. Use groups and codes in Encoding-Decoding

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	2	1		1			1	1		1			
CO2	3	2	1		2			1	1		1			
CO3	3	2	1		1			1	1		1			
CO4	3	2	1		1			1	1		1			
CO5	3	2	1		1			1	1		1			
CO6	3	2	1					1	1		1			

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1	**Laplace Transform**	Definition of Laplace transform and Laplace transform of standard functions, Properties of Laplace Transform: Linearity, First Shifting Theorem, change of scale Property, multiplication by t, (Properties without proof). Inverse of Laplace Transform by partial fraction and convolution theorem.	07
2	**Fourier Series, Fourier Transform**	Dirichlet's conditions, Fourier series of periodic functions with period 2π and 2L, Fourier series for even and odd functions, Half range sine and cosine Fourier series, Orthogonal and Ortho-normal functions, Fourier Integral Representation, Fourier Transform and Inverse Fourier transform of constant and exponential function.	06
3	**Linear Algebra Matrix Theory, Quadratic Forms**	Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Quadratic forms over real field, Linear Transformation of Quadratic form, Reduction of Quadratic form to diagonal form using congruent transformation. Rank, Index and Signature of quadratic form, Sylvester's law of inertia, Value- class of a quadratic form-Definite, Semidefinite and Indefinite. Reduction of Quadratic form to a canonical form using congruent transformations.	07
4	**Complex Integration**	Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula(withoutproof). Taylor'sandLaurent'sseries(withoutproof). Definition of Singularity, Zeroes, poles of f(z), Residues, Cauchy's ResidueTheorem(withoutproof)	06
5	**Relation and Function**	Partition of A Set, Relation, Diagram of A Relation, Matrix of A Relation, Digraph of A Relation, Types of Relation, Number of Binary Relations, Number of Reflexive Relations, Equivalance Relation, Relation of the Path, Operations on Relations, Closures, Warshall's Algorithm,	07
6	**Algebraic Structures, coding theory**	Properties of Binary Operations, Semi-Group. Monoid, Group, Ring, Isomorphism, Homomorphism, Group Code, Decoding and Error Correction, Maximum Likelihood Technique	06

Theory Assessments:

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

2. End Sem Theory Examination:

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

Practical Assessment: The final certification and acceptance of TW ensures the satisfactory performance of assignments and practicals and minimum passing in the TW.

A. Term Work:

1. Batch wise practical's are to be conducted. The number of students per batch should be as per norms.
2. Students must be encouraged to write Matlab Programs . Each student has to perform at least 4 Matlab practical's and at least 6 assignments on the entire syllabus.
3. Matlab Practical's will be based on

(i) Laplace Transform.
(ii) Inverse Laplace Transform
(iii) Fourier series
(iv) Eigen values and Eigen Vector.
(v)Singular Value Decomposition
(vi) Diagonalization of matrices
(vii) Evaluate the Complex Integral
(viii) Warshall's Algorithm.

Text Books & References:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 202	Analog Electronics Circuits	03	-	--	03	-	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
ECS 202	Analog Electronics Circuits	40	40	40	60	-	-	--	100

Prerequisite: Basic Electrical Engineering

Course Objectives:

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

Course Outcomes:

After successful completion of the course students will be able to

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

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	2	2	2	2	1	-	-	1	1	2	3	2	2
CO2	3	3	2	2	2	2	-	-	-	1	1	3	1	2
CO3	3	3	2	2	2	2	-	-	-	1	1	3	1	1
CO4	3	3	2	2	2	2	-	-	-	2	2	3	3	2
CO5	3	3	2	2	2	2	-	-	-	1	1	3	3	2
CO6	3	3	2	2	2	2	-	-	-	3	2	3	3	2

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Semiconductor devices**	1.1Bipolar Junction Transistor - BJT operations, voltages and current equations, BJT characteristics (CE, CB, CC configurations), early effect. 1.2 Field Effect Devices- JFET: Construction, operation and characteristics. MOSFET: Construction, operation and characteristics of D-MOSFET and EMOSFET.	06
2.	**Biasing Circuits of BJTs and MOSFETs**	2.1 Concept of DC load line, Q point and regions of operations, Analysis and design of biasing circuits for BJT (Voltage divider Bias ONLY) 2.2 DC load line and region of operation for MOSFETs. Analysis and design of biasing circuits for E-MOSFET (voltage divider bias ONLY).	06
3.	**Small Signal Amplifiers**	3.1Concept of AC load line and Amplification, Small signal analysis (Zi, Zo, Av and Ai) of CE amplifiers using hybrid pi model ONLY. 3.2 Small signal analysis (Zi, Zo, Av) of CS (for EMOSFET) amplifiers. Introduction to multistage amplifiers. Cascade and cascode only.(Concept, advantages & disadvantages)	07
4.	**Operational Amplifiers**	4.1The ideal operational amplifier (op-amp), internal block diagram of op-amp, characteristics of op-amp, ideal & practical op-amp parameters / specifications (no detailed description or any analysis), mathematical model of op-amp, IC 741 op-amp with pin diagram & description 4.2 Operational amplifier open loop & closed loop configurations (theoretical description only), the concept of virtual ground & virtual short	06
5.	**Applications of Operational Amplifier**	5.1 The op-amp inverting amplifier & op-amp non-inverting amplifier (mathematical analysis for derivation of output voltage only,numerical examples & designing) 5.2 Adder, summing amplifier, averaging circuit, subtractor, integrator (ideal), differentiator (ideal), op-amp instrumentation amplifier (only mathematical analysis for derivation of output voltage)	07
6.	**Special Purpose Integrated Circuits**	6.1 IC 555 timer internal block diagram & pin configuration, operation in astable & monostable multivibrator with mathematical analysis & numerical examples, design problems on astable & monostable multivibrator, applications in astable & monostable configuration 6.2 Functional block diagram, working and design of general purpose IC 723 (HVLC and HVHC).(theoretical description only). working of the switching regulator. (theoretical description only)	07

Theory Assessments:

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

2. **End Sem Theory Examination:**

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

Books:

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

References:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 203	Digital Circuits and System Design	03	-	--	03	-	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
ECS 203	Digital Circuits and System Design	40	40	40	60	-	--	-	100

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

Course Objectives:

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

Course Outcomes:

After successful completion of the course students will be able to

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

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	2	2	2								2	3	2	
CO2	2	2	2								2	3	2	
CO3	2	2	2								2	3	2	1
CO4	2	2	2	2							2	3	2	1
CO5	2	2	2	2		2					2	3	2	1
CO6	2	2	2	2							2	3	2	1

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Logic Gates and Boolean Algebra**	Digital logic gates, Realization using NAND, NOR gates, Boolean Algebra, De Morgan's Theorem, SOP and POS representation, K Map up to four variables.	05
2.	**Combinational Circuits using basic gates as well as MSI devices**	Arithmetic Circuits: Half adder, Full adder, Ripple carry adder, Carry Look ahead adder, Half Subtractor, Full Subtractor, multiplexer, cascading of Multiplexer, demultiplexer, decoder, Comparator (Multiplexer and demultiplexer gate level up to 4:1). MSI devices: IC7483, IC74151, IC74138, IC7485.	06
3.	**Elements of Sequential Logic Design**	Sequential Logic: Latches and Flip-Flops. RS, JK, Master slave flip flops, T & D flip flops with various triggering methods, Conversion of flip flops Counters: Asynchronous, Synchronous Counters, Up Down Counters, Mod Counters, Ring Counter, Twisted ring counter, Shift Registers, Universal Shift Register.	07
4.	**Sequential Logic Design**	Sequential Logic Design: Mealy and Moore Machines, Clocked synchronous state machine analysis, State reduction techniques (inspection, partition and implication chart method) and state assignment, sequence detector, Clocked synchronous state machine design. Sequential logic design practices: MSI counters (7490, 7492, 7493,74163, 74169) and applications, MSI Shift registers (74194) and their applications.	07
5.	**Logic Families and Programmable Logic Devices**	Logic Families: Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in), transfer characteristics of TTL NAND (Operation of TTL NAND gate),CMOS Logic: CMOS inverter, CMOS NAND and CMOS NOR, Interfacing CMOS to TTL and TTL to CMOS. Programmable Logic Devices: Concepts of PAL and PLA. Simple logic implementation using PAL and PLA, Introduction to CPLD and FPGA architectures.	07
6.	**Introduction to VHDL**	Design of Combinational circuits using VHDL: Introduction to Hardware Description Language, Core features of VHDL, data types, concurrent and sequential statements, data flow, behavioral, structural architectures, subprograms, Examples like Adder, subtractor, Multiplexers, De-multiplexers, decoder. Design of Sequential circuits using VHDL: VHDL code for flip flop, counters.	07

Theory Assessments:

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

2. End Sem Theory Examination:

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.

- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

Books:

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

References:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 204	Data Structures and Algorithms	03	02	--	03	01	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
ECS 204	Data Structures and Algorithms	40	40	40	60	25	–	25	150

Prerequisite: C Programming

Course Objectives:

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

Course Outcomes:

After successful completion of the course students will be able to

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

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	2	1	1	2	1	1	-	-	-	-	-	2	1	1
CO2	1	1	1	1	1	-	-	-	-	-	-	2	1	1
CO3	1	1	1	1	1	-	-	-	-	-	-	2	1	1
CO4	2	2	2	2	3	-	-	-	-	-	-	3	2	1
CO5	3	3	2	3	3	-	-	-	1	-	2	3	2	2
CO6	3	3	3	3	3	-	-	-	2	-	2	3	2	2

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1	**Introduction to Data Structures**	Introduction to Data Structures, Types of Data Structures – Linear and Nonlinear, Operations on Data Structures, Concept of array, Static arrays vs Dynamic Arrays, structures, Array Data Type:- Single and Multidimensional Arrays. Introduction to Analysis of Algorithms, characteristics of algorithms, Time and Space complexities, Asymptotic notations.	04
2	**Stack and Queue**	**Stack:** Basic Stack Operations, Representation of a Stack using Array, Applications of Stack – Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation. **Queue:** Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Dequeue, queue-Round Robin Algorithm, Applications of Queue:- Interrupt handling	07
3	**Linked List**	Representation of Linked List, Linked List v*/s* Array, Types of Linked List - Singly Linked List (SLL), Doubly Linked List, Circular Linked List, Operations on Singly Linked List: Insertion, Deletion, reversal of SLL, Print SLL. Implementation of Stack and Queue using Singly Linked List. Singly	08
4	**Tree**	Tree Terminologies, Binary Tree, Types of Binary Tree, Binary Tree Representation: Array and Linked Representation of Binary trees, Binary Tree Traversals algorithms: In-order, Pre-order, Post-order, Binary Search Tree Operations on Binary Search Tree, Applications of Binary Tree - Expression Tree, Huffman Encoding.	07
5	**Graph**	Graph Terminologies, Representation of graph (Adjacency matrix and adjacency list), Graph Traversals – Depth First Search (DFS) and Breadth First Search (BFS), Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal's algorithm, Application of Graph – Topological Sorting.	06
6	**Sorting and Searching**	**Searching:** Linear search, Random search, Binary search, Hashing, Applications:- Finding a root of a general quadratic polynomial over a finite interval. **Sorting:** Bubble, Insertion, selection, Quick Sort, Merge Sort, Two Way Merge Sort, Counting sort, Comparison of sorting Techniques based on their complexity, A few practical considerations for in-memory sorting	07

DETAILED LAB SYLLABUS:

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

Sr. No.	Detailed Lab/Tutorial Description
1	Program to reverse a list of given numbers using stack ADT.
2	Program to Check whether parentheses are balanced or not.
3	Convert an Infix expression to Postfix expression using stack ADT.
4	Program to evaluate Postfix Expression using Stack ADT.
4	Program to implement Linear Queue ADT using array.
5	Program to implement Stack/Queue using linked list.
6	Program to implement Circular Queue ADT using array.
7	Program to implement Priority Queue ADT using array.

8	Program to implement Binary Search Tree ADT using Linked List.
9	Program to implement searching algorithms -Linear search, Binary search.
10	Implement Depth First Search and Breadth First Search Graph Traversal technique.
11	Program to implement sorting algorithms (any 2)- bubble, selection, insertion, merge, quick.
12	Implementation of Prim's and Kruskal's algorithms for finding out Minimum Cost Spanning Tree of a given input graph. For eg. Finding out electricity distribution cable network with minimum overall cable length.

Theory Assessments:

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

2. End Sem Theory Examination:

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

Lab Assessment:

1. Term work Assessment :

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

2. Oral/Viva Assessment:

The oral examination will be based on the entire syllabus.

Text Books:

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

Reference Books:

1. C & Data Structures, Prof. P.S. Deshpande, Prof. O.G. Kakde, DreamTech press
2. E. Balagurusamy, "Data Structure Using C", Tata McGraw-Hill Education India
3. Rajesh K Shukla, "Data Structures using C and C++", Wiley-India

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 205	Database Management System	03	02	–	03	01	–	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
ECS 205	Database Management System	40	40	40	60	25	25	--	150

Prerequisite: Data Structures

Course Objectives:

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

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

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

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	1			1						1	1	1	2
CO2	3	2	2	1	1	1					1	--	3	2
CO3	3	3	2		1						1	--	3	1
CO4	3	2	2		1					1	1	--	1	1
CO5	3	2	1		1						1	--	1	1
CO6	3	1									1	1	1	1

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1	**Introduction Database Concepts**	Introduction, Characteristics of databases, File system v/s Database system, Data abstraction and data Independence, DBMS system architecture, Database Administrator	04
2	**Entity–Relationship Data Model**	The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Relationship constraints: Cardinality and Participation,	06
3	**Relational Model and relational Algebra**	Introduction to the Relational Model, relational schema and concept of keys. Relational Algebra-operators, Relational Algebra Queries.	07
4	**Structured Query Language (SQL)**	Overview of SQL, Data Definition Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity , check constraints, Data Manipulation commands, Data Control commands, Set and string operations, aggregate functions, group by, having, Views in SQL, joins, Nested and complex queries, Triggers.	08
5	**Relational-Database Design**	Concept of normalization, Function Dependencies, First Normal Form, 2NF, 3NF, BCNF.	06
6	**Transactions Management and Concurrency and Recovery**	Transaction concept, Transaction states, ACID properties, Transaction Control Commands, Concurrent Executions, Serializability-Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols, Recovery System: Log based recovery, Deadlock handling.	07

DETAILED LAB SYLLABUS:

Hardware Requirements: 2GB RAM

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

Sr. No.	Detailed Lab/Tutorial Description
1	Identify the case study and detail statement of the problem. Design an Entity-Relationship(ER) / Extended Entity-Relationship (EER) Model.
2	Mapping ER/EER to Relational schema model.
3	Create a database using Data Definition Language (DDL) and apply integrity constraints for the specified System.

4	Apply DML Commands for the specified system.
5	Perform Simple queries, string manipulation operations and aggregate functions.
6	Implement Views and Join operations.
7	Perform Nested and Complex queries
8	Perform DCL and TCL commands.
9	Implement function and trigger.
10	Demonstrate Database connectivity
11	Implementation and demonstration of Transaction and Concurrency control techniques using locks.

Theory Assessments:

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

2. End Sem Theory Examination:

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

Lab Assessment:

1.Term work Assessment:

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

2.Oral/ Practical Assessment:

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

Books:

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

References:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 206	Analog and Digital Electronics Lab		2	--	-	1	--	1

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
ECS 206	Analog and Digital Electronics Lab	-	-	-	-	25	–	25	50

Course Objectives:

1. To Enhance students' understanding of electronic circuits.
2. To Perform DC and AC analysis of BJT and MOSFET amplifiers.
3. To Learn operational amplifier principles and applications.
4. To Develop skills in IC selection, functionality, and application.
5. To Explain combinational and sequential circuit design using MSI chips.
6. To Introduce logic families, PLDs, and VHDL programming.

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

1. Understand construction, characteristics and working of semiconductor devices such as BJT, MOSFET
2. Derive expressions for performance parameters of BJT and MOSFET based Electronic circuits.
3. Derive and determine various performances-based parameters and their significance for Op-Amp and analyze and identify the linear and nonlinear applications of operational amplifiers.
4. Design an application with the use of integrated circuits.
5. Analyze, design and implement Combinational logic circuits, Sequential logic circuits and implementation of various counters using flip flops and MSI chips.
6. Understand basics of VHDL Hardware Description Language and its programming with combinational and sequential logic circuits.

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	2	2	2	2	1	-	-	1	1	2	3	2	2
CO2	3	3	2	2	2	2	-	-	-	1	1	3	1	2
CO3	3	3	2	2	2	2	-	-	-	1	1	3	1	1
CO4	3	3	2	2	2	2	-	-	-	3	2	3	3	2
CO5	3	3	3	2	3	1		1		2	2	3	3	2
CO6	3	2	2	2	3	1		1		2	2	3	2	2

DETAILED LAB SYLLABUS:

Software Requirements for AEC : LTSpice

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

Software Requirements for DCSD: VHDL simulation software

Hardware Requirements for DCSD: Hardware Kits

Sr. No.	Detailed Lab/Tutorial Description
1	To study input and output characteristics of CE configuration
2	Analyze Integrator using op-amp IC 741
3	Design Monostable Multivibrator using IC 555.
4	To perform DC analysis of voltage divider bias for (BJT) CE amplifier.
5	To study BJT as CE amplifier.and calculate its voltage gain
6	Design inverting, non-inverting amplifier and buffer using IC 741
7	Design Wein bridge and RC phase shift Oscillator using op-amp IC 741
8	Simulation experiment on drain and transfer characteristics of JFET
9	Simulation experiment on multistage amplifier.
10	Design High Voltage High Current voltage regulator using IC 723.
11	Study and design of Combinational circuits.
12	Study and design of sequential circuits.
13	Implementation of Asynchronous counter using MSI counter IC and flip flops.
14	Implementation of synchronous counter using MSI counter IC and flip flops.
15	VHDL program for Combinational circuits.
16	VHDL program for sequential circuits.

Lab Assessment:

1. **Term work Assessment :**

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

2. **Practical/Viva Assessment:**

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
MGMT 290	Personal Finance Management	02	-	–	02	-	–	02

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		1	2	Average					
MGMT 290	Personal Finance Management	20	20	20	40	-	-	--	60

Course objectives: The course is aimed

1. To understand the fundamentals of budgeting and create effective personal budgets.
2. Gain knowledge of investment options, risk and returns for informed decision making.
3. Learn how to assess insurance needs
4. Implement tax - saving strategies for financial security
5. To know the various financial scams and frauds & to overcome them.

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

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

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1		1		1	1	1								
CO2	2	2	1		2									
CO3		2	3	1		1								
CO4	2	3	2		2	1								
CO5	1	2	2	1	2	1								

Detailed Theory Syllabus:

Sr. No.	Module	Detailed Contents of Module	Hrs
1	Budgeting	1. Understanding income & expenses: - Identifying sources of income, tracking expenses, balancing necessary Vs. discretionary spending. 2. Creating a Personal Budget: - Applying budgeting methods (e.g., 50/30/20 rule), setting financial goals and allocating for savings and debt repayment. 3. Budgeting Tools and Techniques: - Exploring budgeting apps and tools to automate savings and expense tracking.	4
2	Investment	1. Types of Investment: Equities (stocks), Fixed income (bonds), Real Estate and Mutual Funds/ ETFs. 2. Understanding investment risks: Market risk, credit risk, liquidity risk and interest rate risk. 3. Risk and return relationship: How risk affects returns, diversification and assessing personal risk tolerance. 4. Evaluating investment opportunities: Analysing potential investments and choosing based on financial goals and risk profile.	5
3	Insurance	1. Types of insurance: Health, Life, Disability, Auto and Property Insurance. 2. Key Insurance concepts: Premiums, deductibles, coverage limits and policy terms, Grace Period, Free Look period and revival of policy. 3. Evaluating insurance needs: Calculating the right coverage for personal risk and financial security 4. Choosing the right insurance products: Comparing different policies, terms and conditions based on personal needs.	5
4	Tax Planning	1. Tax Savings Strategies: Contribution to tax-advantaged accounts and using tax-efficient investments 2. Tax deductions: Common deductions like mortgage interest, medical expenses, and charitable contributions. 3. Tax Exemptions: Exemptions for personal income, dependent exemptions and specific retirement income 4. Understanding tax planning tools: Leveraging tools and resources to maximize tax efficiency.	5
5	Financial Scams and Frauds	1. Common Financial Scams: Ponzi Schemes, Phishing, Identity theft and online fraud.	5

		2. Recognizing Red Flags of Fraud: Identifying warning signs of financial scams. 3. Preventing Financial Scams: Best practices for protecting personal information and avoiding scams. 4. Reporting Scams: How to report financial fraud to relevant authorities like FTC, SEC and local consumer agencies.	

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)
HUM 201	Human Values and Social Ethics	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
HUM 201	Human Values and Social Ethics	--	--	--	--	50	--	--	50

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

Course Objectives:

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

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

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

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	1	2	3	1	1	1	1	1	2	1	1	1	2	1
CO2	2	2	1	3	2	1	2	1	2	2	1	1	1	2
CO3	2	3	3	1	3	3	2	3	2	3	3	2	3	1
CO4	2	1	2	2	2	2	1	1	1	2	2	1	2	3
CO5	1	3	2	2	1	3	3	2	3	3	1	3	1	2

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1.	**Ethics and Values**	Meaning & Concept of Ethics Difference between Ethics and Values Ethical code of conduct	03
2.	**Professional Ethics**	Professional Ethics vs Personal ethics Components of professional ethics 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	04
4.	**Ethics in Technical writing**	Documenting sources Presentation of Information Ethics & Plagiarism	07
5.	**Ethics and Technology Development**	Risk management and Individual rights Moral issues in development and application of technology Privacy/confidentiality of information Managing Technology to ensure fair practices	07

Assessments:

Termwork : 50 marks (Continuous evaluation)

Books/References:

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

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)
MATH 209E	Mathematics for Electronics and Computer Science IV	02+1*	02	-	02	01	-	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
MATH 209E	Mathematics for Electronics & Computer Science 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. Use the concept of sampling theory to engineering problems and Use concepts of vector calculus to analyze and model engineering problems.
4. Understand the concepts of vector spaces used in the field of machine learning and engineering problems.
5. Introduce students to equivalence relations, Lattices, recurrence relation..
6. Introduce students to graphs and trees.

Course Outcomes:

After successful completion of the course students will be able to

1. Able to use the concept of Correlation , Regression & fitting of curves to the engineering problems in data science, machine learning, and AI.
2. Able to iIllustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
3. Able to use the concept of sampling theory to engineering problems and Able to Apply the concepts of vector calculus in real life problems.
4. Able to use the concept of vector spaces and orthogonalization process in Engineering Problems.

5. Able to use concepts equivalence relations and Lattices in hierarchy based technological applications and Able to Express recursive functions of subjects like Data Structures as recurrence relation.
6. Ability to use graphs and trees in programming applications.

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	2	1		1			1	1		1	1	1	1
CO2	3	2	1		2			1	1		1	1	1	1
CO3	3	2	1		1			1	1		1	1	1	1
CO4	3	2	1		1			1	1		1	1	1	1
CO5	3	2	1		1			1	1		1	1	1	1
CO6	3	2	1		1			1	1		1	1	1	1

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.	07
3	**Sampling Theory, Vector Integration**	**Sampling Theory:** Sampling distributions, Testing of Hypothesis, Level of significance, critical region, one-tailed and two-tailed test, Degree of freedom, central limit Theorem(Statement only), Test of significance for large samples: Test for significance of the difference between sample mean and population, Small samples**:** Student's t-distribution Test for significance of the difference between sample mean and population mean, Test for significance of the difference between means between two different samples, **Vector integral:** Line Integral, Green's theorem in a plane (Without Proof), Stokes' theorem (Without Proof) only evaluation. Gauss' divergence theorem (Without Proof).	08

4	**Linear Algebra : Vector Spaces**	Vectors in R^n , 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 R^n to R^m.	06
5	**Graphs and Trees**	**Graphs:** Types of Graphs, Isomorphism Of Graphs, Subgraphs, Types of Graphs, Complement of Graph, Connected Graphs, Eulerian And Hamiltonian Graphs, **Trees:** Trees, Binary Trees, Minimum Spanning Tree, Kruskal's Algorithm	06
6	**Lattice Theory & Recurrence relation**	**Lattice Theory:** Poset, Hasse Diagram, Lattices, Special Types of Lattices, **Recurrence relation:** Solving Recurrence relation, Linear Homogenous Recurrence relation with constant coefficients, Introduction to Non-Homogenous Recurrence relation	06

Theory Assessments:

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

2. End Sem Theory Examination:

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

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

B. Term Work:

1. Batch wise practical's are to be conducted. The number of students per batch should be as per norms.
2. Students must be encouraged to write Matlab Programs . Each student has to perform at least 4 Matlab practical's and at least 6 assignments on the entire syllabus.
3. Matlab Practical's will be based on
(i) Correlation, Regression, Curve Fitting
(ii) Probability, Probability Distributions
(iii) Sampling Theory
(iv) Vector Integration
(v) Linear Algebra : Vector Spaces

(vi) Graphs and Trees
(vii) Lattice Theory
(viii) Recurrence relation

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)
ECS 210	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					
ECS 210	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. Understand notations used for time complexity analysis of algorithms.
2. Explain Divide and Conquer Approach with its applications.
3. Understand Dynamic Programming Approach for finding the shortest path.
4. Apply the concept of Greedy Method Approach with different applications.
5. Use Backtracking and Branch-and-bound Method for various applications.
6. Understand the concept of Number Theoretic, Graph Theoretic and Non-deterministic polynomial time algorithms

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	1	-	-	-	-	-	-	-	-	-	2	--	--
CO2	3	2	2	3	-	-	-	-	-	-	-	**3**	--	--
CO3	2	3	2	2	-	-	-	-	-	-	-	**3**	**2**	--
CO4	2	2	2	1	-	-	-	-	-	-	-	**3**	2	--
CO5	3	2	1	3	-	-	-	-	-	-	-	**2**	1	1

CO6	2	1	1	2	-	-	-	-	-	-	-	**2**	**2**	**1**

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1	**Introduction to algorithms and analysis of algorithm**	Brief introduction of Algorithms and its design methods. Analysis of Algorithm - Time & Space Complexity, Asymptotic Analysis in best, average and worst case & Asymptotic Notations (O, Ω, θ, w, o). Brief introduction of Randomized Algorithms.	05
2	**Divide and Conquer Approach**	Recurrence Equations, Solution of Recurrence equations - Master Theorem, Recurrence Tree method & Substitution method. General Structure of a Divide and Conquer Algorithm, Applications - Analysis of Merge & Quick sort Algorithms. Strassen's Matrix Multiplication Algorithm & Finding the closest pair of points in a 2D plane Algorithm.	06
3	**Dynamic Programming Approach**	General Method, Applications - Matrix chain multiplication, Optimal binary search trees, Single Source Shortest Path - Bellman-Ford Algorithm, Dijkstra's algorithm. All pairs shortest path problem - Floyd-Warshall Algorithm, Travelling salesperson problem.	08
4	**Greedy Method Approach**	General Method, Applications - Job sequencing with deadlines, fractional & 0/1 knapsack problem, Minimum cost spanning trees - Prims & Kruskal's Algorithms.	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.	06
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 of non deterministic algorithms, Complexity classes - P, NP.	06

DETAILED LAB SYLLABUS:

Lab Prerequisite:

Software Requirements: C/Python/C++

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

Theory Assessments:

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

2. End Sem Theory Examination:

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

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

Lab Assessment:

1.Termwork Assessment:

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

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

Text Books:

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

Reference Books:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/ Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 211	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					
ECS 211	Basics of VLSI	40	40	40	60	25	--	25	150

Course Objectives:

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

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

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

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1		2									2	3	2	
CO2	2	2	2								2	3	2	
CO3	2	2	2								2	3	2	1
CO4	2			2							2	3	2	1
CO5	2	2		2		2					2	3	2	1
CO6	2	2	2	2							2	3	2	1

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

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs
1	**Technology Comparison, MOSFET Scaling**	Comparison of BJT, NMOS and CMOS technology Types of scaling, MOSFET Models, MOSFET capacitances	05
2	**MOSFET Inverters**	**Circuit Analysis:** Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load, E mode MOSFET load, D mode MOSFET load inverter and CMOS inverter, comparison of all types of MOS inverters, design of CMOS inverters	07
3	**Universal gates, Complex circuits using MOSFETs**	**Logic Circuit Design**: Analysis and design of 2-I/P NAND and NOR using equivalent CMOS inverter, W/L ratio, Complex circuits.	07
4	**MOS Circuit Design Styles**	**Design Styles:** Static CMOS, pass transistor logic, transmission gate, Pseudo NMOS, Domino, NORA, Zipper, C2MOS, sizing using logical effort	08
5	**Circuit Realization using MOSFETs**	**Circuit Realization:** SR Latch, JK FF, D FF, 1 Bit Shift Register, MUX, decoder using above design styles	06
6	**Semiconductor Memories**	**SRAM:** ROM Array, SRAM (operation, design strategy, leakage currents, read/write circuits), DRAM (Operation, leakage currents, refresh operation), Flash memory- NOR flash, NAND flash.	06

DETAILED LAB SYLLABUS:

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

Sr. No.	Detailed Lab Description
1	Effect of parasitic capacitance and threshold voltage on output of NMOS inverter with resistive load.
2	Circuit characteristics and performance estimation of NMOS inverter with resistive load.

	1) Verification of V_{OH} level for different values of load resistance. 2) Find rise time for different values of load resistance.
3	Circuit characteristics and performance estimation of NMOS inverter with Enhancement mode MOSFET load.
4	Circuit characteristics and performance estimation of NMOS inverter with Depletion mode N channel MOSFET as a load.
5	Circuit characteristics and performance estimation of CMOS inverter. 1) Verification of V_{OH} and V_{OL} levels. 2) Comparison of rise and fall times for different values of W/L ratio of pull up and pull down devices.
6	Circuit characteristics and performance estimation of CMOS Dynamic 2 Input NAND Gate. 1) Verification of V_{OH} and V_{OL} levels for various input possibilities. 2) Verification of precharge and evaluate condition for different inputs. 3) Verification of charge leakage problem.
7	Design of 4:1 MUX using pass transistor logic and transmission gates.
8	Design of 6T SRAM using Microwind dsch3.1.

Theory Assessments:

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

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

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

Lab Assessments:

Term work should consist of 8 experiments.

Journal must include at least 3 assignments.

Term work Assessment:

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

Oral/Viva Assessment:

Based on the above contents and entire syllabus.

Text Books:

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

References

1. Etienne Sicard and Sonia Delmas Bendhia, "Basics of CMOS Cell Design", Tata McGraw Hill, First Edition. 2. Neil H. E. Weste, David Harris and Ayan Banerjee, "CMOS VLSI Design: A Circuits and Systems Perspective", Pearson Education, 3rd Edition.

2. Debaprasad Das, "VLSI Design", Oxford, 1st Edition. 6. Kaushik Roy and Sharat C. Prasad, "Low-Power CMOS VLSI Circuit Design", Wiley, Student Edition.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 212	System Software and Operating Systems	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
ECS 212	System Software and Operating Systems	40	40	40	60	--	--	--	100

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 introduce the concept of a process, thread and its management, Inter-process communication (IPC) and also understand the concepts of process synchronization and deadlock.
6. To understand the concepts and implementation of memory management policies, virtual memory and functions of Operating Systems for device management.

Course Outcomes:

After successful completion of the course students will be able to

1. Identify the relevance of different system programs.
2. Explain various data structures used for assembler and macro processor design.
3. Understand the functions of linkers, loaders and fundamentals of compiler design also identify the relationships among different phases of the compiler.
4. Understand the objectives, functions and structure of OS.
5. Analyze the concept of process management and evaluate performance of process scheduling algorithms.
6. Apply and analyze different techniques of memory management and I/O management.

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	3	--	--	--	--	--	1	--	--	--	3	--	2
CO2	3	3	--	--	--	--	--	1	--	--	--	**3**	--	2
CO3	3	3	--	--	--	2	--	--	1	1	--	**3**	2	--
CO4	3	3	--	--	--	2	--	--	1	1	--	**3**	2	--
CO5	--	--	3	2	3	2	1	--	--	1	--	**2**	3	3
CO6	--	--	3	3	3	2	1	--	--	2	2	**2**	**3**	**3**

DETAILED THEORY SYLLABUS:

Sr. No.	Module	Detailed Content	Hrs.
1	**Introduction to System Software**	Concept of System Software, Introduction to various system programs such as Assembler, Macro processor, Loader, Linker, Compiler, Interpreter, Device Drivers, Operating system, Editors, Debuggers.	03
2	**Assemblers and Macro Processors**	Elements of Assembly Language programming, Assembler Design: Introduction to single pass Assembler Design for Hypothetical machines, data structures used. Macro definition and call, parameterized, conditional Macro, Design of Two pass macro processor for Hypothetical machines, data structures used.	08
3	**Linkers, Loaders and Compilers**	Functions of loaders, Absolute loader/Compile and Go loader, Phases of compilers:Lexical Analysis, Syntax analysis, SR Parser, Introduction to semantic analysis, Intermediate Code Generation:Types of Intermediate codes, Code optimization techniques, Introduction to Code Generation.	08
4	**Overview of operating System**	Introduction, Objectives, Functions and Types of Operating System, Operating System Services and Interface; Operating system structures: Layered, Monolithic and Microkernel.	04
5	**Process Management**	Concept of a Process, Process States, Operation on Process Uniprocessor Scheduling-Types: Preemptive and Non-preemptive, scheduling algorithms Threads: Definition and Types, Concept of Multithreading, Inter-Process Communication, Process Synchronization, Mutual Exclusion: ,Semaphores, Producer Consumer problem, Principles of Deadlock: Conditions Deadlock Handling Mechanism.	08

6	**Memory Management and I/O Management**	Basic Concepts of Memory Management; Memory Allocation Techniques, Paging, TLB, Segmentation, Virtual Memory; Demand Paging, Page Replacement Algorithms, I/O Devices, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C- LOOK, Linux I/O.	08

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.

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 鈥?ISBN-13: 9780133805918 .

4. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons , Inc., 9th Edition, 2016, ISBN 978-81-265-5427-0

References:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 213	Microprocessor and 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					
ECS 213	Microprocessor and Microcontrollers	40	40	40	60	25	-	25	150

Prerequisite: Digital System Design

Course Objectives:

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

Course Outcomes:

After successful completion of the course students will be able to

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

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	3	2	-	1	1	-	-	-	-	1	3	3	2
CO2	3	3	3		2	1	-	-	-	-	1	3	3	2
CO3	3	2	2	-	2	1	-	-	-	-	1	3	3	3
CO4	3	3	3		3	1	-	-	-	-	1	3	3	3
CO5	2	3	2	-	3	1	-	-	-	-	1	2	2	1
CO6	2	3	1	-	2	1	-	-	-	-	1	3	3	3

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 Features of 8086 Microprocessor. 1.3 Comparison between Microprocessor and Microcontroller. 1.4 Concept of Harvard & Von Neumann Architecture. 1.5 pipelined operation.	04
2	**8051 Microcontroller Architecture**	2.1 8051 Features & its architecture (ALU, PC, DPTR, PSW, Internal RAM, Internal ROM, Latch, SFRs, General purpose registers, Timer/Counter, Interrupt, Ports). 2.2 Pin configuration of 8051 Microcontroller. 2.3 Memory organization (Program and Data memory Map)	04
3.	**8051 Microcontroller assembly language programming**	3.1 Addressing modes of 8051. 3.2 Assembler directives of 8051. 3.3 Instruction Set: Data transfer, Arithmetic, Logical, Branching. 3.4 Programming concepts: Looping , Counting, sorting and Indexing, Data manipulation, Masking. 3.5 Programs related to: arithmetic, logical, Branch & delay.	08
4.	**Internal Hardware of 8051 Microcontroller & Programming**	4.1 I/O port structure and programming. 4.2 Timer/Counter and programming.. 4.3 Serial port and programming. 4.4 Interrupts and programming. 4.5 Power saving modes of 8051: Power down and idle mode.	08
5.	**8051 Interfacing & Applications**	6.1 Display interfacing: 7-segment LED display, 16x2 generic alphanumeric LCD display. 6.2 Analog devices interfacing: 8-bit ADC and DAC 6.3 Motor interfacing: Dc motor & Stepper motor. 6.4 Waveform (Ramp, triangular & Sine wave) generation program using DAC.	08
6.	**Advanced Microcontroller Architecture (ARM CORTEX-M3)**	6.1 Comparison of CISC & RISC architectures. 6.2 Overview of ARM family. 6.3 ARM Cortex-M3 architecture,. 6.4 Programmer's model: Operation Modes and States, registers, special registers, Application Program Status Register- Integer status flags, Q status flag, GE bits. 6.5 Memory system: Features and memory map 6.6 Exceptions and Interrupts - Nested vectored interrupt controller.	07

DETAILED LAB SYLLABUS:

Lab Prerequisite: Digital System Design

Hardware Requirements: Experiments can be conducted on Assembler, Emulator

Software Requirements: Hardware kits

Sr. No.	Detailed Lab/Tutorial Description
1	Introduction to 8086 microprocessor kit and assembler.
2	To write an assembly language program to perform Arithmetic and Logical Operations using 8051 microcontroller.
3	To write an assembly language program to transfer of data bytes between Internal and External Memory using 8051 microcontroller.
4	To write an assembly language program to perform experiments based on General Purpose Input-Output & Timers.
5	Program for Serial communication of 8051 using UART.
6	Programs for Interfacing of Stepper Motor/DC motor with 8051 microcontroller.
7	Programs for generating waveform (Square, Triangular, Sine wave) with 8051 microcontroller.
8	Programs for Interfacing of LCD with 8051
9	Mini project based on any application related to 8051 microcontroller.

Theory Assessments:

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

2. End Sem Theory Examination:

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

Lab Assessment:

1. Term work Assessment:

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

2.Oral/Practical Assessment: Practical /Oral exam will be based on the experiments and project implemented in the semester.

Text Books:

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

Reference Books:

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

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 214	System Software and Operating Systems Lab	-	02	--	-	01	--	01

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Average					
ECS 214	System Software & Operating Systems Lab	-	-	-	-	25	--	25	50

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 introduce the concept of a process, thread and its management, Inter-process communication (IPC) and also understand the concepts of process synchronization and deadlock.
6. To understand the concepts and implementation of memory management policies, virtual memory and functions of Operating Systems for device management.

Course Outcomes:

After successful completion of the course students will be able to

1. Identify the relevance of different system programs.
2. Explain various data structures used for assembler and macro processor design.
3. Understand the functions of linkers, loaders and fundamentals of compiler design also identify the relationships among different phases of the compiler.
4. Understand the objectives, functions and structure of OS.
5. Analyze the concept of process management and evaluate performance of process scheduling algorithms.
6. Apply and analyze different techniques of memory management and I/O management.

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	3	--	--	--	--	--	1	--	--	--	3	--	2
CO2	3	3	--	--	--	--	--	1	--	--	--	**3**	--	2
CO3	3	3	--	--	--	2	--	--	1	1	--	**3**	2	--
CO4	3	3	--	--	--	2	--	--	1	1	--	**3**	2	--
CO5	--	--	3	2	3	2	1	--	--	1	--	**2**	3	3
CO6	--	--	3	3	3	2	1	--	--	2	2	**2**	**3**	**3**

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.
2	Implementation of single pass Macro Processor.
3	Implementation of Lexical analysis phase of compilers.
4	Implementation of Parser (Any one).
5	Implementation of Intermediate code generation phase of compilers.
6	Implementation of code generation phase of compilers.
7	Explore usage of basic and advanced Linux Commands. For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc).
8	Explore the file and process management system calls.
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.

Lab Assessment:

1.Term work Assessment:
Term work should consist of 8 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).

2.Oral/Practical Assessment:

Based on the experiments and entire syllabus.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
ECS 291	Programming Lab I (Java Programming)		1#+2	--	-	1	--	1

1# to be taken class wise

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

Course Objectives:

1. To understand Java's evolution, architecture, IDE usage, and basic I/O operations for program development.
2. To apply object-oriented programming principles for designing modular, maintainable, and efficient software solutions.
3. To explore inheritance, polymorphism, and advanced OOP features for enhancing code reusability and flexibility.
4. To utilize Java packages and JAR files for organizing code, encapsulation, and creating reusable libraries.
5. To manage exceptions and implement multithreaded applications with synchronization and concurrency concepts.
6. To design interactive GUIs and implement graphics programming for modern application development.

Course Outcomes:

After successful completion of the course students will be able to

1. Demonstrate proficiency in Java programming using its architecture, IDEs, and I/O operations.
2. Apply object-oriented programming techniques to solve real-world problems effectively.
3. Implement advanced OOP concepts like inheritance and polymorphism for scalable software development.

4. Create modular and reusable code using Java packages and libraries adhering to industry standards.
5. Develop robust applications by implementing exception handling and multithreading techniques.
6. Design and build interactive graphical user interfaces using JavaFX, Swing, and Java2D.

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	1	2	1	1	1	--	--	--	--	--	3	3	1
CO2	3	3	3	2	3	--	--	--	--	--	--	3	3	3
CO3	3	3	3	2	3	--	--	--	--	--	--	3	3	2
CO4	3	3	3	3	2	2	--	--	3	3	2	3	3	3
CO5	3	2	3	3	2	3	3	3	2	3	3	3	2	3
CO6	3	--	--	1	1	3	3	3	1	--	--	3	--	1
Avg	3.00	2.40	2.80	2.00	2.00	2.25	3.00	3.00	2.00	3.00	2.50	3.00	2.80	2.17

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Lab/Tutorial Description	No of Hours
1	Introduction to Java	1.1 Java History, Java Features, **Java Editions (SE, EE, ME)**, 1.2 Java Virtual Machine **and Its Architecture**, 1.3 Data Types and Size 1.4 Java Program Development, **"Java IDEs"** like IntelliJ IDEA, Eclipse, or NetBeans 1.5 Java Source File Structure, Compilation, Executions. 1.6 **Basic I/O operations (reading from and writing to files or console)..**	3
2	Object-Oriented Programming Fundamentals	2.1 Core OOP Concepts: Classes, Objects, Object References, Access Modifiers (private, protected, public), and static 2.2 Constructors and Initialization Blocks: Purpose, overloading, and use in object creation.2.3 Abstract Classes and Interfaces: Abstract methods, abstract classes, and Interfaces (default and static methods in Java 8+). 2.4 Object Class Basics: Methods like toString(), equals(), and hashCode().	5
3	Advanced OOP - Inheritance and Polymorphism	3.1 Inheritance: Benefits, Types (Single, Multilevel, Hierarchical), and Role of Constructors in Inheritance. 3.2 Polymorphism: Method Overloading (compile-time) and Method Overriding (runtime). 3.3 Advanced Features: Use of super, final for class/method restriction, Object Cloning, and Reusability Best Practices.	5
4	Packages	4.1 Organizing Classes and Interfaces: Role of packages in modular design and logical grouping. 4.2 Access Protection: Use of packages for encapsulation and controlled access to classes/methods. 4.3 Creating and Using Packages: Defining	4

		packages, setting up classpath, compiling with packages. 4.4 Working with JAR Files: Creating reusable libraries (JAR files), importing packages, and static imports. 4.5 Best Practices: Naming conventions and guidelines for creating packages in professional environments.	
5	Exception Handling & Multithreading	5.1 Introduction to Exceptions: Difference between Exceptions and Errors, Types of Exceptions (Checked and Unchecked). 5.2 Exception Handling Mechanisms: Control flow in exceptions, use of try, catch, finally, throw, and throws. 5.3 Custom Exceptions: Defining and handling user-defined exceptions. 5.4 Multithreading Basics: Introduction to threads, lifecycle of a thread, and creating threads using Thread class and Runnable interface. 5.5 Thread Management: Thread methods (start(), sleep(), join(), etc.), thread synchronization, and handling thread exceptions. 5.6 Concurrency Concepts: Basic introduction to thread safety and inter-thread communication.	5
6	Modern GUI Development and Graphics Programming in Java	**6.1 GUI Programming with JavaFX & Swing:** Introduction to modern GUI development using **Swing** and **JavaFX**, covering basic components like buttons, labels, and text fields, with event handling for user interactions. **6.2 Layouts & Design:** Use of layout managers in **Swing** (FlowLayout, BorderLayout) and **JavaFX** (HBox, VBox, GridPane) for creating responsive UIs. **6.3 Graphics Programming:** Drawing shapes, colors, and simple animations using **Java2D API** for graphics programming.	4

DETAILED LAB SYLLABUS:

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

Sr. No.	Detailed Lab/Tutorial Description
1	Write a Java program to demonstrate basic file and console I/O operations, such as reading input from the user and writing output to a file.
2	Create a Java program to define a class with attributes and methods. Implement constructors (default and parameterized) and demonstrate the use of access modifiers (private, public, protected).
3	Develop a program using an abstract class and an interface with Java features like default and static methods. Show polymorphism with overriding methods.
4	Design a program to demonstrate single and multilevel inheritance. Implement method overriding to achieve runtime polymorphism and use the super keyword.

5	Write a program to demonstrate object cloning in Java. Show how to create deep copies of objects and reuse methods for efficient design.
6	Create a Java project with multiple packages to organize classes logically. Include encapsulation and access protection, compile with classpath settings, and create a JAR file for reuse.
7	Write a program to demonstrate the use of try-catch-finally, throw, and throws.
8	Develop a multithreaded program to simulate a real-world scenario .
9	Build a GUI application using JavaFX or Swing. Implement buttons, labels, text fields, and event handling. Incorporate basic Java2D API features to draw shapes and create a simple animation.
10	Mini Project

Guidelines for Mini Project

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do surveys and identify needs, which shall be converted into problem statements for mini projects in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students shall submit an implementation plan, 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. The solution to be validated with proper justification and report to be compiled in standard format.

Lab Assessment:

1.Term work Assessment:

For performance experiments : **10-**Marks

Attendance : 05 Marks

Quality of Project report : **10** Marks

2.Oral/Practical Assessment: Practical /Oral exam will be based on the experiments and project implemented in the semester.

Course Code	Course Name	Theory (Hrs.)	Practical (Hrs.)	Tutorial (Hrs.)	Theory (Credits)	Practical /Oral (Credits)	Tutorial (Credits)	Total (Credits)
ENGG 201	Entrepreneurship	02	-	-	02	-	-	02

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		1	2	Avg. of 2					
ENGG 201	Entrepreneurship	20	20	20	40	-	-	-	60

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
5. Identify and understand marketing plan and strategies
6. Identify the causes of entrepreneurial failure

CO-PO-PSO Mapping (3 High , 2 Medium , 1 Low)

Course outcomes	Programme Outcomes											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	1	2	3
CO1	3	3	3	1	1	-	--	--	--	--	--	3	3	1
CO2	3	3	3	2	3	--	--	--	--	--	--	3	3	3
CO3	3	3	3	2	3	--	--	--	--	--	--	3	3	2
CO4	3	3	3	3	2	2	--	--	-	-	-	3	3	3
CO5	3	3	3	3	2	3	-	-	-	-	-	3	2	3
CO6	3	--	--	1	1	3	-	-	-	--	--	3	--	1
	3.00	2.50	2.80	2.00	2.00	2.25	3.00	3.00	2.00	3.00	2.50	3.00	2.80	2.17

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	6
2	Recognizing, assessment and Exploiting the Opportunity, Conducting Internal and External Analyses, Determining the Feasibility of the Concept, Selecting a Marketing Strategy	4
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	4
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	4
5	The Marketing Plan, conducting a Market Analysis, Understanding the Target Market, Reaching the Target Market through Locale and Engagement	4
6	Entrepreneurial failure, early stage failure, late stage failure	4

Assessment:
Internal Assessment:20 marks

End Semester Examination: 40 Marks

Books and References:

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