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JECRC UNIVERSITY

School of Engineering & Technology

Course Structure and Syllabus

B. Tech.

(Electronics & Communication Engineering)

Academic Programs

July, 2025

JECRC UNIVERSITY

Department of Electronics and Communication Engineering

Minutes of the Board of Studies Meeting

1. Minutes of the meeting of the Board of Studies assembled on 26 July, 2025 held in the Conference Hall, Dean's office, Engineering block, JECRC University Jaipur.

2. The following members attended the meeting.

   a. Dr. Dinesh Sethi, Professor & HOD. Electronics and Communication Engineering Department (ECE) -Convener
   b. Dr. Ghanshyam Singh, Professor (ECE), MNIT Jaipur -External Member
   c. Dr. Ram Rattan, Professor, Department of ECE -Member
   d. Dr. K.M.Singh, Professor, Department of ECE -Member
   e. Dr. Vaibhav Jain, Associate Professor, Department of ECE -Member
   f. Mr. Pratik, Assistant Professor, Department of ECE -Special Invitee
   g. Dr.Abhilasha,Assistant Professor, Department of ECE -Special Invitee
   h. Ms. Divya Mathur, Assistant Professor, Department of ECE -Special Invitee
   i. Ms. Ramandeep, Assistant Professor, Department of ECE -Special Invitee
   j. Dr. Rituraj Singh Rathore, Associate Professor, ECE -Special Invitee

3. At the outset Dr. Dinesh Sethi, Professor & Head, Department of ECE welcomed all the members and briefly apprised about the agenda of the meeting list below: -

   a. Revision of Course Structure of B.Tech (ECE) w.e.f Session 2025-2026
   b. Revision of Course Structure of M.Tech (Communication Systems)
   c. Revision of Course Structure of M.Tech (VLSI & Embedded System)

4. The complete curricula of B.Tech (Electronics and Communication Engineering) course was discussed to rationalize the syllabus and ensure the maximum input is given to the students within the available duration to optimize the utility of various stream. The discussion was mainly focused to ensure that syllabus should be designed in such manner so that all the B.Tech (ECE) students be imparted the requisite interdisciplinary knowledge for effective implementation at a later date. The syllabus was discussed carefully and threadbare to make it more useful from students' point of view to handle the practical scenarios efficiently and apply their knowledge with better understanding in the interrelated and interdependent fields. Following points were discussed and necessary changes have been incorporated for overall optimization of available time with student's the knowledge that is required to be gained.

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In the present scenario, fast changing technology spectrum demand engineering graduate with self-learning abilities and hands on experience to match with the industry demands. Presently, there is too much for the engineering graduates to munch on. They don't get time for anything else than to study the books. The number of credits is being reduced with the objective to prompt young minds to explore the unchartered territories and indulge in self learning of engineering and other subjects of their choice and taste.

5. Collaboration with L&T Edu Tech-

In the Session 2022-23 Department of ECE got a distinguished Collaboration with LnT, which is offering joint degree programs in Electronics and Communication Engineering in association with them.

Important Points of the Collabration:

1. Program name: "B.Tech. in Electronics and Communication Engineering" in association with LnT Edutech.
2. There would be a total of 10 subjects (30 Credits) during the tenure of 4 years, which shall be taken care of by LnT-Edutech. Partial subjects will be delivered in Offline Mode (at JU Campus) by LnT's subject expert. Each subject shall be integrated with a project for ensuring deeper learning.
3. LnT will be offering internship (immersion at LnT project site for well-performing students) and placement assistance to students enrolled in the joint degree programs.
4. Following courses were introduced as per LnT guidelines.

S.No	Course	Course Code	Course Credits	Semesters in which to be introduced
1	DM011A	**Engineering Graphics and Design**	3	I SEM
2	DCI009A	**Design Thinking and Creativity**	3	II SEM
3	BEE110A	**Industrial applications of Microcontrollers – A Practice based Approach**	3	III SEM
4	BEL097A	**Applied Industrial IoT**	3	IV SEM

5	BEE109A	i) Fundamental of Microsoft Azure	3	V SEM
6	BEE072A	ii)Drone Technology	3	V SEM
7	BEE080A	i) 5G Technology for smarter secure connectivity	3	VI SEM
8	BEE082 A	ii)AI and Edge Computing	3	VI SEM
9	DCI008A	i)Chip Based VLSI Design for Industrial Applications	3	VII SEM
10	BEE086A	ii) Renewable Energy and Power Evacuation	3	VII SEM

6. ***New course on 5G technologies***- Introducing new course on 5G technologies (based on AICTE directives) as per instructions of Govt of India (department of telecommunication) to prepare a base for indigenous development of 6G-7G in India itself. Details are as follows:

S.No	Course	Course Code	Course Credits	Semesters in which to be introduced
1	**BEE080A**	*5G Technology for smarter secure connectivity*	3	VI SEM

7. The following emerged from the discussions and course structure of the B. Tech. (ECE) for the Batch 2025-2029 has been designed as follows:-

a) <u>This Syllabus is applicable to the students who have taken admission in first year in July 2025)</u>

b) Course Structure-

Total Credit from the Session 2025-2029= 163 Credits

- *Min. Credit Required*= 163
- *Options can be availed in Department Electives and Open Elective Subjects*

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Semester	Ist Sem	IInd Sem	IIIrd Sem	IVth Sem	Vth Sem	VIth Sem	VIIth sem	VIIIth Sem	Total	Minimum Credit Required to Earn Degree
Total Credits	20	25	26	20	22	18	16	16	163	**163**

c) Details of Course Category and Credits

Semester	AEC	Core	Core (L&T)	Elective	Foundation	Foundation (L&T)	SEC	VAC	Multi-Disciplinary	Grand Total
1	2				12	3	3	0		20
2	2				16	3	2	2		25
3	2	14	3		3		2	2		26
4	2	8	3	3			2	2		20
5		7	6	6					3	22
6		3	6	6					3	18
7		1	6	6					3	16
8		16								16
Grand Total	**8**	**49**	**24**	**21**	**31**	**6**	**9**	**6**	**9**	**163**

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d) Details of Number of Courses

SEMESTER	Ist Sem	IInd Sem	IIIrd Sem	IVth Sem	Vth Sem	VIth Sem	VIIth sem	VIIIth Sem	Total
TOTAL COURSES (Theory & Labs)	11	13	12	9	10	7	6	1	**69**

8. Department of Electronics and Communication Engineering Department has been adopted following specialization courses:

1. B. Tech in Electronics and Communication Engineering

Specializations in (i) Communication Engineering
(ii) VLSI & Embedded System
(iii) Signal Processing
(iv) Computer Engineering
(v) Artificial Intelligence & Machine Learning

2. M. Tech in Electronics and Communication Engineering

Specializations in
(i) VLSI & Embedded System
(ii) Communication System

3. PhD in Electronics and Communication Engineering

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9. List of Courses of Specializations (**Tracks/Streams**)

	Track 1	Track 2	Track 3	Track 4	Track 5	Track 6
Semester & Department Elective	**Communication Engineering**	**VLSI & Embedded System**	**Signal Processing**	**Software Development**	**AI & Machine Learning**	**Miscellaneous**
Department Elective 1 (SEMESTER-4)	Random Variables & Stochastic Processes	Engineering System Modeling and Simulation	**Signal and Systems**	Object Oriented Programming	Artificial Intelligence	Electromagnetic Field Theory
Department Elective 2 &3 (SEMESTER-5)	Microwave Theory and Techniques	**Control System**	Information Theory and Coding	Computer Organization & Architecture	Mathematical Concepts for AI	Electronic Measurement & Instrumentation
	Fundamental of Microsoft Azure	Digital Hardware Design	Microprocessor & Microcontroller System	Data Base Management System	Introduction to Machine Learning	Optimization Techniques
Department Elective 4 &5 (SEMESTER-6)	IC Technology	Microcontrollers and Embedded system	Adaptive Signal Processing	Operating Systems	Optimization Techniques in Machine Leaning	Power Electronics
	Broad Band Communication	VLSI System	Speech and Audio Processing	Web Designing Techniques	**AI and Edge Computing**	**5G Technology for smarter secure connectivity**
Department Elective 6,7 (SEMESTER-7)	Communication Networks	ASIC & FPGA	**Image &Video Processing**	Theory of Computation	**Artificial neural Network**	Micro Electro Mechanical systems
	Radar &Satellite Communication	DSP Processors and Applications	**Fiber Optic Communication**	Deep Learning	Advanced Machine Learning	**Network Theory & System**
	Antennas and Wave Propagation	Embedded networks and protocol	Telecommunications and Data Communications	Embedded Computing System	Data and Visual analytics in AI	**Electronic Measurement & Instrumentation**

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Ram Rattan

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SEC,AEC &VAC COURSES-2025-26

Skill Enhancement Courses (SEC-COURSES)

	Semester	SEC Course Name	L	T	P	Credit
1	1	Digital Data and AI Literacy	0	0	2	1
2	1	Entrepreneurship Development Program	0	0	4	2
3	2	Advance Excel	0	0	4	2
4	3	Prompt Engineering for Electrononics and Communication Engineering	0	0	4	2
5	4	Circuit Design Lab Using Altium Software	0	0	4	2
Total Credit						9

Ability Enhancement Courses (AEC-COURSES)

	Semester	AEC Course Name	L	T	P	Credit
1	1	Communication Skills	1	0	0	1
2	1	Communication Skills Lab	0	0	2	1
3	2	Professional Skills	1	0	0	1
4	2	Professional Skills Lab	0	0	2	1
5	3	Leadership and Management Skills	2	0	0	2
6	4	Universal Human Values (UHV)	2	0	0	2
Total Credit						8

VALUE ADDED COURSES (VAC-COURSES)

	Semester	VAC Course Name	L	T	P	Credit
1	1	Environmental Sciences	2	0	0	0
2	2	Inculcation of Human Values and Professional Ethics in Higher Education Institutions	2	0	0	2
3	2	Indian Constitution	2	0	0	0
4	3	Any of IKS Basic Courses	2	0	0	2
5	4	Any of IKS Elective Course	2	0	0	2
Total Credit						6

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School of Engineering and Technology

Department of Electronics and Communication Engineering

11. Course-wise Revision Details-2025-26

S. No.	Semester	Course Code	Course Title	Credits (C_i)	Type of Revision	% Content Revision (C_{pr})	Credits Considered as Revised (C_r) = Credits (C_i)×% Content Revision (C_{pr})/100
1	1	DEN001A	Communication Skills	1	New Course Introduced	100.00	1
2	1	DEN001B	Communication Skills Lab	1	New Course Introduced	100.00	1
3	1	DMA001A	Engineering Mathematics-I *	4	No Change	0.00	0
4	1	DPH001A/ DCH 002A	Applied Physics/ Engineering Chemistry	3	No Change	0.00	0
5	1	DCO013A	Computer Programming and Logical	3	No Change	0.00	0
6	1	DPH002A/I	Applied Physics Lab/ Chemistry Lab	1	No Change	0.00	0
7	1	DCO014A	Computer Programming and Logical Thinking Lab	1	No Change	0.00	0
8	1	JIC001A/	Entrepreneurship Development	1	No Change	0.00	0
9	1	BCO570A	Digital Data and AI Literacy	2	New Course Introduced	100.00	2
10	1	DME011A	Engineering Graphics and Design	3	No Change	0.00	0
11	1	DCH001A/	Environmental Sciences/ Indian Constitution	0	No Change	0.00	0
12	2	DEN002A	Professional Skills	1	New Course Introduced	100.00	1
13	2	DEN002B	Professional Skills Lab	1	New Course Introduced	100.00	1
14	2	DMA002A	Engineering Mathematics-II	4	No Change	0.00	0
15	2	DEE 003A	Basic Electrical and Electronics	3	No Change	0.00	0
16	2	DCO001B	Computer Programming in C++	2	No Change	0.00	0
17	2	DPH001A/ DCH 002A	Applied Physics/ Engineering Chemistry	3	No Change	0.00	0
18	2	DPH002A/ DCH003A	Applied Physics Lab/Chemistry Lab	1	No Change	0.00	0
19	2	DCO018A	Advance Excel	2	New Course Introduced	100.00	2
20	2	DCO002B	Computer Programming in C++ Lab	2	No Change	0.00	0

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21	2		Foundation of Indian Knowledge System(IKS)	2	New Course Introduced	100.00	2
22	2	DME010A	Engineering workshop	1	No Change	0.00	0
23	2	DCH004A /DLW001 A	Environmental Sciences/Indian Constitution	0	No Change	0.00	0
24	2	DCI009A	Design Thinking and Creativity	3	No Change	0.00	0
25	3	BAS003E	Advanced Engineering Mathematics	3	Partially Revised	40.00	1.2
26	3	BEE001A	Electronics Devices	3	No Change	0.00	0
27	3	BEE002A	Digital Electronics	4	No Change	0.00	0
28	3	BCO 002B	Data Structure and Algorithm	3	No Change	0.00	0
29	3	BEE110A	Industrial applications of Microcontrollers – A Practice based	3	Partially Revised	60.00	1.8
30	3	BEE005A	Electronics Devices Lab	1	No Change	0.00	0
31	3	BEE006A	Digital Electronics Lab	1	No Change	0.00	0
32	3	BCO 002C	Data Structure and Algorithm Lab	1	New Course Introduced	100.00	1
33	3	BEE022A	Microprocessors & Microcontroller System Lab	1	No Change	0.00	0
34	3		Leadership and Management Skills	2	New Course Introduced	100.00	2
35	3		Prompt Engineering for Electrononics and Communication Engineering	2	New Course Introduced	100.00	2
36	3		Any of IKS Basic Courses	2	New Course Introduced	100.00	2
37	4	BEE012A	Analog Electronics	3	No Change	0.00	0
38	4	BEE014A	Principle of Communication Engineering	3	No Change	0.00	0
39	4		Department Elective 1	3	No Change	0.00	0
40	4	BEE017A	Electronic Workshop	1	No Change	0.00	0
41	4	BEE018A	Analog Electronics Lab	1	No Change	0.00	0
42	4	DCO008A	Applied Industrial IOT	3	New Course Introduced	100.00	3
43	4		Universal Human Values (UHV)	2	New Course Introduced	100.00	2
44	4	BEE111A	Circuit Design Lab Using Altium Software	2	New Course Introduced	100.00	2
45	4	BEE112A	Any of IKS Elective Course	2	New Course Introduced	100.00	2
46	5	BEE072A	Drone Technology	3	No Change	0.00	0
47	5	BEE021A	Digital Communication Engineering	3	No Change	0.00	0
48	5	BCO035A	Python Programming	3	No Change	0.00	0
49	5		Department Elective 2	3	No Change	0.00	0
50	5		Department Elective 3	3	No Change	0.00	0

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51	5		Open Elective 1	3	No Change	0.00	0
52	5	BEE038A	Control System Lab	1	No Change	0.00	0
53	5	BEE023A	Communications Engineering Lab	1	No Change	0.00	0
54	5	BEE024A	Basic Simulation Lab	1	No Change	0.00	0
55	5	BCO035B	Python Programming Lab	1	New Course Introduced	100.00	1
56	6	BEE033A	Digital Signal Processing	3	Partially Revised	40.00	1.2
57	6	BEE086A	Chip Based VLSI Design for Industrial Applications	3	New Course Introduced	100.00	3
58	6		Department Elective 4	3	No Change	0.00	0
59	6		Department Elective 5	3	No Change	0.00	0
60	6	BEE053A	Project	1	No Change	0.00	0
61	6		Open Elective 2	3	No Change	0.00	0
62	6	BEE036A	Digital Signal Processing Lab	1	No Change	0.00	0
63	6	BEE037A	VLSI Design Lab	1	No Change	0.00	0
64	7	BEE051B	Mobile Communication	3	Partially Revised	40.00	1.2
65	7		Department Elective 6	3	No Change	0.00	0
66	7		Department Elective 7	3	No Change	0.00	0
67	7	BEE082 A	Renewable Energy and Power Evacuation	3	New Course Introduced	100.00	3
68	7		Open Elective 3	3	No Change	0.00	0
69	7	BEE052A	Communication Networks Lab	1	No Change	0.00	0
70	8	BEE063C	Industry Internship	16	No Change	0.00	0

Total Credits $C_{total} = \Sigma C_i =$ 163

Total Revised Credits $C_R = \Sigma C_r =$ 38.4

Percentage of Syllabus Revision $\%R = 100 \times C_R/C_{total} =$	**23.56**

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Board of Studies (Department of Electronics & Communication Engineering)

Prof. Ram Rattan
(Member of BOS & Professor, Department of ECE)

Prof. K.M.Singh
(Member of BOS & Professor, Department of ECE)

Dr. Vaibhav Jain

(Member of BOS & Associate Professor, Department of ECE)

Mr. Pratik

(Special Invitee of BOS & Assistant Professor, Department of ECE)

Ms. Divya Mathur

(Special Invitee of BOS & Assistant Professor, Department of ECE)

Ms. Ramandeep

(Special Invitee of BOS & Assistant Professor, Department of ECE)

Dr. Rituraj Singh Rathore

(Special Invitee of BOS & Assistant Professor, Department of ECE)

Dr. Abhilasha

Prof. Ghanshyam Singh (External Member) -

(Professor, Department of ECE, MNIT Jaipur)

Prof. Dinesh Sethi
(Convener of BOS, Professor & HOD, Department of ECE)

26/07/25
Head
Department of Electronics & Communication Engineering
ASEAN University, Jaipur-303905

Counter Signature

Prof. Naveen Hemrajani
(Dean, School of Engineering & Technology)

B.Tech. in Electronics & Communication Engineering

(This Syllabus is applicable to the students who have taken admission in first year in July 2025)

Course Structure

Total Credit from the Session 2025-2029= *163* Credits

- Min. Credit Required= *163*
- Options can be availed in Department Electives and Open Elective Subjects.

Semester	Ist Sem	IInd Sem	IIIrd Sem	IVth Sem	Vth Sem	VIth Sem	VIIth sem	VIIIth Sem	Total	Minimum Credit Required to Earn Degree
Total Credits	**20**	**25**	**26**	**20**	**22**	**18**	**16**	**16**	**163**	**163**

Vision and Mission of the Department:

Vision

The vision of the department of Electronics & Communication Engineering is to be recognized as a center for imparting technical education of high standards in all its programs through focus on core competencies, multi-disciplinary collaborations, and quality in education.

Mission

The Electronics and Communication Engineering Department will educate each student to be a responsible and productive engineer who can effectively manage future challenges.

B.Tech. (ECE) Program Educational Objective (PEO's):

A graduate of the Electronics and Communication Engineering Program should:

PEO≠1: Core competence

The Graduates shall able to use modern techniques, innovate, design, simulate, develop, and test hardware components by pursuing successful careers in Indian and multinational companies, PSUs as Team Leaders, Managers, Consultants or as entrepreneurs and also to pursue higher education.

PEO ≠ 2: Leadership

The Graduates are provided with an academic environment to become aware of excellence, leadership and the life-long learning needed for a successful professional career.

PEO ≠ 3: Professionalism:

The Graduates of the program shall have professional and ethical attitude, communication skills, multidisciplinary approach and competence to relate engineering issues to broader social perspective.

PROGRAMME OUTCOMES (POs):

All Electronics and Communication Engineering graduates shall demonstrate:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, Manual for Affiliated / Constituent Colleges NAAC for Quality and Excellence in Higher Education 126 and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

PSO1: An ability to engage in life-long learning to follow developments in electronics and communication engineering.

PSO2: An ability to pinpoint and define engineering problems in the fields of electronics & communication engineering and able to solve problems through analytical thinking in their own or related fields.

PSO3: Graduates will exhibit research and problem-solving skills to support lifelong personal and professional development and able to face competitive exams like GATE, IES, ISRO, BSNL (JTO), DRDO, DMRC etc.

LIST OF OPEN ELECTIVE SUBJECTS OFFERED BY ECE DEPARTMENT

S. No.	Course No.	Course Title	Hrs/Wk L: T: P	Credits
1	BEE064A	Analog communication	3: 0: 0	3
2	BEE013A	Signals and Systems	3: 0: 0	3
3	BEE067A	Introduction to VLSI	3: 0: 0	3
4	BEE065A	Microprocessor and interfacing	3: 0: 0	3
5	BEE070A	Digital Communication	3: 0: 0	3
6	BEE033A	Digital Signal Processing	3: 0: 0	3
7	BEE071A	Engineering System Modeling and Simulation	3: 0: 0	3
8	BEE068A	Microcontrollers and Embedded system	3: 0: 0	3
9	BEE072A	Artificial Intelligence and Robotics	3: 0: 0	3
10	BEE069A	Embedded networks and protocol	3: 0: 0	3
11	BEE066A	Telecommunications and Data Communications	3: 0: 0	3

LIST OF SUBJECTS OFFERED BY ECE DEPARTMENT TO OTHER DEPARTMENTS

S. No.	Course No.	Course Title	Branch	Semester
1	BEE008A	Electronic Devices and Systems	EE	III
2	BEE020A	Microprocessor & Microcontroller System		V
3	BEE022A	Microprocessor & Microcontroller System Lab		V
4	BEE045A	Communication Systems		VI
5	BEE046A	Communication Systems Laboratory		VI
6	BEE009A	Digital Systems	CSE	III
7	BEE010A	Digital Systems lab		III
8	BEE047A	Embedded Computing System		VI

Schemes: B. Tech (Electronics & Communication Engineering) (This Syllabus is applicable to the students who have taken admission in first year in July 2025)

S. No.	Semester	Course Code	Course Title	L	T	P	Contact Hrs.	Credits	Type
1	**1**	DEN001C	Communication Skills	1	0	0	1	1	AEC
2	**1**	DEN001D	Communication Skills Lab	0	0	2	2	1	AEC
3	**1**	DMA024A	Engineering Mathematics-1	3	1	0	4	4	Foundation
4	**1**	DPH001B	Applied Physics	3	0	0	3	3	Foundation
5	**1**	DCO013A	Computer Programming and Logical Thinking	3	0	0	3	3	Foundation
6	**1**	DPH002B	Applied Physics Lab	0	0	2	2	1	Foundation
7	**1**	DCO014A	Computer Programming and Logical Thinking Lab	0	0	2	2	1	Foundation
8	**1**	JIC001A	Entrepreneurship Development	0	0	2	2	1	SEC
9	**1**	DCO021A	Digital Data and AI Literacy	0	0	4	4	2	SEC
10	**1**	DCH010A	Environmental Education	2	0	0	2	0	VAC
11	**1**	DM011A	Engineering Graphics and Design	3	0	0	3	3	Foundation (L&T)
1	**2**	DEN002C	Professional Skills	1	0	0	1	1	AEC

2	**2**	DEN002D	Professional Skills Lab	0	0	2	2	1	AEC
3	**2**	DMA002A	Engineering Mathematics-2	3	1	0	4	4	Foundation
4	**2**	DEE 003A	Basic Electrical and Electronics Engineering	3	0	0	3	3	Foundation
5	**2**	DCO001B	Computer Programming in C++	2	0	0	2	2	Foundation
6	**2**	DCH 002A	Engineering Chemistry	3	0	0	3	3	Foundation
7	**2**	DCH003A	Chemistry Lab	0	0	2	2	1	Foundation
8	**2**	DCO018A	Advance Excel	0	0	4	4	2	SEC
9	**2**	DCO02B	Computer Programming in C++ Lab	0	0	4	4	2	Foundation
10	**2**	IKS001A	Inculcation of Human Values and Professional Ethics in Higher Education Institutions	2	0	0	2	2	VAC
11	**2**	DCO006A	Engineering Workshop	0	0	2	2	1	Foundation
12	**2**	DLW001A	Indian Constitution	2	0	0	2	0	VAC
13	**2**	DCI009A	Design Thinking and Creativity	3	0	0	3	3	Foundation (L&T)
1	**3**	BAS003E	Advanced Engineering Mathematics	3	0	0	3	3	Foundation
2	**3**	BEE001A	Electronics Devices	3	0	0	3	3	Core
3	**3**	BEE002A	Digital Electronics	3	1	0	4	4	Core

4	**3**	BCO 002B	Data Structure and Algorithm	3	0	0	3	3	Core
5	**3**	BEE110A	Industrial applications of Microcontrollers – A Practice based Approach	3	0	0	3	3	Core (L&T)
6	**3**	BEE005A	Electronics Devices Lab	0	0	2	2	1	Core
7	**3**	BEE006A	Digital Electronics Lab	0	0	2	2	1	Core
8	**3**	BCO 002C	Data Structure and Algorithm Lab	0	0	2	2	1	Core
9	**3**	BEE022A	Microprocessors & Microcontroller System Lab	0	0	2	2	1	Core
10	**3**	DBA112A	Leadership and Management Skills	2	0	0	2	2	AEC
11	**3**	BEE113A	Prompt Engineering for Electrononics and Communication Engineering	0	0	4	4	2	SEC
12	**3**	IKS Code	Any of IKS Basic Courses	2	0	0	2	2	VAC
1	**4**	BEE012A	Analog Electronics	3	0	0	3	3	Core
2	**4**	BEE014A	Principle of Communication Engineering	3	0	0	3	3	Core
3	**4**		Department Elective 1	3	0	0	3	3	Elective
4	**4**	BEE017A	Electronic Workshop	0	0	2	2	1	Core
5	**4**	BEE018A	Analog Electronics Lab	0	0	2	2	1	Core
6	**4**	DCO008A	Applied Industrial IOT	3	0	0	3	3	Core (L&T)

7	**4**	IKS002A	Universal Human Values (UHV)	2	0	0	2	2	AEC
8	**4**	BEE111A	Circuit Design Lab Using Altium Software	0	0	4	4	2	SEC
9	**4**	BEE112A	Any of IKS Elective Course	0	0	4	4	2	VAC
1	**5**	BEE072A	Drone Technology	3	0	0	3	3	Core (L&T)
2	**5**	BEE021A	Digital Communication Engineering	3	0	0	3	3	Core (L&T)
3	**5**	BCO035A	Python Programming	3	0	0	3	3	Core
4	**5**		Department Elective 2	3	0	0	3	3	Elective
5	**5**		Department Elective 3	3	0	0	3	3	Elective
6	**5**		Open Elective 1	3	0	0	3	3	Multi-Disciplinary
7	**5**	BEE038A	Control System Lab	0	0	2	2	1	Core
8	**5**	BEE023A	Communications Engineering Lab	0	0	2	2	1	Core
9	**5**	BEE024A	Basic Simulation Lab	0	0	2	2	1	Core
10	**5**	BCO035B	Python Programming Lab	0	0	2	2	1	Core
1	**6**	BEE033A	Digital Signal Processing	3	0	0	3	3	Core (L&T)
	6	BEE080A	5G Technology for smarter secure connectivity	3	0	0	3	3	Core (L&T)

2	**6**		Department Elective 4	3	0	0	3	3	Elective
3	**6**		Department Elective 5	3	0	0	3	3	Elective
4	**6**	BEE053A	Project	0	0	2	2	1	Core
5	**6**		Open Elective 2	3	0	0	3	3	Multi-Disciplinary
6	**6**	BEE036A	Digital Signal Processing Lab	0	0	2	2	1	Core
7	**6**	BEE037A	VLSI Design Lab	0	0	2	2	1	Core
1	**7**	BEE051B	Mobile Communication	3	0	0	3	3	Core (L&T)
2	**7**		Department Elective 6	3	0	0	3	3	Elective
3	**7**		Department Elective 7	3	0	0	3	3	Elective
4	**7**	BEE086A	Chip Based VLSI Design for Industrial Applications	3	0	0	3	3	Core (L&T)
5	**7**		Open Elective 3	3	0	0	3	3	Multi-Disciplinary
6	**7**	BEE052A	Communication Networks Lab	0	0	2	2	1	Core
	8	BEE063C	Industry Internship	0	0	0	0	16	Core

		Track 1		Track 2		Track 3		Track 4		Track 5		Track 6
Semester & Department Elective	**CODE**	**Communication Engineering**	**CODE**	**VLSI & Embedded System**	**CODE**	**Signal Processing**	**CODE**	**Software Development**	**CODE**	**AI & Machine Learning**	**CODE**	**Miscellaneous**
Department Elective 1 (SEMESTER-4)	BAS004B	Random Variables & Stochastic Processes	BEE071A	Engineering System Modeling and Simulation	**BEE013A**	**Signal and Systems**	BEE016B	Object Oriented Programming	BEE101A	Artificial Intelligence	BEE015A	Electromagnetic Field Theory
Department Elective 2 &3 (SEMESTER-5)	BEE025A	Microwave Theory and Techniques	**BEE035A**	**Control System**	BEE028A	Information Theory and Coding	BEE029A	Computer Organization & Architecture	BEE102A	Mathematical Concepts for AI	BEE004A	Electronic Measurement & Instrumentation
	BEE109A	**Fundamental of Microsoft Azure**	BEE044A	Digital Hardware Design	BEE020A	Microprocessor & Microcontroller System	BCO010B	Data Base Management System	BEE103A	Introduction to Machine Learning	BEE040A	Optimization Techniques
Department Elective	BEE027A	IC Technology	BEE068A	Microcontrollers and Embedded system	BEE054A	Adaptive Signal Processing	BEE083A	Operating Systems	BEE105A	Optimization Techniques in Machine Leaning	BEE030A	Power Electronics

4 &5 (SEMESTER-6)	BEE058A	Broad Band Communication	BEE034B	VLSI System	BEE055A	Speech and Audio Processing	BEE082A	Web Designing Techniques	**DCO010A**	**AI and Edge Computing**	**BEE080A**	**5G Technology for smarter secure connectivity**
Department Elective 6,7 (SEMESTER-7)	BEE049 B	Communication Networks	BEE056A	ASIC & FPGA	**BEE059A**	**Image &Video Processing**	BEE106A	Theory of Computation	**BEE060A**	**Artificial neural Network**	BEE057A	Micro Electro Mechanical systems
	BEE042A	**Radar &Satellite Communication**	BEE062A	DSP Processors and Applications	**BEE050B**	**Fiber Optic Communication**	BEE108A	Deep Learning	BEE107A	Advanced Machine Learning	**BEE003A**	**Network Theory & System**
	BEE039A	Antennas and Wave Propagation	BEE069A	Embedded networks and protocol	BEE066A	Telecommunications and Data Communications	BEE047A	Embedded Computing System	BEE104A	Data and Visual analytics in AI	**BEE004A**	**Electronic Measurement & Instrumentation**

B. Tech. (common to all disciplines)-II Semester
Contact Hours (L-T-P): 3-0-0

DEE 003A	**Basic Electrical and Electronics Engineering**	**3-0-0**

Objective

- To understand basic concepts required in understanding electrical and electronic circuits
- To understand the concept of Semiconductor Diode and their applications.
- The student will be able to understand fundamental circuit analysis techniques and basic electronics backgrounds, including PN Diode and Opto-Electronic Devices.
- To understand basic concepts of construction and working of single phase Transformer.
- To understand basic concepts of Electrical DC Circuit.
- The student will be able to understand the concept of Various Binary Number Systems and conversions.
- To understand Logic Gates and Logic Circuit focusing on basic and universal gates.

UNIT 1	**Electrical-DC Circuit–** Ohm's law, Kirchoff's Current Law(KCL) & Kirchoff's Voltage Law (KVL), Voltage & Current Sources, Star-Delta and Delta-Star transformations, Nodal & Mesh Analysis.
UNIT 2	**Transformers -** Principle of operation and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation
UNIT 3	**Semiconductors-** Comparison of Insulator, conductor and semiconductor with energy band diagrams. Semiconductor materials-Intrinsic and Extrinsic semiconductor (P-type and N-type SC), Crystal structures of p-type and N type materials, resistivity, conductivity, mobility.
UNIT 4	**Electronics Devices**- Diode, PN diode-construction, working and V-I plot, Diode as a Rectifier, Half Wave and Full Wave Rectifiers, Zener Diode – construction, Operation, characteristics; Opto-Electronic Devices – LEDs, Photo Diode.
UNIT 5	**Digital Electronics**-Number Systems: Binary system, Hexadecimal System, Octal system, Decimal system, Code conversions. **Basic Logic Gates** (AND, OR , NOT), Universal Gates(NAND and NOR) and other gates(EX-OR,EX-NOR), Truth Tables.

Course Outcome (CO):

At the end of this course students will have:

CO1- To understand, analyze and solve DC electrical circuits
CO2- To understand basic concepts of construction and working of single phase Transformer.
CO3- Ability to understand the physical properties of different types of semiconductors used in fabricating devices.
CO4- Ability to understand the functioning of PN junction diode and explains its main application as rectifiers and opto-electronic devices.
CO5- Ability to understand the concept of Various Binary Number Systems and Codes, Logic Gates and Logic Circuit.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H	H		H								H	H	L	
CO2	H	H					L				L	H	H	H	L
CO3	H		H	M	L	M		L				H	H		L
CO4	H			H	H				L		L	H	H	M	
CO5	H		M			H				L		H	H		L

H = Highly Related; M = Medium L = Low

Text Books:

1. R. L. Boylestad & Louis Nashlesky (2007), Electronic Devices &Circuit Theory, Pearson Education
2. David A. Bell (2008), Electronic Devices and Circuits, Oxford University Press

Reference Books

1. Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India
3. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals, Pearson Education
4. R. S. Sedha (2010), A Text Book of Electronic Devices and Circuits, S.Chand & Co.
5. R. T. Paynter (2009), Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education

JECRC UNIVERSITY
Faculty of Engineering & Technology
B.Tech.(common to all disciplines)-II Semester
Contact Hours (L-T-P): 0-0-2

Engineering Workshop (ELECTRICAL AND ELECTRONICS MODULE) (SET001A)

CODE-SET001A	**ENGINEERING WORKSHOP (MODULE OF ELECTRONICS)**	**0-0-2**

Objectives:-

- Understand the nature and scope of modern electronics.
- Designing of electronic circuit and PCB designing using software.
- To provide students engineering skills by way of breadboard circuit design with electronic devices and components.
- To design and analyze various Electronic projects using IOT lab so that students are able to understand the practical aspects of basic electronics theory.
- Design and construct simple electronic circuits to accomplish a specific function, e.g., designing filters, clippers, clamper.
- Understand student's capabilities and limitations and make decisions regarding their best utilization in a specific situation.
- To make students understand how these small circuits are used in their day to day life.

Experiment 01 **(ON VIRTUAL LAB)**	Electronics Work Bench Software-Designing of Electronic Circuits and PCB designing using software. **LINK FOR VIRTUAL LAB:** ***http://vlabs.iitkgp.ac.in/be/exp5/index.html***
Experiment 02	Breadboard Circuit Designing -Circuit designing and to determine static resistance and dynamic resistance of p-n junction diode and plot the-I characteristics.
Experiment 03	PCB Designing: (a) Artwork & printing of a simple PCB. (b) Etching & drilling of PCB.
Experiment 04	C.R.O and Function Generator –To Generate a sine wave using a function generator and measure its amplitude and frequency using C.R.O.
Experiment 05	Digital Multimeter-Measurement of AC and DC voltage, current, capacitance and resistance using Digital Multimeter
Experiment 06 **(ON VIRTUAL LAB)**	Generation of output waveform of half wave rectifier with and without filter capacitor and measure DC voltage, DC current, ripple factor with and without filter capacitor. **LINK FOR VIRTUAL LAB:** **http://vlabs.iitkgp.ac.in/be/exp6/index.html**

Experiment 07 **(ON VIRTUAL LAB)**	Generation of output waveform of full wave rectifier with and without filter capacitor and measure DC voltage, DC current, ripple factor with and without filter capacitor. **LINK FOR VIRTUAL LAB:** **http://vlabs.iitkgp.ac.in/be/exp7/index.html**
Experiment 08	Designing of Bridge rectifier with and without filter capacitor and measure DC voltage, DC current, ripple factor with and without filter capacitor.
Experiment 09	Design a half wave rectifier using discrete components on a breadboard and measure DC voltage, DC current, ripple factor, with and without filter capacitor
Experiment 10	Design full wave rectifier using discrete components on a breadboard and measure DC voltage, DC current, ripple factor with and without filter capacitor.
IOT (INTERNET OF THINGS) LAB EXPERIMENTS	
Experiment 1	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
Experiment 2	To interface LED/Buzzer with Arduino/Raspberry Pi and WAP{ to turn ON LED for 1 Sec after every 2 seconds.
Experiment 3	To interface Push button/Digital sensor 9IR/LDR) with Arduino/Raspberry Pi and WAP to turn ON LED when push button is pressed or at sensor detection.
Experiment 4	To interface DHT11 sensor with Arduino/Raspberry Pi and WAP to print temperature and humidity readings.
Experiment 5	To interface motor using relay with Arduino/Raspberry Pi and WAP turn ON motor when push button is pressed.
Experiment 6	To interface OLED with Arduino/Raspberry Pi and WAP to print temperature and humidity readings on it.
Experiment 7	To interface Bluetooth with Arduino/Raspberry Pi and WAP to send sensor data to smartphone using Bluetooth.
Experiment 8	To interface Bluetooth with Arduino/Raspberry Pi and WAP to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
Experiment 9	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data from thingspeak cloud
Experiment 10	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
Experiment 11	To install MySQL database on Raspberry Pi and perform basic SQL queries.
Experiment 12	Write a Program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
Experiment 13	Write a Program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
Experiment 14	Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
Experiment 15	Write a Program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.

ENGINEERING WORKSHOP (MODULE OF ELECTRICAL)

Experiment 01	Assemble house wiring including earthling for 1- phase energy meter, MCB, ceiling fan, tube light, three pin sockets and a lamp operated from two different positions. Basic functional study of components used in house wiring.
Experiment 02	To make house wiring for a lamp operated from two different positions.
Experiment 03	Prepare the connection of ceiling fan along with the regulator and vary the speed.
Experiment 04	Prepare the connection of single phase induction motor through 1- phase Auto transformer and vary the speed.
Experiment 05	Prepare the connection of three phase squirrel cage induction motor through 3- phase Autotransformer and vary the speed.
Experiment 06	Prepare the connection of Fluorescent Lamp, Sodium Vapor and Halogen Lamp and measure voltage, current and power in the Circuit.
Experiment 07	To verify the transformation ration by measuring primary and secondary sides voltages of single phase transformer by using phase auto transformer.
Experiment 08	To find out relation b/w primary voltages and secondary voltages at different configurations and also relation b/w line voltage & phase voltage in & phase transformer.
Experiment 09	To run 3Q motor induction motor at varying speed by using 3 phase auto transformer.
Experiment 10	To measure power 3Q load. (a) By one watt meter method. (b) By two watt meter method. (c) By three watt meter method.

Course Outcome (CO):

CO1- Ability to understand the working of Electronics Work Bench Software

CO2-Ability to understand the use of Arduino/Raspberry Pi

CO3- Ability to understand the operation and interfacing of devices using relay with Arduino/Raspberry Pi and WAP.

CO4- Ability to understand the Designing of electronic circuits on Breadboard.

CO5- Ability to make Project based on IOT.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

H = Highly Related; M = Medium L = Low

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3
CO1	H	L	L	H	H						L	H	H	L	
CO2	H	H	M	M			L					H	H	H	
CO3	H		H	H		M						H	H		
CO4	H		L	H	M							H	H	M	
CO5	H					H						H	H		

Text Books:

R. L. Boylestad& Louis Nashlesky (2007), Electronic Devices &Circuit Theory, Pearson Education

Reference Books

SantiramKal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India

David A. Bell (2008), Electronic Devices and Circuits, Oxford University Press

Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals, Pearson Education

R. S. Sedha (2010), A Text Book of Electronic Devices and Circuits, S.Chand& Co.

R. T. Paynter (2009), Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education

SEMESTER-III

BAS003E	Advanced Engineering Mathematics	3-0-0 [3]

OBJECTIVE:

- To understand the Laplace transform.
- To understand Fourier series and Z-transform.
- To understand Fourier Transform
- To understand Analytic Functions and Cauchy Riemman equations.
- To understand Taylor Series, Laurents Series.

Unit 1	LAPLACE TRANSFORM - Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficients with special reference to the wave and diffusion equations.
Unit 2	FOURIER SERIES & Z TRANSFORM – Expansion of simple functions in fourier series. Half range series, Change of intervals, Harmonic analysis. Z TRANSFORM - Introduction, Properties, Inverse Z Transform.
Unit 3	FOURIER TRANSFORM - Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant coefficient with special reference to heat equation and wave equation.
Unit 4	COMPLEX VARIABLES-1 - Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy;s theorem. Cauchy's integral formula.
Unit 5	COMPLEX VARIABLES-2 -Taylor's series Laurent's series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.

Text Books:

1. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley (2010)
2.Engineering Mathematics: A Foundation for Electronic, Electrical, Communications and Systems Engineers, 3/e Croft, Pearson (2009)

Reference Books:

1. Mathematical methods of science and engineering, Cengage Learning,Datta(2006)
2. Advanced engineering mathematics, Cengage learning,O'neil (2012)
3. Engineering Mathematics, T Veerarajan, TMH (2005)
4. Advance Engineering Mathematics, Potter, Oxford (2005)

Course Outcomes

At the end of this course, students will be able to:

CO1: Explain the Laplace Transform.
CO2: Understand Fourier Series and Z-Transform.
CO3: Better utilization of Fourier Transform.
CO4: DefineAnalytic Functions and Cauchy-Riemann equation.
CO5: Calculate Taylor Series and Laurent's Series.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H										M	M		
CO2	H			H							M	M	H		
CO3	H		H			M								H	M
CO4	H			M	H						M	L			M
CO5	H		L									H	M		

H = Highly Related; M = Medium; L=Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 36**
B.Tech in Electronics and Communication Engineering Semester III
Contact Hours (L-T-P): 3-0-0

DATA STRUCTURES AND ALGORITHMS (BCO002B)

UNIT 1	Introduction: Notions of data type, abstract data type and data structures. Importance of algorithms and data structures in programming. Notion of Complexity covering time complexity, space complexity, Worst case complexity & Average case complexity. BigOh Notation, Omega notation, Theta notation. Examples of simple algorithms and illustration of their complexity. Sorting- Bubble sort, selection sort, insertion sort, Quick sort; Heap sort; Merge sort; Analysis of the sorting methods. Selecting the top k elements. Lower bound on sorting.
UNIT 2	Stack ADT, Infix Notation, Prefix Notation and Postfix Notation. Evaluation of Postfix Expression, conversion of Infix to Prefix and Postfix Iteration and Recursion- Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion.
UNIT 3	List ADT. Implementation of lists using arrays and pointers. Stack ADT. Queue ADT. Implementation of stacks and queues. Dictionaries, Hash tables: open tables and closed tables. Searching technique- Binary search and linear search, link list- single link list, double link list, Insertion and deletion in link list.
UNIT 4	Binary Trees- Definition and traversals: preorder, post order, in order. Common types and properties of binary trees. Binary search trees: insertion and deletion in binary search tree worst case analysis and average case analysis. AVL trees. Priority Queues -Binary heaps: insert and delete min operations and analysis.
UNIT 5	Graph: Basic definitions, Directed Graphs- Data structures for graph representation. Shortest path algorithms: Dijkstra (greedy algorithm) and Operations on graph, Worshall's algorithm , Depth first search and Breadth-first search. Directed acyclic graphs. Undirected Graphs, Minimal spanning trees and algorithms (Prims and Kruskal) and implementation. Application to the travelling salesman problem.

Course Outcomes:

CO1. To study various data structure concepts like Stacks, Queues, Linked List, Trees and Files
CO2. To overview the applications of data structures.

CO3. To be familiar with utilization of data structure techniques in problem solving.
CO4. To have a comprehensive knowledge of data structures and algorithm.
CO5. To carry out asymptotic analysis of algorithm

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specifice Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M									M	M	L		
CO2	H	M			M							M		L	
CO3	H	M		M		L							L		
CO4	H	M									L	H		L	
CO5	H	M	M									L		L	

H = Highly Related; M = Medium L=Low

Text Books:

1. Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft , Addison-Wesley Series (1983)

Reference Books:

1. T.H. Cormen, C.E. Leiserson, and R.L. Rivest. Introduction to Algorithms.The MIT Press and
2. McGraw-Hill Book Company, Cambridge, Massacusetts, 1990 (Available in Indian Edition).
3. Steven S. Skiena. The Algorithm Design Manual.Springer, Second Edition, 2008.
4. Data Structures and Algorithm Analysis in Java (3rd Edition) by Mark Allen Weiss, Addison Wesley(2011).

BCO 005B	DATA STRUCTURE AND ALGORITHMS LAB	0-0-2 [1]

List of Experiments

1.Write a program to implement following searching algorithms using array data structure
- 1.1 Matrix Addition and Subtraction
- 1.2 Matrix Multiplication and Transpose

2.Write a program to implement following searching algorithms using array data structure
- 2.1. Linear Search
- 2.2. Binary Search

3. Write a program to implement following searching algorithms using array data structure
- 3.1. Insertion Sort
- 3.2 Bubble Sort

4. Write a program to implement following searching algorithms using array data structure
- 4.1. Selection Sort
- 4.2 Quick Sort

5. Write a program to implement following operations on stack using array data structure.
- 5.1 Traversing
- 5.2 Push
- 5.3 POP

6. Write a program to implement following examples of recursion
- 6.1 Fibonacci Series
- 6.2 Factorial Function
- 6.3 Tower of Hanoi

7. Write a program to implement Merge Sort.

8. Write a program to implement following operations on Queue using array data structure.
- 8.1 Insertion8.2 Deletion8.3 Traversing

9. Write a program to implement Postfix evaluation.

10. Write a program to implement Infix to Postfix Notation.

11. Write a program to implement following operations on Link List data structure.
- 11.1 Insertion at beginning
- 11.2 Insertion at last
- 11.3 Insertion at any location

12. Write a program to implement following operations on Link List data structure.
- 12.1 Deletion at beginning
- 12.2 Deletion at last
- 12.3 Deletion at any location

13. Write a program to implement Doubly Link List
- 13.1 Insertion13.2 Traversing

14. Write a program to implement Breadth First Search Algorithm.

15. Write a program to implement Depth First Search Algorithm.

Course Outcomes:

CO1: Show the understanding of various data structure concepts like Stacks, Queues, Linked List, Trees and Files
CO2: Understand the applications of data structures.
CO3: Understand with utilization of data structure techniques in problem solving.
CO4: Use comprehensive knowledge of data structures and algorithm.
CO5: Use asymptotic analysis of algorithm.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H												M		
CO2			H		M								M		
CO3		H							M			L		H	
CO4	H	M											L		L
CO5		M		H											L

H = Highly Related; M = Medium; L = Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester III
Contact Hours (L-T-P): 3-0-0

Electronics Devices (BEE001A)

Course Objectives:

1. *Understand the working of diodes, transistors.*
2. *Understand the application of different electronic devices and simple circuits.*
3. *This course gives an overview of various semiconductor devices.*
4. *At the end of this course, the students will be able to analyze and design amplifier circuits, Oscillators and filter circuits employing BJT, FET devices.*
5. *To develop the knowledge of semiconductor devices and circuits, and explain their use in communication applications.*
6. *To inculcate circuit analysis capabilities in students.*
7. *To make students aware of various types of integrated circuits that can be used in computer applications.*
8. *To make students aware that knowledge gained in electronic devices and circuits is useful in real life applications.*

Unit 1: Semiconductor physics: Allowed and forbidden energy bands, electrical conduction in solids, Density of state function, Statistical mechanics, Charge carriers in semiconductors, dopant atoms and energy levels, Extrinsic semiconductors, Statistics of donors and acceptors, charge neutrality, position of Fermi level, Carrier drift, Carrier diffusion, graded impurity distribution, Hall effect, Carrier generation and recombination, characteristics of excess carriers, A bipolar Transport.

Unit 2: The pn junction: basic structure of pn junction, zero applied bias, non-uniformly doped junctions, pn junction current, small signal model of the pn junction, generation and recombination currents, junction breakdown, charge storage and diode transients, the tunnel diode, schottky barrier diode, metal semiconductor ohmic contacts, heterojunctions.

Unit 3: The bipolar transistor: The bipolar transistor action, minority carrier distribution, low frequency common base current gain, non-ideal effects, Ebers-Moll model,Gummel-poon model, Hybrid equivalent model, Hybrid-π Model, frequency limitations, large signal switching, polysilicon emitter BJT, silicon- germanium base transistor, heterojunction bipolar transistors.

Unit 4: Fundamentals of MOS field effect transistors: The two terminal MOS structure, capacitance voltage characteristics, basic MOSFET operation, Frequency limitations, CMOS technology, non ideal effects, MOSFET scaling, threshold voltage modifications, additional electrical characteristics, radiation and hot electron effects.

Unit 5: Discrete transistor amplifiers: Common-emitter fixed bias configuration, Voltage-divider bias, CE emitter bias configuration, Emitter follower configuration, Common-base

configuration, Collector feedback configuration, Collector DC Feedback Configuration, Determining Current Gain, Effect of R_L and R_S, Two port systems approach, Cascaded systems, Darlington Connection.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand semiconductor physics
CO2- Ability to understand diodes & its application.

CO3-Ability to understand & analyse transistors.

CO4-Ability to understand Mosfets.

CO5-Ability to understand small signal amplifiers.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L								H	L	
CO2	H		L	L	M	L					L		H	H	L
CO3	H	M										L	H		M
CO4	H		L		H								H		
CO5	H	L		L		L					L	L	H	M	

H = Highly Related; M = Medium L = Low

Text Books

1. Semiconductor Physics and Devices, Donald A. Neamen, TMH
2. Electronic Devices And Circuit Theory, Boylestad, Pearson

Reference books

1. Semiconductor Devices: Modelling And Technology, Nandita Dasgupta, PHI.
2. Solid State Electronic Devices,B.G. Streetman, PHI.
3. Electronic Devices And Circuits, Salivahanan, TMH
4. Electronic Devices, Floyd, Pearson.
5. Electronic Devices And Circuits, Bell, Oxford

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester III
Contact Hours (L-T-P): 3-1-0

Digital Electronics (BEE002A)

Course Objectives:

1. *To introduce number systems and codes.*
2. *To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions.*
3. *To introduce the methods for simplifying Boolean expressions.*
4. *To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.*
5. *To introduce the concept of memories, programmable logic devices and digital ICs*
6. *On completion of this course, the students can design combinational and sequential digital logic circuits. Also they will have knowledge on Programmable Logic devices and its usage.*
7. *To illustrate the concept of synchronous and asynchronous sequential circuits.*

Unit 1: Introduction- Digital Systems; Data representation and coding; Logic circuits, integrated circuits; Analysis, design and implementation of digital systems; CAD tools. Number Systems and Codes- Positional number system; Binary, octal and hexadecimal number systems; Methods of base conversions; Binary, octal and hexadecimal arithmetic; Representation of signed numbers; Fixed and floating point numbers; Binary coded decimal codes; Gray codes; Error detection and correction codes - parity check codes and Hamming code.

Unit 2: Combinatorial Logic Systems- Definition and specification; Truth table; Basic logic operation and logic gates. Boolean Algebra and Switching Functions- Basic postulates and fundamental theorems of Boolean algebra, Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map and Quine-McCluskey tabular methods, Synthesis of combinational logic circuits.

Unit 3: Logic families-Introduction to different logic families; Operational characteristics of BJT in saturation and cut-off regions; Operational characteristics of MOSFET as switch; TTL inverter - circuit description and operation; CMOS inverter - circuit description and operation; Structure and operations of TTL and CMOS gates; Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product. Combinational Logic Modules and their

applications-Decoders, encoders, multiplexers, de multiplexers and their applications, Parity circuits and comparators, Arithmetic modules- adders, subtractors and ALU, Design examples.

Unit 4: Sequential Logic systems- Definition of state machines, state machine as a sequential controller; Basic sequential circuits- latches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop; Timing hazards and races; Analysis of state machines using D flip-flops and JK flip-flops; Design of state machines - state table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Design examples. State machine design approach-Designing state machine using ASM charts, Designing state machine using state diagram, Design examples.

Unit 5: Sequential logic modules and their applications- Multi-bit latches and registers, counters, shift register, application examples. Memory- Read-only memory, read/write memory – SRAM and DRAM. Programmable Logic Devices-PLAs, PALs and their applications; Sequential PLDs and their applications; State- machine design with sequential PLDs; Introduction to field programmable gate arrays (FPGAs).

Course Outcomes (COs):

CO1: Able to understand number system, basic logic gates and Boolean algebra.

CO2: Able to understand the various characteristics of Digital Logic circuits

CO3: Able to apply various minimization techniques to reduce complexity in Digital Circuits

CO4: Able to design various combinational circuits and & understand their utility

CO5: Able to understand various types of sequential circuits and their applications

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			H		L				L	

CO2	H	M					L					L			M
CO3			L		H			L		H			H		
CO4	H		H		L			H		L				L	
CO5	M	L		L		L	L		L		L	L	L	M	

H = Highly Related; M = Medium L = Low

Text Books

1. Digital Design, M.Morris Mano, Pearson
2. Digital Design Principles – Fletcher.

Reference books

1. Modern Digital Electronics, R.P. Jain, TMH
2. Fundamentals of Digital Logic with VHDLDesignby Stephen Brown, Zvonko Vranesic - McGraw-Hill Science.
3. Digital Principles And Applications (Special Indian Edition), Leach & Malvino, TMH
4. Digital Fundamental, Floyd & Jain, Pearson.
5. Digital Logic And Computer Design, Mano, Pearson
6. Digital Systems: Principles And Applications, Tocci, Pearson
7. Digital System Design – John Wakerley.

JECRC UNIVERSITY

Faculty of Engineering & Technology **Hours: 36**
B. Tech in Electronics and Communication Engineering Semester III
Contact Hours (L-T-P): 3-0-0

Network Theory & System (BEE003A)

Course Objectives:

1. *To deal with elementary network Theory and transient response of circuit with various type of Signals. It also gives the students the knowledge of fundamental of network synthesis in order to solve the problem involved in design. It also includes two port network; electrical filter; and topology. All Topics are concerned with and are based on electric circuit theory and it is hoped that the students will find to this advantages to understand the basic approach from circuit view point.*
2. *Introduce students to different methods involves in analysis both linear and nonlinear networks.*
3. *Provide students with basic information on how to perform circuit analysis using network parameters and provide students with required knowledge on how to determine system stability using network stability criteria.*

Unit 1: NETWORK THEOREMS AND ELEMENTS: Introduction to basic circuit elements, KVL, KCL, Ohm's Law. Theorems - Thevenin's, Norton's, Reciprocity, Superposition, Compensation, Miller's, Tellegen's and maximum power transfer theorems. Networks with dependent sources.

Unit 2: NETWORK GRAPH THEORY: Network Graph, Tree, Fundamental loop, Cut set, Incidence matrix, augmented Incidence matrix.

Unit 3: TRANSIENTS ANALYSIS: Response of circuits to Impulse, step, ramp and sinusoidal inputs. Analysis of first order and second order circuits. Time domain & frequency domain analysis. Initial and final value theorem. Complex periodic waves and their analysis by Fourier analysis. Different kinds of symmetry. Power in a circuit.

Unit 4: NETWORK FUNCTIONS & SYNTHESIS: Terminals and terminal pairs, driving point impedance transfer functions, poles and zeros. Procedure of finding network functions for general two terminal pair networks. Stability & causality. Hurwitz polynomial, positive real function. RL & RC networks synthesis, Foster First & Second forms, Cauer forms.

Unit 5: TWO PORT NETWORKS: Two port parameters and their interrelations, z –parameter, y-parameters, h-parameters, ABCD parameters. Equivalence of two ports, transformer equivalent, interconnection of two port networks, image parameters. Attenuation and phase shift in symmetrical T- and O –network.

Course Outcome (CO):

At the end of this course students will have:

CO1-*Ability to understand the concept of circuit elements lumped circuits, waveforms, circuit laws and network reduction*
CO2- *Ability to solve the electrical network using mesh and nodal analysis by applying network theorems*.

CO3- *Ability to understand the concept of active, reactive and apparent powers, power factor and resonance in series and parallel circuits.*

CO4- *Ability to know the basic concepts of coupled circuits, three phase loads and power measurement.*

CO5- *Ability to analyze the transient response of series and parallel A.C. circuits and to solve problems in time domain using Laplace Transform.*

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L				H		L	L	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text Book

1. Engineering Circuit Analysis-Willian H. Hayt & Jack E. Kemmerly TMH.
2. Networks and Systems- "D. Roy Choudhury" New Age International.

Reference Book

1. Circuits And Networks: Analysis And Synthesis, Sudhakar, TMH
2. Network Analysis And Synthesis, Ghosh & Chakrabarti, TMH
3. Schaum's Outlines Of Electric Circuits (Sie), Nahvi, TMH
4. Basic Engineering Circuit Analysis, Irwin, Wiley
5. Network Analysis & Synthesis, Kuo, Wiley

6. Network Theory: Analysis And Synthesis, Smarjit Ghosh, PHI
7. Network Analysis- “M.E. Van Valkenburg” Pearson Education.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 24**
B.Tech in Electronics and Communication Engineering Semester III
Contact Hours (L-T-P): 3-0-0

Electronic Measurement & Instrumentation (BEE004A)

Course Objectives:

1. *Understand principle, working and operation of various Electrical and electronic instruments.*
2. *Learn techniques for measuring electrical parameters and electrical components.*
3. *Applications of electrical and electronic instruments.*
4. *To understand basic functions and principle of working of sensors and components used in Electronic Measurement.*
5. *To understand principles of advanced electronic instruments and application in measurement of electronics parameters.*
6. *Students will learn measurement of physical parameters using various transducers and working of sensors.*
7. *They will become familiar with basics of instruments and details of operation of measuring instruments and their applications.*

Unit 1: SCIENCE OF MEASUREMENT: Measurement Systems, Instrumentation, Static Characteristics of measurement systems –(Accuracy, Precision, Resolution, Threshold), Errors in Measurements; Absolute standards(International, Primary , Secondary , Working standards)

Unit 2: MEASURING INSTRUMENTS: PMMC (Permanent magnet moving coil), PMMI (Permanent magnet moving iron, Electrodynamics, Induction instruments: construction , working, torque equation, errors, advantages and disadvantages.

Unit 3: TRANSDUCERS: Classification of Transducers – Variable Resistive transducers, Strain gauges, Thermistor, RTD, Variable Inductive transducers, LVDT, RVDT, Variable Capacitive Transducers, Capacitor microphone, Photo electric transducers, Piezo electric transducers, Thermocouple. IC sensors Fibre optic sensors, Smart/intelligent sensors.

Unit 4: SIGNAL CONDITIONING AND SIGNAL ANALYZERS: Filters – Data acquisition systems. Spectrum Analyzers –Wave and Logic analyzers. **:** DIGITAL INSTRUMENTS:

Digital Voltmeters, Millimeters, automation in Voltmeter, Accuracy and Resolution in DVM, Frequency counter, Data Loggers.

Unit 5: DATA DISPLAY AND RECORDING SYSTEMS OSCILLOSCOPES: CRT Construction, Basic CRO circuits, CRO Probes, Oscilloscope Techniques of Measurement of frequency, Phase Angle and Time Delay, Multibeam, multi trace, storage & sampling Oscilloscopes. Curve tracers Dual trace CRO – Digital storage and Analog storage oscilloscope.

Course Outcome (CO):

At the end of this course students will have:

CO1 Able to understand about measurement and errors encountered in measurement.
CO2 Able to understand the working of electronic measurement instruments.
CO3 Able to understand of different transducers and its applications.
CO4 Able to understand about different signals and digital instruments
CO5 Able to understand working of different types of oscilloscope

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	M			H	L	H		M	M			H	H	H	
CO2	L	H	M	H	M	M			L	L		H	H		M
CO3	H	M		M			L								M
CO4				L						M	M				
CO5	H	M	M	L		M	L				L				M

H = Highly Related; M = Medium L = Low

Text Book

1. A Course In Electrical & Electronic Measurement & Instrumentation, A.K.Sawhney, Dhanpatrai

Reference books

1. Electronic Instrumentation, H S Kalsi, TMH
2. Instrumentation Measurement & Analysis, B.C.Nakra, K.K. Chaudhry, TMH
3. Electronic Measurements And Instrumentation, Lal Kishore, Pearson
4. Electronic Instrumentation And Measurements, David A. Bell, PHI

5. Introduction To Measurements And Instrumetation, Arun K. Ghosh, PHI

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 24**
B.Tech in Electronics and Communication Engineering Semester III
Contact Hours (L-T-P): 0-0-2

Electronics Devices Lab (BEE005A)

List of Experiments

1. Design and test diode clipping circuits on breadboard, using discrete components for peak clipping and peak detection.

i) Positive and Negative Clipping Circuit.

ii) Diode series positive and negative Clipping Circuit.

2. Design and test positive and negative clamping circuit on breadboard, using discrete components for a given reference voltage.

3. Graphical measurement of forward and reverse resistance in Zener diode characteristics.

4. Application of Zener diode: Zener diode as voltage regulator. Measurement of percentage regulation by varying load resistor.

5. Plot the I-V characteristics of BJT in CB and CE configuration using suitable discrete components.

6. Design discrete transistor amplifier with common-emitter fixed bias configuration and plot the frequency response.

7. Design discrete transistor amplifier with Voltage-divider bias configuration and plot the frequency response.

8. Design and setup an RC Coupled amplifier using BJT & to plot the frequency response of the RC-Coupled amplifier.

9. Design a BJT Darlington Emitter Follower and determine the Gain and plot the frequency response.

10. Verify Thevenin's theorem for DC Circuits.

11. Characteristic of FET: FET in common source configuration. Graphical measurement of its parameters g_m and r_d from input and output characteristics.

12. Characteristic of silicon-controlled rectifier.

13. To plot V-I Characteristics of DIAC.

14. To draw V-I characteristics of TRIAC for different values of Gate Currents.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand semiconductor physics
CO2- Ability to understand diodes & its application.

CO3-Ability to understand &analyze transistors.

CO4-Ability to understand Mosfets.

CO5-Ability to understand small signal amplifiers.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			H		L				L	
CO2	L		L	L	M	L		L	L	M	L		L	H	L
CO3	H	M					L					L			M
CO4			L		H			L		H			H		
CO5	M	L		L		L	L		L		L	L	L	M	

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:24**
B.Tech in Electronics and Communication Engineering Semester III
Contact Hours (L-T-P): 0-0-2

Digital Electronics Lab (BEE006A)

List of Experiments

1. To study and verify the truth table of logic gates.
2. Design and implementation of Adder and Subtractor using logic gates.
3. Design and implementation of BCD to excess-3 code converter using logic gates.
4. Design and implementation of Binary to gray code converter using logic gates.
5. Design and implementation of 4 bit binary Adder/ subtractor using IC 7483
6. Design and implementation of 4 bit binary BCD adder using IC 7483
7. Design and implementation of 2 bit Magnitude Comparator using logic gates.
8. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
9. Design and implementation of multiplexer using logic gates, IC74150 and IC74154.
10. Design and implementation of De-multiplexer using logic gates, IC74150 and IC74154
11. Design and implementation of encoder using logic gates, IC7445 and IC74147
12. Design and implementation of decoder using logic gates, IC7445 and IC74147
13. Construction and verification of 4 bit ripple counter.
14. Design and implementation of 3-bit synchronous up/down counter.
15. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops

Course Outcome (CO):

CO1: Able to understand and perform various experiments on bread board.

CO2: Able to understand the various characteristics of Digital ICs.

CO3: Able to design various types of Digital Circuits.

CO4: Able to design various combinational circuits and & understand their utility.

CO5: Able to understand various types of sequential circuits and their applications.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			H		L				L	
CO2	H	M					L					L			M
CO3			L		H			L		H			H		
CO4	H		H		L			H		L				L	
CO5	M	L		L		L	L		L		L	L	L	M	

H = Highly Related; M = Medium L = Low

SEMESTER-IV

JECRC University

Life Skills - 2 (Aptitude)

(COURSE CODE- DMA003A)

Semester-IV

Common to all disciplines
Contact Hours (L-T-P): 1-0-2

L-T-P	Life Skills-II	Credits 1-0-1 2

Course Objectives

1. Students will be able to interpret and communicate quantitative information and mathematical and statistical concepts using language appropriate to the context and intended audience.
2. Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.
3. Students will be able to reason, model, and draw conclusions or make decisions with mathematical, statistical, and quantitative information.
4. Students will be able to critique and evaluate quantitative arguments that utilize mathematical, statistical, and quantitative information.
5. Students will be able to use appropriate technology in a given context.

Course Outcomes (CO):

At the end of this course students will have:

CO1: Demonstrate procedural fluency with real number arithmetic operations and use those operations to represent real-world scenarios and to solve stated problems. Demonstrate number sense, including dimensional analysis and conversions between fractions, decimals, and percentages. Determine when approximations are appropriate and when exact calculations are necessary.
CO2: Solve linear equations, graph and interpret linear models, and read and apply formulas. Demonstrate a basic understanding of displays of univariate data such as bar graphs, histograms, dotplots, and circle graphs, including appropriate labeling.
CO3: Take charge of their own learning through good classroom habits, time management, and
persistence. Participate in the classroom community through written and oral communication.

Syllabus: Theory

UNIT 1	**Number System:** a. Number system b. Power cycle c. Remainder cycle d. Factors, Multiples e. HCF and LCM
UNIT 2	**Data Arrangements and Blood Relations:** a. Linear Arrangement b. Circular Arrangement c. Multi-dimensional Arrangement d. Blood Relations
UNIT 3	**Time and Work:** a. Work with different efficiencies b. Pipes and cisterns c. Work equivalence d. Division of wages
UNIT 4	**Coding &Decoding, Series, Analogy, Odd Man Out and Visual Reasoning:**a. Coding and Decoding b. Series c. Analogy d. Odd Man Out e. Visual Reasoning
UNIT 5	**Percentages, Simple Interest and Compound Interest:** a. Percentages as Fractions and Decimals b. Percentage Increase / Decrease c. Simple Interest d. Compound Interest

	e. Relation Between Simple and Compound Interest
UNIT 6	**Permutation, Combination and Probability:** a. Fundamental Counting Principle b. Permutation and Combination c. Computation of Permutation d. Circular Permutations e. Computation of Combination f. Probability
UNIT 7	**Data Interpretation and Data Sufficiency:** a. Data Interpretation – Tables b. Data Interpretation - Pie Chart c. Data Interpretation - Bar Graph d. Data Sufficiency
UNIT 8	**Profit and Loss, Partnerships and Averages:** a. Basic terminologies in profit and loss b. Partnership c. Averages d. Weighted average e. Mixtures and allegations

Methodology for Evaluation

1. Internal Assessment (Theory)
   a) Home Assignments: One from each Unit : 15 Marks
   b) In Semester Tests (Minimum two) : 30 Marks
   c) Attendance : 05 Marks

2. Term End (Theory) : 50 Marks

3. Internal Assessment (Lab)
   (a) Daily Performance in the Lab : 50 Marks
4. Term End (Lab) : 50 Marks

Suggested Reading:

1. Speed Mathematics, Secrets of Lightning Mental Calculations, by Bill Handley, Master Mind books;
2. The Trachtenberg Speed System of Basic Mathematics, Rupa& Co., Publishers;
3. How to Ace the Brainteaser Interview, by John Kador, McGraw Hill Publishers.
4. Quick Arithmetics, by AshishAgarwal, S Chand Publ.;
5. Quicker Maths, by M tyra& K Kundan, BSC Publishing Co. Pvt. Ltd., Delhi;
6. Owl Purdue University online teaching resources

JECRC University

Value Education -2

Semester-IV

Common to all disciplines
Contact Hours (L-T-P): 1-0-0

L-T-P	Value Education-2	Credits	1-0-0	1

Course Objectives

1. To give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

2. Making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Course Outcomes (CO):

At the end of this course students will have:

CO1: Ability to acknowledge and appreciate the ethical beauty of India
CO2: Ability to incorporate the values of human lives in real life applications

Yoga and Meditation

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali's Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

Rajasthan Mural Art and Painting

Mural painting is an offshoot of the devotional tradition in Rajasthan. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Rajasthani mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples, principally in Rajasthan. Ancient temples and tourists places in different States of Rajasthan, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

Course on Organic Farming and Sustainability

Organic farming is emerging as an important segment of human sustainability and healthy life. Haritamritam' is an attempt to empower the youth with basic skills in tradition of organic farming and to revive the culture of growing vegetables that one consumes, without using

chemicals and pesticides. Growth of Agriculture through such positive initiatives will go a long way in nation development. It is a big step in restoring the lost harmony of nature.

Benefits of Indian Medicinal Systems

Indian medicinal systems are one of the most ancient in the world. Even today society continues to derive enormous benefits from the wealth of knowledge in Ayurveda of which is recognised as a viable and sustainable medicinal tradition. This course will expose students to the fundamental principles and philosophy of Ayurveda and other Indian medicinal traditions.

Traditional Fine Arts of India

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is 'Únity in Diversity" and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

Science of Worship in India

Indian mode of worship is unique among the world civilisations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realisation of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India

Insights into Indian Classical Music

The course introduces the students into the various terminologies used in Indian musicology and their explanations, like Nadam, Sruti, Svaram – svara nomenclature, Stayi, Graha, Nyasa, Amsa, Thala,- Saptatalas and their angas, Shadangas, Vadi, Samavadi, Anuvadi. The course takes the students through Carnatic as well as Hindustani classical styles.

Insights into Traditional Indian Painting

The course introduces traditional Indian paintings in the light of ancient Indian wisdom in the fields of aesthetics, the Shadanga (Six limbs of Indian paintings) and the contextual stories from ancient texts from where the paintings originated. The course introduces the painting styles such as Madhubani, Kerala Mural, Pahari, Cheriyal, Rajput, Tanjore etc.

Insights into Indian Classical Dance

The course takes the students through the ancient Indian text on aesthetics the Natyasastra and its commentary the AbhinavaBharati. The course introduces various styles of Indian classical dance such as Bharatanatyan, Mohiniyatton, Kuchipudi, Odissy, Katak etc. The course takes the students through both contextual theory as well as practice time.

Indian Martial Arts and Self Defense

The course introduces the students to the ancient Indian system of self-defense and the combat through various martial art forms and focuses more on traditional Kerala's traditional KalariPayattu. The course introduces the various exercise technique to make the body supple and flexible before going into the steps and techniques of the martial art. The advanced level of this course introduces the technique of weaponry.

Social Awareness Campaign

The course introduces the students into the concept of public social awareness and how to transmit the messages of social awareness through various media, both traditional and modern. The course goes through the theoretical aspects of campaign planning and execution.

Organic Farming in Practice

Organic agriculture is the application of a set of cultural, biological, and mechanical practices that support the cycling of farm resources, promote ecological balance, and conserve biodiversity. These include maintaining and enhancing soil and water quality; conserving wetlands, woodlands, and wildlife; and avoiding use of synthetic fertilizers, sewage sludge, irradiation, and genetic engineering. This factsheet provides an overview of some common farming practices that ensure organic integrity and operation sustainability.

Ayurveda for Lifestyle Modification

Ayurveda aims to integrate and balance the body, mind, and spirit which will ultimately leads to human happiness and health. Ayurveda offers methods for finding out early stages of diseases that are still undetectable by modern medical investigation. Ayurveda understands that health is a reflection of when a person is living in harmony with nature and disease arises when a person is out of harmony with the cycles of nature. All things in the universe (both living and non-living) are joined together in Ayurveda. This leaflet endow with some practical knowledge to rediscover our pre- industrial herbal heritage.

Life Style and Therapy using Yoga

Yoga therapy is the adaptation of yogic principles, methods, and techniques to specific human ailments. In its ideal application, Yoga therapy is preventive in nature, as is Yoga itself, but it is also restorative in many instances, palliative in others, and curative in many others. The therapeutic effect comes to force when we practice daily and the body starts removing toxins and the rest is done by nature.

*Each student shall write a detailed Report/ Critique on one topic leading to publication of Newspaper/ Magazine article or a review paper in a Research Journal. In addition to s/he will be required to make a Power Point Presentation on the learning and face Viva-voce. Alternatively a Student may undertake a Project on any one of the topics and submit a detail Project Report leading to publication of Newspaper/ Magazine article or a review paper in a Research Journal. If the topic is related to Performing Arts including Yoga, Marshal Arts etc. the performance on stage may be given instead of PPT. In case of Fine Arts, an exhibition or a portfolio may be presented in place of PPT.

On the basis of the above points, a panel of experts from the department will award the credits.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester IV
Contact Hours (L-T-P): 3-1-0

Analog Electronics (BEE012A)

Course Objective:

- *The course aim is to review and study in depth various subjects of Analog Electronics, with an emphasis on contents related with circuit design and telecommunication applications.*
- *The most relevant issues related with analog and telecommunication subsystems are analyzed in detail, to establish a reference point for the following subjects like LIC Circuit analysis, which addresses more specific subjects.*
- *On the completion of this subject students would have the knowledge of basic electronics, ability to analyze electric networks and circuits.*
- *Knowledge of linear and large signal models of MOS and BJTs, and ability to use these models in basic amplifier circuits. Knowledge and design of most used functional units, such as filters, voltage regulators, and signal generators.*

Unit 1: Introduction: Scope and applications of analog electronic circuits. Amplifier models:Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT amplifiers, bias stability, various configurations (such as CE, CB, CC) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications.

Unit 2: Frequency response amplifiers:-Low frequency analysis: Effect of coupling, bypass and output capacitor at low frequency, high frequency transistor models, Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc. Power amplifiers: Class A, Class B, Class AB and Class C, their power efficiency and linearity issues.

Unit 3: OP-AMP design:design of differential amplifier for a given specification, design of gain stages and output stages, compensation.OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier,

Schmitt trigger and its applications**.** Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Unit 4: Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Collpitts etc.). Current mirror: Basic current mirror, Widlar current source etc.Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain and CMRR.

Unit 5: Multi-vibrator: Mono-stable and Astable multi-vibrator. 555 timer:Basic block diagram, 555 timer Applications: monostable and astable multivibrator, Schmitt trigger etc.

Course Outcome (CO):

CO1-Ability to understand the concept of *Feedback circuits.*

CO2- Ability to understand *Oscillator Circuits*.

CO3-Ability to understand*High frequency networks.*

CO4-Ability to understand *Tuned Amplifiers*.

CO5-Ability to understand *Power Amplifier.*

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1			L		L			M	M			H		H	
CO2	M		H	L	M	L			L	L		H	M	H	L
CO3	H	M					L								M
CO4			L		H					M	M		H		
CO5	H	M					L				L				M

H = Highly Related; M = Medium L = Low

Text Books

1. Integrated Electronics J. Millman and Halkias McGraw Hill.
2. Microelectronic Circuits-"Adel S. Sedra, Kenneth Carless Smith" Oxford.

Reference Books:

1. Introduction to Operational Amplifier theory and applications, J.V. Wait, L.P. Huelsman and GA Korn,McGraw Hill, 1992.
2. Analysis and Design of Analog Integrated Circuits, Paul R.Gray \& Robert G.Meyer, John Wiley, 3rd Edition.
3. Op-amps and Linear Integrated Circuits-"Ramakant A. Gayakwad " Prentice Hall.

JECRC UNIVERSITY

Faculty of Engineering & Technology **Hours: 48**

B.Tech in Electronics and Communication Engineering Semester IV

Contact Hours (L-T-P): 3-1-0

Signals and Systems (BEE013A)

Course objectives:

1. *To develop an understanding of the fundamental tools and concepts used in the analysis of signals and the analysis and design of linear shift-invariant systems.*
2. *To develop an understanding of their application in a broad range of areas, including electronics & electrical networks, telecommunications, signal-processing and automatic control.*

Unit 1:Signals: Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one-dimensional/multi-dimensional; commonly used signals: unit impulse, unit step, unit ramp, exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals.

Systems: Definition, types of systems: linearand non-linear, time invariant and time varying, Deterministic and Stochastic, Casual and non causal, Analog and Discrete/Digital, memory and memoryless.

Unit 2:Linear Time-Invariant Systems: Introduction, Continuous –time and Discrete-Time LTI Systems ,The Convolution Integral, Properties of the Convolution Integral, The Convolution sum, Properties of the Convolution sum, Properties of Linear Time-Invariant Systems, Relationship between LTI system properties and the Impulse response.System representation through differential equations and difference equations.

Unit 3:Fourier Analysis for Continuous-Time Signals and Systems: Introduction, The Response of Continuous-Time LTI Systems to Complex Exponentials, Representation of Periodic Signals: The Continuous-Time Fourier Series, Properties of Continuous-Time Fourier Series, Approximation of Periodic Signals Using Fourier Series and the Convergence of Fourier Series. Representation of Aperiodic Signals : The Continuous -Time Fourier Transform, Properties of the Continuous –Time Fourier Transform.

Fourier Analysis for Discrete-Time Signals and Systems: Introduction, Properties of Discrete Fourier series, Fourier Transform and Properties of Discrete Fourier Transform.

Unit 4: The Laplace-Trasform: Introduction, The Laplace-Transform, The Region of Convergence for the Laplace-Transform, Properties of Laplace-Transform, Inverse Laplace-Transform, Application & Characteristics of LTI System Using Laplace- Transform.

Unit 5:The Z-Transform: Introduction, The Z-Transform, The Region of Convergence for the Z-Transform, Properties of Z-Transform, The Inverse z-Transform, Application & Characteristics of LTI System Using Z Transform.

Sampling: Introduction, Representation of a Continuous- Time Signal by Its Samples , The Sampling Theorem, Reconstruction of a signal from its Samples, The Effect of Under sampling : Aliasing.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand Definition, types of signals and their representations and types of systems.
CO2- Ability to understand LTI Linear Time-Invariant Systems.

CO3-Ability to understand Fourier Analysis for Continuous-Time and Discrete-Time Signals and Systems.

CO4-Ability to understand Laplace-Trasform

CO5-Ability to understand Z-Transform and ROC.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1		H	H					H	H		H	M		H	
CO2	H			H	M	M							M	M	M
CO3	H	L	M				L	M		H	M	H			H
CO4			L	M	H				M				H		
CO5	H	H				H	L			H		H			L

H = Highly Related; M = Medium L = Low

Text Book:

1.A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

Reference Books:

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
2. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
3. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
4. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
5. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
6. I. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester IV
Contact Hours (L-T-P): 3-1-0

Principles of Communication (BEE014A)

Course Objectives:

1. Comprehend the thoughts of random process and several types of noise.

2. Design and advance simple schemes for modulation and demodulating AM, FM, DSB-SC and SSB-SC signals

3. Comprehend the conceptions in Angle modulation.

4. Design of modulating and demodulating frequency modulated signals.

5. Estimate the performance of the designed communication system in presence of noise and nonlinear models.

Module-1 AMPLITUDE MODULATION 10 hours

AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching Modulator, Envelop detector. DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION (DSB-SC): Time and Frequency–Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. SINGLE SIDE–BAND SUPPRESSED CARRIER (SSB-SC) AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.

Module-2 ANGLE MODULATION **10 hours**

ANGLE MODULATION: Basic definitions, Frequency Modulation:Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems, Super heterodyne Receiver.

Module-3RANDOM VARIABLES & PROCESS **10 hours**

RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions. NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth, Noise Figure.

Module-4NOISE IN ANALOG MODULATION**10 hours NOISE IN ANALOG MODULATION:** Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM

receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.

Module-5DIGITAL REPRESENTATION OF ANALOG SIGNALS **10 hours**

DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse– Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing.

Course Outcomes

1. The students can understand the random process and several types of noise.

2. The students can design modulation and demodulating AM, FM, DSB-SC and SSB-SC signals

3. The students can understand the concepts of Angle modulation.

4. The students can design modulating and demodulating frequency modulated signals.

5. The student can learn to analyse the performance of the designed communication system in presence of noise and nonlinear models.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H	H	M				H	H		H	M		H	
CO2	H			H	M	H					M		M	H	M
CO3	H	L	H				L	M		H	M	H			H
CO4	M		H	M	H	M			H		L	H	H		
CO5	H	H					L			H	L	H			L

H = Highly Related; M = Medium L = Low

Text Books:

1. Communication Systems, Simon Haykins & Moher, 5th Edition, John Willey, India Pvt. Ltd, 2010

2. An Introduction to Analog and Digital Communication, Simon Haykins & Moher, John Wiley India Pvt. Ltd., 2012.

Reference Books:

1. Principles of Communications, Herbert Taub & L.Schilling, TMH, 3rd Edition, 2008.

2. Modern digital and analog Communication systems, P. Lathi, Oxford University Press., 4th ed, 2010.

3. Communication Systems, Harold E, Stern Samy and A Mahmond, Pearson Edn, 2004.

4. Communication Systems Analog and Digital, P.Singh and S.D.Sapre, TMH.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester IV
Contact Hours (L-T-P): 3-1-0

Electromagnetic Field Theory (BEE015A)

Course Objectives:

1. *To introduce the important physical concepts and mathematical methods used in treating all types of E.M. wave phenomena particularly importance in electrical & communication engineering.*
2. *To provide essential background and basic preparation for more advanced work in device physics, microwave and ultra-fast circuitry, antenna design, optics, optical communication and optoelectronics.*

Unit 1: Introduction to Vector Calculus- Scalars and Vectors, unit vector, vector addition and subtraction, position and distance vectors; vector multiplication; components of vector; Coordinate systems and transformation- Cartesian, Circular Cylindrical and Spherical; Differential Length, Area, and Volume; Line, Surface, and Volume Integrals; Del Operator; Gradient of a scalar; Divergence of a Vector; Curl of a Vector.

Unit 2: Electrostatics- Coulomb's Law, Electric field intensity, Electric field due to point charge, line charge, sheet of charge, Electric Flux Density, Gauss's law, Application of Gauss's law: point charge , infinite line charge, infinite sheet of charge; Maxwell's Equation for Static Electric Field, Divergence Theorem, Definition of Potential Difference and Potential, Potential Gradient, an Electric Dipole and Flux Lines.

Unit 3: Magnetostatics- Biot-Sevart Law, magnetic field due to finite and infinite length current element, Ampere's Circuital Law, Stokes's Theorem, Magnetic Flux and Magnetic Flux Density, Maxwell's equations for static magnetic field, Magnetic force, Magnetic Energy.

Unit 4: Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Wave propagation in conducting medium, Wave propagation and phase velocity, Power flow and Poynting vector, Plane Waves at a Media Interface- Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction at media interface, Total internal reflection, Polarization at media interface, Reflection from a conducting boundary.

Unit 5: Waveguides- Parallel plane waveguide,Rectangular waveguide, TE mode, TM mode, TEM mode, Dominate mode, Critical Wave length, Phase and Group Velocity. Equations of

Voltage and Current on TX line, Propagation constant, characteristic impedance and reflection coefficient, VSWR, Smith Chart, Impedance Matching.

Course Outcome (CO):

By the end of this course, students will be able to:

CO1- Ability to understand physical concepts and Mathematical methods used in E.M. wave
Phenomena.

CO2- Ability to understand Electrostatics concept of E M Wave.

CO3-Ability to understand Magneto statics concept of E M Wave and also the importance, necessity & use of Maxwell's Equations.

CO4- Ability to understand plane wave.

CO5- Ability to understand waveguide with various modes

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2		PSO 3
CO1	H		M		L			H			L			L		
CO2	L		L	M	M	H				H		L	L	H		L
CO3	H	M					M		L		L					M
CO4			M		H		H								H	
CO5	H	M					L									M

H = Highly Related; M = Medium L = Low

Text Books:

1. Elements of Electromagnetics Matthew N. O. Sadiku Oxford University Press.
2. Engineering Electromagnetics, Hayt, TMH

Reference Books

1. Electromagnetics (Sie) (Schaum's Outlines Series), Edminister, TMH
2. Electromagnetics With Applications, Jd Kraus, TMH
3. Fundamentals Of Electromagnetics For Engineers, Rao, Pearson

4. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
5. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.

JECRC UNIVERSITY

Faculty of Engineering & Technology **Hours: 24**

B.Tech in Electronics and Communication Engineering Semester IV

Contact Hours (L-T-P): 2-0-0

Object Oriented Programming (BEE016A)

Course Objectives:

1. *To consolidate and extend student's knowledge and skills in structured programming and to introduce them to the concepts and practice of object oriented programming.*
2. *To develop skills in using the object-oriented concepts of inheritance, encapsulation, construction, access control, overloading and messaging; develop and display competency in the design and implementation of object-oriented programs to solve business problems.*

Unit 1: C++ Overview, C++ Characteristics, Object-Oriented Terminology, Polymorphism, Object-Oriented Paradigm, Abstract Data Types, I/O Services, Standard Template Library, Standards Compliance, Functions and Variables.

Unit 2: Functions: Declaration and Definition, Variables: Definition, Declaration, and Scope, Variables: Dynamic Creation and Derived Data, Arrays and Strings in C++, Qualifiers, Classes in C++, Defining Classes in C++.

Unit 3: Classes and Encapsulation, Member Functions, Instantiating and Using Classes, Using Constructors, Multiple Constructors and Initialization Lists, Using Destructors to Destroy Instances.

Unit 4: Using Destructors to Destroy Instances, Operator Overloading, Operator Overloading, Working with Overloaded Operator Methods, Initialization and Assignment, Initialization vs. Assignment.

Unit 5: The Copy Constructor, Assigning Values, Specialized Constructors and Methods, Constant and Static Class Members, Inheritance, Overview of Inheritance, Defining Base and Derived Classes, Constructor and Destructor Calls, Input and Output in C++ Programs, Input and Output in C++ Programs, Standard Streams, Manipulators, Unformatted Input and Output.

Course Outcome (CO):

At the end of this course students will have:

CO1- To understand the differences between C and C++ characteristics.

CO2- Ability to understand the declaration and definition of functions.

CO3-Ability to understand the advantages of C++ like classes and encapsulation.

CO4-Ability to understand the usage of overloading.

CO5-Ability to understand the concept of Inheritance.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	M	H								M				L	
CO2	M	H						H					L	H	L
CO3			H	M	L				L						M
CO4				H	H						L		H		
CO5						H	H					H			M

H = Highly Related; M = Medium L = Low

Textbooks:

1. Programming with C, C++: Bala Guruswamy
2. Let Us C: Yashwant Kanitkar, TATA McGraw Hill.

3.
JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 24**
B.Tech in Electronics and Communication Engineering Semester IV
Contact Hours (L-T-P): 0-0-2

Electronic Workshop (BEE017A)

Course Objective:

To enable the student to acquire competency in the safe use of electronic laboratory test equipment and to acquire competency in constructing and testing electronic assemblies. The practical element of the Electronic Production subject is considered to be of great importance. Students gain valuable experience in physical component identification and the use of supplier catalogues in the component identification and ordering procedure. The skill of electronic soldering is developed in this subject.

1. Introduction & Hands on experience to use circuit creation & simulation software like TINAPRO, P-SPICE or ORCAD.
2. Design a half wave rectifier using ORCAD software. Calculateits $V_{rms,}$ PIV, and Form Factor.
3. Design a full wave rectifierusing ORCAD software. Calculate its $V_{rms,}$ PIV, and Form Factor.
4. Design a Hartley oscillator and to observe its output waveform using ORCAD software. Find its frequency of oscillation.
5. Design a Colpitts oscillator and to observe its output waveform using ORCAD software. Find its frequency of oscillation.
6. Design a Wien-Bridge oscillator and to observe its output waveform using ORCAD software. Find its frequency of oscillation.
7. Design and obtain the frequency response of second order low pass filter using IC-741 by ORCADsoftware.
8. Design and obtain the output waveform ofIntegrator and Differentiator circuit IC-741by ORCAD software.
9. Design and obtain the output waveform of Inverting, Non-inverting amplifier using IC -741by ORCAD software.
10. Design differential amplifier using BJT using ORCAD software. Calculate the itsCMRR.
11. Design of single stage class-C single tuned amplifier using ORCAD software. Plot its frequency response.
12. Design of current series feedback amplifier using ORCAD software. Plot its frequency response.
13. Design of voltage series feedback amplifier using ORCAD software. Plot its frequency response.
14. Design and obtain the output waveform of CMOS inverter by using ORCAD software.
15. Design and obtain the output waveform of CMOS NOR gate by using ORCAD software.
16. Design and obtain the output waveform of CMOS NAND gate by using ORCAD software.

Course Outcome (CO):

CO1-Ability to understand the concept of *Feedback circuits.*

CO2- Ability to understand *Oscillator Circuits*.

CO3-Ability to understand*High frequency networks.*

CO4-Ability to understand *Tuned Amplifiers*.

CO5-Ability to understand *Power Amplifier.*

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1			L		L			M	M			H		H	
CO2	M		H	L	M	L			L	L		H	M	H	L
CO3	H	M					L								M
CO4			L		H					M	M		H		
CO5	H	M					L				L				M

H = Highly Related; M = Medium L = Low

Faculty of Engineering & Technology **Hours: 24**
B.Tech in Electronics and Communication Engineering Semester IV
Contact Hours (L-T-P): 0-0-2

Analog Electronics Lab (BEE018A)

List of Experiments

1. Design a voltage amplifier using BJT in common emitter mode and
    a) Plot I/P vs. O/P voltage and calculate voltage gain.
    b) Draw gain frequency response and determine bandwidth.
2. Design a voltage amplifier using BJT in common Base mode and
    a) Plot I/P vs. O/P voltage and calculate voltage gain.
    b) Draw gain frequency response and determine bandwidth.
3. Design a voltage amplifier using BJT in common Collector mode and
    a) Plot I/P vs. O/P voltage and calculate voltage gain.
    b) Draw gain frequency response and determine bandwidth.
4. Design a class B Push Pull amplifier.
5. Design and Verify adder and subtractor circuit using OP-AMP(IC-741).
6. Design and Verify a subtractor circuit using OP-AMP(IC-741).
7. Design and Verify Differentiator circuit using OP-AMP(IC-741).
8. Design and Verify Integrator circuit using OP-AMP(IC-741).
9. Design the square wave oscillator using OP-AMP(IC-741). Find frequency of oscillation.
10. Design RC Phase Shift Oscillator. Find frequency of Oscillation
11. Design Wein Bridge Oscillator. Find frequency of oscillation.
12. Design Hartley Oscillator. Find frequency of oscillation.
13. Design Colpitts Oscillator. Find frequency of oscillation.

Course Outcome (CO):
CO1-Ability to understand the concept of *Feedback circuits.*
CO2- Ability to understand *Oscillator Circuits*.

CO3-Ability to understand*High frequency networks.*
CO4-Ability to understand *Os*

CO5-Ability to understand *Power Amplifier.*

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1			L		L			M	M			H		H	
CO2	M		H	L	M	L			L	L		H	M	H	L
CO3	H	M					L								M
CO4			L		H					M	M		H		
CO5	H	M					L				L				M

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 24**
B.Tech in Electronics and Communication Engineering Semester IV
Contact Hours (L-T-P): 0-0-2

Object Oriented Programming Lab (BEE019A)

1. To write a simple program for understanding of C++ program structure without any CLASS declaration. Program may be based on simple input output, understanding of keyword using.

2. Write a C++ program to demonstrate concept of declaration of class with public & private member, constructors, object creation using constructors, access restrictions, defining member functions within and outside a class. Scope resolution operators, accessing an object's data members and functions through different type of object handle name of object, reference to object, pointer to object, assigning class objects to each other.

3. Program involving multiple classes (without inheritance) to accomplish a task. Demonstrate composition of class.

4. Demonstration Friend function friend classes and this pointer.

5. Demonstration dynamic memory management using new & delete & static class members.

6. Demonstration of restrictions an operator overloading, operator functions as member function and/ or friend function, overloading stream insertion and stream extraction, operators, overloading operators etc.

7. Demonstrator use of protected members, public & private protected classes, multilevel inheritance etc.

8. Demonstrating multiple inheritance, virtual functions, virtual base classes, abstract classes Object Oriented Programming Lab.

9. Write a C++ program to input the record of multiple students having multiple fields and changing a specific field of a specific student using array of objects.

10. Write a C++ program to add more fields for all the students using inheritance of classes.

11. Write a C++ program to input the time in 24 hour format from the user in hours, minutes and seconds and convert it into 12 hour format using a member function of a class.

12. Write a C++ program append the record of one student from multiple records using this pointer.

13. Write a C++ program to enqueue and dequeue a data in a queue using a classes.

14. Write a C++ program to develop a simple calculator using classes.

15. Write a C++ program to maintain an inventory of a company.

Course Outcome (CO):

At the end of this course students will have:

CO1- To understand the differences between C and C++ characteristics.

CO2- Ability to understand the declaration and definition of functions.

CO3-Ability to understand the advantages of C++ like classes and encapsulation.

CO4-Ability to understand the usage of overloading.

CO5-Ability to understand the concept of Inheritance.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	M	H								M				L	
CO2	M	H						H					L	H	L
CO3			H	M	L				L						M
CO4				H	H						L		H		
CO5						H	H					H			M

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 24**
B.Tech in Electronics and Communication Engineering Semester IV

BAS004B	**Random Variables & Stochastic Processes**	**2-1-0 [3]**

OBJECTIVE:

- Understand the Probability and probability distribution.
- Compute variance and standard deviation for discrete and continuous probability distributions.
- Understanding the basics concepts of Joint distributions.
- Understand the basics concepts of sample standard error.
- Understand the Properties of random processes.

Unit 1	PROBABILITY- Introduction, definitions, conditional probability, combined experiments.
Unit 2	RANDOM VARIABLES - Introduction, Distribution and density functions, Discrete and continuous random variables, (Gaussian), Exponential, Rayleigh, Uniform, Bernoulli, Binominal, Poisson, discrete Uniform and conditional distributions. Functions of one random variable: distribution, mean, variance, moments and characteristics functions.
Unit 3	MULTIPLE RANDOM VARIABLES - distributions, Pne function of two random variables, Two functions of two random variables, Joint moments, Joint characteristics functions, Conditional distributions, conditional expected values, statistical independence. Multiple random variables: multiple functions of multiple random variables, jointly Gaussian random variables, sums of random variable, Central limit theorem.
Unit 4	STOCHASTIC PROCESSES - Definitions, Random process concept, Statistics of stochastic processes: mean, autocorrelation, strict and wide sense stationary, random processes and Linear Systems.
Unit 5	STOCHASTIC PROCESSES IN FREQUENCY DOMAIN - Power spectrum of stochastic processes, Transmission over LTI systems, Gaussian and White processes, Properties of power spectral density.

Text Books:

1 Devor –Probability and statistics for engineering and sciences, Cengage learning 2011
2 Mendenhall – Introduction to probability and statistics, Cengage learning 2012.

Reference Books:

1 Probability, Random Variables And Random Signal Principles, Peebles, TMH 2002
2 Probability Theory and Stochastic Processes for Engineers, Bhat, Pearson 2011.

3 Probability and Random Processes with Application to Signal Processing, 3/e, Stark, Pearson 2002.
4 Random Variables & Stochastic Processes, Gaur and Srivastava, Genius publications 2003.
5 Random Processes: Filtering, Estimation and Detection, Ludeman, Wiley 2002 8 An Introduction to Probability Theory & Its App., Feller, Wiley 1969.

Course Outcomes

At the end of this course, students will be able to:

CO1 Understand the Basic requirement and methods of Probability and probability laws Understand the concepts of a random variable and a probability distribution.Distinguish between discrete and continuous random variables.

CO2 Compute and interpret the expected value, variance, and standard deviation for discrete and continuous probability distributions.

CO3 Understanding the basics concepts of Joint distributions, Conditional distribution, densities and moments

CO4 Understand the basics concepts of sample standard error,Strong and weak laws of large numbers, central limit theorem.

CO5 Understand the Properties of random processes: Stationarity, correlation function, power spectral density, spectral analysis

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specifice Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H	H			M	L	L					H	H	L	L
CO2	H	M		L	M			L			L	H	H		
CO3	H	H	M		H	M			L		M	H	H	L	
CO4	H	M		M	L		L			L		H	H	M	
CO5	H	H			M	L		L	L	L		H	H	M	L

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY

Faculty of Engineering & Technology **Hours:24**
B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 2-1-0

BAS005B	**Numerical Methods, Optimization Techniques and Special Functions**	**2-1-0 [2]**

OBJECTIVE:

- Understand the solutions methods for nonlinear programming problems.
- Methods for Linear programming, transportation and assignment problem.
- Develop an understanding of CalculusofVariations

Unit 1	NUMERICAL ANALYSIS- Finite differences – Forward, Backward and Central differences. Newton's forward and backward differences, interpolation formulae. Stirling's formula, Lagrange's interpolation formula.
Unit 2	NUMERICAL ANALYSIS- Integration-Trapezoidal rule, Simpson's one third and three-eighth rules. Numerical solution of ordinary differential equations of first order - Picard's method, Euler's and modified Euler's methods, Miline's method and Runga-Kutta fourth order method, Differentiation
Unit 3	SPECIAL FUNCTIONS – Bessel's functions of first and second kind, simple recurrence relations, orthogonal property of Bessel's, Transformation, Generating functions, Legendre's function of first kind. Simple recurrence relations, Orthogonal property, Generating function.
Unit 4	LINEAR PROGRAMMING PROBLEMS - Linear Programming(Graphicaland Simplex solution);Transportation and Assignment Method.
Unit 5	CALCULUS OF VARIATIONS - Functional, strong and weak variations simple variation problems, the Euler's equation.

Text Books:

1 Datta – Mathematical methods of science & engineering, Cengage learning 2012
2 O'neil – Advanced Engineering mathematics, Cengage learning 2007

Reference Books:

1 Applied Statics & Probability, Montgomery, Wiley 2013
2 Engineering Mathematics, T Veerarajan, TMH 2011
3 Mathematical Techniques, Jordan, Oxford 2002

4 Engineering Mathematics IV, K.C. Sarangi and others, Genius publications 2011
5 Advance Engineering Mathematics, Potter, Oxford 2005
6 Advanced Engineering Mathematics, 2/e, Greenberg 1998

Course Outcomes

At the end of this course, students will be able to:

CO1: Explain the Finite differences.
CO2: Understand Miline's method and Runga- Kutta fourth order method.
CO3: Better utilization of Bessel's functions orthogonal property of Bessel's, Transformation,
Generating functions, Legendre's function of first kind.
CO4: Define Linear Programming(Graphical and Simplex solution)Transportation and Assignment Method.
CO5: Calculate Functional, strong and weak variations simple variation problems, the Euler's equation.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specifice Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H								M	M		M	M		
CO2		H	H								M	M	M		
CO3			H		M		M						L	M	M
CO4				M	H			L			M	M			L
CO5	H	H			M	L						M			

- H = Highly Related; M = Medium L=Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 3-0-0

Microprocessor & Microcontroller System (BEE020A)

Course Objective:

Objective of this course is to introduce to the students the fundamentals of microprocessor and microcontroller.

Unit 1: Evolution of microprocessors, technological trends in microprocessor development. The Intel family tree. CISC Versus RISC. Applications of Microprocessors. 8086 Block diagram; description of data registers, address registers, pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module. Instruction formats, addressing modes.

Unit 2: Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions, process control instructions; Assembler directives. Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions. Writing procedures, Data tables, modular programming, Macros.

Unit 3:8086 Interrupt types and interrupt vector table. DOS interrupt INT 21 h functions. INT 10h and INT 16h functions. Intel 8086 bus cycles, instruction queue, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode, reset operation, wait state, halt state, hold state, lock operation, interrupt processing. Address decoding techniques.

Unit 4: Intel's 8255 description, 8255 different modes operation and interfacing with 8086. Interfacing ADC(0808/0809),DAC-(0808) using 8255. Wave form generation. Intel's 8251 description and operation. Intel's 8259. DMA operation. Intel's 8237. Intel's 8279. Intel's 8253. Introduction to i3,i5,i7 processors.

Unit 5:8051 microcontroller pin diagram, Block diagram, Flag, RAM configuration, Register Banks, addressing modes, instruction set, 8051 programming &,interfacing.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand the evolution of microprocessor.

CO2- Ability to understand set of instructions supported by 8086 microprocessor.

CO3-Ability to understand the interrupt process and instructions functions in 8086 microprocessor process.

CO4-Ability to understand and design an interfacing structure of Intel's 8255,8253,8278.i3,i7 processors.

CO5-Ability to understand the concept and working of 8051 microcontroller.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H	H								L		H	H	L	
CO2	H	H					L	L				H	H	H	L
CO3	H		H	M	L				L			H	H		M
CO4	H	H		H	H						L	H	H		
CO5	H					H	L					H	H		M

H = Highly Related; M = Medium L = Low

Text Books:

1. Douglas Hall Microprocessors Interfacing, Tata McGraw Hill, 1991
2. The 8051 Microcontroller and Embedded systems by Muhammad Ali Mazidi Pearson Education Asia.

Reference Books

1. Computer Organization and Design, The hardware and software interface by D A Patterson and J H Hennessy, Morgan Kaufman Publishers.
2. The 8051 Microcontroller Architecture, programming and Applications by Kenneth Ayala, Penram International

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Faculty of Engineering & Technology **Hours:48**
B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 3-1-0

Introduction to Digital Communication (BEE021A)

Course Objectives:

Subjectdeals with different features of digitized mode of communication. All the real time signals are analog, still we are using digital TV, Radio, Telephone Channel or Satellite Communication, so how we can convert a real time signal in digitized form, make it ready for transmission and again converting it in original signal is covered in this subject. Speed of transmission, Error control techniques, bandwidth utilization, limits of resources are different aspects we study.

Unit 1: Review of Random Variables. Probability Theory- Joint probability, Conditional probability, Bay's rule, Cumulative distribution function (CDF), Probability density function (PDF), Mean, Auto-coorelation, Cross- coorelation and their properties for random variables. Random Process, Energy density function (ESD), Power spectral density (PSD).

Unit 2: Introduction to Pulse modulation, PAM, PPM, PWM. Pulse code modulation- Generation, Sampling, Quantization, Quantization noise voltage, Quantization noise power, signal to noise ratio,SNR calculation with sinusoidal input. Companding in PCM- A-law and μ-law companding, Differential pulse code modulation, Delta modulation- step size, slope overload, threshold conditions, Adaptive Delta modulation.

Unit 3: Sampling and reconstruction of analog signal, natural sampling, sample and hold circuit, flat top sampling, Proof of sampling theorem, Sampling for Low pass signal as well as Band pass signal, Nyquist criteria for sampling, Intersymbol Interference (ISI), Interchannel Interference (ICI).

Unit 4: Digital Modulation schemes- Binary Phase Shift Keying (BPSK), Binary Frequency Shift Keying(BFSK),Concept of Quadrature Amplitude Modulation (QAM),Quadrature Phase Shift Keying(QPSK), Continuous Phase Modulation and Minimum Shift Keying (MSK). Signal point representation on orthonormal axis, Bandwidth requirement and symbol detection error probability for coherent BPSK, QPSK, BFSK.

Unit 5:. Transmission of digital signals over bandlimited channels- Shannon Hartley theorem. Coherent and non-coherent detection. Synchronization techniques in analog and digital transmission.

Course Outcome (CO):

At the end of this course students will have:

C0-1: The students will able to understand the evolution of different generation of Mobile.

CO-2: The student will have the ability to understand the characteristics of communication for different channels and environment.

CO3- The student will be able to analyze and design different accessing techniques.
C0-4:The student will be able to analyze and design different standard of communication system.

CO-5- The student can work in advanced research wireless and mobile cellular programs.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12	PSO1	PSO2	PSO3
CO1	H		H			M			M	M	H	M		H	
CO2	H		H	M		H	M			H	M		M	H	M
CO3	H	M						H	H						H
CO4			M			H					M	H	H		
CO5	M	M							L			H			M

H = Highly Related; M = Medium L = Low

Text Books:

1. *Digital Communications*- "Simon Haykin" wiley Publication.

Reference Book:

1.Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley, 1965.
2.Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.
3. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:24**
B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 0-0-2

Microprocessors & Microcontroller System Lab (BEE022A)

Course Objective :

To understand the internal organization of INTEL 8085,8086 Microprocessors and Assembly Language Programs using the instruction sets of processors and to study the interfacing of the processor with various peripheral devices.

1. a) Write a program using Microprocessor 8085 to add two 8 bits numbers.
   b) Write a program using Microprocessor 8085 to subtract two 8 bits numbers.
   c) Write a program using Microprocessor 8085 to add two 16 bits numbers.
2. a) Write a program using Microprocessor 8086 to add two 8 bits numbers.
   b) Write a program using Microprocessor 8086 to subtract two 8 bits numbers.
   c) Write a program using Microprocessor 8086 to add two 16 bits numbers.
   d) Write a program using Microprocessor 8086 to add ten 16 bits numbers with carry.
3. (a) Write an assembly language program to find whether the given number is even or odd.
   (b) Write an assembly language program to find the number of even and odd numbers from given series of 16 bit numbers.
   (c) Write an assembly language program to find the number of 1's in a given number.
   (d) Write an assembly language program to find whether the given number has even parity or odd parity.
4. (a) Write an assembly language program to find the largest number from an array of 16 bit numbers.
   (b) Write an assembly language program to find the smallest number from an array of 16 bit numbers.
   (c) Write an assembly language program to arrange the given array of 16 bit numbers in ascending order.
   (d) Write an assembly language program to arrange the given array of 16 bit numbers in descending order.

5. (a) Write an assembly language program to find the number of +ve and -ve numbers from given series of 16 bit numbers.

(b)Write an assembly language program to perform 1 byte BCD addition

(c) Write an assembly language program to perform addition, subtraction, Multiplication and Division of given operands. Perform BCD addition and subtraction.

(d) Write an assembly language program to move 16 bytes from the offset 0200H to 0300H.

6. (a) Write an assembly language program to find whether the given byte is present in the string or not.

(b) Write an assembly language program to compare two given strings.

(c) Write an assembly language program to find square of the given number.

(d) Write an assembly language program to find square of the given array of 16 bit number.

7. (a) Display a message " very large scale integration"

(b) Write an assembly language program to convert BCD number 0 to 9 to their 7 segment codes, using look up table.

(c) Write an ALP for (i) addition and (ii) Multiplication of two 3x3 Matrices.

8. a) Write a program to calculate squares of BCD number 0 to 9 and store then sequentially from 2000H offset onward in the current data segment. The number and their square are in BCD format. Write a subroutine for the calculation of square of number.

b) Write a program to change a sequence of 16 two byte number from ascending to descending order and store them in same data segment.

9. a) Write a program to generate a delay of 100ms using an 8086 system that runs on 10MHz frequency.

(b) Write a program to generate delay of 1Minutes.

10. (a)Write a program in 8051

(i) to clear the accumulator and add 3 to accumulator 10 times.

(ii) to load accumulator with the value 55H and complement the accumulator 700Times.

(b) Write a program to toggle all the bits of port1. put a time delay in between each issuing of data to port 1.

11. (a) Write a program to generate a delay of 1μsec. assuming that crystal frequency is 11.05MHz.

(b) Write a program in 8051 to perform the following

(i) Keep monitoring the port P2.2 bit until it becomes high

(ii) When it becomes high write a value 45H to port 0 send a high to low pulse to P3.3.

12. (a) Write a program to get X value from P1 and send X^2 to P2 continuously.

(b) Assume P1 is I/P port and connected to a temperature sensor. Write a program to read the temperature and test it for the value 75. according to test result place the temperature value into the registers indicated by the following

If T = 75 then A = 75

If T < 75 then R1 = T

If T > 75 then R2 = T

13. (a) Write a program to find number of 1's in given number.

(b) Write a program tfor conversion of packed BCD to ASCII

14. Write a program to Interface 7-segment LED displays to a microprocessor and displaying a real-time clock.

15. Write a program for the implementation of a traffic signal controller.

16. Write a program for implementation of a programmable frequency synthesizer using timers.

17. Write a program to interfacing ADC & DAC -capturing a waveform from signal generator and CRO display.

18. Write a program to interfacing a stepper motor to a 8051 microcontroller.

Conclusion: The whole conclusion of this lab is that now the students can make their final year projects based on microprocessor.

Course Outcome (CO):

At the end of this course students will have:

CO1- Understand and apply the fundamentals of assembly level programming of microprocessors.

CO2- To work with standard microprocessor real time interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters

CO3- Analyze abstract problems and apply a combination of hardware and software to address the problem

CO4- Learn to troubleshoot interactions between software and hardware

CO5- Understand and apply the fundamentals of assembly level programming of microcontroller.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	M	H								M				L	
CO2	M	H						H					L	H	L
CO3			H	M	L				L						M
CO4				H	H						L		H		
CO5						H	H					H			M

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JECRC UNIVERSITY
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Contact Hours (L-T-P): 0-0-2

Communications Lab (BEE023A)

List of Experiments

1. Perform Full- and suppressed-carrier AM DSB modulation and Calculate Depth of Modulation.

2 Perform Demodulation for full-carrier as well as suppressed carrier AM DSB signal.

3. Observe FM modulation and demodulation and compare different modulator and demodulator also.

4. Study the concept of sampling and reconstruction of analog signal. Also see the effect of sampling frequency, duty cycle and order of low pass filter on quality of reconstructed signal.

5. Perform and observe Frequency Division Multiplexing (FDM).

6 Perform and observe Time Division Multiplexing (TDM).

7. Perform modulation and demodulation of Pulse Amplitude Modulation (PAM).

8. Perform and observe modulation and demodulation of Pulse Position Modulation (PPM).

9. Perform and observe modulation and demodulation of Pulse Width Modulation (PWM).

10. Perform PCM generation.

11. Perform different error checking codes Parity code and Hamming code.

12. Perform and observe Delta as well as Adaptive Delta modulation and demodulation.

13. Perform and observe MSK modulation and demodulation.

14 Perform A- law, u- law companding

15. Perform different line codes.

Course Outcome (CO):

At the end of this course students will have:

C0-1: The students will able to understand the evolution of different generation of Mobile.

CO-2: The student will have the ability to understand the characteristics of communication for different channels and environment.

CO3- The student will be able to analyze and design different accessing techniques.
C0-4:The student will be able to analyze and design different standard of communication system.

CO-5- The student can work in advanced research wireless and mobile cellular programs.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12	PSO1	PSO2	PSO3
CO1	H		H			M			M	M	H	M		H	
CO2	H		H	M		H	M			H	M		M	H	M
CO3	H	M						H	H						H
CO4			M			H					M	H	H		
CO5	M	M							L			H			M

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JECRC UNIVERSITY
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Contact Hours (L-T-P): 0-0-2

Basic Simulation Lab (BEE024A)

(Simulation Lab. Experiments may be carried out using MATLAB/ SCILAB)

1. Creating a One-Dimensional Array (Row / Column Vector) Exercise – Creating a vector of even whole numbers between 31 and 75; Creating a Two-Dimensional Array (Matrix of given size) and (A). Performing Arithmetic Operations - Addition, Subtraction, Multiplication and Exponentiation. (B). Obtaining Modified Matrix - Inverse, Transpose, with Appended and Deleted Elements;

2. Performing Matrix Manipulations - Concatenating, Indexing, Sorting, Shifting, Reshaping, Resizing and Flipping about a Vertical Axis / Horizontal Axis; Creating Arrays X & Y of given size (1 x N) and Performing
(A) Relational Operations - >, <, ==, <=, >=, ~=
(B) Logical Operations - ~, &, |, XOR

3. Generating a set of Commands on a given Vector (Example: X = [1 8 3 9 0 1]) to
(A) Add up the values of the elements (Check with **sum**)
(B) Compute the Running Sum (Check with **sum**), where Running Sum for element j = the sum of the elements from 1 to j, inclusive.
(C) Compute the Sine of the given X-values (should be a vector).
Also, Generating a Random Sequence using **rand() / randn()** functions and plotting them.

4. Evaluating a given expression and rounding it to the nearest integer value using Round, Floor, Ceil and Fix functions; Also, generating and Plots of
(A) Trigonometric Functions - sin(t), cos(t), tan(t), sec(t), cosec(t) and cot(t) for a given duration't'.
(B) Logarithmic and other Functions – log(A), $\log_{10}(A)$, Square root of A, Real n_{th} root of A.

5. Write a MATLAB program to generate an exponential Sequence.

$X(n) = (a)^n \quad for \quad (i)\, 0 \le a \le 1 \quad (ii) -1 \le a \le 0 \quad (iii)\, a \le -1 \quad (iv)\, a > 1$

6.Write a MatLab program to generate the signal $S(n) = 2 * n * (0.8\hat{}\, n)$ corrupted by the noise $d(n)$resulting the signal $X(n)$.

$$X(n) = s(n) + d(n).$$

Also down sample the corrupted signal

7. Creating a vector X with elements, $X_n = (-1)_{n+1}/(2n-1)$ and Adding up 100 elements of the vector, X; And, plotting the functions, x, x_3, e_x and $\exp(x_2)$ over the interval $0 < x < 4$ (by choosing appropriate mesh values for x to obtain smooth curves), on

(A) A Rectangular Plot

(B) A Semi log Plot

(C) A log-log Plot

8. Generating a Sinusoidal Signal of a given frequency (say, 100Hz) and Plotting with Graphical Enhancements - Titling, Labelling, Adding Text, Adding Legends, Adding New Plots to Existing Plot, Printing Text in Greek Letters, Plotting as Multiple and Sub- Plots; Also, Making Non-Choppy and Smooth Plot of the functions,

$f(x) = \sin(1/x)$ for $0.01 < x < 0.1$ *and* $g(x) = (\sin x)/x$

9. To Plot the following Functions:

h(n)={4rn cos[pi*n(1+r)/m]+m sin[pi*n(1-r)/m]}/[1-4rn/m)^2]*pi*nm

h (0)=(1/m)+(r/(m * 4/pi -1))

h (|m/4|)=(-r/m)*[(2*cos{(pi/4*r)*(1+4)}-cos{pi*(1-r)/4*r}]

Given: - m=4, r=0.1

10. Creating A Structure, An Array of Structures and Writing Commands to Access Elements of the created Structure and Array of Structures; Also, Solving First Order Ordinary Differential Equation using Built-in Functions; And, Creating an M x N Array of Random Numbers using **rand** and setting any value that is < 0.2 *to* 0 and any value that is ≥ 0.2 to 1 by moving through the Array, Element by Element.

11. Write a MatLab/SciLab program to generate a Fibonacci series up-to 20.

12. Write a MatLab/SciLab program to check whether a number is prime or not.

13.Write a MatLab/SciLab program to convert a decimal number to binary.

14.Generating normal and integer random numbers $(1-D \ \& \ 2-D)$ and plotting them;Also, Writing a Script (which keeps running until no number is provided to convert) that asks for Temperature in degrees Fahrenheit and Computes the Equivalent Temperature in degrees Celsius. [Hint: Function **is empty** is useful]

15. Writing brief Scripts starting each Script with a request for input (using input) to Evaluate the function $h(T)$ using if-else statement, where

$$h(T) = (T - 10) \text{ for } 0 < T < 100$$

$$= (0.45\,T + 900) \text{ for } T > 100$$

Exercise: Testing the Scripts written using

(A) $T = 5, h = -5$

(B) $T = 110, h = 949.5$

Also, Creating a Graphical User Interface (GUI); And, Curve Fitting using

(A) Straight line Fit

(B) Least Squares Fit

16.Interpolation based on following Schemes (A) Linear (B) Cubic (C) Spline Also, Generating the first Ten Fibonacci numbers according to the relation $F_n = F_{n-1} + F_{n-2}$ with $F_0 = F_1 = 1$, and computing the ratio F_n / F_{n-1} for the first 50 Fibonacci numbers.

Course Outcome (CO):

CO1- Understand Basics of MATLAB syntax, functions and programming.

CO2- Analyze the generation Various Signals and Sequences in MATLAB, including the operations on Signals and Sequences

CO3- Applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

CO4- To analyze a given system and/or design for its specification based performance and to devise any design changes for performance improvement, if need be.

CO5- Learn to Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L				H		L	L	H	L
CO3	H	M					L		M		L				M
CO4			L		H					L			H		
CO5	H	M					L				L	L			M

H = Highly Related; M = Medium L = Low

Text Books:

Brian R. Hunt, A Guide To Matlab: For Beginners And Experienced Users

Reference Books

Nicholas Higham, Desmond Higham (2000), MATLAB Guide

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B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 3-1-0

Microwave Theory and Techniques(BEE025A)

Course Objectives:

1. *To introduce the history, applications(Civil and Military, Medical, EMI/ EMC) and basics of microwave.*
2. *To analysis Transmission line, waveguide and active passive component.*
3. *To study basics of antenna and its application and microwave instruments.*

Unit 1: Introduction to Microwaves-History of Microwaves, Microwave Frequency bands;Applications of Microwaves: Civil and Military, Medical, EMI/ EMC. Mathematical Model of Microwave Transmission-Concept of Mode, Features ofTEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

Unit 2: Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangularwaveguide, Circular waveguide, Strip line, Micro strip line. Microwave Network Analysis- Equivalent voltages and currents for non-TEMlines, Network parameters for microwave circuits, Scattering Parameters.

Unit 3: Passive and Active Microwave Devices- Microwave passive components:Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

Unit 4: Microwave Design Principles- Impedance transformation, Impedance Matching,Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas-Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

Unit 5: Microwave Measurements- Power, Frequency and impedance measurement atmicrowave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters. Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Course Outcome (CO):

By the end of this course, students will be able to::

CO1- Ability to understand the history, applications(Civil and Military, Medical, EMI/ EMC) and basics of microwave.

CO2- Ability to understand Transmission line, waveguide.

CO3-Ability to understand active and passive component.

CO4- Ability to understand Designing of microwave Filter, also basics of Antenna.

CO5- Ability to understand microwave measurement and Satellite communication.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L				H		L	L	H	L
CO3	H	M					L		M		L				M
CO4			L		H					L			H		
CO5	H	M					L				L	L			M

H = Highly Related; M = Medium L = Low

Text Book:

1.R.E. Collins, Microwave Circuits, McGraw Hill.

Reference Book

1.K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house.

School of Engineering
B.Tech. in Electrical Engineering – Semester V
Contact Hrs per week (L-T-P): 3-0-0

Course Outlines
BCO035A- PROGRAMMING in PYTHON

OBJECTIVE:

- To study various core programming basics—including data types, control structures, algorithm development,
- To overview the applications of Python.
- To be familiar with program design with functions—via the Python programming language.
- Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications

UNIT 1	**Introduction:** Features of Python, History of Python, installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages
UNIT 2	Introduction to Operators, Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation. **Strings:** subscript operator, indexing, slicing a string, String methods & operations; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers. **Text files;** manipulating files and directories, os and sys modules; reading/writing text and numbers from/to a file; creating and reading a formatted file
UNIT 3	**Lists, tuples, and dictionaries**; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. **Design with functions:** hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions.
UNIT 4	**Classes and OOP:** classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects **OOP, continued:** inheritance, polymorphism Operator overloading (_eq_, _str_, etc); abstract classes; Exception handling, try block
UNIT 5	**Graphical user interfaces;** Event-driven programming paradigm; tkinter module,,turtle module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Multithreading, CSV(Accesing, updating, Creating)

Course Outcome:

CO1: Various core programming basics—including data types, control structures, algorithm development,
CO2: Overview the applications of Python.
CO3: Show the program design with functions—via the Python programming language.
CO4: Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications
CO5: Students will be able to solve the problems on Graphical user interfaces.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specifice Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M										H		
CO2		L			M									L	L
CO3			H		M						L		M		L
CO4		M		L					L	L				M	
CO5	H	H	H		H							H			

H = Highly Related; M = Medium L = Low

Text Book:

1. *Fundamentals of Python: First Programs* Author: Kenneth Lambert Publisher: Course Technology, Cengage Learning, 2012 ISBN-13: 978-1-111-82270-5

Reference Books:

1. Python: Real World Machine LearningBy Prateek Joshi et al.ISBN 13: 9781787123212 Packt Publishing 941 pages (November 2016)

Programming in Python Lab

A Basic

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Program to create random number generator which generate random number between 1 and 6
4. Program to swap two number and display number before swapping and after swapping
5. Write a program in python, that calculates the volume of a sphere with radius r entered by the user. (Assume $\pi = 3.14$)

B Conditional Statements

1. Write a program to check whether an entered year is leap or not.
2. Write a program to find largest among 3 numbers.
3. Write a Program to check if the entered number is Armstrong or not.
4. Write a program that reads roll no. from a student. Then your program should display a message indicating whether the number is even or odd.
5. Let us say a teacher decided to give grades to her students as follows:

a) Mark greater than or equal to 80: Excellent
b) Mark greater than or equal to 65 but less than 80: Good
c) Mark greater than or equal to 50 but less than 65: Pass
d) Mark less than 50: Fail

Write a program in python to print a grade according to a student's mark with multiple if statements

C Loops

1. Write a python program to find factorial of a number
2. Write a python program that prints prime numbers less than 20.
3. Write a Program to print multiplication table of any number
4. Write a Program to check whether a number is palindrome or not
5. Write a Program to construct the following pattern using nested for loop:

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

6. Write a Program to print Fibonacci series up to n terms using loop statement

D String

1. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
2. Write a program find length of a string.
3. Write a Program to check whether a string is palindrome or not.
4. Write a Program to count all letters, digits, and special symbols from a given string.
5. Write a Program to calculate the sum and average of the digits present in your registration number.

E Lists

1. Write a program to demonstrate various list operations in python.
2. Write a program to find even numbers from a list
3. Write a program to interchange first and last element of a list
4. Write a program to turn every item of a list into its square
5. Write a program to check all elements are unique or not in Python
6. Write a program to replace list's item with new value if found
7. Write a program to find the position of minimum and maximum elements of a list.
8. Write a program to find the cumulative sum of elements of a list
9. Write a program that reads integers from the user and stores them in a list. Your program should continue reading values until the user enters 0. Then it should display all of the values entered by the user (except for the 0) in order from smallest to largest, with one value appearing on each line.
10. Write a program that reads integers from the user and stores them in a list. Use 0 as a sentinel value to mark the end of the input. Once all of the values have been read your program should display them (except for the 0) in reverse order.

F Tuples

1. Write a program to demonstrate various tuple operations in python.
2. Write a program to find the size of a tuple
3. Write a program to find the maximum and minimum K elements in a tuple
4. Write a program to create a list of tuples from given list having number and its cube in each tuple

G Dictionary

1. Write a program to demonstrate working with dictionaries in python
2. Write a Program to create a dictionary from a sequence
3. Write a Program to generate dictionary of numbers and their squares (i, i*i) from 1 to N
4. Write a Program that determines and displays the number of unique characters in a string entered by the user. For example, "Hello, World!" has 10 unique characters while "zzz" has only one unique character. Use a dictionary to solve this problem.
5. Two words are anagrams if they contain all of the same letters, but in a different order. For example, "evil" and "live" are anagrams because each contains one 'e', one 'I', one 'l', and one 'v'. Create a program that reads two strings from the user, determines whether or not they are anagrams, and reports the result.

H Functions

1. Write a Program to write user defined function to swap two number and display number before swapping and after swapping
2. Write a Program to calculate arithmetic operation on two number using user defined function
3. Write a Program to Calculate diameter and area of circle using user defined function
4. Write a function that takes three numbers as parameters, and returns the median value of those parameters as its result. Include a main program that reads three values from the user and displays their median.
5. Write a function that generates a random password. The password should have a random length of between 7 and 10 characters. Each character should be randomly selected from positions 33 to 126 in the ASCII table. Your function will not take any parameters. It will return the randomly generated password as its only result.
6. Write a Program to filter even values from list using lambda function
7. Write a Program to find the sum of elements of a list using lambda function
8. Write a Program to find small number between two numbers using Lambda function

I Recursion

1. Write a python program to find factorial of a number using Recursion.

2. Write a Program to print Fibonacci series up to n terms using recursion
3. Write a program that reads values from the user until a blank line is entered. Display the total of all of the values entered by the user (or 0.0 if the first value entered is a blank line). Complete this task using recursion. Your program may not use any loops.

J OOP

1. Write a Program to implement destructor and constructors using __del__() and __init__()
2. Write a Program to implement Getters and Setters in a class
3. Write a Program to calculate student grade using class
4. Write a Program to illustrate single inheritance in Python
5. Write a Program to illustrate multiple inheritance in Python
6. Write a Program to illustrate multilevel inheritance in Python

K Exception Handling

1. Write a Program to illustrate handling of divide by zero exception
2. Write a Program to illustrate handling of IndexError Exception
3. Write a Program to illustrate handling of ValueError Exception
4. Write a Program to illustrate handling of Type exception

L Regular Expression

1. Write a Program to match a string that contains only upper and lowercase letters, numbers, and underscores
2. Write a Program that matches a string that has an a followed by zero or more b's
3. Write a Program that matches a string that has an a followed by one or more b's
4. Write a Program that matches a string that has an a followed by three 'b'
5. Write a Program to find the sequences of one upper case letter followed by lower case letters
6. Write a Program that matches a word at the beginning of a string
7. Write a Program to search some literals strings in a string.
8. Write a Program to replace whitespaces with an underscore and vice versa.
9. Write a Program to remove all whitespaces from a string.
10. Write a Program to validate a 10-digit mobile number

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 3-1-0

Database Management System (BEE080A)

OJECTIVE:

- To provide a general introduction to relational model
- To learn about ER diagrams.
- To learn about Query Processing and Transaction Processing

UNIT 1	Introduction - Database Systems versus File Systems, View of Data, Data Models, database languages, Database Users and Administrators. Transaction Management, Decision Support Systems, Components of a Database management System. Distributed Processing and Client- Server Architecture. Entity-Relationship Model – Basic Concepts, Constraints,Keys, Design Issues, E-R Diagrams.
UNIT 2	Relational Model- Structures of relational databases, Integrity Constraints, Logical database Design, Tables, Views, Data Dictionary. Relational Algebra, Relational Calculus. SQL – Basic Structures, Query Handling, Embedded SQL, Open Database Connectivity (ODBC), Java Database Connectivity (JDBC), Triggers, Security and Authorization. Query by Example (QBE), User Interfaces and Tools, Forms and Graphical User Interfaces. Report Generators. Overview of Relational Query Optimization.
UNIT 3	Relational Database Design- Functional Dependencies, Multi-valued Dependencies, Normal Forms, Decomposition into Normalized Relations, Physical Database Design – File Structures. Object-Relational Databases – Nested Relations, Complex Data types, Object-Relational Features in SQL: 1999.
UNIT 4	Internet Databases- World Wide Web, Client Side Scripting and Applets, Web Servers and Sessions, Services, Server Side Scripting. XML – Structure of XML Data, XML Document Schema, XQuery, Storage of XML Data, XML Applications.
UNIT 5	Advanced Topics- Fundamental Concepts of Transaction Management, Concurrency Control, Recovery Systems, Data Analysis and OLAP. Introduction to Data Mining, Data Farming, Data Warehousing, Spatial and Geographic Databases, Temporal databases.

OUTCOMES

At the end of the course, the student should be able to:

- CO1:Give a description of the Database Management structure and can define basic functional terms of Database
- CO2:Know the advantages and disadvantages of the different models compare relational model with the Structured Query Language (SQL)
- CO3:Know the constraints and controversies associated with RDBMS
- CO4:Compare and contrast the types of RDBMS based on several criteria and understand the concept of data planning and Database design
- CO5:Trace the history and development process of SQL and know the scope and extension of SQL

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L				H		L	L	H	L
CO3	H	M					L		M		L				M
CO4			L		H					L			H		
CO5	H	M					L				L	L			M

H = Highly Related; M = Medium L = Low

Text Books:

1. Database Systems Concepts by Korthet. Al.
2. An Introduction to Database Design by Date
3. Object-Oriented Database Design by Harrington

Reference Books:

1. Fundamentals of Database Systems – Elmasri and Navathe
2. Database Management and Design – Hansen and Hansen .

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 3-1-0

IC Technology (BEE027A)

Course Objectives:

This course aims at understanding the manufacturing methods and their underlying scientific principles in the context of technologies used in VLSI chip fabrication. This course follows a top to bottom approach. Right in the beginning of the course, we study a complete process flow for both CMOS and advanced bipolar technologies. The idea is to introduce you at an early stage to the complexities and challenges associated with VLSI chip fabrication. Discussions on the unit steps will follow in greater detail in the context of the complete CMOS and bipolar process flow. It is expected that this will help you in gaining a better understanding of both the constituent processes and the global picture of VLSI manufacturing.

Unit 1: Environment for VLSI Technology: Clean room and safety requirements. Wafer cleaningprocesses and wet chemical etching techniques. Impurity incorporation: Solid State diffusion modeling and technology; Ion Implantationmodeling, technology and damage annealing; characterization of Impurity profiles.

Unit 2: Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultrathin films.Oxidation technologies in VLSI Lithography: Photolithography, E-beam lithography and newer lithography techniquesfor VLSI/ULSI, Mask generation.

Unit 3: Chemical Vapour Deposition techniques: CVD techniques for deposition of polysilicon,silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon; modelling and technology.Metal film deposition: Evaporation and sputtering techniques. Failure mechanisms inmetal interconnects; Multi-level metallisation schemes.

Unit 4: Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques;RTP techniques for annealing, growth and deposition of various films for use in ULSI.

Unit 5: Process integration for NMOS, CMOS and Bipolar circuits; Advanced MOStechnologies.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand basics of MOSFET fabrication.
CO2- Ability to understand oxidation techniques and how pattern transfer using lithography.

CO3-Ability to understand & analyse different deposition techniques.

CO4-Ability to learn etching process.

CO5-Ability to understand advance fabrication techniquies.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		H		L			M			L			H	L
CO2		M		H	M	L				H		L	L		M
CO3	L			H		M	L		M		L		L		
CO4		H	L		H					L			H		M
CO5	H	M					H				L	L		M	

H = Highly Related; M = Medium L = Low

Textbook:

1.C.Y. Chang and S.M. Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.

Reference Books

2.S.K. Ghandhi, VLSI Fabrication Principles, John Wiley Inc., New York, 1983.

3.S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 3-1-0

INFORMATION THEORY AND CODING (BEE028A)

Course Objectives:

1. *To impart the basic knowledge of Information Theory & Coding.*
2. *To understand the different kind of codes and various coding techniques used in communication system.*
3. *To find the different entropies, channel capacity & rate of information.*

Unit 1: Probability and random processes: Probability, random variables, Probability distribution and density functions, Joint Statistics, Conditional Statistics, independence, Functions of random variables & random vectors, Expectation, moments, Characteristic Functions, Convergence of a sequence of random variables, Central Limit Theorem, Random Processes, mean and Auto Correlation, Stationary ergodicity,

Unit 2: Power Spectral density, Response of memory- less and linear systems, Gaussian Poisson, Markov processes.Elements of information theory and source coding: Introduction, information as a measure of uncertainty, Entropy, its properties, discrete memoryless channels, Mutual information, its properties, BSC, BEC. Channel capacity, Shanon's theorem on coding for memoryless noisy channels. Separable binary codes, Shanon–Fano encoding, Noiseless coding, Theorem of decodability, Average length of encoded message, Shanon's binary encoding,

Unit 3: Fundamental theorem of discrete noiseless coding, Huffman's minimum redundancy codes.Linear block codes: Introduction to error control coding, Types of codes, Maximum Likelihood decoding, Types of errors and error control strategies,

Unit 4: Galois fields, Linear block codes, Error detecting and correcting capabilities of a block code, Hamming code, cyclic code, B.C.H. codes.Convolutional codes and ARQ: Transfer function of a convolutional code, Syndrom decoding, Majority logic decodable codes,

Unit 5: Viterbi decoding, distance properties of binary convolutional codes, Burst error correcting convolutional codes, general description of basic ARQ strategies, Hybrid ARQ schemes.

CO1: Design the channel performance using Information theory.

CO2: Comprehend various error control code properties

CO3: Apply linear block codes for error detection and correction

CO4: Apply convolution codes for performance analysis & cyclic codes for error detection and correction.

CO5: Design BCH & RS codes for Channel performance improvement against burst errors.

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	L		H		L			M			L			H	L
CO2		M		H	M	L				H		L	L		M
CO3	L			H		M	L		M		L		L		
CO4		H	L		H					L			H		M
CO5	H	M					H				L	L		M	

Textbooks:

1. Papoulis, A. Probability, Random Variables and Stochastic Processes, MGH.

2. Gray, R.M. Davission, L.D,Introduction to Statistical Signal Processing- Web Edition 1999.

Reference books:

1. F. M. Reza, Information Theory, McGraw Hill.

2. Das, Mullick and Chatterjee, Digital Communication, Wiley Eastern Ltd.

3. Shu Lin and J. Costello, Error Control Coding, Prentice Hall.

4. B. R. Bhat, Modern Probability Theory, New Age International Ltd.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:48**
B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 3-1-0

Computer Organization and Architecture (BEE029A)

Course Objective:

To give a robust understanding of various software and hardware techniques required to boost the performance of single as well as multi-core processors. This course also aims at discussing future micro-architectures in processor design.

Unit 1: Introduction to basic computer architecture, register transfer, bus and memorytransfers, arithmetic, logic and shift micro operations.

Unit 2: Instruction codes, computer registers, computer instructions, timing and control,instruction cycle, memory reference instructions, I/O interrupt, complete computerdescription, design of basic computer, design of accumulator logic.

Unit 3: Micro programmed control, control memory, address sequencing, micro program example, and design of control unit. Central Processing Unit: Introduction, general registerorganization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, RISC.

Unit 4: Pipeline and Vector Processing: Parallel processing, pipelining, arithmeticpipeline, instruction pipeline, RISC pipeline, vector processing, array processors.Input-output Organisation: Peripheral devices, input-output interface,asynchronous data transfer, modes of transfer, priority interrupt, DMA, IOP serialcommunication.

Unit 5: Memory Organisation: Memory hierarchy, main memory, auxiliary memory,associative memory, cache memory, virtual memory, memory management, hardwaremultiprocessor architectures and their characteristics, interconnection structures, interprocessor arbitration, inter-processor communication and synchronization, cache coherence.

1. Master the binary and hexadecimal number systems including computer arithmetic,
2. Be familiar with the history and development of modern computers,
3. Be familiar with the Von Neumann architecture,
4. Be familiar with the functional units of the processor such as the register file and arithmetic-logical unit,
5. Be familiar with the basics of systems topics: single-cycle (MIPS), multi-cycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures.

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L				H		L	L	H	L
CO3	H	M					L		M		L				M
CO4			L		H					L			H		
CO5	H	M					L				L	L			M

H = Highly Related; M = Medium L = Low

Textbook:

1. Morris Mano, "Computer System Architecture", PHI.

Reference Books:

1. J.F. Heys, "Computer Organization and Architecture", TMH.
2. Hwang K. and F.A. Briggs, "Computer Architecture and Parallel Processing", TMH.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester V
Contact Hours (L-T-P): 3-1-0

Power Electronics (BEE030A)

Course Objectives:
The objectives of this subject are to enable students to:

acquire an

be aware of the electromagnetic interference problems associated with power electronic systems;

use commercial software for the rigorous circuit analysis of real power electronic systems; analysis and design circuits to meet specific specifications; and fabricate basic power electronic circuits such as a chopper.

Unit 1:Semiconductor Power Devices - Basic characteristics & working of Power Diodes, DIAC, SCR, TRIAC, Power Transistor, MOSFETs, IGBT and GTO.

Unit 2:Rectifiers & Inverters - Working principles of single and three phase bridge rectifiers, Voltage and current source inverters.

Unit 3:Power Supplies- Principle of operation of choppers. Step up, Step down and reversible choppers. High frequency electronic ballast, Switch Mode Power Supply: Fly back converter, forward/buck converter, Boost converter and buck-boost converter. Uninterruptible Power Supply.

Unit 4:Motor Control- Introduction to speed control of DC motors using phase controlled converters and choppers, Basic idea of speed control of three phase induction motors using voltage and frequency control methods.

Unit 5:Stepper Motors- Variable reluctance, Permanent magnet and hybrid stepper motors. Induction and dielectric heating control.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understanding of the nature of power semiconductor devices and their control and use in switch-mod.

CO2- Ability to understand the arrangement and topology of the circuits in which switch-mode devices are used;

CO3-Appreciate the use of power electronic circuits in high-power applications such as motor drives.

CO4-Ability to use commercial software for the rigorous circuit analysis of real power electronic systems.

CO5-Ability to use commercial software for the rigorous circuit analysis of real power electronic systems; analysis and design circuits to meet specific specifications; and fabricate basic power electronic circuits such as a chopper.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		H		L			M			L			H	L
CO2		M		H	M	L				H		L	L		M
CO3	L			H		M	L		M		L		L		
CO4		H	L		H					L			H		M
CO5	H	M					H				L	L		M	

H = Highly Related; M = Medium L = Low

Text Book:

1. Power Electronics by P. S. Bimbhra: Khanna Publication.

Reference Books:

1. Power Electronics Principles & Applications, Joseph Vithayathil, TMH
2. Power Electronics, Ravish Singh, TMH
3. Industrial Electronics And Control, Ttti, TMH
4. Power Electronics: Converters Applications., Mohan, Robbins, Wiley
5. Power Electronics, Moorthi, Oxford
6. Elements Of Power Electronics, Krein, Oxford
7. Power Electronics, R.S.Murthy, Pearson
8. Power Electronics: Circuits, Devices And Applications, Muhammad.H.Rashid, Pearson

SEMESTER-VI

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 4-0-0

Digital Signal Processing(BEE033A)

Course Objectives:

1. *To Introduce Discrete time signals and systems, FIR and IIR filters. Methods for computing FFT. Characterization & classification of signals.*
2. *To study Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals.*
3. *To study DFT properties, computation of the DFT of real sequences. Sampling,Filter Design, Sample-and Hold circuits, A/D & D/A converter*

Unit 1: Introduction to signals and systems Discrete time signals and systems, Z-transforms, structures for digital filters, design procedures for FIR and IIR filters. Frequency transformations: linear phase design; DFT. Methods for computing FFT. Noise analysis of digital filters, power spectrum estimation. Signals and signal Processing: characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signal Processing applications.

Unit2: Time Domain Representation of Signals & Systems- Discrete Time Signals,Operations on Sequences, the sampling process, Discrete-Time systems, Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals.

Unit 3: Transform-Domain Representation of Signals-The Discrete-Time FourierTransform, Discrete Fourier Transform, DFT properties, computation of the DFT of real sequences, Linear Convolution using the DFT. Z-transforms, Inverse Z-transform, properties of z-transform, transform domain representations of random signals. Transform-Domain Representation of LTI Systems: the frequency response, the transfer function, types of transfer function, minimum-phase and maximum-Phase transfer functions, complementary transfer functions, Discrete-Time processing of random signals.

Unit 4: Digital Processing of Continuous-Time Signals - sampling of Continuous Signals,Analog Filter Design, Anti-aliasing Filter Design, Sample-and Hold circuits, A/D & D/A converter, Reconstruction Filter Design.

Unit 5: Digital Filter Structure and Design- Block Diagram representation, Signal FlowGraph Representation, Equivalent Structures, bone FIR Digital Filter Structures, IIR Filter Structures, State-space structure, all pass filters, tunable IIR Digital filters. cascaded Lattice realization of IIR and FIR filters, Parallel all pass realization of IIR transfer function, Digital Sine-Cosine generator. Digital Filter Design: Impulse invariance method of IIR filter design,Bilinear Transform method of IIR Filter Design, Design of Digital IIR notch filters, FIR filter Design based on truncated fonner sens, FIR filter design based on Frequency Sampling approach.

Course Outcome (CO):

At the end of this course students will have:

CO1-Recognize the fundamentals of fixed and floating point architectures of various DSPs.

CO2- Learn the architecture details and instruction sets of fixed and floating point DSP

CO3- Infer about the control instructions, interrupts, and pipeline operations.

CO4-Analyze and learn to implement the signal processing algorithms in DSPs

CO5- Learn the DSP programming tools and use them for applications & design and implement signal processing modules in DSPs

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L				H		L	L	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text Books:

1. Proakis J.G., and Manolakis, Introduction to DSP, PHI, 2007
2. Sanjit K. Mitra, “Applications DSP a Computer based approach”, TMH, 2006

Reference Books:

1. Allan Y. Oppenhein & Ronald W. Schater , "Applications DSP”,.
2. C.Sydney Burrus (Eds), DSP and Digital Filter Design

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:48**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-0-0

VLSI System (BEE034B)

Course Objectives:

1. *To introduce Basics of MOS transistors and its types.*
2. *To study MOSFET circuits, their power analysis and noise margin.*
3. *To study Memory latches and registers using MOS and Layout designing rules, and introduction to VHDL coding.*

Unit 1: Basic MOS transistors, Enhancement Mode transistor action, Depletion Mode transistor action, NMOS and CMOS fabrication. Ids versus Vds relationship, Aspects of threshold voltage, Transistor Transconductance gm.Inverter, nMOS inverter, Pull up to Pulldown ratio for a NMOS Inverter and CMOS Inverter (Bn/Bp), MOS transistor circuit Model, Noise Margin.

Unit 2: Combinational MOS Logic Circuit: NAND, NOR gate, Compound Gates, 2 input CMOS Multiplexer, Transmission Gate, Gate delays, CMOS-Gate Transistor sizing, Power dissipation.

Unit 3: Sequential MOS Logic Circuits:Behavior of Bistable Elements,SR Latch, clocked Latch and flip flop circuits, CMOS D latch andedge triggered flip flop, Basic Principles of Pass Transistor Circuits.

Unit 4: MOS Layers Stick/Layout Diagrams; Layout DesignRules, Issues of Scaling, Scaling factor for device parameters.Layout issues for inverter, Layout for NAND and NOR Gates, Complex Logic gates Layout, Layout optimization for performance.

Unit 5: Verilog and other design tools. VHDL Code for simple Logic gates, flip-flops, shift registers.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand MOSFET and their fabrication.
CO2- Ability to understand any combinational circuit analysis using MOSFET

CO3-Ability to understand & analyse sequential MOS circuits

CO4-Ability to draw layout of any circuit.

CO5-Ability to understand hardware description language.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course	Program Outcome	Program Specific

Outcome													Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			H	
CO2	L		L	H	M	L				H		L	L		M
CO3	L	M		H			L				L				H
CO4			L		H		H						H		
CO5	H	M					H							M	

H = Highly Related; M = Medium L = Low

Text Books:

1. CMOS Digital Integrated Circuits Analysis , Sung-Mo (Steve) Kang, TMH

Reference Book:

1. Essentials Of VLSI Circuits And Systems, Kamran Eshraghian, Eshraghian, PHI
2. Introduction To VLSI Circuits And Systems, John P. Uyemura, John Wiley & Sons
3. Modern VLSI Design, Wayne Wolf, Pearson
4. Principles Of Cmos VLSI Design, Neil H.E.Weste, Pearson
5. VLSI Design, Shanthi, A. Kavitha, A., New Age International
6. VLSI Design And Technology, Bose, D.N., New Age International
7. Digital Systems Design Using VHDL, Charles H. Roth, PWS Publishing Company, 01-Jan-1998
8. Verilog HDL: A Guide to Digital Design and Synthesis, 2nd ed. (English) 2nd Edition, Samir Palnitkar, Pearson Education

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:36**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-0-0

Control System(BEE035A)

Course Objectives:

1. *Introduction to control problem, Transfer function models of mechanical, Closed-loop systems. Transfer function.*
2. *To understandthe Time response analysis.*
3. *To understandthe Concept of Stability and Routh stability criterion.*
4. *To acquaint with different Frequency-response analysis methods, Polar plots, Bode's plot, stability in frequency domain, Nyquist plots.*
5. *To develop robust understanding of State space Techniques.*

Unit 1: **Introduction to Control Systems**- Introduction to Control system, control system terminology, classification of Control Systems. Mathematical Models of Systems- Differential equations of physical systems, transfer function of linear systems, block diagram models, block diagram reduction technique, Signal flow graph.

Unit 2: **Time Response Analysis-** Time response analysis - First Order Systems – Impulse, Ramp and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation.

UNIT 3*:* **Stability Analysis-** Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram -

UNIT 4: **Frequency Response Analysis-** Frequency Response - Bode Plot, Polar Plot, Nyquist Stability Criterion - Relative Stability- Frequency Domain specifications, Parallel,series-parallel Compensators - Lead, Lag, and Lead Lag Compensators.

Unit5: **State Variable Models**- State variables of a dynamic system, state equation, transfer function from the state equation and vice-versa. State Transition Matrix, Controllability, Observability, Ackerman's formula, limitations of state variable feedback. Introduction to P/I/D and ON-OFF control actions.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand the concept of control system and *Transfer function.*
CO2- Ability to understand the physical *models of mechanical and electrical system*

CO3- *Basic knowledge of characteristics of feedback control systems and measure the stability of a system for any given input.*

CO4-Ability to *acquaint with different time and Frequency-response analysis methods, Polar plots, Bode plot, stability in frequency domain.*

CO5-Ability to understand *compensation techniques.*

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L			M			L			H	
CO2	M		H	L	M	L				H		L	M	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text Books

1. Nagrath & Gopal, "Control Systems Engineering", New Age International, New Delhi
2. Nise, N., "Control Systems Engineering", Wiley, sixth edition, 2014.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.

References

1. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
2. Joseph Distefano III, Sanjoy Mandal, "Control Systems", Tata McGraw-Hill,Third edition.
3. Gopal. M., "Control Systems: Principles and Design",Tata McGraw-Hill, 1997.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 45**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-0-0

Course	Course Code	Course Credits	Semesters
BEE080A	5G Technology for smarter secure connectivity	3	VI SEM

Module-1 Introduction to 5G Technologies

- Overview of 5G technologies
- Key features and benefits of 5G networks
- Comparison between 5G and previous wireless technologies
- Radio Access Networks (RAN)
- 5G NR air interface and physical layer
- Radio resource management
- Multiple access techniques in 5G networks

Module-2 Core Networks

- 5G core network architecture
- Network slicing
- Virtualization and cloud computing in 5G networks

Module-3 Edge Computing in 5G Networks

- Overview of edge computing
- Role of edge computing in 5G networks
- Edge computing architectures and protocols

Module-4 5G Applications and Services

- Overview of 5G applications and services
- Use cases of 5G in smart cities, healthcare, and transportation
- Security and privacy issues in 5G networks

Module-5 Implementation and Optimization of 5G Networks

- Planning and designing 5G networks
- Deployment and configuration of 5G networks
- Performance evaluation and optimization of 5G networks

Course Outcomes

1. Understand the principles and concepts of 5G technologies
2. Learn about the key components of 5G networks, including radio access networks, core networks, and edge computing
3. Analyze the design and architecture of 5G networks

4. Understand the application of 5G technologies in areas such as smart cities, healthcare, and transportation
5. Develop skills in implementing and optimizing 5G networks

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		H	H	M				H	H		H	M		H	
CO2	H			H	M	H					M		M	H	M
CO3	H	L	H				L	M		H	M	H			H
CO4	M		H	M	H	M			H		L	H	H		
CO5	H	H					L			H	L	H			L

H = Highly Related; M = Medium L = Low

Text Books:

- "5G NR: The Next Generation Wireless Access Technology" by Erik Dahlman, Stefan Parkvall, and Johan Skold

Reference Books:

- "5G Mobile and Wireless Communications Technology" edited by Afif Osseiran, Jose F. Monserrat, and Patrick Marsch
- "5G Networks: Powering Digitalization" edited by Stefan Rommer, Peter Hedman, Magnus Olsson, and Lars Frid

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:24**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 0-0-2

Digital Signal Processing Lab(BEE036A)

List of Experiments

A. Modeling and simulation using MATLAB/ SCILAB

1.TO write a MATLAB/SCILAB program to compute linear convolution and de-convolution of two given sequences.

2. TO write a MATLAB/SCILAB program to compute circular convolution of two given sequences.

3. Write a program to compute M Point DFT of following M Point sequence.

$$X(n)=\begin{cases} n & 0<=n<=N-1 \\ 0 & otherwise \end{cases}$$

Assume N=16 and M=32.

4. Write a program to compute M point IDFT of following M Point sequence

$$X(k)=\begin{cases} K/N & 0<K<N-1 \\ 0 & otherwise \end{cases}$$

Assume M=32 and N=16

5.Realizing a given block diagram having multiplier, adder/subtractor and system (Discrete/Continuous) with given Impulse response. Calculating output for given input.

6.To simulate the transmitter and receiver for BPSK

7.To design and simulate FIR digital filter (LP/HP).

8.To design and simulate IIR digital filter (LP/HP).

9. Design a FIR lowpass filter with given specification and verify the magnitude ,phase,impulse response using FDA toolbox.

Order=100

Window =Rectangular window

Cut off Frequency in radian/sec=0.4

10. Design a IIR lowpass Butterworth filter with following specification and verify magnitude, phase,impulse response using FDA tool

Order Minimum

Pass Band attenuation in dB: .36

Stop Band attenuation in dB: 36

Pass Band freq in Hz: 1500

Stop Band freq in Hz: 2000

Sampling freq in Hz: 6000

B. DSP Lab using TMS320C6XXX DSP Kits

11. To study the architecture of TMS320C6XXX DSP kits using Bloom with DSP

12. To generate wave forms (SINE, COSINE, SQUARE & TRIANGULAR).

13. Verification of Sampling Theorem.

14. Verification of linear/circular convolution.

15. To design FIR and IIR digital filter (LP/HP).

CO1: Able to understand of signal in time domain with continuous and discrete format.
CO2: Able to understand transforms of signal from time to frequency domain and analyze them
On to the basis of their spectrums.
CO3: Able to design & analyze of the filters on the basis of their responses
CO4: Able to design filters and checking responses with their mathematical expression.
CO5: Able to analyze various transforms and also see their computational part with the Application of FFT algorithms under various Radix bases

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			H		L				L	
CO2	M	L		L		L	L		L		L	L	L	M	
CO3			L		H			L		H			H		
CO4	H		L		L			H		L				L	
CO5	M	L	H			L	L		L		L	L	L	M	

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:24**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 0-0-2

VLSI Design Lab(BEE037A)

List of Experiments:

1. To design Schematic view of any logic using Tanner tool.
2. To study the transient characteristics of all the logic gates. Technology: 180um
3. To study the transient characteristics of SR flip flop. Technology file: 180um
4. To study the dc characteristics of CMOS inverter Technology:180 um
5. To study the dc characteristics of resistive load inverter Technology:180 um
6. To study the transient characterisitics of z=AB+A'C'+AB'C by designing it through transmission gates. Technology:180um
7. To study the transient characteristics of the full adder using 28 transistors.
8. To study power dissipation and delay of the full adder 10 transistors .
9. To study power dissipation and delay of the full adder using 8 transistors
10. To design Layout of an Inverter using 250nm technology file using λ-rule.
11. To design layout of any logic and study of its delay.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand basics of Tanner Tool Software.
CO2- Ability to understand basics of characteristics of CMOS.

CO3 - Transient characteristics of SR flip flop

CO4 - Learn about layout of any logic and study of its delayCO5-Ability to develop and execute relatively simple VHDL models.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			H	
CO2	L		L	H	M	L				H		L	L		M
CO3	L	M		H			L				L				H
CO4			L		H		H						H		
CO5	H	M					H							M	

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:24**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 0-0-2

Control System Lab(BEE038A)

List of Experiments

1. Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs, scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects, Multidimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets).

2. Simulink:Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets)

3. (a) To plot step response of a given Transfer Function. Take different values of damping ratio and _n natural undamped frequency, (b) Plot ramp response.

4. For a given 2nd order system plot step response and obtain time response specification.

5. To design 1st order R-C circuits and observe its response with the following inputs and trace the curve.(a)Step (b)Ramp (c)Impulse.

6. To design 1st order electrical network and study its transient response for step input and following cases.(a)Lag network (b)Lead network (c)Critically damped system.

7. PID CONTROLLER

(a) To observe open loop performance of building block and calibration of PID Controls.

(b) To study P, PI and PID controller with type 0 system with delay.

(c) To study P, PI and PID controller with type 1 system.

8. LEAD LAG COMPENSATOR

(a) To study the open loop response on compensator.

(b) Close loop transient response.

9. Introduction to MATLAB (Control System Toolbox)

a. Different Toolboxes in MATLAB, Introduction to Control Systems Toolbox.

b. Determine transpose, inverse values of given matrix.

10. Plot the pole-zero configuration in s-plane for the given transfer function.

11. Determine the transfer function for given closed loop system in block diagram representation.

12. Plot unit step response of given transfer function and find peak overshoot, peak time.

13. Plot unit step response and to find rise time and delay time.

14. Plot locus of given transfer function, locate closed loop poles for different values of k.

15. Plot root locus of given transfer function and to find out S, W_d, W_n at given root & to discussstability.

Course Outcome (CO):

At the end of this course students will have the

CO1. Knowledge of Basics of simulink.

CO2. To Plot time response of first and second order control system.

CO3 Ability to Implement and realization of First order and second order systems.

CO4 Designing of PID control system.

CO5 Checking stability of closed and open loop system.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L			M			L			H	
CO2	M		H	L	M	L				H		L	M	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY

Faculty of Engineering & Technology **Hours:48**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-1-0

Antennas and Wave Propagation (BEE039A)

Course Objective:

Antenna Theory is central for all radio systems, and this course will enable the students to understand different radio antennas and their usage. The student will understand the applications of the electromagnetic waves in free space. The students will be able to apply the fundamentals to design different types of antennas.

Unit 1: Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-andfar-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Unit 2: Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linearelements near conductors, dipoles for mobile communication, small circular loop Aperture and Reflector Antennas- Huygens' principle, radiation from rectangularand circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Unit 3: Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequencyindependent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feedingmethods, methods of analysis, design of rectangular and circular patch antennas.

Unit 4: Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

Unit 5: Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, Fixedweight beam forming basics, Adaptive beam forming. Different modes of Radio Wave propagation used in current practice.

Course Outcome (CO):

At the end of this course students will have the

CO1. Able to understand fundamentals of Antenna system and terminologies.

CO2. Able to understand antennas arrays , their classifications and radiation field intencity

CO3. Able to design and measurement of different types of antennas at different frequencies

CO4. Able to understand meachanism of radio wave propogation with their associated factors

CO5. Able to understand meachanism of radio wave propogation with their associated factors

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L			M			L			H	
CO2	M		H	L	M	L				H		L	M	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text Books

1. J.D. Kraus, Antennas, McGraw Hill, 1988.

Reference Books:

1. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
2. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
3. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw Hill, 1984.

4. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House,1980.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-1-0

Optimization Techniques (BEE040A)

Course Objective:

To learn fundamental principles of Multi objective Optimization (MOP) and survey different Multi objective Optimization algorithms. The linear, non linear and dynamic programming is covered in detail and various design issues are discussed.

Unit 1: Introduction -Historical development, engineeringapplications of optimization, Formulation of design problems for a mathematical programming problem, Classification of optimization problems.

Unit 2: Linear Programming-Simplex methods, Revised simplex method, Duality in linear programming, Post optimality analysis.

Unit 3: Applications Of Linear Programming-Transportation and Assignment problems.

Unit 4: Nonlinear Programming - Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and Indirect methods.

Unit 5: Dynamic Programming-Introduction, multi-decision processes, computational procedures.

Course Outcome (CO):

At the end of this course students will have the

CO1. Able to formulate the real world problem into mathematical form.

CO2. Able to apply simplex methods in solving linear programming problem and To understand the effect of change in parameters of LPP after the attainment of optimal solution

CO3. Able to optimize tansportation problem and assignment problem.

CO4. Able to obtain the optimum values of non-linear programming problems.

CO5. Able to reduce multi-stage dynamic programming problem into a single variable problem

and to solve it.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L			M			L			H	
CO2	M		H	L	M	L				H		L	M	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text books:

1. Gillet B.E: Introduction to Operation Research, Computer Oriented Algorithmic approach - Tata McGraw Hill Publishing Co. Ltd. New Delhi.

Reference books:

1. P.K. Gupta & D.S. Hira, "Operations Research", S.Chand & Co.
2. J.K. Sharma, "Operations Research: Theory and Applications", Mac Millan.
3. S.D. Sharma, "Operations Research", Kedar Nath Ram Nath, Meerut (UP).
4. S.S. Rao "Optimization Theory and Application", Wesley Eastern.
5. Tata Handy, A "Operations Research - An Introduction", Fifth Edition, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Taha H.A. "Operations Research an Introduction" McMillan Publication

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:48**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-1-0

Embedded System (BEE041A)

Course Objective:

1. *To teach students about embedded system Design and implementation.*
2. *To teach AVR architecture and programming.*

Unit 1: Introduction to Embedded System: An Embedded System, Embedded system Vs General computing systems, Classification of embedded systems, Major application areas of embedded systems, Purpose of embedded systems, Processor, Processor selection for an Embedded systems, Characteristics of Embedded system, Quality attributes of Embedded systems. Memory devices, memory selection for an embedded system, RISC Vs CISC Processor, Harvard Vs Von Neumann Processors/Controllers architecture, Big Endian Vs Little Endian Processors/Controllers.

Unit 2: sensors and actuators, I/O subsystem: LED, 7 segment LED Display, Opto-coupler, Stepper Motor, Relay, keyboard, PPI chip.

Communication interface: onboard communication interfaces-I2C, SPI, UART, 1-wire interface, Parallel interface. External communication interfaces: RS232C, USB, IEEE 1394, Infrared, Bluetooth, Wi-Fi, ZigBee and GPRS.

Unit 3: AVR Microcontroller architecture- registers and memory in AVR. Assembly language programming of AVR- Addressing modes, instruction sets, Assembler directive, Advanced programming- time delay, I/O port programming, I/O bit manipulation programming.

Unit 4:AVR timer and counter programming, AVR interrupt programming, AVR interfacing-Serial Ports, LCD, Keyboard, ADC, DAC, sensors, stepper motor,PWM control, DC Motor Speed Control. Watchdog timer,Real Time Clock.

Unit 5: HARDWARE SOFTWARE CO-DESIGN: issues in hardware software co-design, Computational models in embedded design-data flow graph/diagram model, Control data flow graph/diagram, State Machine model, Sequential program model, Concurrent/ Communicating process model, Object oriented model. Introduction to unified modelling language.

Embedded Network Devices: CAN, LIN, Fail Safe SBC, Safe by wire.

Course Ooutcomes:

CO1- To acquire knowledge about microcontrollers embedded processors and their applications.

CO2- Foster ability to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.

CO3- Foster ability to write the programs for microcontroller.

CO4- Foster ability to understand the role of embedded systems in industry.

CO5- Foster ability to understand the design concept of embedded systems.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L		L			L			L	H	H	H	
CO2	H		H	L	M	L				L		H	H	H	L
CO3	H	M					L				L	H	H		H
CO4	H		L		H							H	H		
CO5	H	M					L					H	H		M

H = Highly Related; M = Medium L = Low

Text Books:

1- Shibu K V, "Introduction to Embedded Systems", MacGraw Hill Education

2- M.A. Mazidi, S. Naimi and S. Naimi, "The AVR Microcontroller and Embedded Systems using assembly and C", Prentice Hall

References: -

1- Raj Kamal, "Embedded systems - architecture, programming and design" , Tata McGraw Hill, 2007.

2- Daniel Pack, Mitchell Thornton, Steven F. Barrett , "Atmel AVR microcontroller primer: programming and interfacing**",** Morgan & Claypool Publishers

3- Dhananjay Gadre, “Programming and Customizing the AVR Microcontroller”**,** McGraw-Hill Companies
4- Mitchell Thornton **, Steven Barrett “Embedded Systems Design with the Atmel AVR Microcontroller”,** Morgan & Claypool Publishers.
5- Frank Vahid, Tony D. Givargis , “Embedded System Design: A Unified Hardware Software Introduction”, Wiley publications.

JECRC UNIVERSITY
Faculty of Engineering & Technology
Hours:48
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-1-0

Programming in JAVA (BEE 081A)

Objective

- Cover issues related to the definition, creation and usage of classes, objects and methods.
- Discuss the principles of inheritance and polymorphism and demonstrate though problem analysis assignments how they relate to the design of methods, abstract classes and interfaces.
- Provide the foundation of good programming skills by discussing keys issues to the design of object-oriented software, including programming design patterns, automatic documentation techniques and programming testing.
- Cover the basics of creating APIs as well as allow students to explore the Java Abstract Programming Interface (API) and Java Collection Framework through programming assignments.
- Discuss basic principles and tools of collaborating programming (versioning systems, code review) and study their usage through group programming projects.

UNIT 1	**Java Fundamentals:** Features of Java ,OOPs concepts , Java virtual machine , Reflection byte codes ,Byte code interpretation , Data types, variable, arrays, expressions, operators, and control structures , Objects and classes
UNIT 2	**Java Classes:** Abstract classes ,Static classes ,Inner classes ,Packages,Wrapper classes Interfaces ,This ,Super ,Access control
UNIT 3	**Exception handling:** Exception as objects ,Exception hierarchy ,Try catch finally ,Throw, throws
UNIT 4	**IO package:** Input streams ,Output streams ,Object serialization ,De serialization ,Sample programs on IO files ,Filter and pipe streams
UNIT 5	**Multi threading:** Thread Life cycle ,Multi threading advantages and issues ,Simple thread program ,Thread synchronization .GUI: Introduction to AWT programming, Layout and component managers ,Event handling ,Applet class ,Applet life-cycle ,Passing parameters embedding in HTML ,Swing

	components – JApplet, JButton, JFrame, etc. Sample swing programs

CO 1: Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.

CO 2: Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.

CO 3: Understand the principles of inheritance, packages and interfaces.

CO 4 :Identify classes, objects, members of a class and relationships among them needed for a specific problem

CO 5 : Demonstrate the concepts of polymorphism and inheritance

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L			M			L			H	
CO2	M		H	L	M	L				H		L	M	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

References:

1. Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill Companies

2. Java Programming John P. Flynt Thomson 2nd

3. Java Programming Language Ken Arnold Pearson

4. The complete reference JAVA2, Herbert schildt. TMH

JECRC UNIVERSITY

Faculty of Engineering & Technology
Hours:48
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-1-0

Radar and Satellite Communication(BEE042A)

Course Objectives:

Satellite communication is most popular mode of transmission and reception of information at very long distance points. TV , Radio, Voice Channels, Mobile Communication, GPS , Weather forecasting , all are sub parts of this subjects.We study ,how to decide the location and operating bandwidth of satellite, what factors decide life, performance, cost of satellite link.

Unit 1: Radar Block diagram, Frequencies and Applications. Radar range Equation. Continuous Wave (CW) & FM radar.

Unit 2: Delay line Cancellers, Blind velocity Pulse Doppler Radar. Tracking radar sequential lobbing, Conical scan and Mono-pulse radar, Types of display, Radar receivers, Noise figure. Introduction.

Unit 3: Orbital mechanics and launching, Earth station and satellite sub systems, Satellite link, Design and Analysis.

Unit 4: Multiple accesses for satellite links: FDMA, TDMA, CDMA & DAMA. Propagation effects.

Unit 5: Network architecture, Access control protocol & Link Analysis.

Course Outcome (CO):

At the end of this course students will have the

CO1. Able to understand the fandamentals and working or RADAR, Moving target indicator (MTI), Types of RADAR Displays and RADAR Receivers.

CO2. Able to understand the Radar direction finder & range system. LORAN system, DME, TACAN, Aircraft landing systems.

CO3. Able To understand the Principles of Monochrome and colour T.V. system (PAL, SECAM, NTSC). Composite video signal T.V Cameras: Image orthicon, plumbicon, vidicon. CCD camera

tubes, LCD and Plasma displays.

CO4. Able to understand the Vestigial side band transmission, Encoding picture information, Chrominance modulation, Compatibility of colour and monochrome T.V. systems. Students will be able To understand the T.V. transmitters, TV transmission & reception antennas.

CO5. Able to understand the working of T.V. receiver, R.F. Tuner, I.F. amplifier, Video detector, video amplifier, AGC, Synch. Separation, Sync. Students will be able To understand the theory HDTV, DBSTV and 3D-TV.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L			M			L			H	
CO2	M		H	L	M	L				H		L	M	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text Books:

Fundamentals Of Satellite Communications ,K.N. Raja Rao, ,Phi

Wireless Broadband Networks,David T. Wong, Peng-Yong Kong,John Wiley & Sons

Reference Books:

1. Radar Principles, By Peyton Z. Peebles, Oxford

2. Radar HandOBOOK, By Merrill I. Skolnik, Oxford

5. Satellite Communications ,Timothy Pratt, Charles Bostian And, John Wiley & Sons.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-1-0

Web Designing Techniques (BEE082A)

Objective:

At the end of the course, the student should be able to:

- To gain the skills and project-based experience needed for entry into web design and development careers.
- Touse a variety of strategies and tools to create websites.
- To develop awareness and appreciation of the myriad ways that people access the web and will be able to create standards-based websites that are accessible and usable by a full spectrum of users.

UNIT 1	Computer network, uses of computer networks, network hardware, network protocol, Reference models: The OSI reference model, the TCP/IP Reference model, a comparison of the OSI and TCP/IP reference models. Introduction of Ethernet, Hub, Client Server Architecture, Switch, modem.
UNIT 2	**The World Wide Web (WWW): HTML History**, Hypertext and Hypertext Markup Language.**HTML Documents**: Tags, Elements of an HTML Document: Text Elements, Tag Elements, Structural elements of HTML documents, Header tags, Body tags, Paragraphs, Title. **List:** Numbered list, Non-Numbered lists, Definition lists
UNIT 3	**Formatting HTML Documents:** Logical styles (source code, text enhancements, variables), Physical Styles (Bold, Italic, underlined, crossed), **Managing images in html**: Image format (quality, size, type), Importing images (scanners), Tags used to insert images.**Frames** Tables in HTML documents: Tags used in table definition, Tags used for border thickness, Tags used for cell spacing, Tags used for table size, Dividing table with lines, Dividing lines with cells, Cell types: Titles cells, Data cells
UNIT 4	**Hypertext and Link in HTML Documents** URL/FTP/HTTP,Types of links: Internal Links, External Link, Link Tags, Links with images and buttons, Links that send email messages Special effects in HTML documents.
UNIT 5	**Web Designing with PHP (Introduction):Orientation and First Steps:** PHP's Place in the Web World, Basic Rules of PHP Programs, Application

	of PHP on the internet. Advantages of PHP.

CO 1: Apply the tools and techniques for effective Web site planning and analysis (CIT i)

CO2 :Create static Web pages using HTML 5 (CIT a)

CO3 :Create pages using CSS for formatting and layout (CIT a)

CO4 :Construct dynamic Web pages using HTML 5 and JavaScript (CIT a)

CO5 :Use Web authoring tools such as Dreamweaver (CIT i)

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L			M			L			H	
CO2	M		H	L	M	L				H		L	M	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:48**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-1-0

Digital Hardware Design (BEE044A)

Course Objective:

The objective of the course is to introduce the basic concepts of asynchronous and synchronous state machines and their implementation, hazards faced in today's world.

Unit 1: Memory element: Latch, R-S, J-K, D –flip flops, Master Slave arrangement, edge triggered flip flops, shift registers, asynchronous and synchronous counters.

Unit 2: Analysis and Design of Synchronous Sequential Finite state machines: ASM charts, synchronous analysis process, design approaches, state reduction, design of next state decoder and output decoder, design of counters and decoders, code sequence detectors, sequential code generators.

Unit 3: Linked state mechanics: Introduction to system controller design: System controller state specification (MDS diagram) timing and frequency considerations, synchronizing system, state assignments, implementation using ROM, PAL, PLA multiplexers.

Unit 4: Analysis and design of Asynchronous Sequential finite state machines: Need for asynchronous circuits, analysis, cycles and races, Hazards, Map entered variable approaches to asynchronous design.

CO 1. Students can apply logic fundamentals using hardware description languages.

CO 2. Students understand the difference between procedural programming and hardware description languages.

CO 3. Students can write synthesizable verilog code describing basic logic elements a. Combinatorial logic. b. Sequential logic

CO 4. Students can code state machines in a hardware description language.

CO 5. Students can analyze and develop basic logic pipelined machines.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L			M			L			H	
CO2	M		H	L	M	L				H		L	M	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text book:

1. William J. Fletcher- An Engineering approach to Digital Design – PHI 1993.

Reference books:

2. F.P.Frosser and D.E. Winkel – The Art of Digital Design.

3. D.H. Green – Modern Logic Design.

4. Morant M.J. Integrated Circuit Design and Technology, champion and Hall, 1990.

5. Wakerly – Digital Design: Principles and Practices, PHI 1994.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:48**
B.Tech in Electronics and Communication Engineering Semester VI
Contact Hours (L-T-P): 3-1-0

Operating Systems (BEE083A)

UNIT 1	Introduction-OS Concepts – Evolution of OS, OS Structures- Kernel, Shell, General Structure of MSDOS, Windows 2000, Linux. Introduction-UNIX and ANSI Standards: The ANSI C Standard, the ANSI/ISO C++ Standards, Difference between ANSI C and C++, the POSIX Standards.
UNIT 2	Process Management-Process & Threads – Process States - Process Control Block – Process Scheduling – Operations on Processes, Threads, CPU Scheduler – Preemptive and Non- Preemptive; Dispatcher, Scheduling Criteria, Scheduling Algorithms – Process Management in UNIX
UNIT 3	UNIX Processes: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, get limit, set limit Functions, UNIX Kernel Support for Processes. Process Control
UNIT 4	Process Synchronization & Inter process Communication-Concurrent Processes, Co-operating Processes, Precedence Graph, Hierarchy of Processes, Critical Section Problem – Two process solution, Synchronization Hardware, Semaphores – Deadlock- detection, handling, prevention, avoidance, recovery, Starvation, Critical Regions, Monitors, Inter process communication
UNIT 5	Memory Management-Objectives and functions, Simple Resident Monitor Program (No design), Overlays – Swapping; Schemes – Paging – Simple, Multi-level Paging; Internal and External Fragmentation; Virtual Memory Concept, Demand Paging – Page Interrupt Fault, Page Replacement Algorithms; Segmentation – Simple, Multi-level, Segmentation with Paging, Memory Management in UNIX.

Course Outcome (CO):

At the end of this course students will have the

CO1. To understand the structure and functions of OS

CO2. To learn about Processes, Threads and Scheduling algorithms
CO3. To understand the principles of concurrency and Deadlocks
CO4. To learn various memory management schemes
CO5. To study I/O management and File systems

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L			M			L			H	
CO2	M		H	L	M	L				H		L	M	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text Books:

1. Operating Systems Concepts – Silberschatz, Galvin, Wiley Publications (2008)
2. Modern Operating Systems - Andrew S. Tanenbaum, Pearson Education Asia / PHI (2005)

Reference Books:

1. Operating Systems – William Stallings, Pearson Education Asia (2002)
2. UNIX System Programming Using C++, by Terrence Chan: Prentice Hall India, 1999.
3. Advanced Programming in UNIX Environment, by W. Richard Stevens: 2nd Ed, Pearson Education, 2005

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:36**
B.Tech in Electronics and Communication Engineering Semester VII
Contact Hours (L-T-P): 3-0-0

Communication Networks(BEE049A)

Course Objective:
To acquire a foundational understanding of communication network technologies. Networking concepts will be illustrated using the TCP/IP and ATM networks.

Unit 1: Overview of networking principles and of analytical networking. Outline of thecourse. Networking practice. A brief overview of networking technologies and the development of a functional view.
Analysis of packet multiplexed stream traffic; Introduction to DeterministicNetwork Calculus and packet scheduling algorithms and their analysis.

Unit 2: Stochastic analysis of packet multiplexed stream traffic. Overview of queueingmodels, Little's theorem, Brumelle's theorem, M/G/1 queue formulae, development of equivalent bandwidth of a stream source.

Unit 3: Circuit multiplexing. Blocking probability calculations and the Kaufman Robertsrecursion. Application to a simple analysis of cellular network. Stochastic analysis of packet multiplexing of elastic sources. Window flow/congestion control algorithms, detailed description of TCP and a detailed analysis of the TCP protocol.

Unit 4: Introduction to multiple access channels. Description and analysis of the Aloha,Ethernet, and CSMA/CA protocols. Brief overview of ad hoc networks and issues in sensor networks.

Unit 5: Packet Switching and Architecture of routers and packet switches. Queueingissues in packets switches, input and output queueing, virtual-output-queueing, maximum and maximal matching algorithms, stable matching algorithm

Course Outcome (CO):

At the end of this course students will have:

C0-1: The students will able to understand the evolution of different generation of Mobile.

CO-2: The student will have the ability to understand the characteristics of communication for different channels and environment.

CO3- The student will be able to analyze and design different accessing techniques.
C0-4:The student will be able to analyze and design different standard of communication system.

CO-5- The student can work in advanced research wireless and mobile cellular programs.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12	PSO1	PSO2	PSO3
CO1	H		H			M			M	M	H	M		H	
CO2	H		H	M		H	M			H	M		M	H	M
CO3	H	M						H	H						H
CO4			M			H					M	H	H		
CO5	M	M							L			H			M

H = Highly Related; M = Medium L = Low

Text books:

1. Data Communication and Networking , Behroun A. Forouzan, DeAnza College, 4th edition TMH 2007.
2.R G Gallager and D Bertsekas, Data Networks, Prentice Hall of India, 1992.

Reference books:

1.J F Hayes, Modelling and Analysis of Computer Communication Networks, Plenum Publishers, NY,1984. 3.W Stallings, Data and Computer Communications, Prentice Hall of India, 1997.
2.R Rom and M Sidi, Multiple Access Protocols, Springer Verlag, 1990.
3.M DePrycker, ATM-solutions for Broadband ISDN, Prentice Hall of USA, 1995.

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 36**
B.Tech in Electronics and Communication Engineering Semester VII
Contact Hours (L-T-P): 3-0-0

Fiber Optic Communication(BEE050A)

Course Objectives:

1. *To be able analyze the performance of both digital and analog optical fibre.*
2. *To calculate the system bandwidth, noise, probability of error and maximum usable bit rate of a digital fiber system.*
3. *To be able to calculate the system link loss, distortion and dynamic range of an RF photonic link.*

Unit 1:OPTICAL FIBERS: **-** Basic optical laws and definitions, Principles of light propagation in fibers, Ray theory, Optical fiber modes and configurations, Step index and graded index fibers. Monomode and multimode fibers, Fiber materials, fiber fabrication, Fiber optic cables. Attenuation, signal distortion in optical fibers, Dispersionintra modal & inter modal, Dispersion shifted and flattened fiber.

Unit 2:OPTICAL SOURCES: **-** LED's- Structure, Materials, Characteristics, Modulation, Power & efficiency, Laser Diodes - Basic concept, Hetro Structure, properties and modulation.

Unit 3:OPTICAL DETECTORS: **-** PIN and Avalanche photo diodes, photo detector noise, detector response time, Avalanche multiplication noise. Photo diode materials. Fundamental of Optical Receiver Operation.

Unit 4:OPTICAL FIBER COMMUNICATION SYSTEMS:-Source to fiber coupling, fiber to fiber joints, fiber splicing, fiber connectors. Principal components. Link design calculation, Applications, Wavelength division multiplexing.

Unit 5:OPTICAL FIBER MEASUREMENTS:Measurements of Fiber attenuation, Dispersion, refractive index profile, Numerical aperture & diameter.

Course Outcome (CO):

By the end of this course, students will be able to::

CO1- Ability to understand Optical Fiber and light propagation.

CO2- Ability to understand Optical Sources.

CO3-Ability to understand Optical detectors with calculation of bandwidth, noise.

CO4- Ability to understand coupling and multiplexing in optical fiber communication.

CO5- Ability to understand calculation of attenuation, dispersion, numerical aperture.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L				H		L	L	H	L
CO3	H	M					L		L		L				M
CO4			L		H								H		
CO5	H	M					L		M						M

H = Highly Related; M = Medium L = Low

Text book:

1. Optical Fiber Communication: Principles And Practice:John M Senior, Pearson

Reference books:

1. Opto Electronics And Fibre Optics Communication, Sarkar, D.C,
2. Optical Fiber Communication: Principles And Systems, Selvarajan, A, TMH
3. Optical Communication System, Johan Gowar, PHI
4. Introduction To Optical Fiber Communications Systems, William B. Jones, Oxford
5. Optical WDM Networks - Principles and Practice, Biswanath Mukherjee, Oxford
6. Optical Fiber Communications, Keiser, Gerd, TMH

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:48**
B.Tech in Electronics and Communication Engineering Semester VII
Contact Hours (L-T-P): 2-1-0

Mobile Communication(BEE051A)

Course Objectives:

1. To familiarize students with various technologies traversed in the complete evolution in Cellular Communication.
2. To provide sound understanding to the students about the various Multiple Access Technologies
3. To understand the Networking and Roaming Concept.

Module-1 Cellular Communications 14 hours

Cellular Communication : Introduction, Cell, Frequency Re-use, Channel Assignment Strategies, Fixed and Dynamic Channel Assignment Strategies, Handoff Process, Factors affecting Handoff Process, Handoff Strategies, Few practical cases of Handoff Scenario, Interference and System Capacity, Co-channel Interference (CCI), Adjacent Channel Interference (ACI), Cell Splitting, Sectorin, Repeaters, Trunked Radio System.Wireless Communications and Diversity, Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performance in Fading Channels, Diversity modeling for Wireless Communications, Hopping: Frequency and Time Hopping, Autocorrelation.

Module-2Multiple Access Technologies**10 hours**

Multiple Access Technologies: Narrowband Systems, Wideband Systems, Frequency Division Multiple Access, Time Division Multiple Access, Spread Spectrum Multiple Access, Space Division Multiple Access. CDMA, Introduction to CDMA, Walsh codes, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization.

Module-3Orthogonal Frequency Division Multiplexing **12 hours**

OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues. Introduction to MIMO, MIMO Channel Capacity, SVD and Eigenmodes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MIMO - OFDM.

Module-4:Roaming in wireless and Mobile Networks:**5 hours**

Roaming in wireless and Mobile Networks: National and International Roaming, Prepaid and Postpaid Subscriber Roaming, Basic, Structure of Roaming, Roaming Services, Roaming in a GSM Network: Inter-PLMN Signaling Network, Communication between a VPLMN VLR and HPLMN HLR

Module-5 Roaming Procedures**5 hours**

Roaming Procedures, Roaming call scenarios, Short Message Services (SMS). 3G and 4G Wireless Standards WCDMA, LT E, W i-MAX etc.

Course Outcomes:

1. The students will able to understand basic theory and concept of Mobile communication.
2. The students will be able to analyze and understand the concept and technologies used in 4G and 5G.
3. The students will be able to analyze different Roaming standards.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12	PSO1	PSO2	PSO3
CO1	H		H			M			M	M	H	M		H	
CO2	H		H	M		H	M			H	M		M	H	M
CO3	H	M						H	H						H
CO4			M			H					M	H	H		
CO5	M	M							L			H			M

H = Highly Related; M = Medium L = Low

Text Books:

1. Theodore Rappaport, "Wireless Communications: Principles and Practice", Prentice Hall.

2. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communications", Cambridge University Press.

Reference Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press.
2. W. C. Lee, Mobile Communications Engineering, New Delhi: Tata McGraw-Hill, Latest Ed.
3. Lee- Mobile Communication & Networking, TMH
4. Ezio Biglieri, "MIMO Wireless Communications", Cambridge University Press.

5. J. Schiller, “Mobile Communications”, Pearson Education.
6. Shahid K. Diddiqui, “Roaming in Wireless Networks”, McGraw Hill Professional.

JECRC UNIVERSITY
Faculty of Engineering & Technology
B.Tech. Electronics and communications Engineering Semester VII **Hours: 24**
Contact Hours (L-T-P): 0-0-2

Communication Network Lab(BEE052A)

1. To design and simulate CDMA transmitter and receiver with BPSK modulation scheme and measuring the BER in AWGN and Rayleigh channel on SIMULINK.

2. To design and simulate CDMA transmitter and receiver with QPSK modulation scheme and measuring the BER in AWGN and Rayleigh channel on MATLAB SIMULINK.

3. To design and simulate CDMA transmitter and receiver with QAM modulation scheme and measuring the BER in AWGN and Rayleigh channel on MATLAB SIMULINK.
4. To analyze and reduce the effect of co-channel interference in a wireless communication system on MATLAB SIMULINK.
5. To design and simulate the transmitter and receiver of IEEE 802.15 standard on MATLAB SIMULINK.
6. To design and simulate the transmitter and receiver of GSM system using GMSK modulation scheme and analyze the performance in terms of SNR and BER as well as throughput.
7. To design and simulate the CDMA transmitter and receiver with a specific modulation scheme and measuring the BER in AWGN and Rayleigh channel for different coding schemes on MATLAB SIMULINK.

8. To analyze the ADSL by observing the effect of varying SNR on the received signal constellation.

9. To analyze the effect of a specific modulation scheme on the bit rate of OFDM system using MATLAB.

10. To implement MIMO OFDM using MATLAB.

11. To analyze the effect of adaptive modulation and coding on the bit rate of OFDM system using MATLAB.

12. To study various spectrum sensing techniques in wireless communication.

13. To implement OFDMA scheme using MATLAB.

14. To analyze the performance of OFDMA transmission scheme in flat fading as well frequency selective fading.

15. To analyze the performance of OFDMA transmission scheme in fast fading channel.

Course Outcome (CO):

At the end of this course students will have:

C0-1: The students will able to understand the evolution of different generation of Mobile.

CO-2: The student will have the ability to understand the characteristics of communication for different channels and environment.

CO3- The student will be able to analyze and design different accessing techniques.
C0-4:The student will be able to analyze and design different standard of communication system.

CO-5- The student can work in advanced research wireless and mobile cellular programs.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Sp Outcom	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12	PSO1	PSO2
CO1	H		H			M			M	M	H	M		H
CO2	H		H	M		H	M			H	M		M	H
CO3	H	M						H	H					
CO4			M			H					M	H	H	
CO5	M	M							L			H		

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:48**
B.Tech in Electronics and Communication Engineering Semester VII
Contact Hours (L-T-P): 3-1-0

Adaptive Signal Processing(BEE054A)

1. *This course focuses on problems algorithms and solutions for processing signals in an manner that is responsive to a changing environment Adaptive signal processing systems are developed which take advantage of the statistical properties of the received signals.*
2. *The course analyzes the performance of adaptive filters and considers the application of the theory to a variety of practical problems such as interference and echo cancellation signal and system identification and channel equalization.*
3. *The class is designed as an advanced statistical signal processing course in which students will build a strong foundation in approaching problems in such diverse areas as acoustic sonarradar geophysical biomedical and communications signal processing Understanding of the theoretical foundations of adaptive signal processing theory will be achieved through a combination of theoretical and computer based homework assignments Detail.*

Unit 1: General concept of adaptive filtering and estimation, applications and motivation. Review of probability, random variables and stationary random processes;Correlation structures, properties of correlation matrices.

Unit 2: Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued signals.

Unit 3: The LMS algorithm (real, complex), convergence analysis, weight errorcorrelation matrix, excess mean square error and mis-adjustment.Variants of the LMS algorithm : the sign LMS family, normalized LMSalgorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

Unit 4: Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces ,Vector space of random variables, correlation as inner product, forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit 5: Introduction to recursive least squares (RLS), vector space formulation of

RLSestimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topic: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

CO1- Understand the basics of digital signal processing and digital filter design and its realizations

CO2- Classify the various adaptive systems and its applications

CO3-Analyze the basic adaptive signal processing methods, especially linear adaptive filters

CO4-Apply important structures of adaptive filters and algorithms

CO5-Design and integrate an adaptive filter in communication systems etc

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12	PSO1	PSO2	PSO3
CO1	H		H			M			M	M	H	M		H	
CO2	H		H	M		H	M			H	M		M	H	M
CO3	H	M						H	H						H
CO4			M			H					M	H	H		
CO5	M	M							L			H			M

H = Highly Related; M = Medium L = Low

Text Books:

. 1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. B. Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall,1984.

Reference Books:

1. Aurelio Uncini, Fundamentals of Adaptive Signal Processing, Springer, 2015
2. Dimitris G. Manolakis, Vinay K. Ingle, Stephen M. Kogon, Statistical and adaptive signal processing, McGraw-Hill, 2000

3. Lee D. Davisson, Giuseppe Longo,Adaptive signal processing, Springer-Verlag, 1991

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering Semester VII
Contact Hours (L-T-P): 3-1-0

Speech and Audio Processing(BEE055A)

Course Objectives:

1. *This course will give students a foundation in current audio and recognition technologies.*
2. *One objective is to build up a familiarity with the perceptually-salient aspects of the audio signal, and how they can be extracted and manipulated through signal processing.*
3. *Objective is to obtain a thorough understanding of the statistical pattern recognition technology at the core of contemporary speech and audio recognition systems.*
4. *The course aims to deepen each student's familiarity with the practical application of signal processing in general, through the study of specific instances, and through the experience of the term project.*

Unit 1: Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

Unit 2: Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Unit 3: Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Unit 4: Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations

of the LPC model.

Unit 5: Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

Course Outcomes:

CO1. **Analyze and design algorithms for extracting parameters from the speech signal.**

CO2. To provide a broad treatment of the fundamentals in audio and speech processing.

CO3. To give an overview of applications (recognition, synthesis, coding) and to inform about practical aspects of speech algorithms implementation.

CO4. To describe basic algorithms of speech analysis common to many applications.

CO5. To provide students with the knowledge of basic characteristics of speech signal in relation to production and hearing of speech by humans.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12	PSO1	PSO2	PSO3
CO1	H		H			M			M	M	H	M		H	
CO2	H		H	M		H	M			H	M		M	H	M
CO3	H	M						H	H						H
CO4			M			H					M	H	H		
CO5	M	M							L			H			M

H = Highly Related; M = Medium L = Low

Text/Reference Books:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students" Edition), 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders",

W.C. Chu, Wiley Inter science, 2003.

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ASIC & FPGA(BEE056A)

Course Objectives:

To introduce students to the process of designing application specific hardware implementations of algorithms for ASICs and FPGAs. Students will work with commercial computer aided design tools to synthesize designs described in hardware description languages. Topics covered will include differences between hardware description languages for synthesis and simulation, behavioral synthesis, gate-level design, register transfer level design, design methodologies, finite state machines, design reuse and intellectual property cores, and optimization.

Unit 1: Introduction to ASICs, CMOS Logic And ASIC Library Design :Types of ASICs,Design flow **,**CMOS transistors, CMOS Design rules, Combinational Logic Cell, Sequential logic cell , Data path logic cell,I/O cells, Transistors as Resistors, Transistor ParasiticCapacitance, Logical effort, Library cell design, Library architecture, Gate-Array Design.

Unit 2: Programmable ASICs, Logic Cells And I/O Cells:Anti fuse, static RAM, EPROM and EEPROM technology, PREP benchmarks, Actel ACT, Xilinx LCA, Altera FLEX, Altera MAX DC & AC inputs and outputs, Clock & Power inputs, Xilinx I/O blocks.

Unit 3: Programmable ASIC Interconnect, Design Software And Low Level Design Entry :Actel ACT, Xilinx LCA, Xilinx EPLD, Altera MAX 5000 and7000, Altera MAX 9000, Altera FLEX , Design systems, Logic Synthesis, Half gate ASIC,Schematic entry, Low level design language, PLA tools,EDIF, CFI design representation.

Unit 4: Logic Synthesis, Simulation And Testing :Verilog and logic synthesis, VHDL and logic synthesis, types of simulation, boundary scan test, fault simulation, automatic test pattern generation, Introduction to JTAG.

Unit 5:ASIC Construction, Floor Planning, Placement & Routing:System partition, FPGA partitioning, partitioning methods, floor planning, placement, physical design flow, global routing, detailed routing, special routing, circuit extraction, DRC.

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CO 1: Continue discussion synthesis subset. Review finite state machines.

CO 2 Introduce ASIC design methodologies and synthesis tools, VHDL simulation and verification

CO 3: Discuss standard libraries. Introduce optimizations

CO 4 Introduce FPGA Synthesis tools and Intellectual Property Cores

CO 5 : Topics TBA, related to main project.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12	PSO1	PSO2	PSO3
CO1	H		H			M			M	M	H	M		H	
CO2	H		H	M		H	M			H	M		M	H	M
CO3	H	M						H	H						H
CO4			M			H					M	H	H		
CO5	M	M							L			H			M

H = Highly Related; M = Medium L = Low

Text Book:

1. M.J.S .Smith, "Application Specific Integrated Circuits ", Addison -Wesley LongmanInc.,1997

Reference Books:

1. Andrew Brown, "VLSI Circuits and Systems in Silicon", McGraw Hill, 1991

2.S. Y. Kung, H. J. White House, T. Kailath, "VLSI and Modern Signal Processing ",Prentice Hall, 1985.

3. S.D. Brown, R.J. Francis, J. Rox, Z.G. Vranesic, “Field Programmable Gate Arrays”, Kluwer Academic Publishers, 1992.

4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.

5. Jose E. France, Yannis Tsividis, "Design of Analog & Digital VLSI Circuits for Telecommunication and SignalProcessing", Prentice Hall, 1994

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Contact Hours (L-T-P): 3-1-0

Micro Electro Mechanical Systems(BEE057A)

Course Objectives:

1. In this course you will learn about microelectromechanical systems (MEMS). You will learn about elasticity and the static and dynamic behavior of beams and membranes.

2. The Laplace transformation is introduced and used to translate both mechanical and other systems to electrical components ("lumped elements"), which are then analyzed by use of the tools available for systems of electrical components. Transducers (sensors and actuators) are treated with focus on electrostatic, electromagnetic and piezo-resistive/electric transducers.

3. It is central here that you learn to calculate the electrical and mechanical response of simple MEMS-transducers. Related simple electronic circuits are introduced and noise (electrical and in other domains) is introduced. Applications in e.g. accelerometers, microfabricated microphones and pressure sensors are illustrated via examples and problems as well as company visits.

4. The final part of the course is a desktop project, where you will work in groups on an open MEMS-related problem defined by a research group at DTU Nanotech or a company.

Unit 1: Introduction to MEMS:MEMS and Microsystems, Miniaturization, Typical products, Micro Sensors,Micro actuation, MEMS with micro actuators, Microaccelorometers and Micro fluidics, MEMS materials, Micro Fabrication.

Unit 2: Mechanics for MEMS Design:Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations,torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics, material, physical vapor deposition (PVD),chemical mechanical polishing (CMP).

Unit 3: Electro static design:Electrostatics: basic theory, electro static instability, Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators, bistable actuators.

Unit 4: Circuit and system issues:Electronic interfaces, Feed back systems, Noise, Circuit and system issues, Case studies –Capacitive accelerometer, Peizo electric pressure sensor, Thermal sensors, radiation sensors, mechanical sensors, bio-chemical sensors Modeling of MEMS systems, CAD for MEMS.

Unit 5: Introduction to Optical And RF MEMS:Optical MEMS, system design basics – Gaussian optics, matrix operations, Resolution, Case studies, MEMS scanners and retinal

scanning, display, Digital Micro mirror devices, RF Mems – design basics, case study – Capacitive RF MEMS switch, Performance issues.

Course Outcomes:

CO1. Be familiar with the important concepts applicable to MEMS, their fabrication.

CO2. . Be fluent with the design, analysis and testing of MEMS.

CO3. Apply the MEMS for different applications.

CO4. To know various fabrication and machining process of MEMS.

CO5. To know about the polymer and optical MEMS.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	P011	PO12	PSO1	PSO2	PSO3
CO1	H		H			M			M	M	H	M		H	
CO2	H		H	M		H	M			H	M		M	H	M
CO3	H	M						H	H						H
CO4			M			H					M	H	H		
CO5	M	M							L			H			M

H = Highly Related; M = Medium L = Low

Text books:

1. Stephen Santeria, "Microsystems Design ", Kluwer publishers, 2000.
2. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

Reference books:

1. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2000
2. Nadim Maluf, " An introduction to Micro electro mechanical system design", Artech House, 2000.
3. Julian w. Gardner, Vijay k. varadan, Osama O.Awadelkarim,micro sensors mems and smart
devices, John Wiley & son LTD,2002
4. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

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Contact Hours (L-T-P): 3-1-0

Broad Band Communication(BEE058A)

Course Objectives:

1. *study-unit aims to familiarize students with current and future broadband This systems be they interface systems in the PAN, interconnection schemes in Data centers or networked systems in the Local, Metropolitan and Wide Area Network.*
2. *udents will familiarize with various broadband systems and their components, and shall familiarize with the critical design parameters of each of the covered broadband system.*

Unit 1: X.25, Frame relay, X.25 v/s Frame relaying, Frame mode protocol architecture, Frame relay and Frame switching, Frame mode call control, Call control protocol, DLCI, Bearer capability, Link layer core parameters, LAPF. ISDN – Integration of Transmission and Switching, Analog and Digital switching, Principles of ISDN.

Unit 2: User interface, Architecture, ISDN standards, I-series recommendations.ISDN interface and Functions – Transmission structure, User network interface, ISDN protocol architecture, ISDN connections, Addressing, Interworking, B-ISDN architecture and standards**.**

Unit 3: B-ISDN Services and protocols – Conversational, Messaging, Retrieval, Distribution, Business and Residential requirements. User plane, Control plane, Physical layer, Line coding, Transmission structure, Signal Hierarchy, System Hierarchy.

Unit 4: ATM – Overview, Virtual channels, Virtual paths, VP and VC switching, ATM cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL services and protocols, ATM service categories, ATM Traffic related Attributes QOS.

Unit 5: ATM switching – ATM switching building blocks, ATM cell processing in a switch, Matrix type switch, Input, Output buffering, Central buffering, Performance aspects of buffering switching networks.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand basic broadband Communication concepts.

CO2- Ability to understand concept of ISDN standards, interface, function, architecture and addressing.

CO3-Ability to understand different high speed networks supporting B-ISDN.

CO4-Ability to understand Broadband Network architecture, data transmission Broadband network design

CO5-Ability to understand the concept ATM switching and processing.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	H		H	L				M			L			L	
CO2	L		L	M		L				H		L	L	H	L
CO3	H	M			L		L				L				M
CO4	L		L	H	H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text books:

1. ISDN and Broadband ISDN with Frame Relay and ATM, William Satllings –PHI

Reference books:

1. Broadband Communications, Balajikumar, Mac-Graw Hill
2. Broadband Bible - Wiley India Publication

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Image and Video Processing(BEE059A)

Course Objectives:

1. *To introduce students to both the fundamentals and emerging techniques in image and video processing.*
2. *Concepts and applications in image and video processing; introduction to multidimensional signal processing: sampling, Fourier transform, filtering, interpolation, and decimation; human visual perception; scanning and display of images and video; image enhancement, restoration and segmentation; digital image and video compression; image analysis.*

Unit 1: Digital Image Fundamentals-Elements of visual perception, image sensing andacquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

Unit 2: Image Enhancements and Filtering-Gray level transformations, histogramequalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Unit 3: Color Image Processing-Color models–RGB, YUV, HSI; Color transformations–formulation, colr complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.mage Segmentation- Detection of discontinuities, edge linking and boundarydetection, thresholding – global and adaptive, region-based segmentation.

Unit 4: Wavelets and Multi-resolution image processing- Uncertainty principles of FourierTransform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.Image Compression-Redundancy–inter-pixel and psycho-visual; Losslesscompression – predictive, entropy; Lossy compression- predictive and transform

coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Unit 5: Fundamentals of Video Coding- Inter-frame redundancy, motion estimationtechniques – full-search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks andblocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X. Video Segmentation- Temporal segmentation–shot boundary detection, hard-cutsand soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand Digital Image Fundamentals
CO2- Ability to understand Gray Images, Enhancements and Filtering for Images and DCT.

CO3-Ability to understand & Color Image Processing.

CO4-Ability to understand Wavelets and Multi-resolution image processing MRA.

CO5-Ability to understand Fundamentals of Video Coding.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H				H			H		H		H		L	
CO2		H	H	M	L	M			M				L	H	L
CO3	H	M					M	M	H	M	M				H
CO4			L		M							L	H		
CO5	H	H				H	M		L			H			L

H = Highly Related; M = Medium L = Low

Textbook:

1. “Digital Image Processing”, by R.C.Gonzalez and R.E. Woods, Second Edition, Pearson Education.

Reference books

2. “Fundamentals of Digital Image Processing”, by Anil Kumar Jain. Prentice Hall of India.
3. “Video Processing” by Murat Tekalp.

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Artificial Neural Networks(BEE060A)

Course Objective:

1. *The objective of the course is to study basics of biological Neural Network and artificial Neural Network.*
2. *The students will learn about the applications of ANN and different pattern recognition tasks using ANN.*

Unit I : Fundamentals: Introduction & Motivation, Biological Neural Networks and simple models, The Artificial Neuron Model; Hopfield Nets; Energy Functions and Optimization; Neural Network Learning Rules:Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule Widrow-Hoff Rule, Correlation Learning Rule, Winner –Take-All Learning rule, Out Star Learning Rule, summary of Learning rules.

Unit II : Single layer perceptron classifiers: Classification model, features and decision regions, discriminant functions, linear machine and minimum distance classification, nonparametric training concept training and classification using the discrete perceptron: algorithm and example, single layer continuous perceptron network for linearly separable classifications, multicategory

Unit III : Multilayer feed forward networks: Linearly nonseparable pattern classification delta learning rule for multiperceptron layer. Generalized Delta Learning rule. Feed forward Recall and Error Back Propagation Training; Examples of Error Back-Propagation. Training errors: Learning Factors; Initial weights, Cumulative Weight Adjustment versus Incremental Updating, steepness of activation function, learning constant, momentum method, network architecture Versus Data Representation, Necessary number of Hidden Neurons. application of Back propagation Networks in pattern recognition & Image processing, Madaunes: Architecture & Algorithms.

Unit IV: Single Layer Feedback Network: Basic concepts of dynamical systems, mathematical foundation of discrete-time hop field networks, mathematical foundation of Gradient-Type Hopfield networks, transient response of continuous time networks. example solution of optimization problems: summing networks with digital outputs, minimization of the traveling salesman tour length, solving simultaneous linear equations.

Unit V : Associative Memories I: Basic concepts, linear associator basic concepts of recurrent auto associative memory, retrieval algorithm, storage algorithm, storage algorithms performance considerations, performance concepts of recurrent auto associative memory, energy function reduction capacity of recurrent auto associative memory, memory convergence versus corruption, fixed point concept, modified memory convergence towards fixed points, advantages and limitations.

Course Outcome (CO):

At the end of this course students will have:

CO1-Ability to understand the fundamental and types of neural network models and various learning algorithms.

CO2- Ability to understand the layered models, their classification, algorithms and their application.

CO3-Ability to understand the feed forward and back propagation networks, their architecture and algorithms, application in speech recognition and image processing.

CO4-Ability to understand the cocept of single layer feedback networks and application in solving various optimization problems

CO5-Ability to understand the concept associative memories and their various algorithms.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome												Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L	M			H		L	L	H	L
CO3	H	M					L				L				M
CO4			L		H				L				H		
CO5	H	M					L				L				M

H = Highly Related; M = Medium L = Low

Text books:

1. Introduction to Artificial Neural Systems, J.M.Zurada: Jaico Publishers

Reference books:

1. Artificial Neural Networks, Dr. B. Yagananarayana, PHI, New Delhi.
2. Elements of Artificial Neural Networks, Kishan Mehrotra, Chelkuri K. Mohan, Sanjay Ranka: Penram International
3. Introduction Neural Networks Using MATLAB 6.0 - by S.N. Shivanandam, S. Sumati, S. N. Deepa,1/e, TMH, New Delhi.
4. Fundamental of Neural Networks – By Laurene Faus

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Mixed Signal Design(BEE061A)

Course Objective:

The objective of the course is make students learn to design core mixed-signal IC blocks: comparators and data converters, filters and their usage. The course will also take into account frequency synthesizers and usage to various tools for the complete IC design process.

Unit 1: Analog and discrete-time signal processing, introduction to sampling theory;Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Unit 2: Switched-capacitor filters, Non-idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

Unit 3: Basics of data converters; Successive approximation ADCs, Dual slope ADCs,Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Unit 4: Mixed-signal layout, Interconnects and data transmission; Voltage-mode signalingand data transmission; Current-mode signaling and data transmission.

Unit 5: Introduction to frequency synthesizers and synchronization; Basics of PLL,Analog PLLs; Digital PLLs; DLLs.

Course Outcome (CO):

At the end of this course students will have:

CO1-Design noise–shaping data converters given a set of requirements such as bandwidth, clock speed, and signal–to–noise ratio.

CO2- Design, simulate, and implement the digital interpolation and decimation filters used in noise–shaping data converters.

CO3-Design, simulate, and implement the analog filters used for anti–aliasing and reconstruction in a data conversion system.

CO4-Discuss the limitations of op–amps and comparators used in noise–shaping data converters

CO5-Simulate noise–shaping data converting circuits and systems and the filtering used.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

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CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L				H		L	L	H	L
CO3	H	M					L				L				M
CO4	L		L		H				L				H		
CO5	H	M					L			L					M

H = Highly Related; M = Medium L = Low

Text books:

1. Behzad, Razavi: Design of Analog CMOS Integrated Circuits, MGH, 2001.
2. R. Jacob Baker: CMOS: Mixed Signal Circuit design, 2nd Edition, Wiley

Reference books:

1. Allen Holberg: CMOS Analog Integrated Circuit Design, Oxford University Press, 2002.
2. P. R. Gray, Hurst, Lewis and R. G. Meyer. Analysis and Design of Analog Integrated Circuits. John Wiley, 4th Ed. 2001.
3. A. B. Grebene, Bipolar and MOS analog integrated circuits design. John Wiley, 1984.

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DSP Processors and Applications(BEE062A)

Course Objective:

The main aim of the course is to make students learn the concepts and usage of DSP. The student would learn architecture of a Real time Signal Processing Platform; different errors introduced during A-D and D-A converter stage, Digital Signal Processor Architecture, ADSP family, FIR/IIR filtering andfixed point and Floating point implementations.

Unit 1: Introduction: Architecture overview, Fixed and Floating point digital signal processors. TMS320C54X Architecture and Assembly language instructions :
Introduction, Bus structure, CALU, ARAU, index register, ARCR, BMAR, Block repeat registers, Parallel Logic Unit (PLU), Memory mapped registers, Program controller, On chip memory & peripherals, Addressing modes & instructions.

Unit 2:ADSP family **:**Analog 21061 series sharc block diagram, Interrupt Hardware, memory quantization,central arithmetic logic unit, system control , memory addressing modes, instruction set,Software applications – Process initialization , interrupts etc.

Unit 3: An overview of TMS320C6X DSPs **:** Introduction, TMS320C6X architecture, functional units, Fetch & Execute packets, pipelining, registers,addressing modes, instruction set, assembly directives, timers, interrupts, Memory considerations, code improvement, constraints.

Unit 4: DSP Application I: FIR/IIR filtering; Fixed point and Floating point implementation using TMS320C54XFast Fourier Transform ; Fixed point and Floating point implementation using TMS320C54X.

Unit 5:DSP Applications II: FIR/IIR filtering, Adaptive filtering, FFT Analysis, SpectralAnalysis etc. Implementation using TMS320C62X / TMS320C67x.

Course Outcome (CO):

At the end of this course students will have:

CO1-Recognize the fundamentals of fixed and floating point architectures of various DSPs.

CO2- Learn the architecture details and instruction sets of fixed and floating point DSP

CO3- Infer about the control instructions, interrupts, and pipeline operations.

CO4-Analyze and learn to implement the signal processing algorithms in DSPs

CO5- Learn the DSP programming tools and use them for applications & design and implement signal processing modules in DSPs

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

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CO1	H		H		L			M			L			L	
CO2	L		L	L	M	L				H		L	L	H	L
CO3	H	M					L				L				M
CO4			L		H								H		
CO5	H	M					L								M

H = Highly Related; M = Medium L = Low

Text books:

1. Programming with DSP processors – Texas Instruments.
2. Digital Signal Processors Architectures, Implementations & Applications – Sen Kuo, Woon-Seng S. Gen . Pearson Publicatios.

Reference books:

1. Digital Signal Processors – Venkataramani / Bhaskar.
2. Digital Signal Processing and applications with C6713 and C6416 DSK by Rulph Chassaing. A JOHN WILEY & SONS, INC., PUBLICATION
3. DSP Processor fundamentals Architectures and Features by Phil Lapsley, Jeff Bier, Amit Shoham. Wiley India

JECRC UNIVERSITY

Faculty of Engineering & Technology **Hours:36**
B.Tech in Electronics and Communication Engineering
Open Elective
Contact Hours (L-T-P): 3-0-0

Analog Communication (BEE064A)

UNIT – I NOISE: Classification of Noise, Various sources of Noise, Methods of Noise Calculation in networks and inter connected networks. Addition of noise due to several sources; noise in amplifiers in cascade, noise in reactive circuits, Noise figure, its calculation and measurement. Noise temperature, Mathematical representation of random noise, narrow band noise and its representation. Transmission of noise through linear systems, signal to noise ratio, noise bandwidth.

UNIT-II MODULATION TECHNIQUES: Basic constituents of Communication Systems, need of modulation, Amplitude modulation, spectrum of AM wave, modulation index, DSBSC modulation, SSB Modulation, Collector modulation, Square law modulation methods, Methods of generating SSB Signals, vestigial side band modulation, Detection of AM Signal; Diode detector, Square Law Detector. Time Constant RC in diode detector. Diode detector with filter. FDM, Power relations in AM wave.

UNIT-III ANGLE MODULATION: frequency and phase modulation, spectrum of FM Wave, modulation index and Bandwidth of FM Signal, NBFM and WBFM, Comparison between FM and PM Signals, FM and AM signals, AM and NBFM Signals, FM generation methods, Demodulation methods; slope detector, ratio detector, Foster-Seeley discriminator. Pre-emphasis & De-emphasis, effect of noise on carrier; noise triangle.

UNIT-IV TRANSMITER AND RECEIVER: Classification of radio transmitters, Block diagram of AM transmitter, Frequency Scintillation, Frequency drift, Radio broadcast transmitter, Radio telephone transmitter, Privacy devices, Armstrong FM transmitter, Simple FM transmitter using Reactance modulator. Classification of radio receivers, TRF receives, superheterodyne receivers, Image Signal rejection, frequency mixers. Tracking and alignment of receivers, Intermediate frequency, AGC, AFC, SSB receiver.

Text/Reference Books:

1. Taub & Schilling, Principles of Communication Systems, TMH.

2. Mithal G K, Radio Engineering, Khanna Pub.
3. Sirnon Haykin, Communication Systems, John Wiley.
4. Dungan F.R., Electronics Communication System, Thomson-Delmar
5. Electronics Communication System: Kennedy; TMH

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 48**
B.Tech in Electronics and Communication Engineering
Open Elective
Contact Hours (L-T-P): 3-1-0

Signals and Systems (BEE013A)

Course objectives:

3. *To develop an understanding of the fundamental tools and concepts used in the analysis of signals and the analysis and design of linear shift-invariant systems.*
4. *To develop an understanding of their application in a broad range of areas, including electronics & electrical networks, telecommunications, signal-processing and automatic control.*

Unit 1: Signals: Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one-dimensional/multi-dimensional; commonly used signals: unit impulse, unit step, unit ramp, exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals.

Systems: Definition, types of systems: linear and non-linear, time invariant and time varying, Deterministic and Stochastic, Casual and non causal, Analog and Discrete/Digital, memory and memoryless.

Unit 2:Linear Time-Invariant Systems: Introduction, Continuous –time and Discrete-Time LTI Systems ,The Convolution Integral, Properties of the Convolution Integral, The Convolution sum, Properties of the Convolution sum, Properties of Linear Time-Invariant Systems, Relationship between LTI system properties and the Impulse response.System representation through differential equations and difference equations.

Unit 3:Fourier Analysis for Continuous-Time Signals and Systems: Introduction, The Response of Continuous-Time LTI Systems to Complex Exponentials, Representation of Periodic Signals: The Continuous-Time Fourier Series, Properties of Continuous-Time Fourier Series, Approximation of Periodic Signals Using Fourier Series and the Convergence

of Fourier Series. Representation of Aperiodic Signals : The Continuous -Time Fourier Transform, Properties of the Continuous –Time Fourier Transform.

Fourier Analysis for Discrete-Time Signals and Systems: Introduction, Properties of Discrete Fourier series, Fourier Transform and Properties of Discrete Fourier Transform.

Unit 4: The Laplace-Trasform: Introduction, The Laplace-Transform, The Region of Convergence for the Laplace-Transform, Properties of Laplace-Transform, Inverse Laplace-Transform, Application & Characteristics of LTI System Using Laplace- Transform.

Unit 5:The Z-Transform: Introduction, The Z-Transform, The Region of Convergence for the Z-Transform, Properties of Z-Transform, The Inverse z-Transform, Application & Characteristics of LTI System Using Z Transform.

Sampling: Introduction, Representation of a Continuous- Time Signal by Its Samples , The Sampling Theorem, Reconstruction of a signal from its Samples, The Effect of Under sampling : Aliasing.

Text Book:

1.A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

Reference Books:

7. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
8. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
9. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
10. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
11. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
12. I. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

JECRC UNIVERSITY

Faculty of Engineering & Technology **Hours:36**
B.Tech in Electronics and Communication Engineering
Open Elective
Contact Hours (L-T-P): 3-0-0

Introduction to VLSI (BEE067A)

Unit 1- Digital Design: Characteristics (Power dissipation ,Noise margin ,Fan in, Fan out) , Single channel MOS inverter, CMOS inverters, CMOS gates, Transmission gates , Delays and loading consideration.

Unit 2- Finite State Machines: Sequential and combitional circuit design , Moore and Mealy machine, Design examples using PLD's- Barrel shifter ,Synchronous controllers, Timing considerations.

Unit 3- Architecture of VLSI processors: CPLD and FPGA, ARM/SPARTAN, The architecture of above in Xilinx and Altera with specifications, block diagram and their comparision. Multiplex & demultiplex keyboard and display interface.

Unit 4- VHDL: Introduction, entity, architechture , configuration/behaviour, package declaration, data objects, data types, operators, attributes. Statements: process, variable, signal ,wait ,if_then, when, null,next,exit. Overloading, VHDL code for various sequential, combinational circuit , state machines. Multiplexed and non multiplexed keyboard and display interface.

Unit 5- EDA Tools: Information on a complete tool from design entry to place and route with optimisation considerations,. Information to EDA tools for simulation and synthesis, Design of Test bench. Study of download facility to CPLD/FPGA, Physical verification and checking.

Text/Reference Books:-

1.VLSI Design Techniques for analog and digital circuits Randall L. Geiger ,Phillip E. Allen, Noel R.Strader

2.VHDL primer ,J.Bhasker.

3.Digital Design- principles and practices ,Wakerly .

4.VHDL Analysis and Modelling of digital systems , Navabi.

5.Xilinx manual

JECRC UNIVERSITY

Faculty of Engineering & Technology **Hours:36**
B.Tech in Electronics and Communication Engineering
Open Elective
Contact Hours (L-T-P): 3-0-0

Microprocessor and interfacing (BEE065A)

Unit1. 8086 architecture, CPU, address bus, data bus and control bus. Input/ Output devices, buffers, encoders, latches and memories and addressing mode. Instructions and assembly language programming.

Unit2. Assembler and advanced programming. Interrupts of 8086. DOS interrupt 21 h functions.

Unit3. Intel 8086 bus cycles, instruction queue, read/write cycle in MIN and MAX mode, reset operation, wait state, halt state, hold state, lock operation, interrupt processing.

Unit4. Introduction to 80286, 80386, 80486 & Pentium Microprocessors.

8086 MICROPROCESSOR INTERFACING:Interfacing A/D converters, data acquisition. Interfacing D/A converters, wave form generation.

Unit5.8259, 8257, 8255, 8253, 8155 chips and their applications. memory, keyboard and display interface (8279).

Text/Reference Books

1. Microprocessor & interfacing by Douglas V.Hall, McGraw Hill International Ed., 1992

2. Assembly language programming the IBM PC by Alan R. Miller, Sybex Inc., 1987..

3. The Intel Microprocessors: 8086/8088, 80286, 80386, 80486 by Bary B. Brey, Prentice Hall, India 1996.

JECRC UNIVERSITY
Faculty of Engineering & Technology
B.Tech in Electronics and Communication Engineering Semester VII
Open Elective
Contact Hours (L-T-P): 3-0-0

hours: 36

Digital Communication (BEE070A)

Course Objectives:

Subjectdeals with different features of digitized mode of communication. All the real time signals are analog, still we are using digital TV, Radio, Telephone Channel or Satellite Communication, so how we can convert a real time signal in digitized form, make it ready for transmission and again converting it in original signal is covered in this subject. Speed of transmission, Error control techniques, bandwidth utilization, limits of resources are different aspects we study.

Unit 1: Pulse Modulation-Sampling process–PAM- other forms of pulse modulation–Bandwidth –Noise trade off –Quantization –PCM- Noise considerations in PCM Systems-TDM- Digital multiplexers-Virtues, Limitation and modification of PCM-Delta modulation –Linear prediction –differential pulse code modulation – Adaptive Delta Modulation

Unit 2: Baseband Pulse Transmission- Matched Filter- Error Rate due to noise–Inter-symbol Interference- Nyquist‟s criterion for Distortion-less Base band Binary Transmission-Correlative level coding –Baseb and M-ary PAM transmission –Adaptive Equalization –Eye patterns

Unit 3: Passband Data Transmission-Introduction–Pass band Transmission model-Generation, Detection, Signal space diagram, bit error probability and Power spectra of BPSK, QPSK, FSK and MSK schemes –Differential phase shift keying – Comparison of Digital modulation systems using a single carrier – Carrier and symbol synchronization.

Unit 4: Errorr Control Coding- Discrete memory-less channels–Linear block codes -Cyclic codes - Convolutional codes –Maximum likelihood decoding of convolutional codes-Viterbi Algorithm, Trellis coded Modulation, Turbo codes.

Unit 5: Spread Spectrum Modulation- Pseudo- noise sequences–a notion of spreadspectrum –Direct sequence spread spectrum with coherent binary phase shift keying – Signal space Dimensionality and processing gain – Probability of error – Frequency –hop spread spectrum

–Maximum length and Gold codes.

Text books:

1. Simon Haykins, "Communication Systems" John Wiley, 4th Edition, 2001
2. Taub & Schilling , "Principles of Digital Communication " Tata McGraw-Hill" 28th reprint, 2003

Reference book:

1.Sam K.Shanmugam "Analog & Digital Communication" John Wiley

JECRC UNIVERSITY

Faculty of Engineering & Technology

B.Tech in Electronics and Communication Engineering Semester VII

Open Elective

Contact Hours (L-T-P): 3-0-0

hours: 36

Digital Signal Processing (BEE033A)

Course Objectives:

1. *To Introduce Discrete time signals and systems, FIR and IIR filters. Methods for computing FFT. Characterization & classification of signals.*
2. *To study Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals.*
3. *To study DFT properties, computation of the DFT of real sequences. Sampling,Filter Design, Sample-and Hold circuits, A/D & D/A converter*

Unit 1: Introduction to signals and systems Discrete time signals and systems, Z-transforms, structures for digital filters, design procedures for FIR and IIR filters. Frequency transformations: linear phase design; DFT. Methods for computing FFT. Noise analysis of digital filters, power spectrum estimation. Signals and signal Processing: characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signal Processing applications.

Unit 2: Time Domain Representation of Signals & Systems- Discrete Time Signals,Operations on Sequences, the sampling process, Discrete-Time systems, Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals.

Unit 3: Transform-Domain Representation of Signals-The Discrete-Time FourierTransform, Discrete Fourier Transform, DFT properties, computation of the DFT of real sequences, Linear Convolution using the DFT. Z-transforms, Inverse ztransform, properties of z-transform, transform domain representations of random signals. Transform-Domain Representation of LTI Systems: the frequency response, the transfer function, types of transfer function, minimum-phase and maximum-Phase transfer functions, complementary transfer functions, Discrete-Time processing of random signals.

Unit 4: Digital Processing of Continuous-Time Signals - sampling of Continuous Signals,Analog Filter Design, Anti-aliasing Filter Design, Sample-and Hold circuits, A/D & D/A converter, Reconstruction Filter Design.

Unit 5: Digital Filter Structure and Design- Block Diagram representation, Signal FlowGraph

Representation, Equivalent Structures, bone FIR Digital Filter Structures, IIR Filter Structures, State-space structure, all pass filters, tunable IIR Digital filters. cascaded Lattice realization of IIR and FIR filters, Parallel all pass realization of IIR transfer function, Digital Sine-Cosine generator. Digital Filter Design: Impulse invariance method of IIR filter design, Bilinear Transform method of IIR Filter Design, Design of Digital IIR notch filters, FIR filter Design based on truncated fonner sens, FIR filter design based on Frequency Sampling approach.

Text books:

1. Proakis J.G., and Manolakis, Introduction to DSP, PHI, 2007
2. Sanjit K. Mitra, “Applications DSP a Computer based approach”, TMH, 2006

Reference books:

1. Allan Y. Oppenhein & Ronald W. Schater , "Applications DSP”,.
2. C.Sydney Burrus (Eds), DSP and Digital Filter Design

JECRC UNIVERSITY
Faculty of Engineering & Technology
B.Tech in Electronics and Communication Engineering Semester VII
Open Elective
Contact Hours (L-T-P): 3-0-0

hours: 36

Engineering System Modeling and Simulation (BEE071)

Course Objectives:

1. *To understand what is a model, types of models, purpose of models.*
2. *To understand the need for quantification and understand the limits of quantification.*
3. *To transform loose facts into an insightful model, to be used as input for requirements discussions and system design and verification*
4. *To use scenario analysis as a means to cope with multiple alternative specifications and or designs.*
5. *To apply problem-driven light-weight simulations and understand their value and purpose in early design decisions.*
6. *To analyze dependability qualities, such as reliability, safety and security*
7. *To analyze the impact of changes; change and variation cases*
8. *To understand the value of rapid prototyping for: requirements, potential design issues, modeling inputs*

Unit 1: Introduction-Systems, System types, System Modeling, Types of systemmodelling, Classification and comparison of simulation models, attributes of modelling, Comparison of physical and computer experiments, Application areas and Examples

Unit 2: Mathematical and Statistical Models- Probability concepts, Queuing Models,Methods for generating random variables and Validation of random numbers.

Unit 3: Language-System modelling, programming languages, comparison of languages,Identifying and selection of programming language, feasibility study of programming language for the given application.

Unit 4: Experiments-Simulation of different systems, Analysis, validation and verificationof input and output simulated data, study of alternate techniques.

Unit 5: Case study-Developing simulation model for information centers, inventorysystems and analysis of maintenance systems.

Text books:

1. Geoffrey Gordon, “System Simulation”, Second edition, Prentice Hall, India, 2002.
2. Jerry Banks and John S.Carson, Barry L.Nelson, David M.Nicol, “Discrete Event System Simulation”, Third edition, Prentice Hall, India, 2002.

Reference books:

1. Robert E. Shannon, “System Simulation The art and science”, , Prentice Hall, New Jersey, 1995.

2.D.S. Hira, “System Simulation”, S.Chand and company Ltd, New Delhi, 2001.
JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours: 36**
B.Tech in Electronics & Communication
Open Elective
Contact Hours (L-T-P): 3-0-0

MICROCONTROLLER AND EMBEDED SYSTEM (BEE068A)

UNIT I:
Comparing Microprocessors and Microcontrollers. Technological trends in Microcontrollers development. .survey of microcontrollers- 4 bit, 8 bit, 16 bit, 32 bit microcontrollers.Applications of microcontrollers.Block diagram, pin. Diagram of 8051. Functional descriptions of internalunits, registers, PSW, internal RAM, ROM, Stack, Oscillator and Clock.

UNIT 2:
I/O Pins, Ports and Circuits connecting external memory. Counters and timers. Serial data interrupt Serial data transmission&reception and transmission modes. Timer flag interrupt. External interrupt, software generatedinterrupts. External memory and memory space decoding, expanding I/Os, memory mapped I/O Reset& CIK Circuits.8051 8051 Instruction syntax, addressing modes, Datatransfer instructions, logical instructions, arithmetic instructions, Jump and Call instructions.

UNIT 3:
Interruptsand interrupt handler subroutines. Writing assembly Language programs. Time delays. Pure SIW timedelays. S/W polled timer. Pure HIW delay. Lookup tables. Serial data transmission using time delaysand polling. Interrupt driven serial transmission and reception.Interfacing Keyboards Programs for small keyboards and matrix keyboards.

UNIT 4:
Interfacing multiplexed displays, numeric displays and LCD displays. Measuring frequency and pulsewidth. Interfacing ADCs & DACs. Hardware circuits for handling multiple interrupts. 8051 Serial datacommunication modes- Mode 0, Mode I, Mode 2 and Mode 3.

Unit-5:
Embedded system Introduction:Introduction to Embedded System, History, Design challenges, optimizing design metrics, time to market, applications of embedded systems and recent trends in embedded systems, embedded design concepts and definitions, memory management, hardware and software design and testing, communication protocols like SPI, SCI, I2C, CAN etc.

Text &Reference Books:

1. The 8051 Microcontroller Architecture, programming and Applications by Kenneth Ayala Penram International (Third Edition)
2. Microcontrollers (Theory and Applications) by Ajay V. Deshmukh Tata MGH
3. The 8051 Microcontroller and Embedded systems by Muhammad Ali Mazidi Pearson Education Asia LPE (Second Edition)
4. Embedded Systems,Rajkamal -TMH.
5. Embedded systems software primer, David Simon - Pears

JECRC UNIVERSITY
Faculty of Engineering & Technology **hours: 36**
B.Tech in Electronics and Communication Engineering **Open Elective**
Contact Hours (L-T-P): 3-0-0

Artificial Intelligence and Robotics (BEE072A)

Course Objective:

This course is an introduction and survey of survey of artificial intelligence methods for mobile robotsfor undergraduate students. It covers both the theory and the practice of unmanned systems, focusing on biological and cognitive principles that are often different from control theory formulations. This course emphasizes software organization and algorithms.

Unit 1: Scope of AI -Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction.

Unit 2: Problem solving - State space search; Production systems, search space control: depth-first, breadth-first search, heuristic search - Hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End, Means-End Analysis

Unit 3: Knowledge Representation- Predicate Logic: Unification, modus pones, resolution, dependency directed backtracking. Rule based Systems : Forward reasoning: conflict resolution, backward reasoning: use of no backtrack. Structured Knowledge Representation: Semantic Nets: slots, exceptions and default frames, conceptual dependency, scripts.

Unit 4: Handling uncertainty and learning- Non-Monotonic Reasoning, Probablistic reasoning, use of certainty factors, fuzzy logic. Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.

Unit 5: Robotics : Robot Classification, Robot Specification, notation; Direct and Inverse Kinematics: Co-ordinates Frames, Rotations, Homogeneous Coordinates, Arm Equation of four Axis SCARA Robot, TCV, Inverse Kinematics of Four Axis SCARA Robot.

Text books:

1. E. Rich and K. Knight,"Artificial intelligence", TMH, 2nd ed., 1992.
2. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 2000.
3. Robin R Murphy, Introduction to AI Robotics PHI Publication, 2000

Reference books:

1. D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.
2. R.J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.
3. George Lugar, .Al-Structures and Strategies for and Strategies for Complex Problem solving., 4/e, 2002,Pearson Educations.

JECRC University

Faculty of Engineering & Technology **Hours:36**
(Open Elective)
Contact Hours (L-T-P): 3-0-0

EMBEDDEDNETWORKS AND PROTOCOLS (BEE069A)

Unit 1: INTRODUCTIONTO CAN

TheCANbus-General-Conceptsofbusaccessandarbitration - protocol handling-Errorprocessingand management - CAN protocol: 'ISO 11898-1'-Content of the different ISO/OSI layers of the CAN bus-CompatibilityofCAN2.0A and CAN2.0B.

Unit 2: INDUSTRIALNETWORKING PROTOCOL - I

LIN–LocalInterconnectNetwork-BasicconceptoftheLIN2.0protocol-Safe-by-WirePlus-Audio-video buses-I2CBus-D2B(Domesticdigital)bus-MOST(Mediaorientedsystemstransport)bus

Unit 3: INDUSTRIALNETWORKING PROTOCOL – II

Flexray 2.0 characteristics, protocol handling and applications, IEEE 1394busor'FireWire'.

Unit 4 : RF COMMUNICATION

Radio-frequencycommunication:internalandexternal-Remotecontrolofopening parts -PKE(passivekeyless entry) andpassive go-TPMS(tyre pressuremonitoringsystems) - Wireless networks-GSM-Bluetooth.

Unit 5 : EMBEDDEDETHERNET

ExchangingmessagesusingUDPandTCP –Servingwebpages withDynamicData– Servingwebpagesthat respondtouser Input –Email forEmbeddedSystems–Using FTP –KeepingDevices andNetworksecure.

TEXTBOOKS:

1. DominiqueParet,"MultiplexedNetworksforEmbeddedSystems-CAN,LIN, Flexray,Safe-by-Wire..."JohnWiley&SonsLtd-2007.

2. JanAxelson'EmbeddedEthernetandInternet Complete',Penrampublications

REFERENCEBOOKS:

1. GlafP.Feiffer,AndrewAyreandChristianKeyold,"Embeddednetworkingwith CAN andCANopen".EmbeddedSystemAcademy2005.

2. GregoryJ.Pottie,WilliamJ.Kaiser"PrinciplesofEmbeddedNetworkedSystems Design",CambridgeUniversityPress,SecondEdition,200

JECRC University
Faculty of Engineering & Technology **Hours:36**
(Open Elective)
Contact Hours (L-T-P): 3-0-0

Telecommunications and Data Communications (BEE066A)

Unit 1 : Fundamentals of the telecommunication technology: concepts and definitions, Analog vs Digital, Narrow vs Broadband, Multiplexers and switches. Fundamentals of transmission systems: technologies and applications , Electromagnetic spectrum, Telecommunication media : Physical wire, microwave radio Satellite radio, fibre optics , power line carrier, hybrid systems.

Unit 2 : Voice communications systems: Key Telephone systems, Private Branch Exchange ; components and enhancements, features and characteristics, Centrex, and Automatic call distribution, Computer telephony , IP Telephony, Public Switched Telephone Network : network characteristics, functional domains, signaling and network services

Unit 3: Fundamentals of data communications Functional domains, Protocol basics, code sets, data format, compression and Security . Conventional Digital and Data Networks , Digital Carrier Systems and Networks, T-Carrier Concept, Encoding, Framing, Transmission, *E-Carrier, J-Carrier,* Integrated Services Digital Network. Local area networks: Connectivity and Internetworking

Unit 4 : Broadband Network Infrastructure : SONET, ATM and Frame Relay, MPLS. Layer 2 and 3 VPNs, B-ISDN, and AIN

Unit 5: Wireless networking: emphasis on mobility, cell concept and access techniques, cellular and packet radio. The Internet and World Wide Web, IP Addressing, TCP/IP and WWW. Network Convergence : NGN and convergence.

TEXTBOOKS: Telecommunications and Data Communications Handbook 2007 by Ray Horak, A John Wiley & Sons Publication

Faculty of Engineering and Technology

Contact Hrs per week (L-T-P): 3-0-0

Course Outlines

BEE008A Electronic Devices and Systems

OBJECTIVES:

- To study the basic concepts, working and utility of electronic devices such as transistors, OPAMPs.
- Basic concepts of digital electronics such as Logic gates and its families, sequential circuits and A/D and D/A converters.

***Analog**:*

Unit 1: **Transistor biasing circuits:** CE, CC and CB amplifiers, Darlington amplifier. H-parameters and their application in analysis. Class A, B, C and D amplifiers.

Unit 2: **OP-AMP:** OP-AMP, Differential amplifier and its DC, AC analysis, OP-AMP characteristics, Non-Inverting/Inverting Voltage and Current feedback. Regulated power supplies; Oscillators.

***Digital**:*

Unit 3: **Logic gates and Logic Families:** Logic gates, Universal gates, transistor as a switching element, Combinational Logic gates, arithmetic and logical operation, design of Half adder and full adder, subtract or circuits, parity generator and checker, code converter, decoders, multiplexers, demultiplexers, comparators.

Unit 4: **Sequential Circuits**- Flip-flops, bi-stable circuits: RS, JK, D, T, Master/Slave Flip-flop, race around condition, latches, synchronous and asynchronous counters up and down counters, shift registers, state transition diagram.

Unit 5: **A/D and D/A Converters**- D/A converter, accuracy, resolution and precision, variable resistor network, binary ladder, A/D converter, accuracy and resolution, simultaneous conversion, counter method, continuous A/D converter, dual slope, successive approximation method.

OUTCOMES:

- Students can now apply the knowledge of analog and digital circuits and components to make different projects.

Text Books:

Analog:

1.S.Salivahanan, NS Kumar, A Vallavaraj “Electronic Devices & circuits” Vikas Pub house.

Digital:

Digital Design – Morris Mano, PHI, 3rd Edition, 2006.

Faculty of Engineering and Technology

Contact Hrs per week (L-T-P): 3-1-0

Course Outlines

BEE020A Microprocessor and Microcontroller System

OBJECTIVE:

- The course emphasizes on basic structure, programming and advancement in the field of microprocessor and microcontrollers.

Unit 1: Evolution of microprocessors, technological trends in microprocessor development. The Intel family tree. CISC Versus RISC. Applications of Microprocessors. 8086 Block diagram; description of data registers, address registers, pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module. Instruction formats, addressing modes.

Unit 2: Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions, process control instructions; Assembler directives. Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions. Writing procedures, Data tables, modular programming, Macros.

Unit 3:8086 Interrupt types and interrupt vector table. DOS interrupt INT 21 h functions. INT 10h and INT 16h functions. Intel 8086 bus cycles, instruction queue, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode, reset operation, wait state, halt state, hold state, lock operation, interrupt processing. Address decoding techniques.

Unit 4: Intel's 8255 description, 8255 different modes operation and interfacing with 8086. Interfacing ADC(0808/0809),DAC-(0808) using 8255. Wave form generation. Intel's 8251 description and operation. Intel's 8259. DMA operation. Intel's 8237. Intel's 8279. Intel's 8253. Introduction to i3, i5, i7 processors.

Unit 5:8051 microcontroller pin diagram, Block diagram, Flag, RAM configuration, Register Banks, addressing modes, instruction set, 8051 programming and interfacing.

OUTCOMES:

- Students will be able to verify assembly-language instructions which are used in microprocessor, cache memories, and parallel execution.
- They can now understand the parts of a computer and the workings of each part buses and memories.

Text Books:

1. DouglasHall Microprocessors Interfacing, Tata McGraw Hill, 1991.
2. The 8051 Microcontroller and Embedded systems by Muhammad Ali Mazidi Pearson Education Asia.

Reference Books:

1. Computer Organization and Design, The hardware and software interface by D A Patterson and J H Hennessy, Morgan Kaufman Publishers.
2. The 8051 Microcontroller Architecture, programming and Applications by Kenneth Ayala, Penram International.

Faculty of Engineering and Technology
Contact Hrs per week (L-T-P): 0-0-2

Course Outlines

BEE022A Microprocessor and Microcontroller System Lab

OBJECTIVE: To understand the internal organization of INTEL 8086 Microprocessors, 8051 microcontroller and Assembly Language Programs using the instruction sets of processors and to study the interfacing of the processor with various peripheral devices.

List of Experiments (Perform any 12):

4. a) Write a program using Microprocessor 8086 to add two 8 bits numbers.
b) Write a program using Microprocessor 8086 to subtract two 8 bits numbers.
c) Write a program using Microprocessor 8086 to add two 16 bits numbers.
d) Write a program using Microprocessor 8086 to add ten 16 bits numbers with carry.

5. (a) Write an assembly language program to find whether the given number is even or odd.
(b) Write an assembly language program to find the number of even and odd numbers from given series of 16 bit numbers.
(c) Write an assembly language program to find the number of 1's in a given number.
(d) Write an assembly language program to find whether the given number has even parity or odd parity.

3. (a) Write an assembly language program to find the largest number from an array of 16 bit numbers.
(b) Write an assembly language program to find the smallest number from an array of 16 bit numbers.
(c) Write an assembly language program to arrange the given array of 16 bit numbers in ascending order.
(d) Write an assembly language program to arrange the given array of 16 bit numbers in descending order.

4. (a) Write an assembly language program to find the number of +ve and -ve numbers from given series of 16 bit numbers.
(b)Write an assembly language program to perform 1 byte BCD addition
(c) Write an assembly language program to perform addition, subtraction, Multiplication and Division of given operands. Perform BCD addition and subtraction.
(d) Write an assembly language program to move 16 bytes from the offset 0200H to 0300H.

5. (a) Write an assembly language program to find whether the given byte is present in the string or not.
(b) Write an assembly language program to compare two given strings.
(c) Write an assembly language program to find square of the given number.
(d) Write an assembly language program to find square of the given array of 16 bit number.

6. (a) Display a message " very large scale integration"
(b) Write an assembly language program to convert BCD number 0 to 9 to their 7 segment codes, using look up table.

(c) Write an ALP for (i) addition and (ii) Multiplication of two 3x3 Matrices.

7. a) Write a program to calculate squares of BCD number 0 to 9 and store then sequentially from 2000H offset onward in the current data segment. The number and their square are in BCD format. Write a subroutine for the calculation of square of number.

   b) Write a program to change a sequence of 16 two byte number from ascending to descending order and store them in same data segment.

8. a) Write a program to generate a delay of 100ms using an 8086 system that runs on 10MHz frequency.

   (b) Write a program to generate delay of 1Minutes.

9. (a) Write a program in 8051

   (i) to clear the accumulator and add 3 to accumulator 10 times.

   (ii) to load accumulator with the value 55H and complement the accumulator 700Times.

   (b) Write a program to toggle all the bits of port1. put a time delay in between each issuing of data to port 1.

10. (a) Write a program to generate a delay of 1μsec. assuming that crystal frequency is 11.05 MHz.

    (b) Write a program in 8051 to perform the following

    (i) Keep monitoring the port P2.2 bit until it becomes high

    (ii) When it becomes high write a value 45H to port 0 send a high to low pulse to P3.3.

11. (a) Write a program to get X value from P1 and send X^2 to P2 continuously.

    (b) Assume P1 is I/P port and connected to a temperature sensor. Write a program to read the temperature and test it for the value 75. according to test result place the temperature value into the registers indicated by the following

    If T = 75 then A = 75

    If T < 75 then R1 = T

    If T > 75 then R2 = T

12. (a) Write a program to find number of 1's in given number.

    (b) Write a program tfor conversion of packed BCD to ASCII

13. Write a program to Interface 7-segment LED displays to a microprocessor and displaying a real-time clock.
14. Write a program for the implementation of a traffic signal controller.
15. Write a program for implementation of a programmable frequency synthesizer using timers.
16. Write a program to interfacing ADC & DAC -capturing a waveform from signal generator and CRO display.
17. Write a program to interfacing a stepper motor to a 8051 microcontroller.

OUTCOMES: The whole conclusion of this lab is that now the students can make their final year projects based on microprocessor and microcontroller.

Faculty of Engineering and Technology

Contact Hrs per week (L-T-P): 3-0-0

Course outline

Communication Systems (BEE045A)

Module 1: Introduction to communication System: Block diagram, modulation and demodulation, need for modulation, transmission considerations and decibel ratios.

Module 2: Amplitude modulation: Introduction to amplitude modulation, generation of AM waves, concept of SSB and DSB modulation, vestigial sideband transmission, power relationships, AM receivers, S/N ratio .Phase and frequency modulation, pre-and de-emphasis, generation of FM waves, CW modulation systems, narrowband FM, FM detectors and superhetrodyne receivers, S/N ratio.

Module 3: Pulse modulation: introduction to pulse modulation, PAM, PPM, PWM systems. Concept of PCM, basic coding and quantization, sample and hold, quantization noise, signal to noise ratio, companding, TDM delta modulation, adaptive delta modulation, S/N ratio comparison of PCM, delta and adaptive modulation

Module 4: ASK PSK, FSK, differential PSK and quadric phase shift keying, synchronization concepts and phase locked loops.

Module 5: Communication system: Block diagram of fibre optic communication system, light propagation in optical fibers, numerical aperture and acceptance cones of OFs, and losses in optical fibres. Multiplexing in optic fiber links. An introduction to telephone exchange systems. Telecommunication traffic, circuit switching, message switching and packet switching.

Text/Reference Books:

1 G.Kennedy, “Electronic communication system”, McGraw, NY.

2. H.Taub and D.L.Shilling, Principles of communication system TMH. (Textbook)

3. W.D. Stanley, “electronic communication system ”, Reston Pub. Co.Ph Virginia.

4. W Tomariand V.F. Alisauskas, “Telecommunication”, PH Inc., NJ.

Faculty of Engineering and Technology

Contact Hrs per week (L-T-P): 0-0-2

Course outline

Communication System Lab (BEE046A)

1. Generation of DSB-SC AM signal using balanced modulator.
2. Generation of SSB AM signal
3. To study envelop detector for demodulation of AM signal and observe diagonal peak clipping effect.
4. Frequency modulation using voltage controlled oscillator.
5. To generate a FM signal using varactor and reactance modulation
6. Detection of FM signal using PLL & foster seelay method.
7. To study super heterodyne AM receiver and measurement of receiver parameters viz. Sensitivity, selectivity & fidelity.
8. To study the circuit of PAM/PWM/PPM modulator & demodulator.
9. Study of frequency division Multiplexing/Demultiplexing with sinusoidal & audio inputs.
10. Generation and study of analog TDM atleast 4 channels.
11. Study of 4 channel Time Division Multiplexing system.
12. Study of Pulse code Modulation and Demodulation with parity & Hamming code.
13. Study Pulse data coding and decoding techniques for various formats.
14. Study of ASK, FSK Modulator & Demodulator.
15. Study of PSK & QPSK Modulator and Demodulator.
16. Study of Differential Pulse code modulation & demodulation.

BEE009A	DIGITAL SYSTEMS	4-0-0 [4]

OBJECTIVE:

1. To provide a comprehensive introduction to digital logic design leading to the ability to understand number system representations, binary codes, binary arithmetic and Boolean algebra, its axioms and theorems, and its relevance to digital logic design.
2. To provide introduction to combinational circuits(such as Karnaugh maps),synchronous sequential logic and Asynchrnous sequential logic.

UNIT1	IC Digital Logic Families - Characteristics of digital IC's, Transistor – TransistorLogic family, Standard TTL characteristics, Other TTL series, Open collector TTL, WiredOR/AND connection, Tristate TTL, Emitter-Coupled Logic family, ECL NOR/OR gate
UNIT2	Simplification of Boolean Functions - Using Karnaugh map and Quine-Mccluskey methods, SOP, POS simplification, NAND and NOR implementations,other two-level implementation (AND-OR-INVERT).
UNIT 3	Combinational Logic Design- Design procedure, Adder : Half adder, Full adder,Serial adder, Parallel adder & Carry look-ahead adder, Subtractors : Half subtractor&Fullsubtractor, BCD to Excess-3 code convertor, BCD to 7-segment decoder, Parity generator and checker .
UNIT 4	Combinational Logic Design using MSI Circuits - Application of typical IC"s like4-bit parallel adder (ex : 7483), Encoders (ex :74148), Multiplexers (ex: 74151, 74153,74157) and their use in realizing boolean functions, Multiplexer trees, Demultiplexer /Decoders (e.g.: 74138, 74154) and their use in realizing a boolean function and demultiplexertrees, 4- it magnitude comparator (ex:7485).
UNIT 5	Synchronous Sequential Logic- Analysis of clocked sequential logic, Statereduction and assignment, Flip-flop excitation tables, Design procedure, Design ofsequentialciruits ex : 3-bit up/down counter (mod < 8), 3-bit up/down gray code counter,Serial adder.

Text Books:

1. M Morris Mano, Digital Design, 3rd Edition, 2006, PHI

2. R. P Jain, Modern Digital Electronics, Second Edition, TMH

Reference Books:

1. Tocci : Digital Systems PHI , 6e, 2001
2. Bignell&Donovan Digital Electronics, 4th Edition, 2007, Thomson Learning.

BEE010A	DIGITAL SYSTEMS LAB	0-0-2(2)

List of Experiments

1. Truth Table verification – NAND gate, NOR gate, OR gate, AND gate, NOT gate.
2. Verifying if NAND gate is a universal gate.
3. Verifying if NOR gate is a universal gate.
4. Realizing given truth table using SOP form.
5. Realizing given truth table using POS form.
6. Design and Implementation of Adder and Subtractor.
7. Design and Implementation of Multiplexer and Demultiplexer.
8. Design and Implementation of Binary to gray code converters and vice-versa.
9. Design and Implementation of BCD Adder.
10. Design and Implementation of encoder and decoder.
11. Design and Implementation of parity generator and detector.
12. Design and Implementation of Magnitude Comparator.
13. Design and Implementation of flip flops – RS, JK, D and T flip flops.
14. Design and Implementation of 3-bit synchronous up/down counter.
15. Design and Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip-flops

BEE 047A	EMBEDDED COMPUTING SYSTEMS	3-1-0 [4]

OBJECTIVES:-

- To understand and design embedded systems and real-time systems
- To identify the unique characteristics of real-time systems
- To explain the general structure of a real-time system
- To define the unique design problems and challenges of real-time systems
- To apply real-time systems design techniques to various software programs.

UNIT 1	Hardware Concepts -Application and characteristics of embedded systems, Overview of Processors and hardware units in an embedded system, General purpose processors, Microcontrollers:8051, Application- Specific Circuits (ASICs), ASIP, FPGA, ARM-based System on a Chip (SoC), Network on Chip (NoC), Levels of hardware modelling, Verilog, Sensors, A/D-D/A converters, Actuators
UNIT 2	Interfacing using RS-232,UART, USB, I2C, CAN bus, Flexray, SRAM and DRAM, Flash memory.
UNIT 3	Real-Time Operating Systems- Real-Time Task Scheduling: Some important concepts, Types of real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA).
UNIT 4:	Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix-based Real-time operating systems, POSIX-RT, A survey of contemporary Real- time operating systems, Microkernelbased systems, Benchmarking real-time systems.
UNIT 5	Embedded Application Development - UML 2.0, State charts, General language characteristics, MISRA C, Hardware/Software Co- design, Hardware/software partitioning, Testing embedded systems, Design for testability and Self-test.

OUTCOMES:-

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

- Understand and design embedded systems and real-time systems
- Identify the unique characteristics of real-time systems
- Explain the general structure of a real-time system
- Define the unique design problems and challenges of real-time systems
- Apply real-time systems design techniques to various software programs.

Text Books:

1. Embedded Systems Design – A Unified Hardware /Software Introduction, by Frank Vahid and Tony Givargis,John Wiley.(2001)

2. An Embedded Software Primer, by David E.Simon, Pearson Education Asia. (1999)

Reference Books:

1. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers.(2000)

JECRC UNIVERSITY
Faculty of Engineering & Technology **Hours:24**
Contact Hours (L-T-P): 0-0-2

Embedded Computing Lab (BEE048A)

1. a) Write a assembly language program using 8051 to add two 8 bits numbers.
   b) Write a assembly language program using 8051 to subtract two 8 bits numbers.
2. Write a assembly language program using 8051 to add two 16 bits numbers.
3. Write a assembly language program using 8051 for multiplication and division of two 8 bit numbers.
4. Write an assembly language program using 8051 to find whether the given number is even or odd.
5. Write an assembly language programusing 8051 to find whether the given number has even parity or odd parity.
6. Write an assembly language program using 8051 to find the largest number among a given set of numbers.
7. Write an assembly language program using 8051 to find the smallest number among a given set of numbers.
8. Write an assembly language program using 8051 to arrange given 5 numbers in ascending order.
9. Write an assembly language program using 8051 to arrange given 5 numbers in descending order.
10. Write an assembly language program in 8085 to generate a specified time delay.
11. Write an assembly language programusing 8051 to move a block of data from one memory location to another memory location.
12. Write an assembly language programusing 8051 to flash a LED connected at a specified output port terminal.
13. Write an assembly language programusing 8051 to find square of the given number.
14. Write an assembly language program using 8051 to compare two given strings.
15. Write an assembly language program Display a message “Embedded Computing System Lab”.
16. Write an assembly language program to interface a stepper motor and rotate it clock wise or anti clock wise through given angle steps.