Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED CURRICULUM

Curriculum and Syllabus

BACHELOR OF TECHNOLOGY
ELECTRONICS AND COMMUNICATION ENGINEERING
(FULL TIME)
2022

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

DECLARATION

I, **Mrs.U.Jayalatsumi,** Head, Dept of Electronics and Communication Engineering hereby declare that this copy of the syllabus (B.Tech Electronics and Communication Engineering UG – Full Time 2022 Regulation) from page number 1 to 268 is the final version which is being taught in the class and uploaded in our University website. I assure that the Syllabus available in our University website is verified and found correct. The Curriculum and Syllabi have been approved by our Academic Council / Vice Chancellor.

Date: **Signature**

VISION AND MISSION OF THE DEPARTMENT

VISION

- To achieve excellence in academics and research in evolving competent core areas of Electronics and Communication Engineering and to effectively respond to the demands of industry and R & D organizations.

MISSION

- **M1**: To accomplish academic excellence through valuable teaching-learning processes to meet requirements of the industry and society.
- **M2**: To prepare students to face the challenges in the field of electronics and communication engineering and prepare them as responsible engineers with ethical values.
- **M3**: To promote the zeal for innovation and creativity among students towards research and development.
- **M4**: To augment students with skills needed for employability, entrepreneurship and for pursuing higher studies.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- **PEO 1:** Graduates will apply their analytical skills to explore socially acceptable and economically feasible solutions for real-life problems using modern design tools.
- **PEO 2:** Graduates will work in a diverse environment with effective communication skills and ethical teamwork to address the needs of the organization and society.
- **PEO 3:** Graduates will continue to develop in their careers by engaging in life-long learning and research.
- **PEO 4:** Graduates will succeed as entrepreneurs by exhibiting their leadership traits and innovative skills.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon the completion of program, graduates will be able to

- **PSO1**: Recognize, adapt the knowledge of science, engineering and mathematics for providing solutions to techno-economical problems in real world.
- **PSO2**: Formulate logical approach to solve engineering problems in core area of Electronics and Communication Engineering.
- **PSO3**: Demonstrate inter-disciplinary subject knowledge in diverse fields of Engineering and Technology.
- **PSO4**: Apply the emerging technology and open source tool for life-long learning to face the challenges in society.

PROGRAM OUTCOMES (POs)

Engineering graduates will be able to:

- **PO-1** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO-2** Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO-3** Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO-4** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO-5** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO-6** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO-7** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO-8** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO-9** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO-10** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO-11** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO-12** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MISSION/ PEO	PEO1	PEO2	PEO3	PEO4
M1	3	2	2	1
M2	3	2	3	3
M3	2	3	2	1
M4	2	3	1	1

Mapping of MISSION with PEO

PEO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	3	1		1					2
PEO2	2	2	3	3	1			2	1			3
PEO3	2	3	3	3	3					1	1	
PEO4						2	3	2	3	3	3	1

Mapping of PEO with PO

PEO/PSO	PSO1	PSO2	PSO3	PSO4
PEO1	1	3		2
PEO2	2	3	1	2
PEO3	2	2		3
PEO4		1	3	3

Mapping of PEO with PSO

Strength of Correlation: 3-High, 2-Medium, 1-Low

B.Tech. Electronics and Communication Engineering
(Full Time)
Curriculum – 2022 Regulation

I SEMESTER								
S.NO	**SUBJECT CODE**	**SUBJECT NAME**	**TY/LB/ ETL/IE**	**L**	**T/ SLR**	**P/ R**	**C**	**CATEGORY**
1	EBEN22001	Technical English	TY	2	0/0	0/0	2	HS
2	EBMA22001	Mathematics – I	TY	3	1/0	0/0	4	BS
3	EBPH22ET1	Engineering Physics	ETL	2	0/0	2/0	3	BS
4	EBCH22ET1	Engineering Chemistry	ETL	2	0/0	2/0	3	BS
5	EBME22ET1	Basic Mechanical & Civil Engineering	ETL	2	0/0	2/0	3	ES
PRACTICALS*								
1	EBCS22ET1	C Programming and Ms Office Tools	ETL	1	0/0	2/0	2	ES
2	EBCC22I01	Orientation to Entrepreneurship & Project Lab	IE	1	0/0	1/0	1	ES

Credits Sub Total: 18

II SEMESTER								
S.NO	**SUBJECT CODE**	**SUBJECT NAME**	**TY/LB/ ETL/IE**	**L**	**T/ SLR**	**P/ R**	**C**	**CATEGORY**
1	EBMA22003	Mathematics – II	TY	3	1/0	0/0	4	BS
2	EBPH22001	Solid State Physics	TY	3	0/0	0/0	3	BS
3	EBCH22001	Technical Chemistry	TY	3	0/0	0/0	3	BS
4	EBME22001	Engineering Graphics	TY	2	0/0	2/0	3	ES
5	EBEC22001	Circuit Theory	TY	3	0/0	0/0	3	PC
PRACTICALS*								
1	EBCC22I02	Communicative English Lab	IE	1	0/0	1/0	1	HS
2	EBCS22ET2	Python Programming	ETL	1	0/0	2/0	2	ES
3	EBCC22I03	Environmental Science (Audit Course)	IE	1	0/0	1/0	0	HS

Credits Sub Total: 19

C: Credits L: Lecture T: Tutorial S.Lr: Supervised Learning P: Problem / Practical R: Research
Ty/Lb/ETL: Theory /Lab/Embedded Theory and Lab * Internal Evaluation

III SEMESTER								
S.NO	**SUBJECT CODE**	**SUBJECT NAME**	**TY/LB/ ETL/IE**	**L**	**T/ SLR**	**P/ R**	**C**	**CATEGORY**
1	EBEE22ID2	Electrical and Instrumentation Engineering	TY	3	0/0	0/0	3	ID
2	EBEC22002	Signals and Systems	TY	3	1/0	0/0	4	PC
3	EBEC22003	Digital Electronics	TY	3	1/0	0/0	4	PC
4	EBCS22ID2	C++ and Java Programming	TY	3	0/0	0/0	3	ID
PRACTICALS*								
1	EBCC22ET1	Universal Human Values 2: Understanding Harmony	ETL	1	0/0	2/0	2	HS
2	EBCS22IL1	C++ and Java Programming Lab	LB	0	0/0	3/0	1	ID
3	EBEC22L01	Digital Electronics Lab	LB	0	0/0	3/0	1	PC
4	EBEC22ET1	Analysis of Solid State Devices	ETL	2	0/0	2/0	3	PC

Credits Sub Total: 21

IV SEMESTER								
S.NO	**SUBJECT CODE**	**SUBJECT NAME**	**TY/LB/ ETL/IE**	**L**	**T/ SLR**	**P/ R**	**C**	**CATEGORY**
1	EBMA22010	Probability and Random Process	TY	3	1/0	0/0	4	BS
2	EBEC22004	Electronic Circuits	TY	3	0/0	0/0	3	PC
3	EBEC22005	Control Systems Engineering	TY	3	1/0	0/0	4	PC
4	EBEC22006	Linear Integrated Circuits	TY	3	0/0	0/0	3	PC
5	EBEC22007	Analog Communication	TY	3	0/0	0/0	3	PC
6	EBCC22I04/ EBCC22I05	The Indian Constitution/ The Indian Traditional Knowledge (Audit Course)	IE	2	0/0	0/0	0	HS
PRACTICALS*								
1	EBEC22L02	Linear Integrated Circuits Lab	LB	0	0/0	3/0	1	PC
2	EBEC22L03	Electronic Circuits Lab	LB	0	0/0	3/0	1	PC
3	EBEC22L04	Digital Simulation Lab	LB	0	0/0	3/0	1	PC
4	EBEC22I01	Technical Skill I	IE	0	0/0	2/0	1	SC
5	EBCC22I06	Soft Skill I (Employability Skills)	IE	0	0/0	2/0	1	SC

Credits Sub Total: 22

C: Credits L: Lecture T: Tutorial S.Lr: Supervised Learning P: Problem / Practical R: Research Ty/Lb/ETL: Theory /Lab/Embedded Theory and Lab * Internal Evaluation

V SEMESTER								
S.NO	**SUBJECT CODE**	**SUBJECT NAME**	**TY/LB/ ETL/IE**	**L**	**T/ SL R**	**P/ R**	**C**	**CATEGORY**
1	EBEC22008	Communication Networks	TY	3	0/0	0/0	3	PC
2	EBEC22009	Microprocessor and Microcontroller	TY	3	0/0	0/0	3	PC
3	EBEC22010	Digital Signal Processing	TY	3	1/0	0/0	4	PC
4	EBEC22EXX	Program Elective I	TY	3	0/0	0/0	3	PE
5	EBXX22OEX	Open Elective I	TY	3	0/0	0/0	3	ID
6	EBOL22I01	OnlineCourse(NPTEL/SWAYAM/ Any MOOC Online Course Approved By AICTE/UGC)	IE	1	0/0	1/0	1	ID
PRACTICALS*								
1	EBEC22L05	Communication Networks Lab	LB	0	0/0	3/0	1	PC
2	EBEC22L06	Communication Lab - I	LB	0	0/0	3/0	1	PC
3	EBEC22L07	Microprocessor and Microcontroller Lab	LB	0	0/0	3/0	1	PC
4	EBEC22I02	Technical Skill II	IE	0	0/0	2/0	1	SC
5	EBEC22ET2	Field and Wave Electromagnetics	ETL	2	0/0	2/0	3	PC

Credits Sub Total: 24

VI SEMESTER								
S.NO	**SUBJECT CODE**	**SUBJECT NAME**	**TY/LB/ ETL/IE**	**L**	**T/ SL R**	**P/ R**	**C**	**CATEGORY**
1	EBEC22011	Sensors and Robotics	TY	3	0/0	0/0	3	PC
2	EBEC22012	Digital Communication	TY	3	1/0	0/0	4	PC
3	EBEC22013	Digital Image Processing	TY	3	1/0	0/0	4	PC
4	EBEC22EXX	Program Elective II	TY	3	0/0	0/0	3	PE
5	EBXX22OEX	Open Elective II	TY	3	0/0	0/0	3	ID
PRACTICALS*								
1	EBEC22L08	Communication Lab II	LB	0	0/0	3/0	1	PC
2	EBEC22L09	Digital Image Processing Using Open CV Python Lab	LB	0	0/0	3/0	1	PC
3	EBEC22L10	Sensors And Robotics Lab	LB	0	0/0	3/0	1	PC
4	EBCC22I07	Soft Skill II (Qualitative And Quantitative Skills)	IE	0	0/0	2/0	1	SC
5	EBEC22I03	Technical Skill III	IE	0	0/0	2/0	1	SC
6	EBEC22I04	Mini Project/Internship	IE	0	0/0	3/0	1	SC

Credits Sub Total: 23

C: Credits L: Lecture T: Tutorial S.Lr: Supervised Learning P: Problem / Practical R: Research Ty/Lb/ETL: Theory /Lab/Embedded Theory and Lab * Internal Evaluation

VII SEMESTER								
S.NO	**SUBJECT CODE**	**SUBJECT NAME**	**TY/LB/ ETL/IE**	**L**	**T/ SLR**	**P/ R**	**C**	**CATEGORY**
1	EBEC22014	Microwave and Optical Communication	TY	3	0/0	0/0	3	PC
2	EBEC22015	VLSI Design	TY	3	0/0	0/0	3	PC
3	EBEC22016	Embedded Systems	TY	3	0/0	0/0	3	PC
4	EBEC22017	Wireless Networks	TY	3	1/0	0/0	4	PC
5	EBEC22EXX	Program Elective III	TY	3	0/0	0/0	3	PE
PRACTICALS*								
1	EBXX22OLX	Open Lab	LB	0	0/0	3/0	1	ID
2	EBEC22L11	VLSIand Embedded System Design Lab	LB	0	0/0	3/0	1	PC
3	EBEC22L12	Microwave and Optical Communication Lab	LB	0	0/0	3/0	1	PC
4	EBEC22I05	Project Phase – 1	IE	0	0/0	3/3	2	P
5	EBFL22IXX	Foreign Language	IE	1	0/0	1/0	1	HS

Credits Sub Total: 22

VIII SEMESTER								
S.NO	**SUBJECT CODE**	**SUBJECT NAME**	**TY/LB/ ETL/IE**	**L**	**T/ SLR**	**P/ R**	**C**	**CATEGORY**
1	EBCC22ID2	Principles of Management and Behavioral Science	TY	3	0/0	0/0	3	ID
2	EBEC22EXX	Program Elective IV	TY	3	0/0	0/0	3	PE
3	EBEC22EXX	Program Elective V	TY	3	0/0	0/0	3	PE
PRACTICALS*								
1	EBEC22L13	Project Phase – II	LB	0	0/0	12/ 12	8	P

Credits Sub Total: 17

Credit Summary

Semester: 1 : 18
Semester: 2 : 19
Semester: 3 : 21
Semester: 4 : 22
Semester: 5 : 24
Semester: 6 : 23
Semester: 7 : 22
Semester: 8 : 17

Total Credits : 166

PROGRAM ELECTIVES

ELECTIVE I – ELECTRONICS STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**
1	EBEC22E01	Semiconductor Devices And Its Applications	Ty	3	0/0	0/0	3
2	EBEC22E02	Real Time Operating Systems	Ty	3	0/0	0/0	3
3	EBEC22E03	Introduction To PLC	Ty	3	0/0	0/0	3

ELECTIVE I – COMMUNICATION STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**
1	EBEC22E04	Antenna and Wave Propagation	Ty	3	0/0	0/0	3
2	EBEC22E05	Telecommunication Switching System	Ty	3	0/0	0/0	3
3	EBEC22E06	Audio Signal Processing	Ty	3	0/0	0/0	3

ELECTIVE II – ELECTRONICS STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**
1	EBEC22E07	Intelligent Instrumentation	Ty	3	0/0	0/0	3
2	EBEC22E08	Advanced Microprocessors	Ty	3	0/0	0/0	3
3	EBEC22E09	Nano Electronics	Ty	3	0/0	0/0	3
4	EBEC22E10	Computer Architecture and Parallel Processing	Ty	3	0/0	0/0	3

ELECTIVE II – COMMUNICATION STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ETL/IE**	**L**	**T/SLr**	**P/R**	**C**
1	EBEC22E11	Internet of Things and Its Applications	Ty	3	0/0	0/0	3
2	EBEC22E12	Next Generation IP Networks	Ty	3	0/0	0/0	3
3	EBEC22E13	Neural Networks and Its Applications	Ty	3	0/0	0/0	3
4	EBEC22E14	Radar and Navigational Aids	Ty	3	0/0	0/0	3

ELECTIVE III – ELECTRONICS STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**
1	EBEC22E15	Advanced Digital System	Ty	3	0/0	0/0	3
2	EBEC22E16	Embedded Software Design	Ty	3	0/0	0/0	3
3	EBEC22E17	Quantum Computing	Ty	3	0/0	0/0	3
4	EBEC22E18	Power Electronics	Ty	3	0/0	0/0	3

ELECTIVE III – COMMUNICATION STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**
1	EBEC22E19	High Speed Switching Architecture	Ty	3	0/0	0/0	3
2	EBEC22E20	Information Coding Techniques	Ty	3	0/0	0/0	3
3	EBEC22E21	Optical Network and Switching Techniques	Ty	3	0/0	0/0	3
4	EBEC22E22	Photonics	Ty	3	0/0	0/0	3

ELECTIVE IV – ELECTRONICS STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**
1	EBEC22E23	Device Modeling	Ty	3	0/0	0/0	3
2	EBEC22E24	VLSI Technology	Ty	3	0/0	0/0	3
3	EBEC22E25	Biomedical Instrumentation	Ty	3	0/0	0/0	3

ELECTIVE IV – COMMUNICATION STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**
1	EBEC22E26	Spread Spectrum Communication	Ty	3	0/0	0/0	3
2	EBEC22E27	Network Management	Ty	3	0/0	0/0	3
3	EBEC22E28	Satellite Communication	Ty	3	0/0	0/0	3
4	EBEC22E29	Next Generation Communication	Ty	3	0/0	0/0	3
5	EBEC22E30	Cognitive Radio	Ty	3	0/0	0/0	3

ELECTIVE V - ELECTRONICS STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**
1	EBEC22E31	Introduction To MEMS System Design	Ty	3	0/0	0/0	3
2	EBEC22E32	Analysis and Design Of Analog IC's	Ty	3	0/0	0/0	3
3	EBEC22E33	Cyber Physical System	Ty	3	0/0	0/0	3
4	EBEC22E34	Digital Control System	Ty	3	0/0	0/0	3

ELECTIVE V – COMMUNICATION STREAM							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**
1	EBEC22E35	Electromagnetic Interference and Compatibility	Ty	3	0/0	0/0	3
2	EBEC22E36	Advanced Concepts In Signal Processing	Ty	3	0/0	0/0	3
3	EBEC22E37	Ultra Wide Band Communication	Ty	3	0/0	0/0	3
4	EBEC22E38	Under Water Acoustic Signal Processing	Ty	3	0/0	0/0	3

COMMON ELECTIVE FOR BOTH STREAMS							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**
1	EBEC22E39	Cryptography and Network Security	Ty	3	0/0	0/0	3
2	EBEC22E40	Introduction to Artificial Intelligence	Ty	3	0/0	0/0	3
3	EBEC22E41	Machine Learning	Ty	3	0/0	0/0	3
4	EBEC22E42	Fuzzy Logic and Systems	Ty	3	0/0	0/0	3
5	EBEC22E43	Introduction to Discrete Mathematics	Ty	3	0/0	0/0	3
6	EBEC22E44	Wireless Sensor Networks	Ty	3	0/0	0/0	3
7	EBEC22E45	Database Management System	Ty	3	0/0	0/0	3
8	EBEC22E46	Theory Of Computation	Ty	3	0/0	0/0	3

LIST OF OPEN ELECTIVES OFFERED TO OTHER DEPARTMENTS BY ECE							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**
1	EBEC22OE1	Internet of Things and Its Applications	Ty	3	0/0	0/0	3
2	EBEC22OE2	Cellular Mobile Communication	Ty	3	0/0	0/0	3
3	EBEC22OE3	Satellite Technology And Remote Sensing Sytems	Ty	2	0/0	1/1	3
4	EBEC22OE4	Fundamentals Of Sensors	Ty	3	0/0	0/0	3
5	EBEC22OE5	Microprocessor Based System Design	Ty	3	0/0	0/0	3
6	EBEC22OE6	Industry 4.0 Concepts	Ty	3	0/0	0/0	3

LIST OF OPEN LABS OFFERED TO OTHER DEPARTMENTS BY ECE							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	EBEC22OL1	Sensors and IOT Lab	Lb	0	0/0	3/0	1
2	EBEC22OL2	Robotics Control Lab	Lb	0	0/0	3/0	1
3	EBEC22OL3	Basics of MATLAB	Lb	0	0/0	3/0	1

LIST OF FOREIGN LANGUAGES							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	EBFL22I01	French	Ty	1	0/0	0/1	1
2	EBFL22I02	German	Ty	1	0/0	0/1	1
3	EBFL22I03	Japanese	Ty	1	0/0	0/1	1
4	EBFL22I04	Arabic	Ty	1	0/0	0/1	1
5	EBFL22I05	Chinese	Ty	1	0/0	0/1	1
6	EBFL22I06	Russian	Ty	1	0/0	0/1	1
7	EBFL22I07	Spanish	Ty	1	0/0	0/1	1

LIST OF OPEN ELECTIVES OFFERED TO ECE BY OTHER DEPARTMENTS

COMPUTER SCIENCE AND ENGINEERING

S.NO	SUBJECT CODE	SUBJECT NAME	Ty/Lb / ETL	L	T/ SLr	P/R	C
1	EBCS22OE1	Cyber security & Forensics	Ty	3	0/0	0/0	3
2	EBCS22OE2	Artificial Intelligence	Ty	3	0/0	0/0	3
3	EBCS22OE3	Data Base Concepts	Ty	3	0/0	0/0	3
4	EBCS22OE4	Software Engineering	Ty	3	0/0	0/0	3

INFORMATION TECHNOLOGY

S.NO	SUBJECT CODE	SUBJECT NAME	Ty/Lb / ETL	L	T/ SLr	P/R	C
1	EBIT22OE1	Web Design	Ty	3	0/0	0/0	3
2	EBIT22OE 2	Digital Marketing	Ty	3	0/0	0/0	3
3	EBIT22OE3	Cyber Security Essentials	Ty	3	0/0	0/0	3
4	EBIT22OE4	Introduction to Multimedia	Ty	3	0/0	0/0	3

ELECTRICAL AND ELECTRONICS ENGINEERING

S.NO	SUBJECT CODE	SUBJECT NAME	Ty/Lb / ETL	L	T/ SLr	P/R	C
1	EBEE22OE1	Electrical Safety for Engineers	Ty	3	0/0	0/0	3
2	EBEE22OE2	Energy Conservation Techniques	Ty	3	0/0	0/0	3
3	EBEE22OE3	Electric Vehicle Technology	Ty	3	0/0	0/0	3
4	EBEE22OE4	Biomedical Instrumentation	Ty	3	0/0	0/0	3
5	EBEE22OE5	Industrial Instrumentation	Ty	3	0/0	0/0	3
6	EBEE22OE6	Solar Energy Conversion System	Ty	3	0/0	0/0	3
7	EBEE22OE7	Wind Energy Conversion System	Ty	3	0/0	0/0	3
8	EBEE22OE8	Energy Storage Technology	Ty	3	0/0	0/0	3
9	EBEE22OE9	Electrical Machines	Ty	3	0/0	0/0	3

CIVIL ENGINEERING

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb / ETL	L	T/ SLr	P/R	C
1	EBCE22OE1	Water Pollution and Its management	Ty	3	0/0	0/0	3
2	EBCE22OE2	Air Pollution Control	Ty	3	0/0	0/0	3
3	EBCE22OE3	Green Building and Vastu Concepts	Ty	3	0/0	0/0	3
4	EBCE22OE4	Climate Change and Sustainable Development	Ty	3	0/0	0/0	3
5	EBCE22OE5	Intelligent Transportation Systems	Ty	3	0/0	0/0	3
6	EBCE22OE6	Environment, Health and Safety in Industries	Ty	3	0/0	0/0	3
7	EBCE22OE7	Industrial Pollution Prevention and Cleaner Production	Ty	3	0/0	0/0	3
8	EBCE22OE8	Fundamentals of nanoscience	Ty	3	0/0	0/0	3

BIOTECHNOLOGY

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb / ETL	L	T/ SLr	P/R	C
1	EBBT22OE1	Food and Nutrition	Ty	3	0/0	0/0	3
2	EBBT22OE2	Human Physiology	Ty	3	0/0	0/0	3
3	EBBT22OE3	Clinical Biochemistry	Ty	3	0/0	0/0	3
4	EBBT22OE4	Bioprocess Principles	Ty	3	0/0	0/0	3
5	EBBT22OE5	Biosensors and Biomedical Devices in Diagnostics	Ty	3	0/0	0/0	3
6	EBBT22OE6	Basic Bioinformatics	Ty	3	0/0	0/0	3

CHEMICAL ENGINEERING

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	C
1	EBCT22OE1	Fundamentals of Nanoscience	Ty	3	0/0	0/0	3
2	EBCT22OE2	Electrochemical Engineering	Ty	3	0/0	0/0	3
3	EBCT22OE3	Alternative Fuels And Energy System	Ty	3	0/0	0/0	3
4	EBCT22OE4	Petrochemical Unit Processes	Ty	3	0/0	0/0	3
5	EBCT22OE5	Principles of Desalination Technologies	Ty	3	0/0	0/0	3
6	EBCT22OE6	Piping Design Engineering	Ty	3	0/0	0/0	3
7	EBCT22OE7	E- Waste Management	Ty	3	0/0	0/0	3

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S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	C
1	EBMG22OE1	Technical Entrepreneurship	ETL	2	0/1	2/0	3

MECHANICAL ENGINEERING

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb / ETL	L	T/ SLr	P/R	C
1	EBME22OE1	Industrial Engineering	Ty	3	0/0	0/0	3
2	EBME22OE2	Refrigeration and Air conditioning	Ty	3	0/0	0/0	3
3	EBME22OE3	Automobile Engineering	Ty	3	0/0	0/0	3
4	EBME22OE4	Industrial Robotics	Ty	3	0/0	0/0	3
5	EBME22OE5	Sustainable Energy	Ty	3	0/0	0/0	3
6	EBME22OE6	Composite Materials	Ty	3	0/0	0/0	3
7	EBME22OE7	Industry 4.0	Ty	3	0/0	0/0	3
8	EBME22OE8	Virtual and Augmented Reality	Ty	3	0/0	0/0	3

LIST OF OPEN ELECTIVES LABOFFERED TO ECE BY OTHER DEPARTMENTS

COMPUTER SCIENCE AND ENGINEERING

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	C
1	EBCS22OL1	Artificial Intelligence Lab	Lb	0	0/0	3/0	1
2	EBCS22OL2	PHP/My SQL Programming Lab	Lb	0	0/0	3/0	1
3	EBCS22OL3	Database Lab	Lb	0	0/0	3/0	1

INFORMATION TECHNOLOGY

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	C
1	EBIT22OL1	Visual Programming Lab	Lb	0	0/0	3/0	1
2	EBIT22OL2	Web Design Lab	Lb	0	0/0	3/0	1
3	EBIT22OL3	Digital content creation Lab	Lb	0	0/0	3/0	1
4	EBIT22OL4	Computer Network Lab	Lb	0	0/0	3/0	1
5	EBIT22OL5	PHP/My SQL Programming Lab	Lb	0	0/0	3/0	1

ELECTRICAL AND ELECTRONICS ENGINEERING

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	C
1	EBEE22OL1	Transducer Lab	Lb	0	0/0	3/0	1
2	EBEE22OL2	PLC and SCADA Lab	Lb	0	0/0	3/0	1
3	EBEE22OL3	Electrical Maintenance Lab	Lb	0	0/0	3/0	1
4	EBEE22OL4	Power Electronics Lab	Lb	0	0/0	3/0	1
5	EBEE22OL5	Bio Medical Instrumentation Lab	Lb	0	0/0	3/0	1
6	EBEE22OL6	Electrical Machines Lab	Lb	0	0/0	3/0	1

MECHANICAL ENGINEERING

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	C
1	EBME22OL1	Internal Combustion Engines and Steam Lab	Lb	0	0/0	3/0	1
2	EBME22OL2	ComputerAidedDesign and Simulation Lab	Lb	0	0/0	3/0	1
3	EBME22OL3	Engineering Metrology Lab	Lb	0	0/0	3/0	1
4	EBME22OL4	Automation Lab	Lb	0	0/0	3/0	1
5	EBME22OL5	Virtual and Augmented Reality Lab	Lb	0	0/0	3/0	1

CIVIL ENGINEERING

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb / ETL	L	T/ SLr	P/R	C
1	EBCE22OL1	Building Drawing Practice using Auto CADD	Lb	0	0/0	3/0	1
2	EBCE22OL2	Geographical Information System And Mapping Lab	Lb	0	0/0	3/0	1
3	EBCE22OL3	Environmental Engineering Laboratory	Lb	0	0/0	3/0	1

BIOTECHNOLOGY

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	C
1	EBBT22OL1	Basic Biochemistry Lab	Lb	0	0/0	3/0	1
2	EBBT22OL2	Basic Bioprocess Lab	Lb	0	0/0	3/0	1
3	EBBT22OL3	Basic Microbiology Lab	Lb	0	0/0	3/0	1
4	EBBT22OL4	Basic Bioinformatics Lab	Lb	0	0/0	3/0	1

CHEMICAL ENGINEERING

S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	C
1	EBCT22OL1	Chemical Separation Lab	Lb	0	0/0	3/0	1
2	EBCT22OL2	Chemical Composition Analysis Lab	Lb	0	0/0	3/0	1
3	EBCT22OL3	Alternate Fuel Lab	Lb	0	0/0	3/0	1
4	EBCT22OL4	Food Testing Laboratory	Lb	0	0/0	3/0	1

REVISION/MODIFICATIONS DONE IN THE SYLLABUS

S. No	Course (Subject) Code	Course (Subject) Name	Concept/ topic if any, removed in current curriculum	Concept/topic added in the new curriculum	% of Revision/ Modification done
1	EBEC22001	Circuit Theory	Analysis of Multi Winding Coupled Circuits-Critical Coupling removed in Unit 5	An Introduction to Network Topology,Trees and General Nodal Analysis introduced in Unit 5	10% To appear for Competitive Examination
2	EBEC22005	Control Systems Engineering	State Space Analysis in Unit 5 merged into Unit 1. Nichols Chart, and Constant M and N circles, Compensators, have been included as Qualitative	Design of Controllers asa case study included in Unit 5	20%
3	EBEC22006	Linear Integrated Circuits		Added Active Filters-low pass, High pass-bandpass-band reject – switched capacitor filters from Unit 4 and Butterworth filters included in Unit 2 Added IC555 timer in Unit 2	ETL Converted into theory 30%
4	EBEC22008	Computer Networks			Nomenclature changed as Communication Networks
5	EBEC22L02	Linear Integrated Circuits Lab	**Lab Experiments:** ● Design clipper and clamper circuit using IC 741. **Lab Experiments: (PSPICE)** ● Design & obtain frequency response of first order HPF&LPF filters	**Lab Experiments: (PSPICE)** Calculation of Line and Load Regulation using IC 723. Construction of a 4-bit R-2R ladder type DAC Set Up of a 4-bit Successive Approximation Type ADC	ETL Converted into lab 30%

6	EBEC22009	Microprocessors and Microcontrollers	Advanced 80386 Architecture, Addressing modes – Data types of 80386 – Real address mode of 80386 – Segmentation , paging , Salient Features of PENTIUM. ARM Architecture –ARM programmer's model- ARM development tools-memory hierarchy-ARM assembly language programming-Simple Examples-Architectural support for operating system-ARM instruction Set-Embedded ARM Applications	Register organization, memory segmentation, Signal descriptions of 8086-common function signals, minimum mode and maximum mode system design, timing diagrams, Interrupts of 8086 Instruction formats, Addressing modes, instruction set, assembler Directives. Macros, Simple programs involving Arithmetic, logical, branch and call instructions. Sorting, evaluating arithmetic expressions, string manipulations DC Motor speed Control using PWM, RTC and EEPROM interface using I2C protocol, Traffic Light Interface, Interfacing matrix Keyboard, and (16x2) LCD interfacing	30%
7	EBEC22010	Digital Signal Processing	UNIT4(Multi rate Signal Processing)	UNIT IV: Finite word length effects	20%
8	EBEC22L07	Microprocessors and Microcontroller Lab		8085 Experiments Added	10%
9	EBEC22ET2	Field and Wave Electromagnetics	Electromagnetics topic in Units 1 & 2 have been compressed into a single Unit with qualitative treatment	Plane Wave Propagation has been added	20%

10	EBEC22012	Digital Communication		Geometric Representation of signals – Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK – QAM – Carrier Synchronization – Structure of Non-coherent Receivers – Principle of DPSK. Hamming codes	20% To Study about the digital modulation scheme the contents have been included In Error control coding hamming codes plays a vital role hence it is added
11	EBEC22014	MICROWAVE AND OPTICAL COMMUNICATION	Unit 4- MICROWAVE CIRCUITS has been removed	Unit 5- MICROWAVE MEASUREMENTS has been moved to UNIT 4 and UNIT 5 OPTICAL FIBER LOSSES AND DESIGN has been introduced	Subject Renamed 30%
11	EBEC22015/EBEC22016	VLSI Design / Embedded Systems	Unit 5- PICMicrocontroller has been removed and framed with more content as another syllabus.	VHDL and VERILOG are presented as unit 4 and 5 separately.	A deep insight of VHDL and VERILOG code can be obtained.
12	EBEC22E07	Intelligent Instrumentation	Measurements, Instrumentation Topic in Unit 1		10%
13	EBEC22E08	Advanced Microprocessors	Implementation of Strings, Procedures, Macros, BIOS and DOS Services using X86 Assembly Language Programming, Memory and I/O Interfacing, Analog Interfacing and Industrial Control.	ARM Architecture –ARM programmer's model- ARM development tools- memory hierarchy - ARM assembly language programming-Simple Examples- Architectural support for operating system- ARM instruction Set-Embedded ARM Application	20%
14	EBEC22E09	Nano Electronics	UNIT1 Microelectronics towards biomolecule electronics Growth, fabrication,	UNIT I: Nano-scale electronics; Foundation of nanoelectronics; Size	50%

			and measurement techniques for nanostructures- Bulk crystal and heterostructure growth- UNIT 2 Nanolithography, etching, and other means for fabrication of nanostructures Chemical and biological methods for nanoscale fabrication- Fabrication of nano-electromechanical systems. Electron transport in semiconductors and nanostructures- Time and length scales of the electrons in solids- Statistics of the electrons in solids and nanostructures. UNIT 5 Logic Devices- Silicon MOSFETs- Ferroelectric Field Effect Transistors- Superconductor Digital Electronics- Quantum Computing Using Superconductors- Carbon Nanotubes for Data Processing- Molecular Electronics.	& Scale Units Scaling Atoms, Molecules, Clusters and Supramolecules; Chemical Bonds(Types and Strength) UNIT-II: SYNTHESIS AND MEASUREMENT TECHNIQUES Synthesis- Sol-gel methods, Mechanical methods: ball milling, mechanical attrition, Thin films methods: chemical vapor deposition, physical vapor deposition UNIT III: NANO MATERIALS & ITS PROPERTIES UNIT-IV NANO STRUCTURE DEVICES No Changes UNIT-V: APPLICATIONS OF NANOTECHNOLOGY Nano Sensors- Nano Electronics in Diagnostics applications, Environmental, Agricultural and Food, Nano Electronics for energy systems- batteries, solar cells	
15	EBEC22E10	Computer Architecture			Nomenclature is changed as Computer Architecture and Parallel Processing
16	EBEC22E11	Internet of Things and its Application			ETL Subject changed to elective subject

DETAILS OF NEW COURSES, ELECTIVES, INTER DISCIPLINARY, LIFE SKILL, COURSES FOCUSED ON EMPLOYABILITY, ENTREPRENEURSHIP, SKILL ETC.

S.NO.	New Courses (Subjects)	Value Added Courses	Life Skill	Electives	Interdisciplinary	Focus On Employability/ Entrepreneurship/Skill Development
1					Electrical and Instrumentation Engineering	
2					C++ and Java Programming	
3					C++ and Java Programming Lab	
4	Sensors and Robotics					
5	Sensors and Robotics Lab					
6				Photonics		Principles of Management and Behavioral Science
7				Next Generation Communication		
8				Introduction to Artificial Intelligence		
9				Machine learning		
10				Fuzzy Logic and Systems		
11				Introduction to Discrete Mathematics		
12				Wireless Sensor Networks		
13				Database Management System		
14				Theory of Computation		

SEMESTER – I

Subject Code	Subject Name : TECHNICAL ENGLISH	Ty/ Lb/ ETL/IE	L	T/SLr	P/R	C
EBEN22001	Prerequisite : Pass in Plus 2 English	Ty	2	0/0	0/0	2

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

To refresh and stimulate students' English learning through Content Integrated Language Learning to have an in-depth understanding of the components of English language and its use in communication that they are competent in inter-personal and academic communication for a successful career.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Refresh and stimulate their English learning through Content Integrated Language Learning ming
CO2	Have an in-depth understanding of the components of English language and its use in communication.
CO3	Strengthen their vocabulary and syntactic knowledge for use in academic and technical communication
CO4	Learn to negotiate meaning in inter-personal and academic communication for a successful career
CO5	Engage in organized academic and professional writing for life-long learning and research

Mapping of Course Outcome with Program Outcome (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	1	3	1	1	2	3	3	1	3
CO2	-	1	-	2	3	2	1	1	3	3	-	3
CO3	1	1	1	1	2	1	-	2	3	3	1	3
CO4	1	2	1	1	3	-	1	-	2	2	1	2
CO5	1	2	1	-	2	1	-	1	3	3	1	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3			
CO2	3			
CO3	3			
CO4	3			
CO5	3			

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
			✓						

Subject Code	Subject Name : TECHNICAL ENGLISH	Ty/ Lb/ ETL/IE	L	T/SLr	P/R	C
EBEN22001	Prerequisite : Pass in Plus 2 English	Ty	2	0/0	0/0	2

UNIT I VOCABULARY DEVELOPMENT **6 Hrs**

Affixes: prefixes and suffixes and word formation–synonyms and antonyms-nominal compounds, expanding using numbers and approximation - preposition, prepositional phrases, preposition + relative pronoun-adjective: degrees of comparison, formation of adjectives, irregular comparatives- Infinitive and Gerunds

UNIT II GRAMMAR **6 Hrs**

Tenses- auxiliary and modal –voice: active, passive and impersonal passive - Questions: Wh-pattern, Yes/no questions, tag questions – adverbs and adverbial clauses- 'If' clause, 'cause and effect', 'purpose'- Concord: subject-verb agreement

UNIT III READING **6 Hrs**

Comprehension: extracting relevant information from the text, by skimming and scanning and inferring, identifying lexical and contextual meaning for specific information, identifying the topic sentence and its role in each paragraph, comprehension exercises - Note - making - Précis writing-instructions, suggestions and recommendations.

UNIT IV WRITING **6 Hrs**

Jumbled sentences - paragraph writing coherence devices- discourse markers. Essay writing- Letter writing, Informal and formal: seeking permission to undergo practical training, letter to an editor of a newspaper complaining about civic problems and suggesting suitable solutions

UNIT V VISUAL AIDS IN COMMUNICATION **6 Hrs**

Interpretation of diagrams - tables, flow charts, pie charts and bar charts, and their use in Business reports

Total Number of Hours: 30

TEXT BOOK

1. Panorama: Content Integrated Language Learning for Engineers, M. Chandrasena Rajeswaran & R.Pushkala, Vijay Nicole Imprints Pvt. Ltd., Chennai

REFERENCES

1. *Bhatnagar & Bhatnagar, Communicative English for Engineers and Professionals, Pearson*
2. *Wren and Martin: Grammar and Composition, Chand & Co, 2006*
3. *https://learnenglish.britishcouncil.org*
4. *www.better-english.com/grammar/preposition*.

Subject Code:	Subject Name : MATHEMATICS-I	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBMA22001	Prerequisite: Higher secondary Mathematics	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- To be able to understand concepts in Algebra
- To understand basic concepts in Matrices
- To analyze and solve Problems in trigonometry
- To be able to understand concepts in Differentiation
- To be able to understand the concept of Fucntions of several variables

COURSE OUTCOMES (COs) :

CO1	To be able to find the summation of given series of binomial ,exponential and logarithmics
CO2	To be able to transform a non diagonal matrix into an equivalent diagonal matrix using orthogonal transformation
CO3	To be able to find the expansion of trigonometric fuction into an infinite series and separate real and imaginary parts
CO4	To be able to find the maxima and minima of the given function
CO5	To be able to evaluate the partial/total differentiation and maxima/minima of function of several variable

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	2	2	3	3	1	3
CO2	3	3	1	2	3	2	1	2	3	1	2	3
CO3	3	3	1	2	2	3	1	1	2	3	2	1
CO4	3	2	2	2	1	2	2	2	2	3	2	2
CO5	3	3	1	2	1	1	2	1	2	2	1	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2
CO2	3	1	2	2
CO3	3	1	2	2
CO4	3	1	2	2
CO5	3	1	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
	✓								

Subject Code:	Subject Name :MATHEMATICS-I	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBMA22001	Prerequisite: Higher secondary Mathematics	Ty	3	1/0	0/0	4

UNIT I ALGEBRA **12 Hrs**

Binomial, Exponential, Logarithmic Series (without proof of theorems) – Problems on Summation, Approximation and Coefficients.

UNIT II MATRICES **12 Hrs**

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values – Cayley - Hamilton theorem(without proof) – Orthogonal reduction of a symmetric matrix to Diagonal form.

UNIT III TRIGONOMETRY **12 Hrs**

Expansions of Sin n□, Cos n□ in powers of Sin□ and Cos□–Expansion of Tan n□– Expansions of Sin^n□ and Cos^n□ in terms of Sines and Cosines of multiples of □ – Hyperbolic functions – Separation into real and imaginary parts.

UNIT IV DIFFERENTIATION **12 Hrs**

Basic concepts of Differentiation –Elementary differentiation methods –Parametric functions – Implicit function –Leibnitz theorem(without proof) – Maxima and Minima – Points of inflection.

UNIT V FUNCTIONS OF SEVERAL VARIABLES **12 Hrs**

Partial derivatives – Total differential – Differentiation of implicit functions – Taylor's expansion – Maxima and Minima by Lagrange's Method of undetermined multipliers – Jacobians.

Total Number of Hours: 60

TEXT & REFERENCE BOOKS:

1. *Kreyszig E., Advanced Engineering Mathematics (10th ed.), John Wiley & Sons, (2011).*
2. *Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012).*
3. *John Bird, Basic Engineering Mathematics (5th ed.), Elsevier Ltd, (2010).*
4. *Veerarajan T., Engineering Mathematics (for first year), Tata McGraw Hill Publishing Co., (2008).*
5. *P.Kandasamy, K.Thilagavathy and K. Gunavathy, Engineering Mathematics Vol. I (4th Revised ed.),S.Chand& Co., Publishers, New Delhi (2000).*
6. *John Bird, Higher Engineering Mathematics (5th ed.), Elsevier Ltd, (2006).*

Subject Code	Subject Name : ENGINEERING PHYSICS	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBPH22ET1	Prerequisite : Higher Sec. Physics	ETL	2	0/0	2/0	3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- Outline the relation between Science, Engineering & Technology.
- Demonstrate competency in understanding basic concepts.
- Apply fundamental laws of Physics in Engineering & Technology.
- To identify & solve problems using physics concepts.
- Produce and present activities associated with the course through effective technical communication

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Demonstrate competency in understanding basic concepts.
CO2	Utilize scientific methods for formal investigations & demonstrate competency with experimental methods and verify the concept to content knowledge.
CO3	Identify and provide solutions for engineering problems.
CO4	Relate the technical concepts to day to day life and to practical situations.
CO5	Think analytically to interpret concepts.

Mapping of Course Outcome with Program Outcome (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		2								
CO2	3	3		2	2					1		
CO3	3	2	2	2		2	1					
CO4	3					2	2	1				2
CO5	3											1

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	
CO2	3	2	1	
CO3	3	2	2	1
CO4	3	2	2	2
CO5	3	1	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
	✓								

Subject Code	Subject Name : ENGINEERING PHYSICS	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBPH22ET1	Prerequisite : Higher Sec. Physics	ETL	2	0/0	2/0	3

UNIT I PROPERTIES OF MATTER 12 Hrs

Elasticity - stress, strain and Hook's law - Poisson's ratio - three moduli of elasticity - twisting couple on a wire – Shafts – Solid & Hollow Shafts – Bending moment – Youngs Modulus Determination by non uniform bending -I form of girders.

viscosity - flow of liquid through a narrow tube: Poiseuille's law (Qualitative)- Ostwald`s viscometer – Lubrication**Lab Component – 1. Coefficient of Viscosity determination using Poiseuille's Method.**

UNIT II ACOUSTICS & ULTRASONICS 12 Hrs

Fundamentals of acoustics - reverberation- reverberation time - factors affecting acoustics.Ultrasonics - Production of ultrasonic waves - detection of ultrasonic waves+ - acoustic grating - application of ultrasonic waves.**Lab Component – 2. Ultrasonic Velocity Determination.**

UNIT III WAVE OPTICS 12 Hrs

Huygen`s principle - interference of light – wave front splitting and amplitude – air wedge - Newton`s rings - Michelson interferometer and its applications - Fraunhofer diffraction from a single slit - diffraction grating **Lab Component – 3. Spectrometer – Grating**

UNIT IV LASER 12 Hrs

Laser principle and characteristics - amplification of light by population inversion - properties of laser beams: mono-chromaticity, coherence, directionality and brightness - different types of lasers - Ruby laser-Nd-YAG laser-He-Ne laser-CO_2 laser - semiconductor laser - applications of lasers in science, engineering and medicine.**Lab Component – 4. Determination of Wavelength of the given Laser source & Particle size determination.**

UNIT V FIBER OPTIC COMMUNICATION 12 Hrs

Total Internal Reflection – Propagation of Light in Optical Fibers – Numerical aperture and Acceptance Angle – Types of Optical Fibers (material, refractive index, mode) – Fiber Optical Communication system (Block diagram) – Attenuation–Transmitter, Receiver, Dispersion, Modulation/Demodulation Advantages of Fiber Optical Communication System – IMT, PMT, Wavelength Modulated & Polarization Modulated Sensors – Endoscope Applications.**Lab Component – 5. Determination of Numerical Aperture of Optical Fiber**

Total Number of Hours: 60

TEXT BOOKS

1. Brijlal, M. N. Avadhanulu & N. Subrahmanyam, Text Book of Optics, S. Chand Publications, 25th edition, 2012
2. R. Murugeshan, Electricity and Magnetism, S.Chand Publications, 10th edition, 2017
3. R. Murugeshan & Kiruthiga Sivaprasath, Modern Physics, S.Chand Publications, 2016

REFERENCE BOOKS

1. *Dr. Senthil Kumar Engineering Physics I VRB Publishers, 2016*
2. *N Subrahmanyam & Brijlal, Waves and Oscillations, Vikas Publications, New Delhi,1988*
3. *N Subrahmanyam & Brijlal, Properties of Matter, S. Chand Co., New Delhi, 1982*
4. *N Subrahmanyam & Brijlal, Text book of Optics, S. Chand Co., New Delhi, 1989*
5. *R. Murugeshan, Electricity and Magnetism, S. Chand & Co., New Delhi, 1995*
6. *Thygarajan K & Ajay Ghatak, Laser Theory and Applications, Macmillan, New Delhi, 1988*
7. *Dr. S. Muthukumaran,Dr.G.Balaji,S.Masilamani - PHYSICS LABORATORY I & II by Sri Krishna Hitech Publishing Company Pvt.Ltd.*

Subject Code	Subject Name: ENGINEERING CHEMISTRY	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBCH22ET1	Prerequisite : Higher Sec. Chemistry	ETL	2	0/0	2/0	3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- To deduce practical application of theoretical concepts
- To provide and insight into fundamental concepts of chemical thermodynamics
- To articulate the water treatment methods
- To impart the knowledge in electrical conductance and EMF
- To create awareness about the modern Nano composites along with concepts of polymers
- To introduce analytical tools for characterization techniques.

COURSE OUTCOMES (Cos)
Students completing this course were able to

CO1	Apply relevant instrumentation techniques to solve complex problems
CO2	Recall the fundamentals and demonstrate by understanding the first principles of Engineering sciences.
CO3	Examine the appropriate techniques to interpret data to provide valid conclusion
CO4	Demonstrate the collaboration of science and Engineering to recognize the need for life long learning.
CO5	Analyse the impact of contextual knowledge to access the health and society issues.

Mapping of Course Outcome with Program Outcome (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3	3	3				2			
CO2	3	3				3						3
CO3	3		2	3								
CO4	3	3		3				3				3
CO5	3					2	3	2				3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1
CO2	3	2	2	1
CO3	1	2	3	2
CO4	1	1	3	3
CO5	1	1	1	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
	✓								

Subject Code	Subject Name: ENGINEERING CHEMISTRY	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBCH22ET1	Prerequisite : Higher Sec. Chemistry	ETL	2	0/0	2/0	3

UNIT I CHEMICAL THERMODYNAMICS 12 Hrs

Introduction, Terminology in thermodynamics –System, Surrounding, State and Path functions, Extensive and intensive properties. Laws of thermodynamics – I and II laws-Need for the II law. Enthalpy, Entropy, Gibbs free energy, Helmholtz free energy - Spontaneity and its criteria. Maxwell relations, Gibbs -Helmholtz equation (relating E & A) and (relating H & G).

UNIT II TECHNOLOGY OF WATER 12 Hrs

Water quality parameters – Definition and expression. Analysis of water – alkalinity, hardness and its determination (EDTA method only). Boiler feed water and Boiler Troubles-Scales and sludges, Caustic embrittlement, Priming and Foaming and Boiler corrosion. Water softening processes – Internal conditioning, external conditioning – Demineralization methods. Desalination processes-RO and Electrodialysis.

Lab Component-1. Analyze the water quality parameters for the given water sample.

UNIT III ANALYTICAL AND CHARACTERIZATION TECHNIQUES 12 Hrs

Chromatographic techniques – column, thin layer and paper. Instrumentation-working with block diagram-UV-Visible Spectroscopy , IR Spectroscopy , Scanning electron microscope ,Transmission electron microscope. **Lab Component-2.Determination of Rf values of various components using thin layer chromatography. 3. Compute and interpret the structures of the given molecules using Chem Draw.**

UNIT IV ELECTROCHEMISTRY 12 Hrs

Conductance – Types of conductance and its Measurement. Electrodes and electrode potential, Nernst equation – EMF measurement and its applications-Electrochemical series- Types of electrodes- Reference electrodes-Standard hydrogen electrode- Saturated calomel electrode-Determination of P^H using these electrodes.

Lab Component-4. Studies on acid-base conductometric titration.

5. Determination of redox potentials using potentiometry

UNIT V POLYMERS AND NANO COMPOSITES 12 Hrs

Polymers-Introduction-Monomers – Functionality – Degree of polymerization-Tacticity. Classification-Plastics – Thermoplastics and thermosetting plastics, Compounding of plastics – Compression moulding, injection moulding and extrusion processes. Nano composites: particulates, clay and carbon nano tubes. Graphene nano composites and its applications.

Lab Component-6.Polymeric analysis using capillary viscometer

Total Number of Hours: 60

REFERENCES

1. *Jain &JainEngineering Chemistry 17th Edition, Dhanpat Rai Publishing Company.*
2. *Vasant R. Gowariker,, N. V. Viswanathan, Jayadev Sreedhar, Polymer Science,New Age International, 1986.*
3. *B.K. Sharma, Polymer Chemistry, Goel Publishing House.*
4. *Y. R. Sharma ,Elementary Organic Spectroscopy, S.Chand& Company Ltd.*
5. *N.Krishnamurthy, K.Jeyasubramanian, P.Vallinayagam, Applied Chemistry, Tata McGraw-Hill Publishing Company Limited, 1999.*
6. *Chichester,polymer-clay-nano composites,John wiley(2000).*

Subject Code	Subject Name : BASIC MECHANICAL & CIVIL ENGINEERING	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBME22ET1	Prerequisite : Nil	ETL	2	0/0	2/0	3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- To understand the fundamentals and applications of IC Engines, power plants, manufacturing processes and mechanics.
- To expose the students to the various construction materials and their applications.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Demonstrate the working principles of power plants, IC Engines and boilers..
CO2	Utilize the concept of metals forming, joining process and apply in suitable machining process
CO3	Understand the various machining process in machine tool
CO4	Utilize the concept of Building materials and construction able to perform concrete mix and masonry types
CO5	Demonstrate how Roads, Railways, dams, Bridges have been constructed

Mapping of Course Outcome with Program Outcome (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					2		3	3	3		3
CO2	3				1	2		1	2	2		2
CO3	3	3			1	1		1	2	2		2
CO4	3				1	1			2	2		2
CO5	3				1	1		1	2	2		2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2		3	2
CO2	1		3	2
CO3	1		3	2
CO4	2		3	3
CO5	2		3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
		✓							

Subject Code	Subject Name : BASIC MECHANICAL & CIVIL ENGINEERING	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBME22ET1	Prerequisite : Nil	ETL	2	0/0	2/0	3

UNIT I THERMAL ENGINEERING 14 Hrs

Classification of internal combustion engine – Working of two stroke, four stroke petrol and diesel engines. Classification of Boilers – Cochran boiler – Locomotive boilers – Power plant classification – Working of Thermal and Nuclear power plant- Working of Solar-Wind - Tidal and Geothermal power plants.

Lab component: Study of Boilers and IC engines

UNIT II MANUFACTURING PROCESS 14 Hrs

Metal forming processes – Rolling, forging, drawing, extrusion and sheet metal operations- fundamentals only. Metal Joining processes – Welding - arc and gas welding, Soldering and Brazing. Casting process – Patterns -Moulding tools - Types of moulding - Preparation of green sand mould -Operation of Cupola furnace.**Lab component: Sheet metal works,**

Fitting- Cutting (T, V, L and dovetail joints)

UNIT III MACHINING PROCESS 10 Hrs

Basics of metal cutting operations – Working of lathe- parts-Operations performed. Drilling machine – Classification – Radial drilling machine - Twist drill nomenclature. Milling machine-types-different operations performed.

Lab component: Lathe operation: Step turning and Taper turning

Drilling operation- Making hole drilling

UNIT IV BUILDING MATERIALS AND CONSTRUCTION 12 Hrs

Materials: Brick - Types of Bricks - Test on bricks - Cement – Types, Properties and uses of cement – Steel - Properties and its uses – Ply wood and Plastics.

Construction: Mortar – Ingredients – Uses – Plastering - Types of mortar - Preparation – Uses – Concrete – Types – Grades – Uses – Curing – Introduction to Building Components (foundation to roof) – Masonry – Types of masonry (Bricks & Stones)

Lab component: Carpentry: Joints (Tee halving, Cross Lap, Dovetail Joint)

Plumbing works- Pipe connections

UNIT V ROADS, RAILWAYS, BRIDGES & DAMS 10 Hrs

Roads – Classification of roads – Components in roads – Railways -Components of permanent way and their function – Bridges – Components of bridges – Dams – Purpose of dams – Types of dams.

Total Number of Hours: 60

TEXT BOOKS

1. S. Bhaskar, S. Sellappan, H.N.Sreekanth,, (2002), "*Basic Engineering*" –Hi-Tech Publications
2. K. Venugopal, V. Prabhu Raja, (2013-14), "*Basic Mechanical Engineering*", Anuradha Publications.
3. K.V. Natarajan (2000), *Basic Civil Engineering*,Dhanalakshmi Publishers
4. S.C. Sharma(2002),*Basic Civil Engineering*,Dhanpat Raj Publications

REFERENCES

1. *PR.SL. Somasundaram, (2002), "Basic Mechanical Engineering" –, Vikas Publications.*
2. *S.C. Rangawala(2002), Building Material and Construction, S. Chand Publisher*

Subject Code	Subject Name : C PROGRAMMING AND MS OFFICE TOOLS	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBCS22ET1	Prerequisite: Nil	ETL	1	0/0	2/0	2

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES :

The student should be made to:

- Learn a programming language.
- Learn problem solving techniques.
- Write programs in C and to solve the problems.
- Familiarize the students in preparation of documents and presentations with office automation tools.

COURSE OUTCOMES (COs) : After Completing the course, the student can be able to

CO1	Understand and trace the execution of programs written in C language.
CO2	Write the C code for a given algorithm.
CO3	Apply Arrays and Functions concepts to write Programs
CO4	Apply Structures and pointers concepts for writing Programs
CO5	To perform documentation , accounting operations and presentation skills

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	1	1	1	1	1	2	2
CO2	2	2	2	2	1	1	1	1	1	1	2	2
CO3	2	2	3	2	1	1	1	1	1	1	3	2
CO4	2	2	3	3	1	1	1	1	1	1	3	2
CO5	1	1	1	1	1	1	0	0	2	3	2	0

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3
CO2		2	3	3
CO3			3	3
CO4			3	3
CO5	2		3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
							✓		

Subject Code	Subject Name : C PROGRAMMING AND MS OFFICE TOOLS	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBCS22ET1	Prerequisite: Nil	ETL	1	0/0	2/0	2

UNIT I INTRODUCTION **9 Hrs**

Basic Structure of C programme- Constants, Variables and data types, Keywords, Identifiers- Operators and expressions- executing a C Program

UNIT II DECISION MAKING STATEMENTS AND LOOPING STATEMENTS **9 Hrs**

Decision making with if statement, Simple if statement, else-if statement, Nesting if-else statement, The else if ladder, The switch statement, The goto statement, The while statement,, The do while statement, The for statement, jumps in loops.

UNIT III ARRAYS AND FUNCTIONS **9 Hrs**

Introduction to Arrays- One dimensional arrays, Two dimensional array, and Multidimensional array- Introduction to Functions- calling a function, category of functions- arguments with return values, argument with no return values- parameter passing Mechanism: Call by Value and Call by Reference. Recursion.

UNIT IV STRUCTURES & POINTERS **9 Hrs**

Structures definition, giving values to members, Structure initialization, comparison of structure variables, Structure within structures, Understanding pointers, accessing the address of the variable, declaring and initializing pointer, accessing a variable through its pointer and arrays.

UNIT V MS-OFFICE **9 Hrs**

Introduction to MS-Word- Menus- Introduction to MS-Excel: features of MS- Excel, spread sheet/worksheet, parts of MS-excel window, functions in excel sheet, chart, Introduction to MS-Power point

Total Number of Hours: 45

TEXT BOOKS:

1. E.Balaguruswamy, Programming in ANSI C
2. Padma Reddy ,Computer Concepts & 'C' Programming
3. ShobhaHangirke, Computer Application For Business

List of Experiments: C PROGRAMMING

1. Find the factorial of a given positive number using function.
2. Calculate X raised to y using function.
3. Find GCD and LCM of two given integer numbers using function.
4. Find the sum of N natural numbers using function.
5. Book information using Structure.
6. Student information using Structure.
7. Print the address of a variable and its value using Pointer
8. Find area and perimeter of a circle
9. Check whether the given number is palindrome or not
10. Check whether the given number is prime or not
11. Calculate sum of the digits of the given number
12. Display Fibonacci series up to N terms
13. Check whether a given character is alphabetic, numeric or special character
14. Count vowels and consonants in a given string
15. Find product of two matrices

MS-OFFICE

Preparing a news letter:

16. To prepare a newsletter with borders, two columns text, header and footer and inserting a graphic image and page layout.
17. Creating and editing the table
18. Printing envelopes and mail merge.
19. Using formulas and functions: To prepare a Worksheet showing the monthly sales of a company in different branch offices
20. Prepare a Statement for displaying Result of 10 students in 5 subjects

Subject Code	Subject Name :ORIENTATION TO ENTREPRENEURSHIP & PROJECT LAB	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBCC22I01	Prerequisite : Nil	IE	1	0/0	1/0	1

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- Understand how entrepreneurship Education transforms individuals into successful leaders.
- Identify individual potential &S have career dreams
- Understand difference between ideas & opportunities
- Identify components & create action plan.
- Use brainstorming in a group to generate ideas.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Develop a Business plan & improve ability to recognize business opportunity
CO2	Do a self-analysis to build an entrepreneurial career.
CO3	Articulate an effective elevator pitch.
CO4	Analyze the local market environment & demonstrate the ability to find an attractive market
CO5	Identify the required skills for entrepreneurship & develop

Mapping of Course Outcome with Program Outcome (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	2	3	2	2	2		2	2	2	1
CO2	3	2		3	2	3	2	3	3	3	2	2
CO3		2	2	2		3		3	3	3		
CO4		3	2	2	2	2		3	2	2	3	
CO5		2	2	3	2	2	3	3	2	2	3	1

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1			3	2
CO2			3	3
CO3			3	3
CO4			3	3
CO5			3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
								✓	

Subject Code	Subject Name : ORIENTATION TO ENTREPRENEURSHIP & PROJECT LAB	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBCC22I01	Prerequisite : Nil	IE	1	0/0	1/0	1

UNIT I CHARACTERISTICS OF A SUCCESSFUL ENTREPRENEUR 3 Hrs

Introduction to entrepreneurship education – Myths about entrepreneurship – How has entrepreneurship changed the country – Dream it. Do it - Idea planes - Some success stories – Global Legends – Identify your own heroes.

UNIT II ENTREPRENEURIAL STYLE 3 Hrs

Entrepreneurial styles – Introduction, concept & Different types - Barrier to Communication – Body language speaks louder than words

UNIT III DESIGN THINKING 3 Hrs

Introduction to Design thinking – Myth busters – Design thinking Process - Customer profiling – Wowing your customer – Personal selling – concept & process – show & tell concept – Introduction to the concept of Elevator Pitch

UNIT IV RISK MANAGEMENT 3 Hrs

Introduction to risk taking & Resilience – Managing risks (Learning from failures, Myth Buster) – Understanding risks through risk takers – Why do I do? – what do I do?

UNIT V PROJECT 3 Hrs

How to choose a topic – basic skill sets necessary to take up a project – creating a prototype – Pitch your project – Project presentation.

IDEA GENERATION, EVALUATION & PROJECT PRESENTATION **15Hrs**

Total Number of Hours: 30

REFERENCE BOOKS& WEBSITE

1. *Encyclopedia of Small Business (2011) – (e book)*
2. *Oxford Handbook of Entrepreneurship (2014) – (e book)*
3. *lms.learnwise.org*

SEMESTER – II

Subject Code:	Subject Name : MATHEMATICS-II	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBMA22003	Prerequisite: Higher secondary Mathematics	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- To be able to understand basic concepts in integration
- To understand the concepts in multiple integrals
- To use the basic concepts in ordinary differential equations
- To be able to apply concepts of analytical geometry
- To be able to understand the basic concept of vector calculus

COURSE OUTCOMES (COs) :

CO1	To be able to Integrate the given function by using methods of integration and to find the area under curve and the volume of a solid by revaluation
CO2	To be able to evaluate the multiple integrals /area/volume and to change the order of integration
CO3	To be able to apply concepts in Ordinary Differential equations and to solveeulers differential equation
CO4	To be able to find equation of plannes,lines and sphere and shortest distance between skew lines
CO5	To be able to verify green/stokes/gauss divergence theorem

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	1	2	2	2	1	3
CO2	3	3	1	2	2	3	2	2	3	3	2	2
CO3	3	3	1	2	2	3	1	1	3	3	2	2
CO4	3	3	2	2	1	2	2	2	2	3	2	2
CO5	3	3	1	2	2	2	2	1	2	3	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2
CO2	3	1	2	2
CO3	3	1	2	2
CO4	3	1	2	2
CO5	3	1	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
	✓								

Subject Code:	Subject Name : MATHEMATICS-II	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBMA22003	Prerequisite: Higher secondary Mathematics	Ty	3	1/0	0/0	4

UNIT I INTEGRATION **12 Hrs**

Basic concepts of Integration – Methods of Integration– Integration by substitution – Integration by parts – Definite integrals– Properties of definite integrals – Problems on finding Area and Volume using single integrals (simple problems).

UNIT II MULTIPLE INTEGRALS **12 Hrs**

Double integral in Cartesian and Polar Co-ordinates – Change of order of integration – Triple integral in Cartesian Co-ordinates – Spherical Polar Co-ordinates – Change of variables (simple problems).

UNIT III ORDINARY DIFFERENTIAL EQUATIONS **12 Hrs**

First order differential equations – Second and higher order linear differential equations with constant coefficients and with RHS of the form: e^{ax}, x^n, Sin ax, Cos ax, $e^{ax}f(x)$, x f(x) where f(x) is Sin bx or Cos bx – Differential equations with variable coefficients (Euler's form) (simple problems).

UNIT IV THREE DIMENSIONAL ANALYTICAL GEOMETRY **12 Hrs**

Direction Cosines and Ratios – Equation of a straight line – Angle between two lines – Equation of a plane – Co-planar lines – Shortest distance between skew lines – Sphere – Tangent plane.

UNIT V VECTOR CALCULUS **12 Hrs**

Scalar and Vector functions – Differentiation – Gradient, Divergence and Curl – Directional derivatives – Irrotational and Solenoidal fields– Line, Surface and Volume integrals – Green's, Stoke's and Gauss divergence theorems (statement only) – Verification.

Total Number of Hours: 60

REFERENCE BOOKS:

1. *Kreyszig E., Advanced Engineering Mathematics (10th ed.), John Wiley & Sons, (2011).*
2. *Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012).*
3. *John Bird, Basic Engineering Mathematics (5th ed.), Elsevier Ltd, (2010).*
4. *Veerarajan T., Engineering Mathematics (for first year), Tata McGraw Hill Publishing Co., (2008).*

Subject Code	Subject Name : SOLID STATE PHYSICS	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBPH22001	Prerequisite: Engg. Physics	Ty	3	0/0	0/0	3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- Design, conduct experiment and analyze data.
- Develop a Scientific attitude at micro and nano scale of materials
- Understand the concepts of Modern Physics
- Apply the science of materials to Engineering & Technology

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Enable the student to employ the classical & quantum theories & Laws in general
CO2	Critically evaluate to build models to understand the solid state fundamentals
CO3	Formulate & understand the behaviour of solid state devices
CO4	Articulate the physical properties of condensed matter
CO5	Interpret the role of solid state physics in the advanced technological developments

Mapping of Course Outcome with Program Outcome (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1			2		1
CO2	3	3	1	2	2	1	1		1	2		1
CO3	3	3	3	3	2	2	2	1		2	1	1
CO4	3	3	3	3	2	2	1	1	3	2	1	1
CO5	3	2	2	2	2	1	1	1	2	2	1	1

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	2	3	3	2
CO4	1	3	3	1
CO5	2	2	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
	✓								

Subject Code	Subject Name : SOLID STATE PHYSICS	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBPH22001	Prerequisite: Engg. Physics	Ty	3	0/0	0/0	3

UNIT I CRYSTAL STRUCTURE **9 Hrs**

Space Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Ceramic Materials & Graphite Structures – Crystal Growth Techniques (Slow Evaporation Method & Melt Growth)

UNIT II CONDUCTORS & SUPER CONDUCTORS **9 Hrs**

Qualitative analysis of Free electron theory – Electrical & Thermal Conductivity (Derivation) - Fermi energy & its importance – Qualitative analysis of conductors, semiconductors & insulators – Important electrical materials. Superconductors – Transition temperature – BCS theory – Properties of super conductors – Types – Low & High temperature superconductors – AC & DC Josephson effect – SQUIDS, Magnetic Levitation – Applications of super conductors

UNIT III SEMICONDUCTOR PHYSICS **9 Hrs**

Bonds in Semiconductors – Types – Importance of Germanium & Silicon – Other Commonly Used Semiconducting materials - Carrier concentration in Intrinsic Semiconductors (Electron and Hole Density) – Band Gap Determination – Carrier Transport in Semiconductors – Drift, Mobility and Diffusion – Hall effect – Determination of Hall Coefficient and its Applications – Dilute Magnetic Semiconductors (DMS) & their Applications construction, working and characteristics of semiconductor diode, Zener diode, transistor (n-p-n and p-n-p transistor), Transistor characteristics (CB, CE, CC), JFET (Construction and its characteristics).

UNIT IV MAGNETIC & DIELECTRIC PHYSICS **9 Hrs**

Magnetic Materials: Types – Comparison of Dia, Para and Ferro Magnetism – Heisenberg's interpretation – Domain theory – Hysteresis – Soft and Hard Magnetic Materials – Application of Magnetic Resonance Imaging – Important Magnetic, Insulating & Ferro electric materials.

Dielectric Materials: Electrical Susceptibility – Dielectric Constant – Concept of Polarization – Frequency and Temperature Dependence of Polarization – Dielectric loss – Dielectric breakdown – Commonly used Dielectric materials and their practical applications.

UNIT V OPTO ELECTRONICS **9 Hrs**

Properties & Classification of Optical Materials – Absorption in Metals, Insulators & Semiconductors – Composite Materials – Nano Materials – Bio Materials – MEMS – NEMS – LED's – Organic LED's – LCD's – Laser diodes – Photodetectors – Tunneling – Resonant Tunneling Diodes (RTD's) – Carbon Nanotubes – Various Ttypes of Optical Materials with Properties.

Total Number of Hours: 45

TEXT BOOKS & REFERENCE BOOKS

1. *V. Rajendran&Mariakani "Materials Science", Tata McGraw Hill (2004).*
2. *P.K.Palanisamy," Materials science", Scitech Publication(2002).*
3. *Dr. SenthilKumar,"Engineering Physics II" VRB Publishers (2016).*
4. *V. Arumugam, Materials Science", Anuradha Agencies, (2003 Edition).*
5. *Pillai S.O., "Solid State Physics", New Age International, (2005).*

Subject Code	Subject Name : TECHNICAL CHEMISTRY	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBCH22001	Prerequisite: Engg. Chemistry	Ty	3	0/0	0/0	3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- Toidentify the application of semiconductors in optics and solar cells.
- To analyze the radical improvement in electrical energy storage devices.
- To understand the degradation of electrical fittings and metallic joints.
- To solve chemical problems by simulation.
- To differentiate the various engineering materials by understanding its properties.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Paraphrase the engineering knowledge by identifying proper chemical science technique.
CO2	Interpret appropriate solution for complex problems by using modern engineering and IT tools.
CO3	Retrieve and show the design solutions for safety and sustainable development.
CO4	Integrate the electrical and electronic concepts with professional ethics.
CO5	Articulate the technological changes recognizing the need for lifelong learning.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2		3							
CO2	3		3	3	3							
CO3	3		3	3			3	2				
CO4	3							3				3
CO5	3		3				3					2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	2	3	3
CO3	3	2	3	3
CO4	3	2	3	3
CO5	3	2	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
	✓								

Subject Code	Subject Name : TECHNICAL CHEMISTRY	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBCH22001	Prerequisite: Engg. Chemistry	Ty	3	0/0	0/0	3

UNIT I CHEMISTRY OF SEMICONDUCTORS 9 Hrs

Semiconductors – Introduction – holes and electrons-Band theory-properties of semi conductors-Types of semiconductors-Intrinsic-Extrensic semiconductors -Mobility of electrons and Holes -Fermi level in Semiconductors- Industrial application of Semiconductors-Semiconductors in Optics - LEDs, OLEDs, Semiconductors in solar cells- Types - First generation solar cells - Single crystalline and poly crystalline solar cells -Czochralski Process of single crystalline silicon synthesis

UNIT II ELECTROCHEMICAL CELLS AND BATTERY TECHNOLOGY 9 Hrs

Electrochemical cells: Galvanic cell (Daniel cell);Batteries: Classification of batteries, primary batteries (dry cells) and secondary batteries -nickel-cadmium ,lead-acid battery, Solid state batteries – Lithium battery, Lithium Sulphur battery, Fuel cells.

UNIT III DEVICECORROSION 9 Hrs

Introduction – chemistry of IC and PCB- causes of corrosion on IC, PC-miniaturization, complex material utilization, production and service factors –environmental contamination (airborne contaminants) - Forms of corrosion – anodic, cathodic corrosion- Electrical Contact and metallic joints degradation- fretting corrosion - corrosion costs – corrosion protection of computer hardware.

UNIT IV COMPUTATIONAL CHEMISTRY 9 Hrs

Introduction, Software tools available for chemistry and its applications, Chem Draw- Designing a Chemical Structure- Shortcuts and Hotkeys on designing a chemical structure, Biopolymer Drawing, Advanced drawing Techniques. Structure Analysis, Creating 3D Models, Estimating and displaying Proton and carbon-13 NMR chemical shifts, Creating TLC Plates to find Rf values, Chem Draw/Excel functions.

UNIT V MODERN ENGINEERING MATERIALS FOR ELECTRONIC DEVICES 9 Hrs

Alloys and Need for Alloys - Modern Electronic grade alloys-Applications in electrical components, transducers, electromagnetic shielding of computers, telecommunications equipment and rocket motor casings. Thin films- Preparation by the Sol-Gel Method-Application of thin films.

Total Number of Hours: 45

REFERENCES

1. *Oleg Roussak & H. D. Gesser, Applied Chemistry: A Textbook for Engineers and Technologists, Springer.*
2. *Samuel Glasstone, An Introduction of Electrochemistry, Franklin Classics Trade Press.*
3. *Kharton V.V, Solid state electrochemistry II: Electrodes, interfaces and ceramic membranes, Wiley*
4. *Jain and Jain, Engineering Chemistry, Dhanpat Rai Publishing Company.*
5. *Chemdraw 16.0 User Guide ,Perkin Elmer Informatics Inc.*
6. *Rolf E. Hummel, Electronic Properties of Materials, Springer*

Subject Code	Subject Name : ENGINEERING GRAPHICS	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBME22001	Prerequisite : Nil	ETL	2	0/0	2/0	3

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- To acquire knowledge in geometrical drawing.
- To expose the students in computer aided drafting.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Utilize the concept of Engineering Graphics Techniques to draft letters, Numbers, Dimensioning in Indian Standards
CO2	Demonstrate the drafting practice visualization and projection skills useful for conveying ideas in engineering applications.
CO3	Identify basic sketching techniques of engineering equipments
CO4	Demonstrate the projections of Points, Lines, Planes and Solids. And
CO5	Draw the sectional view of simple building drawing.

Mapping of Course Outcome with Program Outcome (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2			3	3		3
CO2	3	3	3	2	2	2			3	3		3
CO3	3	3	3	1		2			2	2		2
CO4	3	3	2	2		3		2	3	3		3
CO5	3	3	3	2	3	1		2	3	3		3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2
CO2	1	2	3	1
CO3	2	2	3	2
CO4	1	2	3	1
CO5	2	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
		✓							

Subject Code	Subject Name : ENGINEERING GRAPHICS	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBME22001	Prerequisite : Nil	ETL	2	0/0	2/0	3

CONCEPTS AND CONVENTIONS (Not for examination) **5 Hrs**

Introduction to drawing, importance and areas of applications – BIS standards – IS: 10711 – 2001 : Technical products Documentation – Size and layout of drawing sheets – IS 9606 – 2001: Technical products Documentation – Lettering – IS 10714 & SP 46 – 2003: Dimensioning of Technical Drawings – IS : 15021 – 2001 : Technical drawings – Projections Methods – drawing Instruments, Lettering Practice – Line types and dimensioning – Border lines, lines title blocks Construction of polygons – conic sections – Ellipse, Parabola, Hyperbola and cycloids.

UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES **12 Hrs**

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – projection of polygonal surface and circular lamina in simple position only.

UNIT II PROJECTION OF SOLIDS **10 Hrs**

Projection of simple solids like prism, pyramid, cylinder and cone in simple position

Sectioning of above solids in simple vertical position by cutting plane inclined to any one of the reference plane and perpendicular to the other.

UNIT III DEVELOPMMENT OF SURFACES **9 Hrs**

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders, and cones.

UNIT IV ISOMETRIC PROJECTION **9 Hrs**

Principles of isometric projection – isometric scale – isometric projections of simple solids, like prisms pyramids, cylinders and cones.

UNIT V ORTHOGRAPHICS PROJECTIONS **8 Hrs**

Orthographic projection of simple machine parts – missing views

BUILDING DRAWING **7 Hrs**

Building components – front, Top and sectional view of a security shed.

(Basic Auto CAD commands to be taught- not for Examinations)

Total Number of Hours: 60

Note: First angle projection to be followed.

TEXT BOOKS

1. Bhatt, N.D. and Panchal, V.M. (2014) Engineering Drawing Charotar Publishing House
2. Gopalakrishnan, K.R. (2014) Engineering Drawing (Vol.I& II Combined) Subhas Stores, Bangalore.
3. Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.

Subject Code: EBEC22001	Subject Name : CIRCUIT THEORY	Ty / Lb/ ETL/IE	L	T / SLr	P/ R	C
	Prerequisite: Mathematical Knowledge, Basic Electrical Concepts	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To understand the concept of circuit elements lumped circuits, waveforms, circuit laws and network reduction
- To solve the electrical network using mesh and nodal analysis by applying network theorems
- To learn methods of circuits analysis in time domain and frequency domain
- To understand the concept of resonance in Series and parallel circuits and to know the concepts of coupled circuits.
- Obtaining equations to solve circuits in steady state and transient state

COURSE OUTCOMES (COs) : (3- 5)

The student will be able to

CO1	Analyze and solve a given electrical networks using mesh and nodal analysis.
CO2	Done their inferences to analyze circuits analysis in time domain and frequency domain.
CO3	Understand the concept of circuits, network theorems and various circuit laws.
CO4	Apply their understanding to derive the analyze the equations with respect to solving circuit transients.
CO5	Demonstrate their skills in understanding the concept of various resonance and coupled circuits

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3	3	3
CO5	3	3	3	3	3	2	3	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code: EBEC22001	Subject Name : CIRCUIT THEORY	Ty / Lb/ ETL/IE	L	T / SLr	P/ R	C
	Prerequisite: Mathematical Knowledge, Basic Electrical Concepts	Ty	3	0/0	0/0	3

UNIT I BASIC CIRCUIT CONCEPTS **9 Hrs**

V-I Relationships Of R, L And C – Independent Sources – Dependent Sources – Kirchhoff's Laws - Simple Resistive Circuits – Network Reduction – Voltage Division – Current Division – Source Transformation. Formation of Matrix Equations and Analysis Using Mesh-Current and Node-Voltage Methods.

UNIT II AC FUNDAMENTALS **9 Hrs**

AC Quantity, Phasor Representation – Analysis Of Simple Series And Parallel Circuits – Power And Power Factor – Analysis Mesh Current And Node Voltage Methods – Series Resonance And Parallel Resonance

UNIT III NETWORK THEOREM AND DUALITY **9 Hrs**

Useful Circuit Analysis techniques - Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Super position theorem –principle of duality.

UNIT IV TRANSIENT ANALYSIS **9 Hrs**

Transient Concepts-Behavior Of Circuit Elements Under Switching Conditions and Their Representation-Forced and Free Response of RL, RC And RLC Circuits with D.C. And Sinusoidal Excitations Using Laplace Transform Method – Natural Frequency and Damping Factor.

UNIT V COUPLED CIRCUITS AND TOPOLOGY **9 Hrs**

Mutual Inductance – Coefficient Of Coupling – Ideal Transformer – Single & Double Tuned Circuits – An introduction to Network Topology, Trees and General Nodal analysis

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS :

1. A.Sudhakar & Shyanmugam S.Palli *"Circuits & Network Analysis & Synthesis"*, 4th Edition, Tata McGraw Hill, 2010
2. Bruce Carlson, "*Circuits: Engineering Concepts and Analysis of Linear Electric Circuits*", Thomson Learning, 1st Edition, 2002
3. M.L Soni & J.C. Gupta, "*Electric Circuit Analysis"*, Dhanpat Rai & Sons , New Delhi, 1999.

REFERENCE BOOKS:

1. *Hyatt, W.H. Jr and Kimmerly, J.E., "Engineering Circuits Analysis", McGraw Hill International Editions,1993.*
2. *Edminister, J.A., "Theory and Problems of Electric Circuits", Schaum's Outline Series McGraw Hill Book Company, 2nd Edition, 1983.*
3. *Paranjothi S.R., "Electric Circuit Analysis", New Age International Ltd., Delhi, 2nd Edition, 2000.*
4. *Artice.M. Davis, "Linear Circuits Analysis", Thomson Learning 2002*
5. *5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010*
6. *Roy Choudhury, "Networks and Systems", New Age International Ltd, 1992*

Subject Code	Subject Name : COMMUNICATIVE ENGLISH LAB	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I02	Prerequisite : Pass in Plus 2 English	IE	1	0/0	1/0	1

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES

- To engage students in meaningful oral English communication and organized academic and professional reading and writing for a successful career.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Engage in meaningful oral communication in English with writing as a scaffolding activity.
CO2	Have an in-depth understanding of the components of English language and its use in oral communication.
CO3	Strengthen their vocabulary and syntactic knowledge for use in academic and technical communication
CO4	Learn to negotiate meaning in inter-personal and academic communication for a successful career.
CO5	Engage in organized academic and professional writing for life-long learning and research

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	1	3	2	1	1	3	3	-	3
CO2	2	1	1	1	3	3	1	2	3	3	1	2
CO3	1	1	1	1	2	1	-	2	3	3	1	3
CO4	1	-	-	2	3	1	2	1	2	2	-	3
CO5	-	1	1	2	3	1	1	-	3	1	1	2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1		3	3
CO2	2	1	3	2
CO3	1	1	3	3
CO4	1		3	3
CO5		1	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
			✓						

Subject Code	Subject Name : COMMUNICATIVE ENGLISH LAB	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I02	Prerequisite : Pass in Plus 2 English	IE	1	0/0	1/0	1

UNIT I LISTENING **6 Hrs**

Authentic audios and videos

Prescribed Book: English Pronunciation in use – Mark Hancock,

UNIT II SPEAKING **6 Hrs**

Individual- Solo: Self introduction, Describing, anchoring, welcome address, vote of thanks,

Pair & Group: Role play- formal -informal, narrating stories, film review, analysing newspaper headings and reports, interpreting Advertisement pamphlets

Group discussion, mock interviews, formal presentation, power point presentation

Prescribed Book: J. C. Richards with J. Hull &S.Proctor, Interchange, Cambridge University Press, 2015.

UNIT III READING **6 Hrs**

Extensive, focused reading,

Strategies for effective reading - Reading comprehensions – Note making- summarising- paraphrasing, Review

Suggested reading: Short stories, news paper reports, film reviews

UNIT IV WRITING **6 Hrs**

Extensive writing practices – note taking, Cognitive and metacognitive strategies to inculcate a sense of organising ideas into coherent sentences and paragraphs, Formal letters, Business letters. Resume with covering letter

UNIT V NON VERBAL COMMUNICATION/ CHARTS, DIAGRAMS AND TABLE **6 Hrs**

Interpretation of charts Flow chart, pie chart, bar diagram, table, tree diagram, etc.,

Total Number of Hours: 30

PRESCRIBED TEXT:

1. J. C. Richards with J. Hull &S.Proctor, Interchange, Level 2, Cambridge University Press, 2021.
2. M. Chandrasena Rajeswaran & R.Pushkala, English - Communication Lab Work book

REFERENCE

1. *Hancock, Mark, English Pronunciation in Use; Cambridge Univ. Press, 2013*
2. *Dutt, K, Rajeevan, G & Prakash, CLN 2008, A Course on Communication Skills, 1st edn, Cambridge University Press, Chennai*

Subject Code	Subject Name : PYTHON PROGRAMMING	Ty / Lb/ ETL/IE	L	T / S.Lr	P/ R	C
EBCS22ET2	Prerequisite: C Programming and Ms Office Tools	ETL	1	0/0	2/0	2

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE : The student should be made to:

- Develop a basic understanding of programming and the Python programming language
- Write programs in Python to solve real world problems
- See the value of programming in a variety of different disciplines,especially as it relates in engineering.

COURSE OUTCOMES (COs) : After Completing the course, the student can be able to

CO1	Remember the syntax and semantics of python programming language
CO2	Understand how functional and operations are to be utilized
CO3	Applythe fundamental programming constructs like variables, conditional logic, looping, and functions to build basic programs
CO4	design object-oriented programs with Python classes
CO5	Apply the knowledge to solve various real world problems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	1	0	1	1
CO2	3	2	2	2	2	1	1	1	1	0	1	1
CO3	3	2	2	2	2	1	1	1	1	0	1	1
CO4	3	3	3	2	2	1	2	0	2	0	2	2
CO5	3	3	3	3	2	1	2	0	2	0	2	2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2
CO2	2	2	3	2
CO3	1	2	3	2
CO4	1	2	3	1
CO5	3	2	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
		✓							

Subject Code	Subject Name : PYTHON PROGRAMMING	Ty / Lb/ ETL/IE	L	T / SLr	P/ R	C
EBCS22ET2	Prerequisite: C Programming and Ms Office Tools	ETL	1	0/0	2/0	2

UNIT I INTRODUCTION **9 Hrs**

History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

UNIT II TYPES, OPERATORS AND EXPRESSIONS **9 Hrs**

Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass.

UNIT III FUNCTIONS **9 Hrs**

Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

UNIT IV LISTS, TUPLES, DICTIONARIES **9 Hrs**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V OBJECT ORIENTED PROGRAMMING OOP IN PYTHON **9 Hrs**

Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.

Total Number of Hours: 45

TEXT BOOKS:

1. Python Programming: A Modern Approach, VamsiKurama, Pearson.
2. Think Python:How to Think Like a Computer Scientist'', 2nd editionUpdated for Python 3, Shroff/O'Reilly Publishers,Allen B. Downey
3. Learning Python, Mark Lutz, Orielly.

REFERENCE BOOKS:

1. *Core Python Programming, W.Chun, Pearson.*
2. *Introduction to Python, Kenneth A. Lambert, Cengage.*

List of Experiment : Python Programming.

1. Develop a python program to find the area and circumference of a circle.
2. Develop a python program to check if the number is positive or negative or zero using nested if else statement.
3. Develop a python program to find the GCD(Greatest Common Divisor) of two numbers.
4. Develop a Python program using function to compute the factorial of a given number.
5. Develop a Python program to find the sum of square of individual digits of a number using function.
6. Develop a Python program to find the largest digit from a number using function.
7. Develop a Python program to display only the positive elements of the list.
8. Develop a Python program to accept any number and print it in words.
9. Develop a Python program to subtract two matrices.
10. Develop a Python program to perform matrix multiplication.

Subject Code:	Subject Name: ENVIRONMENTAL SCIENCE	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I03	Prerequisite: Nil	Audit Course-IE	1	0/0	1/0	0

C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical
R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVES:

- To acquire knowledge of the Environment and Ecosystem & Biodiversity
- To acquire knowledge of the different types of Environmental pollution
- To know more about Natural Resources
- To gain understanding of social issues and the Environment
- To attain familiarity of human population and Environment

COURSE OUTCOMES (COs): (3 – 5)
Students completing the course were able to

CO1	Know about Environment and Ecosystem & Biodiversity
CO2	Comprehend air, water, Soil, Marine, Noise, Thermal and Nuclear Pollutions and Solid Waste management and identify the importance of natural resources like forest, water, and food resources
CO3	Discover water conservation and watershed management
CO4	Identify its problems and concerns climate change, global warming, acid rain, ozone layer depletion etc.,
CO5	Explain family welfare programmes and role of information technology in human health and environment

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						2	3	2				1
CO2						2	3			2		1
CO3						2	3	2				1
CO4						2	3	2		2		1
CO5						2	3			2		1

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2		1	2
CO2	2		1	2
CO3	2		1	2
CO4	2		1	2
CO5	2		1	2

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
			✓						

Subject Code:	Subject Name: ENVIRONMENTAL SCIENCE	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I03	Prerequisite: Nil	Audit Course-IE	1	0/0	1/0	0

UNIT I ENVIRONMENT AND ECOSYSTEM **3 Hrs**

Definition, Scope and Importance of environment – need for public awareness – concept, structure and function of an ecosystem- producers, consumers and decomposers – energy flow in the ecosystem. Biodiversity at national and local levels – India

UNIT II ENVIRONMENT POLLUTION **3 Hrs**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Nuclear hazards (g) E-Wastes and causes, effects and control measures

UNIT III NATURAL RESOURCES **3 Hrs**

Forest resources: Use and over-exploitation, deforestation. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **3 Hrs**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **3 Hrs**

Population growth, variation among nations – population explosion, environment and human health – human rights – value education – HIV/AIDS – women and child welfare – role of information technology in environment and human health

(A) AWARENESS ACTIVITIES **9 Hrs**

i) small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
ii) Slogan making event
iii) Poster making event
iv) Cycle rally
v) Lectures from experts

(B) ACTUAL ACTIVITIES:

i) Plantation
ii) Gifting a tree to see its full growth
iii) Cleanliness drive
iv) Drive for segregation of waste
v) To live some big environmentalist for a week or so to understand his work
vi) To work in kitchen garden for mess
vii) To know about the different varieties of plants
viii) Shutting down the fans and ACs of the campus for an hour or so

Total Number of Hours: 30

TEXT BOOKS

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).

2. Benny Joseph, 'Environmental Science and Engineering', Tata McGrawHill,NewDelhi, (2006).

REFERENCES

1. *Vairamani, S. and Dr. K. Sankaran. Elements of Environmental and Health Science.Karaikudi: KPSV Publications, 5th Edition, July 2013.*
2. *Ifthikarudeen, Etal, Environmental Studies, Sooraj Publications,2005.*
3. *R.Murugesan, Environmental Studies, Millennium Publishers and Distributors, 2nd Edition, July, 2009.*

SEMESTER – III

Subject Code:	Subject Name : ELECTRICAL AND INSTRUMENTATION ENGINEERING	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBEE22ID2	Prerequisite: Circuit Theory	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- Constructional details, principle of operation, performance, starters and testing of D.C. machines.
- To illustrate the operating principle and performance of transformers.
- Constructional details, principle of operation and performance of AC rotating machines.
- To summarize the operating principle of alternators and special machines.
- Constructional details and principle of operation electrical measuring instruments
- Constructional details and principle of operation electronic measuring instruments

COURSE OUTCOMES (COs) :

CO1	Illustrate the working principle of DC machines.
CO2	Analyze the losses, efficiency and voltage regulation of transformers.
CO3	Identify the appropriate rotating machines for various applications
CO4	Explain the types and operating principles of electrical measuring instruments
CO5	Interpret the features of various electronic instruments

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	2	1	2	2	2	1
CO2	3	3	3	3	2	2	2	1	2	1	2	1
CO3	3	3	2	3	3	3	2	2	2	2	3	2
CO4	3	2	3	3	3	3	2	2	3	2	3	3
CO5	3	3	3	3	3	3	2	2	3	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	2	3	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
							✓		

Subject Code:	Subject Name : ELECTRICAL AND INSTRUMENTATION ENGINEERING	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
EBEE22ID2	Prerequisite: Circuit Theory	Ty	3	0/0	0/0	3

UNIT I D.C MACHINES **9 Hrs**

Introduction – Constructional Features– Motor and Generator mode - EMF and Torque equation –Starting and Speed Control-Testing And Efficiency – Losses in DC Machines -Brushless DC Motors- Universal Motor – Stepper Motor –Servo Motor - Tachogenerator - Linear Induction Motor

UNIT II TRANSFORMERS **9 Hrs**

Introduction - Ideal and Practical Transformer - EMF Equation – Phasor diagram– Per Unit System – Equivalent circuit- Testing- - Losses and Efficiency – Voltage Regulation – Three Phase Transformers –Auto Transformers, Advantages- Harmonics.

UNIT III AC ROTATING MACHINES **9 Hrs**

Principle of operation of three-phase induction motors – Construction –Types –Single phase Induction motors -Construction– Types–starting methods. Alternator: Working principle–Equation of induced EMF Synchronous motors- working principle-starting methods – Torque equation.

UNIT IV MEASUREMENTS USING ELECTRICAL INSTRUMENTS **9 Hrs**

Functional elements of an instrument-Standards and calibration- Operating Principle -types - Moving Coil and Moving Iron meters-Measurement of three phase power -Energy Meter- Instrument Transformers-CT and PT-DSO- Block diagram- Data acquisition

UNIT V MEASUREMENTS USING ELECTRONIC INSTRUMENTS **9 Hrs**

Electronic Instruments: CRO: -Measurements of Voltage & Frequency, Function generator:- Frequency Measurements in Various Range and Wave Form : Power Supply: -Fixed and Variable :Multi-meter:- Measurement of Voltage ,Current, Frequency, R,L,C : IC tester:-Linear ICs and Non Linear ICs

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Mulukutla.S.Sarma, “Electric Machines, Stead state theory and dynamic Performance", 2nd Edition Thomson Learning 1997
2. S.K Bhattacharya, “Electrical Machines”, 3rd Edition Tata McGraw Hill Publications 2008.
3. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, New Delhi, 2015.

REFERENCES:

1. *I.J. Nagrath & D.P. Kothari, “Electrical Machines”, Tata McGraw Hill Publications, Second Edition 1997.*
2. *Nasar S.A, “Electrical Machines & Power Systems”, TMH Publications*
3. *I McKenzie Smith ,“Hughes Electrical Technology”, Revised Low price Edition, Pearson Education, Seventhedition.*
4. *Irving I.Kosow, “Electric Machinery and Transformers”, PHI, Second Edition, 2001*

Subject Code:	Subject Name: SIGNALS AND SYSTEMS	Ty / Lb/ ETL/IE	L	T/ SLr	P/R	C
EBEC22002	Prerequisite: Mathematics I & II	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study the representation of discrete and continuous signals and systems.
- To study the analysis of continuous time systems using Laplace and Fourier transforms.
- To study the analysis of discrete time systems using DFT and Z transforms.

COURSE OUTCOMES (COs) : (3- 5)

The student will be able to

CO1	Classify continuous and discrete time signals and systems.
CO2	Analyze continuous signals and its spectrum with transforms.
CO3	Determine the response of continuous time systems with transforms and state variable approach.
CO4	Analyze discrete signals and its spectrum with transforms.
CO5	Determine the response of discrete time systems with transforms and state variable approach.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3		2			2	2	2
CO2	3	3	3	3	3		2			2	2	2
CO3	3	3	3	3	3		2			2	2	2
CO4	3	3	3	3	3		2			2	2	2
CO5	3	3	3	3	3		2			2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1
CO2	3	2		1
CO3	3	2		1
CO4	3	2		1
CO5	3	2		1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name: SIGNALS AND SYSTEMS	Ty / Lb/ ETL/IE	L	T/ SLr	P/R	C
EBEC22002	Prerequisite: Mathematics I & II	Ty	3	1/0	0/0	4

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 12 Hrs

Continuous Time Signals (CT signals), Discrete Time Signals (DT Signals) –Standard signals Step, Ramp, Pulse, Impulse, Exponential, and Sinusoids,Operations on signals . Classification of CT and DT signals – Periodic and aperiodic, Deterministic and Random signals, Energy & Power signals, Classification of Systems –CT Systems and DT Systems -Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable - Linear Time Invariant Systems(LTI).

UNIT II ANALYSIS OF C.T SIGNALS 12 Hrs

Fourier Series Analysis,Trigonometric Fourier Series and Exponential Fourier Series -Dirichlet's conditions - Spectrum of C.T. Signals, Fourier Transform and Laplace Transform – Properties of Fourier Transform - Inverse Laplace Transform - Applications in Signal Analysis.

UNIT III LTI – CT SYSTEMS 12 Hrs

Differential Equation, Block Diagram Representation, Impulse Response, Step Response, Convolution Integral, Frequency Response, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal - Fourier and Laplace Transforms in Signal Analysis, State Equations and Matrix.

UNIT IV ANALYSIS OF D.T. SIGNALS 12 Hrs

Spectrum of D.T. Signals, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Properties of DFT, Properties of Z – Transform in Signal Analysis, Inverse Z-Transform.

UNIT V LTI – DT SYSTEMS 12 Hrs

Difference Equations, Block Diagram Representation, Impulse Response, Finite impulse response (FIR) and Infinite impulse response (IIR) Convolution, Frequency Response, Z – Transform Analysis, Realization of Digital Filters – Direct Form-I, Direct Form-II, Transposed, Parallel, Cascade Structure, State Variable Equation and Matrix.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXTBOOKS:

1. Alan V Oppenheim, "*Signals and Systems*", Prentice Hall of India Pvt. Ltd, 2nd Edition, 1997.
2. Simon Haykin and Barry Van Veen ," Signals and Systems", John Wiley and Sons, Inc., 1999
3. Hwei P. Hsu, Schaum's Outline Series, "*Signals and Systems*", Mc Graw Hill Companies, 2nd Edition.

REFERENCE BOOKS:

1. *Douglas K Lindner, "Signals and Systems", McGraw Hill International, 1999.*
2. *Roger E. Zeimer et al, "Signals and Systems": Continuous and Discrete, McMillan, 2nd Edition, 1990*
3. *Robert A. Gabel and Richard A. Roberts,"Signals and Linear Systems", John Wiley, 3rd Edition, 1987*

Subject Code:	Subject Name : DIGITAL ELECTRONICS	T y/ Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22003	Prerequisite: None	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To give a conceptual understanding about the Digital fundamentals, Boolean algebra and its applications in digital systems.
- To familiarize with the design of various combinational digital circuits using logic gates.
- To introduce the analysis and design procedure for synchronous and asynchronous sequential circuits.
- To explain various semiconductors memoriesnand relate technology.
- To introduce the electronic circuits involved in making of logic gates.

COURSE OUTCOMES (COs) : (3- 5)

The Student will be able to

CO1	Apply Boolean Algebra, Karnaugh map and Quine McCluskey methodology to minimize the given Boolean functions.
CO2	Design and implement combinational logic circuits.
CO3	Design and analyze the synchronous sequential circuits.
CO4	Design and analyze the asynchronous sequential circuits
CO5	Compare different types of logic families based on their characteristics and summarize types of semiconductor memories.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	3	2	-	-	-	-	-
CO2	3	3	3	2	3	3	2	-	-	-	2	2
CO3	3	3	3	2	3	3	2	-	-	-	2	2
CO4	3	3	3	2	3	3	2	-	-	-	2	2
CO5	3	1	1	1	1	3	2	-	-	-	-	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	2	2	2	2

3/2/1 indicates Strength of Correlation 3- High,2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : DIGITAL ELECTRONICS	T y/ Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22003	Prerequisite: None	Ty	3	1/0	0/0	4

UNIT I DIGITAL FUNDAMENTALS **12 Hrs**

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1 s and 2 s complements, Codes –Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms,Minimization using Karnaugh map, and Quine-McCluskey method.

UNIT II COMBINATIONAL LOGIC **12 Hrs**

Design of Combinational Logic Circuits – Half adder – Full adder, Half Subtractor,Full Subtractor–Binary parallel adder-Carry lookahead adder-BCD adder– Code Converters – Multiplexer – Demultiplexer- Encoder – Decoder –Magnitude comparator

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS **12 Hrs**

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Triggering of FF, – Design - Moore/Mealy models, state minimization, state assignment,State Reduction techniques- Design of Counters- Ring Counters, Shift registers,analysis of clocked sequential circuits.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS **12 Hrs**

Design of asynchronous sequential circutis-Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Design of Hazard free circuits.

UNIT V LOGIC FAMILIES **12 Hrs**

Basic memory structure – ROM -PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) -Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA, PAL.Digital logoc families, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics- TTL, ECL, CMOS-Operation and its Characteristics.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXTBOOKS:

1. Charles H. Roth, "*Fundamentals of Logic Design*", cengageLearning, 5th Edition
2. FLOYD:"*Digital Fundamentals*", 10th Edition Universal Book Stall, New Delhi.1993
3. Morris Mano, "*Digital Electronics and Design*", Prentice Hall of India, 2000 .
4. A.AnandKumar ―Fundamentals of Digital Circuits‖, 4th Edition, PHI Learning Private Limited, 2016.
5. Soumitra Kumar Mandal ― Digital Electronics‖, McGraw Hill Education Private Limited,2016.

REFERENCE BOOKS:

1. *John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008*
2. *Jayadeep Chakravarthy "Digital electronics and logic design", Universities press.(2012)*
3. *John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.*
4. *Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.*
5. *Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.*
6. *Donald D.Givone, "Digital Principles and Design", TMH, 2003*

Subject Code:	Subject Name : C++ AND JAVA PROGRAMMING	Ty /Lb/ ETL	L	T/SLr	P/R	C
EBCS22ID2	Prerequisite: C Programming and MS Office Tools	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To introduce the Object Oriented Programming concepts using C++ and JAVA
- To understand object oriented programming concepts, and apply them in solving problems.
- To introduce the concepts of exception handling and multithreading
- To analyze basic data structures as well as programming techniques and algorithms that operates on them.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand fundamentals of C++ programming such as variables, conditional and iterative execution, methods, etc.
CO2	Analyze the use of function to create programs and evaluate the concepts of inheritance and polymorphism
CO3	Identify the basic concepts of Java programming
CO4	Design and development of programs for File and exceptions handling using JAVA
CO5	Evaluate the concepts data structures and corresponding algorithms

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	3	2	3	2		2		3	2
CO2	2	3	3	3	3	3	3		3	1	3	2
CO3	2	3	3	3	3	3	3		3	1	3	2
CO4	2	3	3	3	3	3	3		3	1	3	2
CO5	2	3	3	3	3	3	3		3		3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3
CO2	3	1	3	3
CO3	3	1	3	3
CO4	3	1	3	3
CO5	2	1	3	3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
							✓		

Subject Code:	Subject Name : C++ AND JAVA PROGRAMMING	Ty /Lb/ ETL	L	T/SLr	P/R	C
EBCS22ID2	Prerequisite: C Programming and MS Office Tools	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO C++ 9 Hrs

Programming Paradigms - Key Concepts of OOP - Advantages of OOP - Usage of OOP -Evolution of C++ - Input and Output in C++-Streams-Stream classes-Keywords, Identifiers, Variables, Operators, Expressions and Control Structures: If, If. Else, Switch - Repetitive Statements- for, while, do…while - arrays

UNIT II CLASSES, INHERITANCE & TEMPLATES 9 Hrs

Main Function – Parts of function - Parameters Passing in Functions - Function Overloading - Constructors and Destructors- types -Operator Overloading - Inheritance - Pointers - Virtual Functions and Polymorphism

UNIT III INTRODUCTION TO JAVA 9 Hrs

Introduction to Java : Basics of Java programming- Data types- Variables –Operators -Control structures Decision making- Looping control- Math class-string class-Arrays in java

UNIT IV FILE AND EXCEPTION HANDLING 9 Hrs

File handling in java- Character stream – Java File class methods – File operations –Exception handling- Exceptions Methods-Catch-throw-Finally

UNIT V DATASTRUCTURES USING JAVA 9 Hrs

Array-One Dimensional -Two Dimensional-Linked list-Single-Doubly-circular- Stack- Queue- Trees –Graphs

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill..
2. Java Fundamentals – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
3. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education.
4. Weiss, Mark Allen (2012). Data Structures and Algorithm Analysis in Java. 3rd ed. Prentice Hall

REFERENCE BOOKS:

1. *OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream Tech Press.*
2. *Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd.*
3. *Java for Programmers, P. J. Deitel and H. M. Deitel, Pearson education (OR) Java: How to Program P. J. Deitel and H. M. Deitel, PHI.*
4. *Object Oriented Programming through Java, P. Radha Krishna, Universities Press.*
5. *Data Structures and Algorithms in Java,Robert Lafore ,Sams Publishing.*

Subject Code:	Subject Name: UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	Ty / Lb/ ETL/IE	L	T/ SLr	P/R	C
EBCC22ET1	Prerequisite: None	ETL	1	0/0	2/0	2

L:LectureT :Tutorial SLr: Supervised Learning P:Project R:ResearchC:Credits
T/L/ETL: Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

Human Values Courses: During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

- Development of a holistic perspective based on self- exploration about themselves (humanbeing), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSEOUTCOMES(Cos) :(3–5) The students will be able to

CO1	Relate self and surroundings and identify responsibility in life
CO2	Associate human relationship and nature to handle problems and provide sustainable solutions
CO3	Develop critical ability and engage in reflective and independent Thinking
CO4	Show commitment towards understanding of values
CO5	Apply Human values in day to day setting in real life

Mapping of Course Outcomes with Program Outcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1	1		2	1		1	1		2
CO2			2	2	1	2	3	1		2		2
CO3			1	1	1	2			1	2		3
CO4			2		1	1	1	3	1	1		3
CO5			1			2	1	2	1	1		3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1			1	
CO2			1	
CO3			1	
CO4			1	
CO5			1	

3/2/1indicatesstrengthofcorrelation3 –High,2–Medium,1– Low

Category	BasicSciences	EnggSciences	Humanities &SocialSciences	ProgramCore	ProgramElectives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
			✓						

Subject Code:	Subject Name: UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	Ty / Lb/ ETL/IE	L	T/ SLr	P/R	C
EBCC22ET1	Prerequisite: None	ETL	1	0/0	2/0	2

UNIT I INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION **9 Hrs**

Purpose and motivation for the course, recapitulation from Universal Human Values-I. - Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. - Continuous Happiness and Prosperity- A look at basic Human Aspirations - Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario - Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF! **9 Hrs**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. - Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). - Understanding the characteristics and activities of 'I' and harmony in 'I'. - Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. - Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available tome. Identifying from one's own life.

Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP **9 Hrs**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship - Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE WHOLE EXISTENCE AS COEXISTENCE **9 Hrs**

Understanding the harmony in the Nature - Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. - Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. - Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS **9 Hrs**

Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. -

Case studies of typical holistic technologies, management models and production systems - Strategy for transition from the present state to Universal Human Order: (a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, (b) At the level of society: as mutually enriching institutions and organizations

Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

Total Number of Hours: 45

TEXT BOOK

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS

1. *Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.*
2. *Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.*
3. *The Story of Stuff (Book).*
4. *The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.*
5. *Small is Beautiful - E. F Schumacher.*
6. *Slow is Beautiful - Cecile Andrews*
7. *Economy of Permanence - J C Kumarappa*
8. *Bharat Mein Angreji Raj - PanditSunderlal*
9. *Rediscovering India - by Dharampal*
10. *Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi*
11. *India Wins Freedom - Maulana Abdul Kalam Azad*
12. *Vivekananda - Romain Rolland (English)*
13. *Gandhi - Romain Rolland (English)*

Subject Code:	Subject Name : C++ AND JAVA PROGRAMMING LAB	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBCS22IL1	Prerequisite: C Programming and MS Office Tools	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To make student learn the programming language.
- To make the student learn an object oriented way of solving problems using C++ and java.
- To make student learn fundamentals concepts of

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand OOP concepts and basics of C++ and Java programming.
CO2	Formulate program that uses the concepts arrays and structure and functions
CO3	Construct programs using methods and overloading concepts
CO4	Design programs for file and exception handling

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2		3		3	2
CO2	3	3	3	3	3	2	2		3	1	3	2
CO3	3	3	3	3	3	2	2		3	1	2	2
CO4	2	2	3	3	3	2	3		3		2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3
CO2	3	1	3	3
CO3	3	1	3	3
CO4	3	1	3	3
CO5	2	1	3	3

3/2/1indicatesstrengthofcorrelation3 –High,2–Medium,1– Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
							✓		

Subject Code:	Subject Name : C++ AND JAVA PROGRAMMING LAB	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBCS22IL1	Prerequisite: C Programming and MS Office Tools	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS USING C++

1. Program to check whether the given number is palindrome or not
2. Program to search an element in a given list
3. Program to find factorial of a given number using recursion
4. Program to demonstrate call by value, call by address and call by reference.
5. Program to demonstrate function overloading.
6. Program to demonstrate Constructor Destructor program
7. Program to demonstrate the concept of different inheritance

LIST OF EXPERIMENTS USING JAVA

1. Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer
2. Write a java program to find the Fibonacci series using recursive and non recursive functions.
3. Write a Java program to add two given matrices
4. Write a Java program to demonstrate I/O streams
5. Write a Java program to demonstrate class and methods
6. Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes
7. Write a Java program to implement the concept of exception handling

Total Number of Hours: 45

Subject Code:	Subject Name : DIGITAL ELECTRONICS LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L01	Prerequisite: None	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To design and develop a programmable digital circuit for practical applications

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Develop a simple digital circuits
CO2	Test the working of logic gates and flip flops.
CO3	Implement a digital sequential circuits for real time applications

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	2	2	1	1		1			1
CO2	3	2	3	2	2					1		
CO3	3	2	3	2	2	1	1		2			1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3		3
CO2	3	3		3
CO3	3	3		3

3/2/1indicatesstrengthofcorrelation3 –High,2–Medium,1– Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : DIGITAL ELECTRONICS LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L01	Prerequisite: None	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS:

1. Verification of Truth tables of Logic Gates
2. Implementation of Boolean function
3. Implementation of Half and full Adders
4. Implementation of Half and full Subtractors
5. Implementation of Multiplexers
6. Implementation of Demultiplexers
8. Implementation of Encoder
9. Implementation of Decoders
10. Verification of Flip – Flops
11. Implementation of Shift Registers
12. Implementation of Counters
13. Study of A to D Converters

Total Number of Hours: 45

Subject Code:	Subject Name : ANALYSIS OF SOLID STATE DEVICES	Ty / Lb/ ETL/IE	L	T/ SLr	P/R	C
EBEC22ET1	Prerequisite: None	ETL	2	0/0	2/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the theory of semiconductor devices such as diodes and zener diode
- To study the working and biasing of bipolar junction transistors both PNP and NPN.
- To understand the construction and operation of FET and MOSFET and their biasing.
- To study behavior of power electronic devices like SCR, UJT, etc and photo devices.
- To study the small signal model and analysis of transistors and FET

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Learn semiconductor devices like diodes and zener diode
CO2	Know working and biasing of bipolar junction transistors.
CO3	Understand the construction and operation of FET and MOSFET
CO4	Study the behavior of power electronic and photo electronic devices.
CO5	Analyze transistors and FET using small signal model

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2		1					1
CO2	2	2	2	3		1						1
CO3	3	3	3	3	2	2						1
CO4	3	2	2	2	2		2					1
CO5	3	3	2	2	2	2						2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2
CO2	3	2		
CO3	3	2	2	3
CO4	3	2		3
C05	3	3		3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	program electives	open electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : ANALYSIS OF SOLID STATE DEVICES	Ty / Lb/ ETL/IE	L	T/ SLr	P/R	C
EBEC22ET1	Prerequisite: None	ETL	2	0/0	2/0	3

UNIT I SEMICONDUCTOR DIODE **12 Hrs**

Theory of PN Junction Diode – VI characteristics – Static and Dynamic Resistance – Effect of Temperature on Diodes – Space Charge and Diffusion Capacitance - Zener Diode – Avalanche and Zener Break Down Mechanisms – Zener Diode as a Voltage Regulator.

Experiments: Characteristics of P-N Junction & Zener Diode

UNIT II BJT & BIASING **12 Hrs**

Principles of Transistor Action – Current Components – Cut Off, Active & Saturation Region – I/P& O/P characteristics CE, CB and CC. Small Signal Large Signal 'β', Break Down & Switching Characteristics – Transistor Biasing – Bias Stabilization – Bias Compensation – Thermal Runaway – Design with Heat Sink.

Experiments: I/P & O/P Characteristics of BJT

UNIT III FET& MOSFET **12 Hrs**

Construction Feature & Working Principles of JFET, MOSFET Depletion and Enhancement Mode, Biasing of FET, and MOSFETS, Transmission Gate using CMOS.

Experiments: Characteristics of JFET, MOSFET Characteristics

UNIT IV POWER DEVICES **12 Hrs**

Charge Transfer Device, UJT, SCR, Diac, Triac, GTO, MCT and Introduction to Gallium Arsenide Devices, FinFET, LDR, Photo Voltaic cell, Varactor diode.

Experiments: Characteristics of SCR and UJT

UNIT V SMALL SIGNAL MODEL **12 Hrs**

Small Signal Model of Transistor- Analysis of Amplifiers using Small Signal Model. Common Emitter, Common Base, Common Collector, Common Source, Common Drain, Common Gate, Multistage Amplifiers.

Experiments: Analysis of BJT in CB,CE and CC Configuration

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXTBOOKS:

1. Nandita Das Gupta, Amitava Das Gupta, "*Semiconductor Devices*", Prentice Hall of India, 2005
2. Sedra and Smith, "*Microelectronic Circuits*", Oxford University Press, 2004
3. Mohammed Gausi and Spencer, "*Introduction to Electronics Circuit Design*", Pearson Education, 2004

REFERENCE BOOKS:

1. *Boylestad, Robert. L and NashelskyLouis ," Electronic Devices and Circuit theory",Prentice Hall of India,6th Edition, 2001*
2. *William & Harris, "Electronic Devices and Circuits", Tata McGraw Hill International Editions, 2000*
3. *MillmanHalkias, "Electron Devices", Tata McGraw Hill, 2000.*
4. *Donald Neamam, "Microelectronics", Tata McGraw Hill, 2007.*
5. *Sedra Smith, "Micro Electronic Circuits" Fifth edition,201*

SEMESTER – IV

Subject Code	Subject Name : PROBABILITY AND RANDOM PROCESS	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBMA22010	**Prerequisite: Mathematics I & II**	**Ty**	**3**	**1/0**	**0/0**	**4**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- To understand the basic concepts in the Probability like Independent events, mutually exclusive events and so on.
- To understand the various Standard Discrete and Continuous probability distributions.
- To understand the Basic concepts in Random process like Poisson process, Markov process and so on.
- To understand the concepts like Auto correlation and Cross correlation
- To understand the concepts like Cross spectral density

COURSE OUTCOMES (COs) :

CO1	To understand the Basic concepts in Probability
CO2	To understand the Basic concepts in Probability distributions
CO3	To understand the Basic concepts in Random process
CO4	To understand the Basic concepts in Correlation
CO5	To understand the Basic concepts in Spectral density

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	1	2	1	1	2	2	3
CO2	3	2	1	3	1	2	2	1	1	1	2	3
CO3	3	3	2	2	1	1	1	2	1	2	1	3
CO4	3	3	2	3	2	1	2	1	2	2	1	2
CO5	2	3	1	3	2	1	2	2	1	1	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	2
CO2	2	2	1	3
CO3	1	2	2	3
CO4	2	3	2	3
CO5	2	3	1	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
	✓								

Subject Code	Subject Name : PROBABILITY AND RANDOM PROCESS	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
EBMA22010	Prerequisite: Mathematics I & II	Ty	3	1/0	0/0	4

UNIT I RANDOM VARIABLES **12 Hrs**

Baye's Theorem – Applications – Random Variables – Distribution functions – Moments – Moment Generating functions – Chebychev's Inequality (Statement and Applications only) – Function of Random Variables.

UNIT II STANDARD DISTRIBUTIONS **12 Hrs**

Marginal and Conditional Distributions – Applications of Discrete Distributions: Binomial – Poisson – Geometric – Applications of Continuous distributions: Uniform – Exponential– Normal distributions – Central Limit theorem (Statement and Applications only).

UNIT III RANDOM PROCESS **12 Hrs**

Stationary Process – Ergodic Process – Poisson Process – Applications: Birth and Death Process – Markov Process – Markov Chains.

UNIT IV CORRELATION **12 Hrs**

Auto Correlation – Auto Covariance – Cross Correlation – Cross Covariance.

UNIT V LINEAR SYSTEMS - APPLICATIONS **12 Hrs**

Spectral Density – Cross Spectral Density – Applications to Linear Systems with Random Inputs and Outputs.

Total Number of Hours: 60

REFERENCE BOOKS:

1. *Veerarajan T., Probability, Statistics and, Random Processes, Tata McGraw Hill Publishing Co., (2008).*
2. *Singaravelu, Probability and Random Processes, Meenakshi Agency, (2017).*
3. *Gupta S.C., Kapoor V.K., Fundamentals of Mathematical Statistics, S.Chand & Co., (2007).*
4. *Richard Johnson A., Miller & Freund's Probability and statistics for Engineers (9thed), Prentice Hall of India, (2016).*

Subject Code:	Subject Name: ELECTRONIC CIRCUITS	Ty / Lb/ ETL/IE	L	T/ SLr	P/R	C
EBEC22004	Prerequisite: Analysis of Solid State Devices	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

On completion of this course the student will understand

- The construction and operation of rectifiers
- Design of amplifier circuits
- Working of oscillators
- Construction of multivibrators
- Design of power amplifiers

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Discuss various types of rectifiers.
CO2	Design different amplifiers with required gain independently
CO3	Construct the feedback amplifiers and oscillators for desired frequency.
CO4	Calculate the delay and design multivibrator circuits
CO5	Design and construct power amplifiers for different applications.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	1	2	3	2	3	3
CO2	3	3	3	3	3	2	2	3	2	2	3	3
CO3	3	3	3	3	3	1	1	2	3	3	3	2
CO4	3	3	3	3	3	1	1	1	3	3	2	2
CO5	3	3	2	3	3	1	2	1	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	2	3	3
CO3	3	2	3	2
CO4	3	3	2	1
CO5	3	3	3	3

H/M/L indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name: ELECTRONIC CIRCUITS	Ty / Lb/ ETL/IE	L	T/ SLr	P/R	C
EBEC22004	Prerequisite: Analysis of Solid State Devices	Ty	3	0/0	0/0	3

UNIT I REGULATEDPOWER SUPPLIES 9 Hrs

Linear mode power supply - Rectifiers: Half-wave rectifier - Full-wave rectifier - Bridge rectifier - Filters: L, C, LC and CLC filter - Voltage regulators - series and shunt - Over load protection - Switched mode power supply (SMPS) –IC voltage regulators.

UNIT II FEEDBACK AMPLIFIERS 9 Hrs

Basic concept of feedback - Gain with feedback - Feedback factor - General characteristics of negative feedback amplifiers - Effect of negative feedback on input and output resistance; topologies of feedback amplifiers - Analysis of series-shunt, series-series, shunt-series and shunt-shunt feedback amplifiers - Nyquist criterion for stability of feedback amplifiers - Gain and phase margin.

UNIT III OSCILLATORS 9 Hrs

Classification of Oscillators - Barkhausen criterion for oscillation - RC phase shift, Wien bridge and Twin-T oscillator - General form of LC oscillator - Hartley, Colpitts and Clapp oscillator - Ring oscillators - Crystal oscillators – Equivalent circuit of crystal - Miller and Pierce crystal oscillator - Frequency stability of oscillator.

UNIT IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS 9 Hrs

RC differentiator and integrator - Diode clippers and clampers – Multivibrators - Collector-coupled astable multivibrator, monostable multivibrator and bistable multivibrator - Triggering methods for bistable multivibrators - Schmitt trigger - UJT relaxation oscillator.

UNIT V POWER AMPLIFIERS AND TUNED AMPLIFIERS 9 Hrs

BJT Power amplifiers - Class A - Class B - Class AB - Class C - MOSFET Power amplifiers –Tuned amplifiers- Q of tank circuits- Single tuned amplifier-Frequency response - Double tuned amplifier - Effect of cascading single tuned and double tuned amplifiers on bandwidth - Stagger tuned amplifiers - Comparison of tuned amplifiers .

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS

1. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, Seventh Edition, 2016.
2. Salivahanan S and Suresh Kumar N, Electronic Devices and Circuits, McGraw Hill Education, Fourth Edition, 2017.

REFERENCE BOOKS

1. *Millman J, Halkias C and Chetan D. Parikh, Integrated Electronics, McGraw Hill Education (India) Private Ltd., Second Edition, 2015.*
2. *Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, Eleventh Edition, 2016.*
3. *Millman J, Taub H and Suryaprakash Rao Mothiki, Pulse Digital and Switching Waveforms, McGraw Hill Education (India) Private Ltd., Third Edition, 2011.*
4. *David A. Bell, Solid State Pulse Circuits, Prentice Hall of India, Fourth Edition, 1992.*
5. *David A. Bell, Electronic Devices and Circuits, Oxford University Press, Fifth Edition, 2017.*

Subject Code:	Subject Name : CONTROL SYSTEMS ENGINEERING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22005	Prerequisite: Mathematics I & II	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the basic elements of control system with mathematical model.
- To understand the time response of first and second order system feedback.
- To learn the frequency response of systems using bode plot and polar plot.
- To check the stability of Control system using various techniques.
- To study different compensators and the need of contollers.

COURSE OUTCOMES (COs) : (3- 5)

The student will be able to

CO1	Model physical systems using block diagram and signal flow graph.
CO2	Analyze the system in time domain for standard input functions
CO3	Perform analysis of open and closed loop systems in frequency domain.
CO4	Explain the nature of stability for the given system.
CO5	Design compensators to obtain the required dynamic response of the system and identify the need of different types of controllers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	1			2	1
CO2	3	3	3	3	3	1					1	1
CO3	3	3	3	3	3	2	1				1	1
CO4	3	3	3	3	3	2					2	1
CO5	3	3	3	3	3	1		1			2	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	3	3	2	2

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : CONTROL SYSTEMS ENGINEERING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22005	Prerequisite: Mathematics I & II	Ty	3	1/0	0/0	4

UNIT I SYSTEM REPRESENTATION & STATE SPACE ANALYSIS 12 Hrs

Control Systems – Basic elements in control systems – Open and Closed loop systems – Mathematical models of physical systems – Transfer function – Block diagram reduction techniques – Signal flow graph- Concepts of state variables -Solution of state equations- Conversion of transfer function to state space model.

UNIT II TIME RESPONSE 12 Hrs

Standard Test Signals-Time Domain study of first order and second order feedback control systems -Time domain Specifications - I and II order System Response - Error Coefficients - Generalized Error Series - Steady State Error

UNIT III FREQUENCY RESPONSE 12 Hrs

Frequency Domain Specifications -Correlation between Frequency Domain and Time Domain Specifications- Bode plot - Polar plot – Introduction to Closed Loop Frequency Response- Constant M and N circles – Nichols chart (Qualitative approach)

UNIT IV STABILITY OF CONTROL SYSTEM 12 Hrs

Characteristics Equation - Location of Roots in S plane for stability - Routh Hurwitz Criterion - Root Locus Construction - Effect of Pole, Zero Addition - Gain Margin and Phase Margin - Nyquist Stability Criterion- Concept of Controllability & Observability.

UNIT V COMPENSATORS AND CONTROLLERS 12 Hrs

Compensator-Types -Lag, Lead and Lag-Lead Compensators (Qualitative approach)- Controllers -Need - Types-P, I, D – Effect of PI, PD and PID controller- Intelligent controllers (Case Study)

Practical component P: Include case studies / application scenarios
Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXTBOOKS:

1. K. Ogata, “Modern Control Engineering”, 4th edition, Pearson Education, New Delhi, 2003 / PHI.
2. I.J. Nagrath& M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. B.C. Kuo, “Automatic Control Systems”, Prentice Hall of India Ltd., New Delhi,7thEdition, 1995.

REFERENCES:

1. *M. Gopal, “Control Systems, Principles & Design”, Tata McGraw Hill, New Delhi, 2002.*
2. *M.N. Bandyopadhyay, “Control Engineering Theory and Practice”, Prentice Hall of India, 2003.*
3. *A.Nagoorkani , “Control System Engineering” RBA Publications.*
4. *Stefani, Shanian, Savant, Hostetter, “Design of Feedback Control Systems”, 4thEdition, Oxford university press 2002.*

Subject Code:	Subject Name : LINEAR INTEGRATED CIRCUITS	Ty / Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22006	Prerequisite: Analysis of Solid State Devices, Digital Electronics	Ty	3	0	0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To introduce the basics of linear integrated circuits.
- To understand the applications of operational amplifiers.
- To design comparators, signal generators and timers.
- To express analog multiplier and PLL.
- To examine the concepts of IC regulators and Data converters.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Recognize the basics of linear IC's and characteristics of operational amplifier
CO2	Express various applications of op-amp.
CO3	Design comparators and signal generators using op-amp.
CO4	Analyze the characteristics of Analog multipliers and PLL.
CO5	Examine IC regulators and implement data convertors for real time application.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	2	1	2	2
CO2	3	3	3	3	3	3	3	1	2	1	2	2
CO3	3	3	3	3	3	2	2	1	3	1	1	2
CO4	3	3	3	3	3	3	3	1	2	1	2	1
CO5	3	3	3	3	3	3	3	1	2	1	2	2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	2	2	2
CO5	3	3	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : LINEAR INTEGRATED CIRCUITS	Ty / Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22006	Prerequisite: Analysis of Solid State Devices, Digital Electronics	Ty	3	0	0	3

UNIT I INTRODUCTION TO INTEGRATED CIRCUITS 9 Hrs

Integrated circuit and its classification, Introduction to Operational amplifier-General operational amplifier stages-Internal circuit diagram of IC 741, Ideal Op-Amp , DC & AC Characteristics, Slew rate and methods of improving slew rate, CMRR, PSRR, Frequency Response and Compensation techniques

UNIT II APPLICATIONS OF OPAMP IC741 9 Hrs

Scale changer, Voltage follower, Inverting and Non-Inverting amplifiers ,V-to-I and I-to-V converters, Summer and Subtractor – Multiplier and Divider – Differentiator and Integrator – Instrumentation Amplifier, Op- Amp Circuits using Diodes, Precision Rectifier – Clipper and Clamper – Sample and Hold Circuit – Log and Antilog Amplifiers.RC Active filters-low pass and High pass-Band pass and Band reject-Switched capacitor and Butterworth filters

UNIT III COMPARATORS AND SIGNAL GENERATORS 9 Hrs

applications of Comparators – Regenerative Comparators (Schmitt Trigger) – Sine wave generator, Square Wave Generator (Astable Multivibrator) – Monostable Multivibrator –Triangular Wave Generator – Saw Tooth Wave Generator – IC 555 Timer

UNIT IV ANALOG MULTIPLIER AND PLL 9 Hrs

Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, PLL Basic Principles, Monolithic PLL IC 565,Functional blocks of PLL-Phase Detector -Comparator-Analog and Digital Voltage Controlled Oscillator, Applications of PLL-AM detection-FM detection-FSK modulation and demodulation-Frequency synthesizing

UNIT V IC REGULATORS AND DATA CONVERTERS 9 Hrs

IC voltage regulators: Introduction, Fixed voltage regulators, SMPS, current limiting and current feedback techniques using IC723.DA converters- DAC Specifications -Weighted resistor type,R-2R Ladder type, A/D converters-ADC Specifications --Counter ramp type, Successive Approximation, Dual slope, Flash type, High Speed A/D Converters.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. James. M. Fiore, "*Operational Amplifiers and Linear Integrated Circuits*", First Edition, Thomson Learning.
2. Roy Choudhury and Shail Jain, "*Linear Integrated Circuits*", Wiley Eastern Ltd., 1991.
3. Coughlin and Dirscol, "*Operational Amplifiers and Linear Integrated Circuits*", Prentice Hall of India Pvt., Ltd., 1992

REFERENCE BOOKS:

1. *Millman and Halkias, "Integrated Electronics", McGraw Hill, 1992.*
2. *Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Third Edition, TMH, 2002.*
3. *Ramakant A. Gayakwad, "Op – amp and Linear Integrated Circuits", Fourth edition, PH*

Subject Code:	Subject Name : ANALOG COMMUNICATION	Ty/Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22007	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study various Amplitude modulation and demodulation systems.
- To provide some depth analysis in noise performance of various receiver.
- To study some basic information theory with some channel coding theorem.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Identify the types of Noise and express the need for modulation.
CO2	Illustrate the concepts of amplitude modulation and its transmission technique.
CO3	Articulate the generation & demodulation of FM systems.
CO4	Analyze the analog to digital conversion methods.
CO5	Implement the coding techniques and calculate the channel capacity.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	2	3	1	2	3	1	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3
CO3	3	3	3	3	3	2	2	1	2	2	3	3
CO4	3	3	3	3	3	1	2	1	2	2	3	3
CO5	3	3	3	3	3	1	2	3	1	2	2	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	2	2	3
CO5	3	2	3	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : ANALOG COMMUNICATION	Ty/Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22007	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO COMMUNICATION SYSTEMS AND NOISE 9 Hrs

Basic Communication Systems – Need for Modulation in Communication Systems - Noise - Sources of Noise – Types of Noise - External Noise – Thermal Agitation – Shot Noise – Noise Figure – Signal to Noise Ratio – Equivalent Noise Resistance, Amplitude Modulation and demodulation- Frequency Spectrum – power relations in Amplitude Modulation.

UNIT II CONTINUOUS MODULATION SYSTEMS 9 Hrs

Balanced Modulator, DSB – SC, SSB and VSB – Modulation and Demodulation - AM Transmitter, Receiver-Types, AM receivers.

UNIT III ANGLE MODULATION 9 Hrs

Frequency modulation – Mathematical representation of FM – Frequency Spectrum – Phase Modulation – Noise triangle – Pre-emphasis, de- emphasis- Comparison of Wide band and Narrow band FM, AFC - Stereophonic FM multiplex system – Generation of FM - FM receivers - Communication receivers.

UNIT IV ANALOG TO DIGITAL CONVERSION 9 Hrs

Sampling Theorem - PAM- Quantization of signal - Quantization Error – PWM , PPM – Introduction to digital modulation systems – ASK, FSK, PSK – Transmitter and receiver.

UNIT V INFORMATION THEORY AND CODING 9 Hrs

Introduction –Information - Entropy - Information rate, Classification of codes, Kraft McMillan inequality –-Source coding theorem - Shannon , Fano coding - Huffman coding, Joint and conditional entropies– Channel capacity -- Mutual information.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS :

1. Roy Blake, "*Electronic Communication Systems*", Thomson Learning 2nd Edition, 2002.
2. George Kennedy: "*Electronic Communication Systems*", Tata McGraw Hill publications, 1992.
3. R Bose, "*Information theory, Coding and Cryptography*", TMH 2007.

REFERENCE BOOKS:

1. *K.C.Raveendranath,"Communication system modeling and simulation using matlab& Simulink" universities press, 2011.*
2. *Taub & Schilling," Principles of Communication", Tata McGraw Hill,1986 3.Simon Haykins, "Principles of Communications", Prentice Hall of India. 2001*

Subject Code:	Subject Name : THE INDIAN CONSTITUTION	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I04	Prerequisite: None	Audit course-IE	2	0/0	0/0	0

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To provideanoverview of thehistoryofthemakingofIndianConstitution
- To understandthepreambleandthebasic structures oftheConstitution.
- To Know the fundamentalrights, dutiesandthedirectiveprinciplesof state policy
- To understand the functionality of the legislature ,theexecutiveand thejudiciary

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	To provide overview of the history of the making Indian Constitution
CO2	To understand preamble and the basic structures oftheConstitution
CO3	To Know the fundamental rights, duties and the directive principles of state policy

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	3	1	1	1	1	1	1
CO2	1	1	1	1	1	3	1	1	1	1	1	1
CO3	1	1	1	1	1	3	1	1	2	1	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1
CO2	1	1	2	1
CO3	1	1	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engg Sciences	Humanities &Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
			✓						

Subject Code:	Subject Name : THE INDIAN CONSTITUTION	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I04	Prerequisite: None	Audit course-IE	2	0/0	0/0	0

UNIT I **6 Hrs**
The historyofthemaking of Indian constitution, preamble and the basic structures

UNIT II **6 Hrs**
Fundamental rights andduties, directive principles of state policy

UNIT III **6 Hrs**
Legislature, Executive and Judiciary

UNIT IV **6 Hrs**
Emergencypowers

UNIT V **6 Hrs**
Special provisions for Jammu and Kashmir, Nagaland and other regions, amendments

Total Number of Hours: 30

TEXT BOOKS:

1. D DBasu, Introductiontothe Constitutionof India,20th Edn.,LexisnexisButterworths, 2012.

REFERENCE BOOKS:

1. *Rajeev Bhargava(ed), Ethics and Politics of the Indian Constitution, Oxford University*
2. *Press, NewDelhi, 2008.*
3. *GranvilleAustin,TheIndianConstitution:CornerstoneofaNation,OxfordUniversityPress, Oxford, 1966.*
4. *Zoya Hassan, E. Sridharan andR. Sudarshan (eds), India's Living Constitution: Ideas,*
5. *Practices, Controversies,Permanent Black, NewDelhi, 2002.*
6. *SubhashC.Kashyap,OurConstitution,NationalBookTrust, NewDelhi, 2011.*

Subject Code:	Subject Name : THE INDIAN TRADITIONAL KNOWLEDGE	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I05	Prerequisite: None	Audit course-IE	2	0/0	0/0	0

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
- To understandtheTraditional Medicine, Traditional Production and Construction Technology
- To Know the History of Physics and Chemistry, Traditional Art and Architecture and VastuShashtra, Astronomy and Astrology
- To understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	To understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
CO2	To understandtheTraditional Medicine, Traditional Production and Construction Technology
CO3	To understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	1	1	2	1	1	1	2	1	1
CO2	1	3	3	1	1	2	1	1	1	2	1	1
CO3	1	3	3	1	1	2	1	1	1	2	1	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1
CO2	1	1	2	1
CO3	1	1	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engg Sciences	Humanities &Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
			✓						

Subject Code:	Subject Name : THE INDIAN TRADITIONAL KNOWLEDGE	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I05	Prerequisite: None	Audit course-IE	2	0/0	0/0	0

UNIT I **6 Hrs**

Historical background: TKS during the pre- colonial and colonial period, Indian traditional knowledge system

UNIT II **6 Hrs**

Traditional medicine, traditional production and construction technology

UNIT III **6 Hrs**

History of physics and chemistry, traditional art and architecture and vastushashtra, astronomy and astrology

UNIT IV **6 Hrs**

Origin of mathematics, aviation technology in ancient India, crafts and trade in ancient India

UNIT V **6 Hrs**

TKS and the contemporary world, tks and the Indian union, tks and it revolution.

Total Number of Hours: 30

TEXT BOOKS:

1. Amit Jha (2009) , Traditional knowledge system in india, 1st Edition, Delhi University (North Campus)
2. Dr.A.K.Ghosh (2011), Traditional Knowledge of Household Products

Subject Code:	Subject Name : LINEAR INTEGRATED CIRCUITS LAB	Ty /Lb/ ETL /IE	L	T/SLr	P/R	C
EBEC22L02	Prerequisite: Analysis of Solid State Devices, Digital Electronics Lab	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To measure different parameters of operational amplifier
- To examine the various applications of op-amp
- To illustrate the characteristics of comparators and signal generators
- To construct different types of filters using op-amp
- To experiment voltage regulator and Data converters

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Measure the parameters of an operational amplifier
CO2	Experiment various applications of operational amplifier.
CO3	Design comparators and signal generators using op-amp
CO4	Characterize voltage regulators and Data converters

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	3	1	3	3
CO2	3	3	3	3	3	3	3	1	2	1	3	3
CO3	3	3	3	3	3	3	3	1	3	1	2	2
CO4	3	3	3	3	3	2	2	1	2	1	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	2	3	2
CO4	3	3	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : LINEAR INTEGRATED CIRCUITS LAB	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L02	Prerequisite: Analysis of Solid State Devices, Digital Electronics Lab	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Measure input bias current; input offset current and input offset voltage of the given op-amp
3. Design voltage follower circuit and measure Slew Rate & CMRR
4. Design an inverting and non-inverting amplifier for required gain using Ic741
5. Design and realize adder and subtractor using IC741
6. Design integrator and differentiator using IC741
7. Design Schmitt trigger using ic741 for given values of UTP & LTP
8. Design Monostable multivibrator for required pulse width using IC741.
9. Design Astable multivibrator for required frequency and duty cycle using ic741
10. Design & obtain frequency response of first order HPF & LPF filters using P-SPICE
11. Calculate line, load regulation for a voltage regulator using IC723 using P-SPICE
12. Construct a 4-bit R-2R ladder type DAC using P-SPICE
13. Set up a 4-bit successive approximation type ADC and study its performance using P-SPICE

Total Number of Hours: 45

REFERENCES:

1. *Lab manual, Department of ECE, DR.MGR UNIVERSITY.*

Subject Code:	Subject Name : ELECTRONICS CIRCUITS LAB	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L03	Prerequisite: Analysis of Solid State Devices	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research
C:Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To gain hands on experience in designing electronic circuits.
- To familiarize students with the implementation of basic analog circuits using discrete components.
- To observe characteristics of electronic circuits.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Construct and Verify rectifier circuits.
CO2	Design amplifiers and oscillators using transistors
CO3	Design multivibrators and power amplifiers
CO4	Verify network theorems,KCLand KVL

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	1	3	2	2	3	2
CO2	3	2	3	2	2	1	2	2	1	2	2	1
CO3	2	3	3	3	1	1	1	1	2	2	2	2
CO4	2	3	2	3	3	2	1	1	2	1	2	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	3	2
CO3	3	2	3	2
CO4	2	2	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : ELECTRONICS CIRCUITS LAB	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L03	Prerequisite: Analysis of Solid State Devices	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Verification of Half–Wave Rectifier
2. Verification of Full-Wave Rectifier
3. Shunt Voltage Regulator
4. Frequency Response of Rc Coupled Amplifier.
5. Hartley and Colpitts Oscillators
6. Wien Bridge Oscillator
7. Waveshapping Circuits Clipper And Clamper
8. Monostable Multivibrator Circuit
9. Astable Multivibrator Circuit
10. Class A Power Amplifier
11. Verification of Network Theorems
12. Mesh and Node Analaysis

Total Number of Hours: 45

Subject Code:	Subject Name : DIGITAL SIMULATION LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L04	Prerequisite: Signals and Systems	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Programmatically generate different types of signals using MATLAB.
- Perform sampling and generate waveforms.
- Generate time series perform convolution check stability perform DFT and IDFT computation using MATLAB.
- Program and analyze behavior of different types of systems using MATLAB.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Generate different types of signals.
CO2	Perform sampling and generate waveforms.
CO3	Generate times series, perform convolution and check stability perform DFT and IDFT computation.
CO4	Program and analyze behavior of different types of systems using MATLAB.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	3	2	2	1	1	1	1	1
CO2	3	2	1	2	3	2	2	1	1	1	1	1
CO3	3	2	2	2	3	2	2	3	2	2	2	2
CO4	3	3	2	2	3	2	2	2	2	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1
CO2	2	2	1	1
CO3	3	3	2	2
CO4	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : DIGITAL SIMULATION LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L04	Prerequisite: Signals and Systems	Lb	0	0/0	3/0	1

SIGNALS AND SYSTEMS

1. Generation of Signal Sequence
2. Sampling & Waveform Generation
3. Representation of Time-Series; Computation Of Convolution
4. Stability of LTI System.
5. Dft & Idft Computation

CONTROL SYSTEM

6. Impulse Response of First and Second Order Systems
7. Time Domain Specifications for Closed Loop Transfer Function.
8. Bode Plot and Polar Plot For Open Loop System
9. Stability Check Using Routh-Hurwitz Criterionbode Plot and Root Locus.
10. Determination of Controlability,Observabilty and Transfer Function from State Model

Total Number of Hours: 45

REFERENCES:

1. Lab manual, Department of ECE, DR.MGR UNIVERSITY.

Subject Code:	Subject Name : TECHNICAL SKILL- 1	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22I01	Prerequisite: None	IE	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The objective is to develop the technical skill of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Develop the technical skills required in the field of study
CO2	Bridge the gap between the skill requirements of the employer or industry and the competency of the students.
CO3	Enhance the employability of the students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	2	2	3	2	3	2
CO2	3	3	2	3	3	3	2	2	3	3	3	3
CO3	3	3	3	3	3	3	2	2	3	3	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	2	3	3
CO3	2	3	2	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
								✓	

Subject Code:	Subject Name : TECHNICAL SKILL- 1	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22I01	Prerequisite: None	IE	0	0/0	2/0	1

Students should acquire skill in the domain/inter disciplinary area from government/private training centers/industries /University for a minimum period of 15 calendar days. The training can be through off line, online or mixed mode. Students are supposed to prepare Technical skill report at the end of the training and submit the report along with the certificate in proof of the training, during the viva voce examination conducted by the examiners duly appointed by the head of the department.

Subject Code:	Subject Name : SOFT SKILL – I (EMPLOYABILITY SKILLS)	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I06	Prerequisite: None	IE	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To create awareness in students, various top companies helping them improve their skill set matrix, leading to develop a positive frame of mind.
- To help students be aware of various techniques of candidate recruitment and help them prepare CV's and resume.
- To help student how to face various types of interview, preparing for HR, technical interviews.
- To help students improve their verbal reading, narration and presentation skills by performs various mock sessions. .

COURSE OUTCOMES (COs) : (3- 5) The Students will be able to

CO1	Gain the knowledge of various top companies leading to improvement in skills amongst them.
CO2	Developing various candidate recruitment techniques like group discussion, interviews and be able to prepare CV's and resumes.
CO3	Prepare for different types of interviews and be prepared for HR and technical interviews.
CO4	Improve their verbal, written and other skills by performing mock sessions.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	2	2	3	3	2	2	3
CO2	2	1	2	1	1	2	2	3	3	2	2	3
CO3	1	3	1	3	1	2	2	3	3	2	2	3
CO4	3	1	1	1	1	2	2	3	3	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	1
CO2	3	3	3	2
CO3	2	3	3	2
CO4	3	2	3	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
								✓	

Subject Code:	Subject Name : SOFT SKILL – I (EMPLOYABILITY SKILLS)	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I06	Prerequisite: None	IE	0	0/0	2/0	1

UNIT I **6 Hrs**

Creation of awareness of top companies / improving skill set matrix / Development of positive frame of mind / Creation of self-awareness.

UNIT II **6 Hrs**

Group discussions / Do's and don'ts – handling group discussions / what evaluators look for interpersonal relationships / Preparation of Curriculum Vitae / Resume.

UNIT III **6 Hrs**

Interview – awareness of facing questions – Do's and don'ts of personal interview / group interview, enabling students to prepare for different proce3dures such as HR interviews and Technical Interviews / self-introductions.

UNIT IV **6 Hrs**

Verbal aptitude, Reading comprehension / narration / presentation / Mock Interviews.

UNIT V **6 Hrs**

Practical session on Group Discussion and written tests on vocabulary and reading comprehension

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 30

SEMESTER –V

Subject Code:	Subject Name : COMMUNICATION NETWORKS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22008	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To understand different storage media and OSI layers
- To introduce the features of different I/O peripheral devices and protocols.
- To introduce the students the functions and standards of LAN.
- To introduce IEEE standard employed in computer networking.
- To make students to get familiarized with different protocols and network components.

COURSE OUTCOMES (COs) : (3- 5)

The Students will able to

CO1	Describe the basic concepts of data communication and OSI layers.
CO2	Analyze data link control protocol.
CO3	Explain different standards and protocols used in LAN
CO4	Express the duties of network support layer and WAN protocols
CO5	Demonstrate the functions of upper OSI layer

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	1	1	1	3	3	2		
CO2	3	3	1	1	2	1	1	1			2	
CO3	2	2	2	1	3	2	2	2				3
CO4	3	1	2	2	2	2	2	2	2			3
CO5	3	2	1	2	1	3	2	1	2	2	2	

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3
CO2	3	2	3	1
CO3	1	3	2	2
CO4	1	1	1	1
CO5	2	2	3	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : COMMUNICATION NETWORKS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22008	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I DATA COMMUNICATION **9 Hrs**

Introduction, Basic concepts, OSI Reference Model, Transmission of Digital Data –Electrical Interface, Modems-Transmission rate-modem standards-Guided Media-Twisted –pair Cable-Coaxial cable-Performance- Error Detection and Correction (CRC) - Time and Frequency domains Signals

UNIT II DATA LINK CONTROL AND PROTOCOLS **9 Hrs**

Flow Control and Error Control, Stop And Wait - Sliding Windows- Automatic Repeat (ARQ), Asynchronous Protocols - X Modem, Y Modem, Synchronous Protocols – Character Oriented and Bit Oriented Protocols (HDLC).

UNIT III LOCAL AREA NETWORKS **9 Hrs**

IEEE 802 Standards, LLC, MAC Layer Protocols –CSMA/CD Ethernet, Token Bus, Token Ring, FDDI, Distributed Queue Dual Bus, Switched Multimegabit Data Service

UNIT IV WIDE AREA NETWORKS **9 Hrs**

Switching, Duties of the Transport Layer, ATM Protocol –Architecture Header Structure, Function of AAL Layer,Internetworking Devices, Repeater,Bridge, Routers and Gateways, Routing Algorithms- Link Stateand Distance Vector routing.

UNIT V UPPER OSI LAYERS **9 Hrs**

Session Layer - Presentation Layer –Translation, Brief Introduction to Encryption / Decryption, Authentication -Data Compression, Application Layer Protocols, MHS, File Transfer , Virtual Terminal, Common Management Information Protocol.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS :

1. Behrouz A. Forouzan , "*Data Communication and Networking*", Tata McGraw Hill, 5th Edition, 2013.
2. William A, Shay, "*Understanding Data Communications and Networks*", Thomson Learning, 3rd Edition 2003.
3. Gallo, "*Computer Communications and Networking Technologies*", Thomson Learning, 1st edition 2001.

REFERENCE BOOKS:

1. *William Stallings, "Data and Computer Communication", Prentice Hall of India, Fifth Edition 1997.*
2. *Andrew S. Tanenbaum, "Computer Networks", prentice hall of India, Third Edition 1996.*
3. *Fred Hallsall, "Data Communication Computer Networks and Open System", Addison – Wesley, 1992*

Subject Code:	Subject Name : MICROPROCESSOR AND MICROCONTROLLER	Ty/Lb/ETL/IE	L	T/S Lr	P/R	C
EBEC22009	Prerequisite: Digital Electronics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To develop an in-depth understanding of the operation of microprocessors.
- To master the assembly language programming using concepts like assembler directives, procedures, macros, software interrupts etc.
- To create an exposure to basic peripherals, its programming and interfacing techniques
- To study the architecture and assembly language programming of 8051 microcontroller
- To design and implement interfacing units with 8051 microcontroller based systems.

COURSE OUTCOMES (COs) :

The students will be able to

CO1	Develop programs in 8086 microprocessor by understanding its architecture and instruction set
CO2	Understand the programming model of micro processors and microcontrollers
CO3	Show their ability to interface peripherals with microprocessors
CO4	Develop programs in 8051 microcontroller by understanding its architecture and instruction set
CO5	Design various interfacing units with 8051 microcontroller based systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	1			2	2	2	1
CO2	3	2	2	2	2				2	3	1	2
CO3	3	3	3	2		1			2	3	2	2
CO4	2	2	2	2	3	3			3	3	3	2
CO5	3	3	2	2	2	1			2	2	1	2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	2	2	2
CO3	2	2	3	
CO4	3	3	3	3
CO5	3	2	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : MICROPROCESSOR AND MICROCONTROLLER	Ty/Lb/E TL/IE	L	T/ S Lr	P/ R	C
EBEC22009	Prerequisite: Digital Electronics	Ty	3	0/0	0/0	3

UNIT I THE 8086 MICROPROCESSOR 9 Hrs

Introduction To 8085 Micro Processor 8086 architecture- functional diagram, Register organization, memory segmentation, Signal descriptions of 8086-common function signals, minimum mode and maximum mode system design, timing diagrams, Interrupts of 8086.

UNIT II INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086 9 Hrs

Instruction formats, Addressing modes, instruction set, assembler directives. Macros, Simple programs involving Arithmetic, logical, branch and call instructions. Sorting, evaluating arithmetic expressions, string manipulations

UNIT III PERIPHERALS AND INTERFACING 9 Hrs

Programmable Peripheral Interface (8255), Serial Communication Interface (8251), Keyboard display controller (8279), Programmable Interval Timer/counter (8254), Programmable interrupt controller (8259),DMA controller(8257), ADC and DAC Interface.

UNIT IV 8051 MICROCONTROLLER 9 Hrs

Comparison between Microprocessor and Microcontroller , 8051 – Architecture, Instruction set, Addressing modes, Assembly language programming, I/O Ports, Timers / counters, serial communication, Interrupt, Special Function Registers (SFRs).

UNIT V MICROCONTROLLER BASED SYSTEM DESIGN 9 Hrs

Interfacing High power devices-Stepper Motor, DC Motor speed Control using PWM, RTC and EEPROM interface using I2C protocol, Traffic Light Interface, Interfacing matrix Keyboard and (16x2) LCD interfacing

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. R.S. Gaonkar,"Microprocessor Architecture Programming and Application, with 8085", Wiley Eastern Ltd., New Delhi, 2013.
2. A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, TMH, 2007.
3. Krishna Kant, "Microprocessors and Microcontrollers, Architecture,programming and system design using 8085, 8086, 8051 and 8096",PHI 2007.
4. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay "The 8051Microcontroller and Embedded Systems", Second Edition, Pearson Education 2008.

REFERENCES:

1. *Douglas V Hall, "Microprocessor and Interfacing, Programming and hardware",TMH, 2006.*
2. *Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC",Delmar Publishers, 2007.*
3. *Steve furber "ARM Systems on chip Architecture", Second Edition Addison Wesley trade computer publication,2000.*
4. *John .B.Peatman"Design with PIC Microcontrollers" ,Pearson Education, 3rd Edition, 2004.*

Subject Code:	Subject Name : DIGITAL SIGNAL PROCESSING	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22010	Prerequisite: Signals and Systems	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the concepts of Fourier transform and it's Applications.
- To understand the design techniques of digital IIR filters
- To learn the concepts and design techniques of digital FIR filters.
- To understand the concepts and applications of Multi – rate sampling.
- To introduce the architecture of Digital Signal Processors.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Illustrate Fourier transform concepts.
CO2	Interpret the knowledge of designing IIR filters.
CO3	Learn to design FIR filters.
CO4	Summarize finite word length effects and quantization errors
CO5	Describe the modules in the architecture of digital signal processor.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	1		1	1	2	2
CO2	3	3	3	3	3	2	2		2	2	1	2
CO3	3	3	3	3	3	2	1		1	1	2	1
CO4	3	3	3	3	3	1	2		2	1	2	2
CO5	3	3	3	2	2	2	1		2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	2	2
CO3	3	3	1	3
CO4	3	3	1	2
CO5	2	2	3	1

H/M/L indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : DIGITAL SIGNAL PROCESSING	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22010	Prerequisite: Signals and Systems	Ty	3	1/0	0/0	4

UNIT I DFT AND FFT **12 Hrs**

Discrete Fourier Transform (DFT) - Properties-Convolution of Sequences - Linear Convolution - Circular Convolution - Introduction to Radix-2 FFT- Properties - DIT (FFT)-DIF (FFT) - Algorithms of Radix-2FFT-Computing Inverse DFT by doing a direct DFT.

UNIT II DESIGN OF IIR FILTER **12 Hrs**

IIR Filters- Properties of IIR Filters -Analog Low pass Filter Design - Butterworth Filter - Chebyshev Filter - Design of IIR Filters from Analog filters - Approximation of Derivatives – Impulse Invariance - Bilinear Transformation – The Matched z- Transformation - Frequency Transformation.

UNIT III DESIGN OF FIR FILTER **12 Hrs**

FIR Filters - Characteristics of FIR Filters with Linear Phase-Properties of FIR Filters-Design of FIR Filters using Windows-Fourier Series Method-Frequency sampling Method

UNIT IV FINITE WORD LENGTH EFFECTS **12 Hrs**

Fixed point and floating-point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power - coefficient quantization error - Product quantization error - Overflow error Limit cycle oscillations- Zero- Input Limit cycle oscillations- Overflow Limit cycle oscillations- Signal Scaling.

UNIT V OVERVIEW OF DIGITAL SIGNAL PROCESSOR **12 Hrs**

Overview of Digital Signal Processors – Application of Digital Signal Processor – Memory Architecture of DSP Processor – Von Neumann Architecture – Harvard Architecture - Architecture of TMS32C5X Processor – Addressing modes – Pipelining .

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXTBOOKS :

1. John . G. Proakis and Dimitris C.Manolakis, "*Digital Signal Processing Principles, Algorithms and Applications",*Pearson Education, Third edition 2006.
2. Sanjit k.Mitra "*Digital signal processing*",A Computer Based Approach,Tata McGraw Hill,New delhi,2001.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "*Discrete – Time Signal Processing*", 8th Indian reprint, Pearson 2004.

REFERENCE BOOKS:

1. *Ashok Ambardar,"Analog and Digital Signal Processing",2nd Edition,Thomson Learning 2000.*
2. *Ashok Ambardar,"Analog and Digital Signal Processing A Modern Introduction",1stedition Thomson Learning 2006*

Subject Code:	Subject Name ONLINE COURSE	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBOL22I01	Prerequisite: None	IE	1	0/0	1/0	1

Students should register for the online course with a minimum course duration of 4 weeks through the online portals such as NPTEL/SWAYAM/Any MOOC in the beginning of the semester. A mentor will be assigned by the department for monitoring the students.

Students are expected to attend the online classes regularly and submit the weekly assignments before the due dates. Students should appear for the online examination and submit the certificate at the end of the semester .Internal Examination will be conducted by the examiners duly appointed by the head of the department.

Subject Code:	Subject Name :COMMUNICATION NETWORKS LAB	Ty/ Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22L05	Prerequisite: C++ and Java Programming Lab	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- The students will be able to implement the different protocols
- The students will be able to implement and compare the various routing algorithms
- The students will be able to independently use the NS2 simulator tool.

COURSE OUTCOMES (COs) : (3- 5)
After completion of the lab using NS2 simulator, Students will be able to

CO1	Establish and observe the characteristics of point to point network with n nodes.
CO2	Transmit messages between different network nodes.
CO3	Encrypt and decrypt the message transmitted through a network.
CO4	Implement and compare various routing algorithms.
CO5	Use the simulation tools like NS2, NetSim, OPNET etc.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	3	3	3	3	3	3
CO2	3	3	3	2	3	2	3	2	3	3	2	3
CO3	3	3	3	2	3	2	2		3	3	2	3
CO4	3	3	3	2	3		2		2	3	2	3
CO5	3	3	3	2	3			3	2	2	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3		2
CO2	3	2		3
CO3	3	2		3
CO4	2	3		2
CO5	2	3		2

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name :COMMUNICATION NETWORKS LAB	Ty/ Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22L05	Prerequisite: C++ and Java Programming Lab	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

Using NS2/OPNET

1. Simulate Three Nodes Point-To-Point Networks With A Duplex Link Between Them. Set The Queue Size And Vary The Bandwidth And Find The Number Of Packets Dropped.
2. Apply Tcp Agent Between N0 To N3 And Udp N1 To N3. Apply Relevant Applications Over Tcp And Udp Agents Changing The Parameters And Determine The Number Of Packets Sent By Tcp/Udp.
3. Simulate The Different Type Of Internet Traffic Such As Ftp And Telnet Over A Network And Analyze The Throughput.
4. Simulate A Transmission Of Ping Message Over A Network Topology Consisting Of 6 Nodes And Find The Number Of Packets Dropped Due To Congestion.
5. Simulate An Ethernet Lan Using N Nodes Change Error Rate And Data Rate And Compare The Throughput.
6. Simulate An Ethernet Lan Using N Nodes And Set Multiple Traffic Nodes And Determine The Collision Across Different Nodes.
7. Simulate An Ethernet Lan Using N Nodes And Set Multiple Traffic Nodes And Plot Congestion Window For Different Source/Destination

Using C/C++

1. Write A Program For Error Detecting Code Using Crc-Ccitt (16bit)
2. Write A Program For Distance Vector Algorithm To Find Suitable Path For Transmission
3. Write A Program For Simple Rsa Algorithm To Encrypt And Decrypt The Data
4. Write A Program For Hamming Code Generation For Error Detection/Correction

Total Number of Hours: 45

REFERENCES:

1. Lab manual, Department of ECE, DR.MGR UNIVERSITY.

Subject Code:	Subject Name : COMMUNICATION LAB - I	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L06	Prerequisite:Analog Communication	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To design and implement FIR & IIR filters, Multi rate signal processing, adaptive filters and fast Fourier transform using DSP processors.
- To measure signal parameters in time domain and frequency domain.
- To perform modulation and demodulation of various signals.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Implement various kinds of digital filter perform Multi rate signal processing and perform Fast Fourier Transform using DSP processors.
CO2	Measure various signal parameters in time domain and frequency domain.
CO3	Perform modulation and demodulation of various signals.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	2	2	
CO2	3	3	3	3	3	2	2	2	2	2	2	
CO3	3	3	3	3	3	2	2	2	2	2	2	

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	3	2

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : COMMUNICATION LAB - I	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L06	Prerequisite: Analog Communication	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Design and Testing Of Amplitude Modulation and Demodulation.
2. Design and Testing Of Frequency Modulation and Demodulation.
3. Design And Testing Of Pre-Emphasis And De-Emphasis Circuits
4. Verification Of Sampling Theorem
5. Pulse Amplitude Modulation And Demodulation
6. Pulse Width Modulation And Demodulation
7. Pulse Position Modulation And Demodulation
8. Determination of the Frequency of Unknown Signals: Using CRO and Lissajous Patterns.
9. To Study Time Division Multiplexing
10. Delta Modulation

Total Number of Hours: 45

Subject Code:	Subject Name :MICROPROCESSOR AND MICROCONTROLLER LAB	T y/ Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22L07	Prerequisite: Digital Electronics Lab	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To write Assembly Language Program for arithmetic and logical operations in 8085 / 8086.
- To write Assembly Language Program for arithmetic and logical operations in 8051.
- To understand string manipulation instruction using 8086.
- To understand various peripheral interfacing techniques using 8086/8051

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Write assembly language programming in 8085 / 8086 microprocessor
CO2	Interface peripherals with 8086 microprocessor/8051 Microcontroller
CO3	Develop programs using 8051 Microcontroller.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1			2	3	3	3
CO2	3	3	3	3	3	2			2	3	3	3
CO3	3	3	3	3	3	2			2	3	3	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	2	
CO3	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name :MICROPROCESSOR AND MICROCONTROLLER LAB	T y/ Lb/ ETL/IE	L	T/ SLr	P/R	C
EBEC22L07	Prerequisite: Digital Electronics Lab	Lb	0	0/0	3/0	1

LIST OF EXERCISES USING 8085/8086 Kits:

1. Basic Arithmetic, Logical operations and move a data block without overlap.

LIST OF EXERCISES USING 8086 kits / MASM

2. Decimal Arithmetic, Code conversion, and Matrix operations.
3. String manipulations.
4. Sorting and Searching

PERIPHERALS AND INTERFACING EXPERIMENTS

5. Traffic light control
6. Stepper motor control
7. Key board and Display
8. Serial interface
9. Parallel interface
10. A/D and D/A interface and Waveform Generation

LIST OF EXERCISES USING 8051 kits

11. Basic Arithmetic, Logical operations, Square and Cube program
12. Find 2s complement of a number
13. Conversion of packed BCD to unpacked BCD

Total Number of Hours: 45

***REFERENCES*:**

1. Lab manual, Department of ECE, DR.MGR UNIVERSITY.

Subject Code:	Subject Name : TECHNICAL SKILL -II	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22I02	Prerequisite:None	IE	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The objective is to develop the technical skill of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Develop the technical skills required in the field of study
CO2	Bridge the gap between the skill requirements of the employer or industry and the competency of the students.
CO3	Enhance the employability of the students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	2	3	2	3	2
CO2	3	3	2	3	3	3	2	2	3	3	3	3
CO3	3	3	3	3	3	3	2	2	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	2	3	3
CO3	2	3	2	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
								✓	

Subject Code:	Subject Name : TECHNICAL SKILL -II	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22I02	Prerequisite:None	IE	0	0/0	2/0	1

Students should acquire skill in the domain/inter disciplinary area from government/private training centers/industries /University for a minimum period of 15 calendar days. The training can be through off line, online or mixed mode. Students are supposed to prepare Technical skill report at the end of the training and submit the report along with the certificate in proof of the training, during the viva voce examination conducted by the examiners duly appointed by the head of the department.

Subject Code:	Subject Name : FIELD AND WAVE ELECTROMAGNETICS	TY Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22ET2	Prerequisite: Mathematics II, Solid State Physics	ETL	2	0/0	2/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the Basics of electromagnetics
- To analyse the different types of transmission lines
- To study 5G wireless channel models

COURSE OUTCOMES (COs) : (3- 5)

Upon the completion of the course the students will be able to

CO1	Understand the fundamental postulates of electrostatics and magnetostatics
CO2	Demonstrate the significance of Telegrapher's equations
CO3	Analyse the impedance matching using different methods
CO4	Illustrate the different polarisation methods adopted
CO5	Apply rhe waveguide principle in real time applications

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	2	2	1					1
CO2	3	2	3	2	3	3			2			1
CO3	3	3	3	3	3	1				3	2	
CO4	3	2	3	2	3	1	1	1		2		
CO5	3	3	3	2	3	3	3	3	2		2	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2		3
CO2	3	2		3
CO3	3	3		3
CO4	3	3		3
CO5	3	3		3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Elective	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : FIELD AND WAVE ELECTROMAGNETICS	TY Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22ET2	Prerequisite: Mathematics II, Solid State Physics	ETL	2	0/0	2/0	3

UNIT I ELECTROMAGNETICS **12 Hrs**

Introduction to Electrostatics and Magnetostatics-Fundamental Laws- Boundary Conditions- Analogy between the parameters-Divergence and Curl Equations-Maxwell's Equations - Poynting Vector and Theorem.

Experiments: Octave Simulation of Laplace Equations, Transmission Line Analysis Using Virtual Neywork Analyser.

UNIT II TRANSMISSION LINES **12 Hrs**

Introduction-Wave Equations of Lossless Lines- Finite Difference Method-Laplace's equations and Telegrapher's Equations-Octave Simulation.

Experiments: Octave Simulation of Wave Equations and Telegrapher's Equations.

UNIT III LOSSY TRANSMISSION LINES **12 Hrs**

Transmission Lines with Losses-Reflections and Reflection Coefficient -Voltage Reflection Coefficient and Standing Wave Ratio - Graphical Representation of Reflection Coefficient - Impedance Matching using Smith Chart - Impedance Matching Demonstration using VNA - Octave Simulation.

Experiments: Octave Simulation of Transmission Lines with Losses, Octave Simulation of Electromagnetic Wave Equations.

UNIT IV POLARISATION **12 Hrs**

Polarisation of Electromagnetic Waves - Electromagnetic Waves in Conducting Media - Plane Waves-Plane Waves at normal incidence - Plane Waves at oblique incidence -Perpendicular Polarisation-Dielectric Conductor Interface-Octave Simulation.

Experiments: Octave Simulation of Different Types of Polarisation, Octave Simulation of Perpendicular Polarisation.

UNIT V WAVEGUIDES **12 Hrs**

Parallel Plate Waveguide- Rectangular Waveguide-Phase Velocity and Group Velocity-Modes and Field Pattern in Waveguides - Cavity Resonators- Octave Simulation-Real Time Applications.

Experiments: Octave Simulation of Rectangular Waveguide Modes, Octave Simulation of a Parallel Plate Waveguide.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXT BOOKS:

1. David K.Cheng,'*Field and Wave Electromagnetics"*, Pearson Education, 2 ed.
2. William Hayt," Engineering Electromagnetics", Tata McGraw Hill

REFERENCES:

1. *"Transmission Lines and Networks";Umesh Sinha,Sathya Prakasam*
1. *2.R.K. Shevgaonkar, "Electromagnetic waves"*

SEMESTER -VI

Subject Code:	Subject Name : SENSORS AND ROBOTICS,	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22011	Prerequisite: Basic Mechanical & Civil Engineering , Electrical and Instrumentation Engineering	TY	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot.
- To develop a deep knowledge sensors and their applications in robot.

COURSE OUTCOMES (COs) : (3- 5)
The students will be able to

CO1	Predict the importance of robotics in today and future goods production.
CO2	Analyze the robot configuration and subsystems.
CO3	Illustrate the role of manipulators and end effectors
CO4	Understand the fundamental concepts of sensor and its characteristics
CO5	Identify the working of sensors in different applications.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	2	3				1	3
CO2	3	3	3	3	2	2	3		1		1	3
CO3	3	2	3	3	2	2	3		1			3
CO4	3	3	3	2	2	2	3					3
CO5	3	3	3	3	2	2	3					3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	2	3	3
CO3	3	2	3	3
CO4	3	3	3	3
CO5	3	3	3	3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : SENSORS AND ROBOTICS	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22011	Prerequisite: Basic Mechanical & Civil Engineering , Electrical and Instrumentation Engineering	TY	3	0/0	0/0	3

UNIT I INTRODUCTION TO ROBOTICS **9 Hrs**

Robot - Definition – Law of Robotics - Robot Anatomy - Co ordinate Systems- Robot Classification- Wrist configuration-Technical Specifications of Robot - Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS **9 Hrs**

Robot drive mechanisms- hydraulic – electric –pneumatic drives- servomotor- stepper motor- Mechanical transmission method - Gear transmission - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion.

UNIT III MANIPULATORS AND END EFFECTORS **9 Hrs**

Construction of Manipulators- Electronic and Pneumatic manipulators-Classification of End effectors – Tools as end effectors -Mechanical grippers- -Magnetic grippers-Vacuum grippers-hydraulic grippers - Gripper force analysis

UNIT IV BASICS OF SENSOR **9 Hrs**

Sensor definition- Sensor Systems - Sensor Characteristics- - Sensor Classification-Types of sensors – Transducer and actuators

UNIT V APPLICATION OF SENSORS **9 Hrs**

Mechanical sensors- Temperature sensor- pressure sensor- optical sensors- proximity sensors-biosensors-Role of sensors in robotics and automation.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010.
2. John J.Craig , “Introduction to Robotics”, Pearson, 2009. 3. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.
3. Jacob Fraden, “Handbook Of Modern Sensors Physics, Designs, And Applications” 2. Jon S. Wilson,” Sensor Technology Handbook 3. S J Prosser,E.Lewis ,”Sensor and their Applications XII” CRC Press

REFERENCES:

1. *Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.*
2. *Fu K S, Gonzalez R C, Lee C.S.G, "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill, 1987*
3. *Ian Sinclair , “ Sensors and Transducers” eBook ISBN: 9780080516998*
4. *H.Rosemary Taylor, “Data acquisition for sensor systems”, Chapman & Hall, 1997. 5. Ramon Pallas-Areny, John G. Webster, “Sensors and signal conditioning” John Wiley & Sons, 2001.*

Subject Code	Subject Name : DIGITAL COMMUNICATION	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22012	Prerequisite: Analog Communication, Probability and Random Process	TY	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To study detection, estimation and discuss the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals.
- To understand the concepts of different digital modulation techniques and their applications in our day to day life
- To learn error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels.

COURSE OUTCOMES (COs) : (3- 5) The students will be able to

CO1	Interpret the sampling process in real-time systems and reconstruct the signal with the estimation of noise
CO2	Design a system without distortion and interference
CO3	Hone their inferences to develop various modulation technologies for the state of the art communication.
CO4	Demonstrate their skills in generating a unique code for detecting the error in digital communication
CO5	Apply their understanding to improve the digital communication efficiency in a multipath environment.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	1	1	3	3	2	1
CO2	3	3	3	3	3	3	1	1	3	3	2	1
CO3	3	3	3	3	3	3	2	1	3	3		3
CO4	3	3	3	3	3	2	2		2	3	1	3
CO5	3	3	3	3	3	2	1	1	3	3		3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1
CO2	3	1	1	2
CO3	3	3	1	2
CO4	3	3	1	1
CO5	3	3	1	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code	Subject Name : DIGITAL COMMUNICATION	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22012	Prerequisite: Analog Communication, Probability and Random Process	TY	3	1/0	0/0	4

UNIT I DETECTION, ESTIMATION AND SAMPLING PROCESS 12 Hrs

Model of Digital Communication System, Gram Schmidt Orthogonalization Procedure, Matched Filters, Correlation Receivers, Error Probability, Maximum Likelihood Estimation, Linear Prediction and Prediction Filters, Sampling Theorem, Quadrature Sampling of Band-Pass Signals, Reconstruction of a message from its samples

UNIT II WAVEFORM CODING TECHNIQUES AND BASEBAND SHAPING 12 Hrs

PCM and TDMA Principles, Channel Noise and Error Probability, Quantization Noise and SNR, Differential Pulse Code Modulation and Delta Modulation, Speech Coding at Low Bit Rates, Power Spectra of PAM Signals, Inter Symbol Interference, Nyquist Criterion for distortionless baseband transmission, Correlative Coding and Precoding, Eye Patterns and Equalization Techniques.

UNIT III DIGITAL MODULATION SCHEME 12 Hrs

Geometric Representation of signals – Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK – QAM – Carrier Synchronization – Structure of Non-coherent Receivers – Principle of DPSK.

UNIT IV ERROR CONTROL CODING 12 Hrs

Need for Coding, Types of Codes,Hamming codes, Linear Block Codes, Cyclic Codes, Convolution Codes, Maximum, Likelihood Decoding of convolutional Codes, Distance Properties and Sequential Decoding of convolutional Codes, Trellis coding, Viterbi coding.

UNIT V SPREAD SPECTRUM SYSTEMS 12 Hrs

Generation of Pseudo Noise Sequences, Correlation Properties, Direct Sequence Spread Spectrum Systems, Frequency Hop System, Signal Space Dimension and Processing Gain , Probability of Error, Antijam and Multipath Performance.

Practical component P: Include case studies / application scenarios
Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXTBOOKS:

1. Simon Haykin, "Digital *communications*", John Wiley & Sons, 1988.
2. John. G. Proakis, "*Digital Communication*", McGraw Hill Inc., Third Edition, Malaysia, 1995.
3. B.P. Lathi, "*Modern Digital and Analog communication system*", Oxford publications, Third edition.

REFERENCE BOOKS:

1. *Roy Blake, "Electronic Communication systems", Thomson Learning, 2nd edition 2002.*
2. *M.K. Simen, "Digital Communication Techniques Signal Design & Detection", Prentice Hall of India, 1999.*
3. *Bernard Sklar, "Digital Communication: Fundamentals and Applications", Prentice Hall, 2011 Edition.*
4. *UpamanyuMadhow, "Fundamentals of Digital Communication",Cambridge University Press, 2008*
5. *Robert G. Gallager, "Principles of Digital Communication", Cambridge University Press 2008.*

Subject Code:	Subject Name : DIGITAL IMAGE PROCESSING	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22013	Prerequisite: Digital Signal Processing	TY	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To provide introduction to students the fundamentals of Digital Image Processing system and its breadth and depth of the field.
- To enable the students acquaint with principles of image acquisition system and imaging technologies are used in various fields.
- To provide in depth knowledge to students on various unitary form of Image transforms techniques and its practical realization.
- To analyze the spatial and frequency domain enhancement techniques and students to apply appropriate algorithms to perform image enhancement, image restoration, image segmentation and image compression.
- To Design a typical digital image processing for specific application like Machine vision, Vision based sensing and control for automobiles, remote sensing, and medical image diagnostics etc.

COURSE OUTCOMES (COs) :

The students will be able to

CO1	Listing the elements of visual perception and recognizing image sensing and acquisition.
CO2	Identify the various image transforms and their inverse operations
CO3	Discuss the image enhancement techniques, defining different kinds of filtering.
CO4	Recognizing the various image degradation models and categorizing image restoration methods.
CO5	Articulate various image compression techniques and interpret the fundamental Python syntax and semantics.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	2				2	3
CO2	3	3	3	2	3	1	3				2	3
CO3	3	3	3	2	3	1	3				2	3
CO4	3	3	3	3	3	1	3			1	2	3
CO5	3	3	3	3	3	1	3			1	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	2	2	3	3
CO3	2	2	3	3
CO4	2	2	3	3
CO5	3	2	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : DIGITAL IMAGE PROCESSING	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22013	Prerequisite: Digital Signal Processing	TY	3	1/0	0/0	4

UNIT I DIGITAL IMAGE FUNDAMENTALS 12 Hrs

Need for DIP- Fundamental steps in DIP – Elements of visual perception -Image sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models

UNIT II IMAGE TRANSFORMS & IMAGE COMPRESSION 12 Hrs

Two dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFT Discrete cosine transform and KL transform. Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG.

UNIT III IMAGE ENHANCEMENT 12 Hrs

Spatial Domain: Basic Gray level Transformations – Histogram Processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Smoothing frequency domain filters- sharpening frequency domain filters- Homomorphic filtering

UNIT IV IMAGE RESTORATION & SEGMENTATION 12 Hrs

Overview of Degradation models –Unconstrained and constrained restorations-Inverse Filtering- Wiener Filter - Feature Extraction Detection of discontinuities – Edge linking and Boundary detection- Thresholding- -Edge based segmentation-Region based Segmentation-- Use of motion in segmentation.

UNIT V APPLICATIONS 12 Hrs

Pattern, Signature, Character Recognition- Texture and Shape Analysis- Biometric and Biomedical Image Processing-Remote Sensing Applications.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXT BOOKS:

1. Rafael C.Gonzalez& Richard E.Woods – Digital Image Processing – Pearson Education- 3/e – Reprint 2014.
2. Anil.K.Jain – Fundamentals of Digital Image Processing- Pearson Education, 9th Reprint, 2002.

REFERENCES:

1. *B.Chanda&D.Dutta Majumder – Digital Image Processing and Analysis – Prentice Hall of India – 2006.*
2. *William K. Pratt – Digital Image Processing – John Wiley & Sons, 4/e, 2007*
3. *Tinku Acharya, Ajoy K. Ray - Image Processing: Principles and Applications- John Wiley& Sons, 2005.*

Subject Code:	Subject Name : COMMUNICATION LAB II	TY /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L08	Prerequisite: Coommunication Lab I	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the concepts of analog pulse modulation techniques.
- To study the working of digital modulation system.
- To study the different types of information coding.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Apply various digital modulation techniques for the state of art of communication.
CO2	Generate error correcting codes for transmitting signals.
CO3	Interpret the sampling process and reconstruct the signal

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2		3	1	2	3
CO2	3	3	3	3	3	2	2		3	1	2	3
CO3	3	3	3	3	3	2	2		3	1	2	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : COMMUNICATION LAB II	TY /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L08	Prerequisite: Communication Lab II	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Ask Generation and Detection
2. Fsk Generation and Detection
3. Psk Generation and Detection
4. Bpsk Generation and Detection
5. Dpsk Generation and Detection
6. Block/Hamming Codes.
7. Pn Sequence Generator.
8. Pulse Code Modulation and Demodulation
9. Study Of Line Coding and Decoding Techniques
10. Design & Testing Of Eye Pattern

Total Number of Hours: 45

***REFERENCES*:**

1. Lab manual, Department of ECE, DR.MGR UNIVERSITY.

Subject Code:	Subject Name : DIGITAL IMAGE PROCESSING USING OPEN CV PYTHON LAB	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L09	Prerequisite: Python Programming, Digital Signal Processing	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- The fundamentals of digital image processing
- Image transform used in digital image processing
- Image enhancement techniques used in digital image processing

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describe different modalities and current techniques in image acquisition and to work in open CV softere using python programming
CO2	Use the mathematical principles of digital image enhancement (contrast, gradients, noise)
CO3	Describe and apply the concepts of feature detection and contour finding algorithms.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	3				1	2		
CO2	3	3	3	3	3				1	2		
CO3	3	3	3	3	3				1	2		

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	2
CO3	3	3	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : DIGITAL IMAGE PROCESSING USING OPEN CV PYTHON LAB	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L09	Prerequisite: Python Programming, Digital Signal Processing	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Image Processing in Open CV
2. Changing Color-Space
3. Image Thresholding
4. Geometric Transformations of Images
5. Smoothing images
6. Morphological Transformations
7. Image Gradients
8. Canny Edge Detection
9. Image Pyramids
10. Contours in Open CV
11. Histograms in Open CV
12. Image Transforms in Open CV
13. Feature Detection and Description
14. Camera Calibration and 3d Reconstruction

Total Number of Hours: 45

***REFERENCES*:**

1. *Lab manual, Department of ECE, DR.MGR UNIVERSITY.*

Subject Code:	Subject Name : SENSOR AND ROBOTICS LAB	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L10	Prerequisite: Microprocessor and Microcontroller Lab	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the different robotic configurations and their subsystems.
- To develop a deep knowledge sensors and their applications in robot

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Built simple robots using motor driver IC and sensor module
CO2	Apply programming knowledge to interface various devices with arduino
CO3	Design robots for control using timer and delay
CO4	Measure the performance of robots by integrating with different sensors

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2		3	1		2
CO2	3	3	3	3	3	1	2		3	1		2
CO3	3	3	3	2	3	2	2		3	1		2
CO4	3	3	3	3	3	1	2		3	1		2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	2	3	3
CO3	3	2	3	3
CO4	3	2	3	3
CO5	3	2	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : SENSOR AND ROBOTICS LAB	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L10	Prerequisite: Microprocessor and Microcontroller Lab	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Simple Robot Circuit
2. Bulid Light Tracking Robot
3. Line Follower Robot
4. Interfacing to Switch Bar Graph LED
5. Lcd Interfacing to Display Integer Alphanumeric Characters
6. Pwm Control of Dc Motor
7. Material Handling Using Motosim
8. Surface Deburring Using Motosim
9. Ultrasonic Proximity Sensor For Distance Measurement
10. Temperature LM 35 Temperature Sensor
11. Humidity Measurement Using DHT-11 Humidity Sensor
12. Automatic Irrigation System

Total Number of Hours: 45

***REFERENCES*:**

1. Lab manual, Department of ECE, DR.MGR UNIVERSITY.

Subject Code:	Subject Name : SOFT SKILLS – II QUALITATIVE AND QUANTITATIVE SKILLS	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I07	Prerequisite: None	IE	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: The main objective is to strengthen the logical and arithmetic reasoning skills of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Recognize and apply arithmetic knowledge in a variety of contexts.
CO2	Ability to identify and critically evaluate philosophical arguments and defend them from criticism.
CO3	Define data and interpret information from graphs.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	1	1	3	2	3	3
CO2	2	2	2	3	1	3	1	3	3	3	3	1
CO3	3	3	3	3	3	3	2	2	3	3	3	3

Cos / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3
CO2	3	2	2	3
CO3	1	2	1	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
								✓	

Subject Code:	Subject Name : SOFT SKILLS – II QUALITATIVE AND QUANTITATIVE SKILLS	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBCC22I07	Prerequisite: None	IE	0	0/0	2/0	1

UNIT 1 Logical Reasoning I 6Hrs

Logical Statements – Arguments – Assumptions – Courses of Action.

UNIT 2 Logical Reasoning II 6Hrs

Logical conclusions – Deriving conclusions from passages – Theme detection.

UNIT 3 Arithmetical Reasoning I 6Hrs

Number system – H.C.F & L.C.M – Problem on ages – Percentage – Profit & Loss – Ratio & Proportion – Partnership.

UNIT 4 Arithmetical Reasoning II 6Hrs

Time & Work – Time & Distance – Clocks – Permutations & Combinations – Heights & Distances – Odd man out and Series.

UNIT 5 Data Interpretation 6Hrs

Tabulation – Bar graphs – Pie graphs – Line graphs.

Total Number of Hours: 30

Reference Book:

1. *R.S.Agarwal, A modern approach to Logical Reasoning, S.Chand& Co., (2017).*
2. *R.S.Agarwal, A modern approach to Verbal and Non verbal Reasoning, S.Chand& Co., (2017).*
3. *R.S.Agarwal, Quantitative Aptitude for Competitive Examinations, S.Chand& Co., (2017).*
4. *A.K.Gupta, Logical and Analytical Reasoning, Ramesh Publishing House, (2014).*
5. *B.S.Sijwali, Indusijwali, A new approach to Reasoning (Verbal and Non verbal), Arihant Publishers, (2014).*

Subject Code:	Subject Name : TECHNICAL SKILL - III	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22I03	Prerequisite:None	IE	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The objective is to develop the technical skill of the students.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Develop the technical skills required in the field of study
CO2	Bridge the gap between the skill requirements of the employer or industry and the competency of the students.
CO3	Enhance the employability of the students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	2	2	3	2	3	2
CO2	3	3	2	3	3	3	2	2	3	3	3	3
CO3	3	3	3	3	3	3	2	2	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	2	3	3
CO3	2	3	2	3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
								✓	

Subject Code:	Subject Name : TECHNICAL SKILL - III	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22I03	Prerequisite:None	IE	0	0/0	2/0	1

Students should acquire skill in the domain/inter disciplinary area from government/private training centers/industries /University for a minimum period of 15 calendar days. The training can be through off line, online or mixed mode. Students are supposed to prepare Technical skill report at the end of the training and submit the report along with the certificate in proof of the training, during the viva voce examination conducted by the examiners duly appointed by the head of the department.

Subject Code:	Subject Name : MINI PROJECT / INTERNSHIP	TY / Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22I04	Prerequisite: Core Courses	IE	0	0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The main objective of the Inplant training is to provide a short-term work experience in an Industry/ Company/ Organization

COURSE OUTCOMES (COs) : (3- 5)

CO1	To get an insight of an industry / organization/company pertaining to the domain of study.
CO2	To acquire skills and knowledge for a smooth transition into the career.
CO3	To gain field experience and get linked with the professional network.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	3	3	3	3	3	3	3
CO2	3	2	3	3	2	3	3	3	3	3	3	2
CO3	3	3	3	3	2	3	3	3	3	3	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	3
CO2	2	3	2	3
CO3	3	3	3	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
								✓	

Subject Code:	Subject Name : MINI PROJECT / INTERNSHIP	TY / Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22I04	Prerequisite: Core Courses	IE	0	0	3/0	1

MINI PROJECT:

Students will have an opportunity to expose their knowledge and talent to make an innovative project. Students are supposed to do innovative projects useful to industries/society in the area of relevant Engineering, inter and multi-disciplinary areas, under the guidance of a staff member . They have to prepare a project report and submit to the department.

At the end of the semester Viva-Voce examination will be conducted by the internal Examiner duly appointed by the Head of the department and the students will be evaluated.

INTERNSHIP:

Students are supposed to undergo internship in related Industries for a minimum period of 30 days cumulatively during the semester. They have to prepare a report on the Internship with a certificate in proof from competent authority in the industry. At the end of the semester Viva-Voce examination will be conducted by the Examiners duly appointed by the Head of the department and the students will be evaluated.

SEMESTER- VII

Subject Code:	Subject Name :MICROWAVE AND OPTICAL COMMUNICATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22014	Prerequisite: Transmission Lines and Waveguides, Antenna and Wave Propagation	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the working of microwave passive devices and generators.
- To Study the operation of microwave active devices and its applications in circuits.
- To learn the importance of Optical fiber link and its losses.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Analyze the characteristics of microwave passive devices using Scattering matrix
CO2	Apply the principle of generators in developing microwave signals
CO3	Demonstrate the characteristics of microwave solid state devices.
CO4	Analyze the parameters of transmission lines in microwave circuits.
CO5	Understand the fiber optical communication system and investigate the losses in it

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	1	2	1	1	1	1	1
CO2	2	3	3	3	3	1	1	1	2	2	1	1
CO3	3	2	2	2	3	1	2	1	1	1	1	1
CO4	3	2	2	2	2	3	1	1	3	1	1	2
CO5	3	3	3	3	3	3	1	1	1	2	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	2
CO2	1	3	1	2
CO3	1	2	1	1
CO4	1	3	2	2
CO5	1	3	1	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium,-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name :MICROWAVE AND OPTICAL COMMUNICATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22014	Prerequisite: Transmission Lines and Waveguides, Antenna and Wave Propagation	Ty	3	0/0	0/0	3

UNIT I MICROWAVE PASSIVE DEVICES 9 Hrs

Transmission Lines for use at Microwave Frequencies – Attenuators, Directional Couplers, Terminators, Phase Shifters, Faraday Rotation Isolators and Circulators, Field Displacement Isolators, Microwave Filters, Frequency Meters, Hybrid Junctions – Scattering Analysis.

Limitations of Conventional Tubes at Very High Frequencies – Velocity – Modulated Tubes, Two –

UNIT II MICROWAVE GENERATOR 9Hrs

Cavity Klystron Amplifiers, Reflex Klystron Oscillators – Periodic Slow Wave Structures and their Use in Travelling Wave Tube Amplifiers, Focusing Techniques, TWTA Performance Characteristics – Electron Motion in Crossed Electric and Magnetic Fields - Magnetron Oscillators, Hartree Equation Rieke Diagram and Performance Charts .

Varactor Diodes, Manley – Rowe Relations, Low Noise Parametric Amplifiers – Transferred –

UNIT III MICROWAVE SOLID-STATE DEVICES 9 Hrs

Electron Devices and Their Operation, Cavity – Controlled Modes, LSA Mode-Avalanche – Transit Time Devices and Their Operation, TRAPATT Mode, BARITT mode, PIN Diodes and Their use as Attenuators and Switches.

Slotted - Line Techniques – Measurements of Wavelength – Measurement of Low and High VSWR –

UNIT IV MICROWAVE MEASUREMENTS 9 Hrs

Measurement of Frequency and Frequency Meters – Measurement of Insertion Loss and Attenuation by Substitution Methods – Measurement of Low and High Powers at Microwave Frequencies – Modern Measurement Techniques using Automatic Network Analyzer and Spectrum Analyzer.

UNIT V OPTICAL FIBER, LOSSES AND DESIGN 9 Hrs

The General System – Evolution of Fiber Optical System – Elements of an Optical FiberTransmission Link – Cylindrical Fiber – Single Mode Fibers and Multimode Fibers - Fiber Splicingand Connectors. Absorption Losses, Scattering Losses – Bending Losses – Core and Cladding Losses– Signal Distortion in SM Fibers - Point to Point Links – System Design Consideration — Link PowerBudget – Rise Time Budget

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Annapurna Das, Sisir. K. Das, "*Microwave Engineering*", Tata McGraw Hill Co., Ltd., 1999. Reprint 2001.
2. Samuel Y. Liao: "*Microwave Devices and Circuits*" , Prentice Hall of India – 3rd Edition (2003)
3. SubalKar , "*Microwave Engineering*" , Universities press(India) private limited – 1st Edition (2016)
4. Gerd Keiser,"Optical Fiber Communication System", McGraw Hill International,3rd Edition 2000

REFERENCE BOOKS:

1. *D.M. Pozer, "Microwave Engineering", Addison – Wesley, 1998.*
2. *R.E. Collins: "Foundations for Microwave Engineering", IEEE Press Second Edition (2002)*
3. *David K. Cheng," Field and Waves in Electromagnetism", Pearson Education, 1989.*
4. *John M.Senior,"Optical Fiber Communication-Principles and Practice", Prentice Hall of India, 1996*

Subject Code:	Subject Name : VLSI DESIGN	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22015	Prerequisite: Analysis of Solid State Devices, Digital Electronics	TY	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn the basics of MOS Transistors.
- To study the design of combinational logic circuit using CMOS.
- To learn CMOS sequential logic circuits design.
- To learn the concepts of modeling a digital system using HDL.
- To study the basics of PIC microcontroller.

COURSE OUTCOMES (COs) :
The students will be able to

CO1	To gain sound knowledge about the basic CMOS Circuits..
CO2	Analysis and design of different combinational ciecuits.
CO3	Identify the techniques involved in the analysis and synthesis of sequencial circuits.
CO4	Expertise in digital system design using VHDL & Verilog.
CO5	Understand the basics of 16F877 PIC Microcontroller.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2			2	2	2	3	2	3
CO2	3	3	3	3	3	2	2		3	2	3	2
CO3	3	3	3	3	3	2			3	2	3	2
CO4	3	2	3	2	3	2			3	2	2	2
CO5	3	-	3	2	3	2			2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	2
CO3	3	3	2	2
CO4	3	3	2	3
CO5	3	3	-	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name :VLSI DESIGN	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22015	Prerequisite: : Analysis of Solid State Devices, Digital Electronics	TY	3	0/0	0/0	3

UNIT I MOS TRANSISTOR THEORY 9 Hrs

Introduction – NMOS and PMOS transistor, Threshold voltage, Body effect, MOS device – Basic DC equations ,Second order effects, MOS models, Small signal AC characteristics, Complementary CMOS Inverter, Power dissipation and scaling of MOS transistors.

UNIT II DESIGNING COMBINATIONAL LOGIC CIRCUITS 9 Hrs

Static CMOS design – Complementary CMOS, Propagation Delay and Power Consumption in static CMOS, Pseudo NMOS Logic, Pass Transistor Logic, Transmission gates, Dynamic CMOS Design – Basic principle, Speed and Power dissipation of Dynamic logic, Signal integrity issues in dynamic design,CMOS Domino logic, np CMOS logic.

UNIT III DESIGNING SEQUENTIAL LOGIC CIRCUITS 9 Hrs

Introduction – Timing metrics for sequential circuits, Classification of memory elements, Static latches and registers – The bi-stability principle, Multiplexer based latch, Master slave edge triggered register, Static SR flip flop, Dynamic latches and registers – Dynamic transmission gate edge triggered registers, clocked CMOS register.

UNIT IV VHDL PROGRAMMING 9 Hrs

VHDL background – VHDL requirement, Elements of VHDL- Importance of HDL- typical design flow-operators, Basic concepts in VHDL, Structural modeling, Behavioral modeling and Dataflow modeling in VHDL and Simple programs-VHDL code for half adder and full adders, half and full subtractors, multiplexers, demultiplexers, decoders, encoders, 2-bt comparator,shift registers.

UNIT V VERILOG PROGRAMMING 9 Hrs

Verilog HDL – Basic concepts and popularity of Verilog HDL – Verilog requirements, Gate Level modeling, Dataflow modeling and Behavioral modeling – Simple programs -Verilog code for half adder and full adder, half and full subtractor, multiplexers, demultiplexers, decoders, encoders, 2-bt comparator,shift registers.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS :

1. Neil H.E. Weste, Kamran Eshraghian, "*Principles of CMOS VLSI Design – A system perspective*", second edition,Addison Wesley,1997.
2. Jan M.Rabaey, Ananth Chandrakasan, Borivoje Nikolic, " *Digital Integrated Circuits : A Design perspective*", second edition, Prentice Hall of India, 2003.
3. Zainalabedin Navabi, " *VHDL – Analysis and modeling of Digital Systems*" , Second edition, Mcgraw – Hill International Editions, 1998.

REFERENCE BOOKS:

1. *A. Pucknell, Kamran Eshraghian, " Basic VLSI Design", Third Edition, Prentice Hall of India,2007.*
2. *R.Jacob Baker, Harry W.Li, David E. Boyce, "CMOS circuit design, Layout and Simulation", Prentice Hall of india, 2005.*
3. *J.Baskar, "A VHDL Primer", Third edition, Pearson Education,2004.*
4. *Samir Palnitkar, "Verilog HDL, A Guide to Digital Design and Synthesis", second edition, Pearson Education,2003.*
5. *pic-microcontroller.com / free- ebook- pic-microcontrollers.*

Subject Code:	Subject Name : EMBEDDED SYSTEMS	TY/Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22016	Prerequisite: Microprocessor and Microcontroller	TY	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To facilitate the students to learn the design issues in microcontrollers and their performance metrics.
- To study the basic hardware components of embeddd controllers based on the characteristics
- Learn the design aspects of I/O interfacing circuits

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the architecture of 8051 and 68HC11 microcontroller.
CO2	Understand the basics of 16F877 PIC Microcontroller.
CO3	Write simple programs using assembly & C language.
CO4	Apply interrupt routines for the measurement of period, frequency
CO5	Demonstrate the interfacing of microcontrollers with peripheral devices

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1		2			1	2	1	2
CO2	2	1	3	2		1			1	1	1	1
CO3	2	3	2	2		1			1	2	2	2
CO4	1	3	3	3					1	2	2	2
CO5	1	2	3	3		2			1	2	3	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	
CO2	3	3		
CO3	2	2	2	3
CO4	2	2	2	
CO5	2	2	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : EMBEDDED SYSTEMS	TY/Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22016	Prerequisite: Microprocessor and Microcontroller	TY	3	0/0	0/0	3

UNIT I 68HC11 AND 8051 MICROCONTROLLER 9 Hrs

Embedded Computer systems: - Applications, Software issues, Memory Mapped Architecture, 68HC11 Architecture and Different Addressing Modes, Study of Intel 8051 Microcontroller Architecture and Instruction Set

UNIT II PIC MICROCONTROLLER 9 Hrs

Introduction - PIC16F877 Micro controller overview - Architecture of PIC Micro Controllers - Pipelining - Program Memory considerations – Register File Structure- I/O Ports and Timers .

UNIT III PROGRAMMING AND INTERFACING 9 Hrs

Programming of PIC Micro Controllers- Instruction Set of PIC Micro Controllers, Simple Assembly language and C Program for PIC Microcontroller , Capture/ Compare and PWM module, Serial communication module, Analog module interfacing

UNIT IV INTERUPPTS AND PERIPHERALS 9 Hrs

68HC11 Interrupt system- Interrupts Polled Versus Vectored Interrupts -Assembler Directives -Serial Communication – UART -A/D Converter Module–Pulse Width Modulation - 6811 Timing Generation and Measurements: MC6811 Input Capture, Output Compare, Square Wave Generation Frequency Measurements.

UNIT V I/O DEVICES AND INTERFACING 9 Hrs

Serial I/O devices: RS232 Specifications, Communication Protocols, MC6811 SCI ad SPI. Parallel port Interfaces: Input Switches and Keyboard, output LED, Stepper Motor. Memory Interfacing: Address Switching, Memory Interface, examples for MC6H16, Introduction to High speed I/O Interfacing.

Practical component P: Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOK:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay “The 8051Microcontroller and Embedded Systems”, Second Edition, Pearson Education 2008.
2. Jonathan.W.Valvano, “Embedded Microcomputer system”, Brooks/COLE Thomson learning series
3.John B Peatman “Design with PIC Microcontroller” Latest Edison

REFERENCES:

1. *Mazidi, M.A.,“PIC Microcontroller” Rollin Mckinlay, Danny causey Printice Hall of India, 2007*
2. *MykePredko TMH. “Programming and customizing the Microcontroller”*

Subject Code:	Subject Name : WIRELESS NETWORKS	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22017	Prerequisite: Communication Networks	TY	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To give a deep insight for the wireless network architectures, protocols, and applications.
- To study about Adhoc wireless networks and its MAC & Routing protocols.
- To understand the wireless sensor networks and its MAC & Routing protocols.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the concepts of WLAN and PAN
CO2	Identify and Analyze the issues in Adhoc wireless networks
CO3	Design MAC protocols and study its implementation in Adhoc networks.
CO4	Classify the different network routing protocols and potray their significance in the field of wireless networks.
CO5	Learn the architecture of wireless sensor networks and the method of data transmission IN SENSOR NETWORKS

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	2	2	2
CO2	3	3	3	3	3	2	2	2	2	2	2	2
CO3	3	3	3	3	3	2	2	2	2	2	2	2
CO4	3	3	3	3	3	2	2	2	2	2	2	2
CO5	3	3	3	3	3	2	2	2	2	2	2	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	3
CO2	3	3	2	3
CO3	3	3	3	2
CO4	3	3	3	2
CO5	2	1	1	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
				✓					

Subject Code:	Subject Name : WIRELESS NETWORKS	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22017	Prerequisite: Communication Networks	TY	3	1/0	0/0	4

UNIT I WIRELESS LANS AND PANS **12 Hrs**

Introduction - FUNDAMENTALS OF WLANS- Technical Issues - Differences Between Wireless and Wired Transmission, Use of WLANs, Design Goals- Network Architecture - Infrastructure Based Versus Ad Hoc LANs, Components in a TypicalIEEE802.11 Network, Services Offered by a TypicalIEEE802.11 Network- IEEE802.11 STANDARD- Physical Layer, Basic MAC Layer Mechanisms- HIPERLAN standard-Bluetooth

UNIT II AD HOC WIRELESS NETWORKS **12 Hrs**

INTRODUCTION - Cellular and Ad Hoc Wireless Networks - definition, characteristics features, Applications of Ad Hoc Wireless Networks- Issues in ad hoc wireless networks - Ad Hoc wireless internet.

UNIT III MEDIUM ACCESS PROTOCOLS **12 Hrs**

MAC Protocols: design issues, Design goals of a MAC protocol For Ad Hoc wireless networksand classification of MAC protocols -Contention based protocols- with reservation, with scheduling mechanisms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15, 802.16.

UNIT IV NETWORK PROTOCOLS **12 Hrs**

Routing Protocols: Design issues, goals and classification of Routing Protocols - Proactive Vs reactive routing, Table-driven routing protocols: Destination sequence Distance – Vector routing Protocol, wireless Routing Protocol - On-demand routing protocols: Dynamic source Routing protocol, Ad Hoc on Demand Distance – vector Routing protocol - Hybrid Routing protocol : Core extraction distributed Ad Hoc routing protocol , Zone routing protocol - Power-aware routing protocols: Power – aware routing metrics.

UNIT V WIRELESS SENSOR NETWORKS **12 Hrs**

Introduction - Sensor Network Architecture - Data Dissemination - Data Gathering - MACPROTOCOLS for Sensor Networks - Location Discovery - Quality of a Sensor Network

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60

TEXT BOOKS:

1. C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures andprotocols, 2nd edition, Pearson Education. 2007
2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000

REFERENCES:

1. *Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobilead hocnetworking, Wiley-IEEE press, 2004.Mohammad Ilyas, The handbook of adhoc wireless networks, CRC press, 2002.*
2. *T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad Hoc Network*
3. *Research," Wireless Commun. and Mobile Comp., Special Issue on Mobile Ad HocNetworking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.*
4. *A survey of integrating IP mobility protocols and Mobile Ad hoc networks, FekriM.Abduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, v no.12007*
5. *V.T. Raisinhani and S.Iyer "Cross layer design optimization in wireless protocolstacks"Comp. communication, vol 27 no. 8, 2004.*
6. *V.T.Raisinhani and S.Iyer,"ÉCLAIR; An Efficient Cross-Layer Architecture forwireless protocol stacks",World Wireless cong., San francisco,CA,May 2004.*
7. *V.Kawadia and P.P.Kumar,"A cautionary perspective on Cross-Layer design,"IEEEWireless commn.*

Subject Code:	Subject Name : VLSI AND EMBEDDED SYSTEM DESIGN LAB	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L11	Prerequisite: Digital Electronics Lab, Microprocessor and Microcontroller Lab	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To design and simulate combinational logic circuits using Xilinx.
- To design and simulate sequential logic circuits.
- To interface ADC, DAC, DC motor, stepper motor with PIC microcontroller.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Design & implement combinational circuits like adder, multiplexer, de multiplexer etc.,
CO2	Construct sequential circuits like FFs, counters, shift registers.
CO3	Investigate I/O devices, ADC, DAC, motors with microcontroller.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		2			1					
CO2	3	2	3	3	3						2	
CO3		2		3	3						2	

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	2	3	1
CO3	3	2	3	2

H/M/L indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : VLSI AND EMBEDDED SYSTEM DESIGN LAB	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L11	Prerequisite: : Digital Electronics Lab, Microprocessor and Microcontroller Lab	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

SIMULATION OF DIGITAL CIRCUITS USING Verilog

1. Design and Verification of Adder and Subtractor
2. Design and Verification of Multiplexer, Demultiplexer, Encoder, Decoder.
3. Design and Verification of Magnitude Comparator with 4 Bits.
4. Design and Verification of Jk, D, T and Sr Flip Flops
5. Design and Verification of Synchronous & Asynchronous Counters.
6. Design and Verification of Shift Registers (Right / Left).

INTERFACING WITH PIC MICROCONTROLLER

7. ADC Interface with LM 35.
8. Stepper Motor Interface
9. Traffic Light Controller Interface
10. DC Motor Interface
11. LCD Display Interface.
12. LED Interface

Total Number of Hours: 45

***REFERENCES*:**

1. Lab manual, Department of ECE, DR.MGR UNIVERSITY.

Subject Code:	Subject Name : MICROWAVE AND OPTICAL COMMUNICATION LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L12	Prerequisite: Field and Wave Electromagnetics	TY	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To have a detailed practical study of microwave diodes
- To study the optical devices and to use in the appropriate application.
- To establish the fiber optical communication link

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Demonstrate the ability to design and conduct microwave experiments, analyze and interpret data.
CO2	Demonstrate the skills to use modern engineering tools, software and equipments to analyze design problems.
CO3	Design a system and to learn about measurement of fiber optic parameters.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3		2		2	2
CO2	3	3	3	3	3	3	3		2		2	2
CO3	3	3	3	3	3	3	3		2		2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	2	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : MICROWAVE AND OPTICAL COMMUNICATION LAB	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L12	Prerequisite: Field and Wave Electromagnetics	TY	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Reflex Klystron Mode Characteristics.
2. Measurement of Guide Wavelength
3. Measurement of VSWR and Impedance of Unknown Loads, Including Measurement of High VSWR.
4. Measurement of the Coupling and the Directivity of Waveguide Directional Couplers.
5. Measurement of Insertion Loss and Isolation of Non – Reciprocal Ferrite Devices.
6. Study of Tee Junction (E-Plane, H-Plane And E-H Plane Tees.)
7. Measurement of The Gain and Radiation Pattern of a Waveguide Horn Antenna
8. Study of Gunn Oscillator Characteristics.
9. Study of A Fiber-Optic Communication Link.
10. Characteristics of Led and Pin Diode
11. Characteristics of Laser Diode
12. Characteristics of Avalanche Photodiode
13. Measurements of Fiber Parameters : Numerical Aperture, Attenuation

Total Number of Hours: 45

***REFERENCES*:**

1. Lab manual, Department of ECE, DR.MGR UNIVERSITY.

Subject Code:	Subject Name : PROJECT PHASE - I	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22I05	Prerequisite: Core Courses	IE	0	0/0	3/3	2

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	Formulate students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	Analyze research skills and demonstrate their proficiency in communication skills.
CO4	Make the students to face challenges of team work, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	3	1	2	2	3	3
CO2	3	3	3	3	3	3	3	2	2	2	3	3
CO3	3	3	3	3	3	3	3	2	2	3	3	2
CO4	3	2	3	3	3	3	2	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	2	3	3
CO4	3	2	2	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : PROJECT PHASE - I	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22I05	Prerequisite: Core Courses	IE	0	0/0	3/3	2

Students are expected to do the Project in a group of 3 to 4 students. They should identify the area/topic of the Project and should collect the literatures related to the project. Students intending to do Industrial projects will approach the industries with the support of the university, identify the industrial problem and finalize the project. In case of Industrial projects apart from Industry guide, a guide has to be appointed by the department. At the end of the Semester the students should submit their Project Phase - I report to the Department and Viva -Voce examination will be conducted by the examiners duly appointed by the Head of the department.

Subject Code:	Subject Name: FOREIGN LANGUAGE	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBFL22IXX	Prerequisite: None	IE	1	0/0	1/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: To recognize the cultural values, practices, and heritage of the foreign country, communicate effectively in a foreign language and interact in a culturally appropriate manner with native speakers of that language.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Achieve functional proficiency in listening, speaking, reading, and writing.
CO2	Develop an insight into the nature of language itself, the process of language and culture acquisition.
CO3	Decode, analyze, and interpret authentic texts of different genres.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	2	1	2	2	2	2	1
CO2	2	1	1	1	1	2	1	2	2	2	2	1
CO3	1	1	2	2	1	2	2	2	2	2	2	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1
CO2	1	1	1	1
CO3	1	1	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
			✓						

Subject Code:	Subject Name: FOREIGN LANGUAGE	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBFL22IXX	Prerequisite: None	IE	1	0/0	1/0	1

Foreign language is introduced in the curriculum to make the students globally employable. Students should select and register for any one of the foreign languages from the given list. At the end of the course students should be able to read, write and converse the language in the basic level. At the end of the semester the assessment will be done through internal examination by the examiner duly appointed by the head of the department.

SEMESTER VIII

Subject Code:	Subject Name : PRINCIPLES OF MANAGEMENT AND BEHAVIORAL SCIENCE	TY/Lb/ETL/IE	L	T/S Lr	P/R	C
EBCC22ID2	Prerequisite:None	TY	3	0/0	0/0	3

L:LectureT:Tutorial SLr:SupervisedLearningP:ProjectR:ResearchC:Credits
T/L/ETL:Theory/Lab./EmbeddedTheoryandLab.

OBJECTIVE: Thestudentwilllearn:

- About the evolution, functions and principles of Management Studies
- The applications of the principles in an organization
- The system and process of effective controlling in the organization.

COURSEOUTCOMES(COs): The student will be able to

CO1	Clear understanding in planning, and have knowledge in aspect of Management Studies (Level 2)
CO2	Understanding the planning process in the organization. (Level 2)
CO3	Understanding the concept of organization. (Level 2)
CO4	Demonstrate the ability to directing and coordinating. (Level 3)
CO5	Analyze and formulate the best control methods. (Level 4)

MappingofCourseOutcomes(COs)withProgramOutcomes(POs)&ProgramSpecificOutcomes(PSOs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3		2	-	3	3	2	3	2
CO2	3	2	2	3		2	-	3	2	3	-	2
CO3	3	-	-	2		-	3	2	-	2	2	2
CO4	3	3	3	3		2	-	2	2	2	2	2
CO5	2	3	3	-	3	3	3	2	3	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	-	2	3	3
CO2	-	2	3	3
CO3	-	2	3	3
CO4	-	2	3	3
CO5	-	2	3	3

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
							✓		

Subject Code:	Subject Name : PRINCIPLES OF MANAGEMENT AND BEHAVIORAL SCIENCE	TY/Lb/ET L/IE	L	T/S Lr	P/ R	C
EBCC22ID2	Prerequisite:None	TY	3	0/0	0/0	3

UNIT I INTRODUCTION **9 Hrs**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and responsibilities – Evolution of Management –need and Importance of Organizational Behavior, Leadership styles – Theories – Leaders Vs Managers.

UNIT II PLANNING & ORGANISING **9 Hrs**

Nature and purpose of planning – planning process – types of planning – Planning premises objectives – hierarchy of objectives, Management By Objectives (MBO)— Decision making process. Nature and purpose of Formal and informal organization structure– types – Line and staff authority– delegation of authority – centralization and decentralization.

UNIT III STAFFING AND COORDINATING **9 Hrs**

Human Resource Planning, Job Analysis, Recruitment, Selection, Training and Development, Performance Management, Career planning. Coordination –Nature and purpose - Coordination at various levels: Top management, Middle management, Supervisory management and workers. Techniques for effective coordination

UNIT IV DIRECTING AND CONTROLING **9 Hrs**

Direction: Principles of direction – Need and Importance for directing, process of controlling – budgetary and non-budgetary control techniques – use of technology. Recent Trends in Management controlling.

UNIT V GROUP BEHAVIOUR AND MOTIVATION **9 Hrs**

Group Dynamics - How Groups Work, Stages of Group Development, Team building, Motivation – Theories of motivation Organizational Conflict – Causes – Types of Conflicts, Managing conflicts.

Total Number of Hours: 45

Reference Books:

1. *Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management" 7th Edition, Pearson Education,2011.*
2. *Robert Kreitner & Mamata Mohapatra, "Management", Biztantra,2008.*
3. *Harold Koontz & Heinz Weihrich "Essentials of management" Tata Mc Graw Hill,1998.*
4. *S.S. Khanka - Organizational Behaviour - S. Chand Ltd. – 2006.*
5. *L.M.Prasad - Organizational Behaviour. S. Chand Company – 3rd edition – 2004.*

Subject Code:	Subject Name : PROJECT PHASE - II	TY /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L13	Prerequisite: Project Phase I	Lb	0	0/0	12/12	8

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	Formulate students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	Analyse research skills and demonstrate their proficiency in communication skills.
CO4	Make the students to face challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	2	3	3	3
CO4	3	3	3	3	3	3	3	2	2	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
									✓

Subject Code:	Subject Name : PROJECT PHASE - II	TY /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22L13	Prerequisite: Project Phase I	Lb	0	0/0	12/12	8

To make the students to make use of the knowledge and skill developed during their four years of study and to apply them for making an innovative product/process for the development of society and industries.

Students are expected to do a Project work either in an Industry or at the University in the field of relevant Engineering /inter-disciplinary /multi-disciplinary area in a group of 3 or 4 students. The work to be carried out in Phase II should be continuation of Phase I. Each group will be allotted a guide based on the area of Project work. In case of industrial Project external guide has to be allotted from Industry. Inter disciplinary/multi-disciplinary project can be done with students of different disciplines as a group. Monthly reviews will be conducted during the semester to monitor the progress of the project by the project review committee. Students have to submit the Project thesis at the end of the semester and appear for the Project Viva-Voce examination conducted by the examiners duly appointed by the Controller of Examination. In case of industrial project certificate in proof has to be included in the report along with the bonofide certificate.

PROGRAM ELECTIVES

ELECTIVE I – ELECTRONICS STREAM

Subject Code:	Subject Name : SEMICONDUCTOR DEVICES AND ITS APPLICATIONS	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E01	Prerequisite: Analysis of Solid State Devices	TY	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the functions of special diodes and their applications.
- To gain the knowledge about operation of power diodes.
- To apply the power diodes for inverters, converters and regulated power supply.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the characteristics of special diodes
CO2	Apply the diodes for basic electronic design
CO3	Remember the operations of inverters.
CO4	Illustrate the different types of converters.
CO5	Demonstrate the design of protection and switch gear

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	1	1	1		2		
CO2	2	1	2	3	2	1	1	1		2		
CO3	2	1	1	2	2	2	2	1	1	2		2
CO4	2	1	1	2	2	2	2	1	1	2	1	
CO5	2	2	3	3	2	1	2	3	2	2	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1
CO2	2	3	1	1
CO3	1	1	2	2
CO4	1	1		2
CO5	1	1	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : SEMICONDUCTOR DEVICES AND ITS APPLICATIONS	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E01	Prerequisite: Analysis of Solid State Devices	TY	3	0/0	0/0	3

UNIT I SPECIAL DIODES 9 Hrs

Breakdown Diodes-Avalanche Multiplication, Zener breakdown and its characteristics, Tunnel Diodes – Principle and Characteristics, Photodiode and its characteristics, Photo Voltaic Effect, and Light Emitting Diodes, Four Layer diode and its characteristics.

UNIT II APPLICATIONS OF DIODES 9 Hrs

Diode as clipper, clamper, comparator, sampling gate, voltage multipliers and peak detectors - Regulated Power Supply.

UNIT III INVERTERS 9 Hrs

Single Phase and three phase inverters-Voltage source inverters-current source inverters-Multilevel inverters-Resonant inverters.

UNIT IV CONVERTERS 9 Hrs

Single phase and three phase converters –Buck-Boost Converters-Dc to Dc converters-Ac to Ac Converters-Resonant Converters-Cycloconverters.

UNIT V FIRING AND PROTECTING CIRCUITS 9 Hrs

Necessity of isolation, pulse transformer, optocoupler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT - Over voltage, over current and gate protections

Total Number of Hours: 45

TEXT BOOKS :

1. Jacob Milman, Christos Halkias and Chetan D.Parikh, ‘Integrated Electronics, Analog and Digital Circuits and Systems”
2. Rashid M.H., " Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004
3. B.W Williams ‘Power Electronics Circuit Devices and Applications’.

REFERENCES :

1. *P.S.Bimbra, ‘Power Electronics” , Khanna Publishers,Eleventh Edition 2003*
2. *Ned Mohan,T.MUndeland and W.P Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Wiley India edition, 2006*
3. *P.C. Sen, “Modern Power Electronics”, Wheeler Publishing Co, First Edition, New Delhi, 1998*

Subject Code:	Subject Name : REAL TIME OPERATING SYSTEMS	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E02	Prerequisite: None	TY	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Review of elements and fundamentals of Systems.
- To know the operation of embedded software tools
- To understand the importance of queues and scheduling

COURSE OUTCOMES (COs) :

The Student will be able to

CO1	Understand the fundamentals of embedded system
CO2	Apply scheduling techniques for completing an operation
CO3	Remember the functions of key elements of RTOS
CO4	Implement the design of simple RTOS
CO5	Demonstrate the applications of software development tools in real time system.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	3	1	1	1			
CO2	2	3	3	3	3	2		1	2	3	2	1
CO3	1	3	3	2	3	1		1	3	3	1	1
CO4	1	3	3	3	3	2	1		2	2		
CO5	2	2	3	3	3	1	1		2	2		

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	2
CO2	1	2	3	
CO3	1	2	2	
CO4	1	2	3	2
CO5	1	2	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : REAL TIME OPERATING SYSTEMS	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E02	Prerequisite: None	TY	3	0/0	0/0	3

UNIT I EMBEDDED SYSTEM FUNDAMENTALS **9 Hrs**

Complex systems and microprocessors– Embedded system design process –Designexample: Model train controller- Design methodologies- Design flows - RequirementAnalysis – Specifications-System analysis and architecture design – Quality Assurancetechniques - Designing with computing platforms – consumer electronics architecture –platform-level performance analysis.

UNIT II SURVEY OF SOFTWARE ARCHITECTURES **9 Hrs**

Round –robin, Round-robin with interrupts, queues. Function- scheduling architecture, Real time operating system architecture, Scheduling architecture.

UNIT III ELEMENTS OF REAL TIME OPERATING SYSTEMS **9 Hrs**

Structure of a Real Time System — Estimating program run times – Task Assignment andScheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock SynchronisationTasks & Task states, Tasks & data, Semaphores & shares data, Message Queues, Mailboxes and Pipes, Timer functions, Events, Memory management and Interrupt Routines in an RTOS environment.

UNIT –IV BASIC DESIGN USING REAL-TIME OPERATING SYSTEMS **9 Hrs**

Principles, encapsulating semaphores & queues, hard real-time scheduling considerations, saving memory space, saving power.

UNIT V EMBEDDED TOOLS **9 Hrs**

Embedded software development tools- host and target machines, linker/locators for embedded software, getting embedded software into the target system. Debugging techniques- testing on host system, instruction set simulators, the assert, macro using laboratory tools.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Wayne Wolf, “Computers as Components- Principles of Embedded Computing Systems Design”, Academic press, 2001.
2. David E. Simon, “An Embedded Software Primer”, Pearson education, 1999.

REFERENCES:

1. *Arnold S. Berger, “Embedded Systems Design- an Introduction to Processes, Tools & Techniques”, CMP books, 2002.*
2. *Jean J. Labrosse, “Embedded Systems Building Blocks”, CMP books, 2002.*
3. *Michael Barr, “Programming Embedded Systems in C andC++”, O’Reilly, 1999.*
4. *Lyla B.Das, ―Embedded Systems : An Integrated Approach‖ Pearson Education, 2013.*
5. *Jonathan W.Valvano, ―Embedded Microcomputer Systems Real Time Interfacing‖, Third Edition Cengage Learning, 2012.*
6. *David. E. Simon, ―An Embedded Software Primer‖, 1st Edition, Fifth Impression, Addison Wesley Professional, 2007.*
7. *Raymond J.A. Buhr, Donald L.Bailey, ―An Introduction to Real-Time Systems- From Design to Networking with C/C++‖, Prentice Hall, 1999.*

Subject Code:	Subject Name : INTRODUCTION TO PLC	TY / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E03	Prerequisite: Electrical and Instrumentation Engineering	TY	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

To study the working principles of Programmable Logic Controller:
Provide students with opportunities to develop basic skills in the design of electronic equipment using PLC
To understand the generic architecture and constituent components of a Programmable Logic Controller.

- To develop architecture of PLC explaining each unit in detail.
- To develop a software program using modern engineering tools and technique for PLC
- To apply knowledge gained about PLC systems and to identify few real-life industrial applications

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Enable the students to develop knowledge on role of automation and importance of PLC
CO2	Interpret the Programming equipment, Various techniques of programming in PLC
CO3	Familiarize the students about the components of PLC
CO4	Understanding the architecture of SCADA and explain the importance of SCADA
CO5	Develop the various industrial applications of PLC

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	2		2	2	2	1
CO2	3	3	3	3	2	2	2		2	2	2	1
CO3	3	3	2	3	3	2	2		2	2	3	2
CO4	3	2	3	3	3	2	2		3	2	3	3
CO5	3	3	3	3	3	2	2		3	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	2	3	2	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : INTRODUCTION TO PLC	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E03	Prerequisite: Electrical and Instrumentation Engineering	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO PLC **9 Hrs**

Role of automation in Industries – benefits of automation – Necessity of PLC – History andEvolution of PLC – Definition, types, selection criterion – Overall PLC system – PLC Input andOutput modules – CPU, programmers and monitors, power supplies – Solid state memory

UNIT II PROGRAMMING OF PLC **9 Hrs**

Programming equipment, Various techniques of programming, Ladder diagram fundamentals ,proper construction of ladder diagram, basic components and their symbols in ladder diagram, Basics of PLC Programming: Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of operation

UNIT III COMPUTER CONTROLLED TEST SYSTEM **9 Hrs**

Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, architecture, PLCs versus Computers, PLC Size and Application.PLC Hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs). Definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, high speed counter, PLC design, study of at least one industrial PLC.

UNIT IV SCADA FUNDAMENTALS **9 Hrs**

Introduction, Open system: Need and advantages, Building blocks of SCADA systems, Remote terminal unit (RTU): Evolution of RTUs, Components of RTU, Communication subsystem, Logic subsystem, Termination subsystem, Testing and human-machine interface (HMI) subsystem, Power supplies, Advanced RTU functionalities, Intelligent electronic devices (IEDs).

UNIT V APPLICATIONS OF PLC **9 Hrs**

Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-in Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Measurement of temperature, flow, pressure, force, displacement, speed, level Developing a ladder logic for Sequencing of motors, Tank level control, ON OFF temperature control, elevator, bottle filling plant, car parking Motors Controls

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Gary Dunning, “Introduction to Programmable Logic Controllers”, Thomson, 2nd Edition
2. John R. Hackworth, Frederick D., Hackworth Jr., “Programmable Logic Controllers ProgrammingMethods and Applications”, PHI Publishers
3. John W. Webb, Ronald A. Reis, “Programmable Logic Controllers: Principles and Application”, PHILearning, New Delhi, 5th Edition
4. L.A. Bryan, E. A. Bryan, “Programmable Controllers Theory and Implementation” Industrial TextCompany Publication, Second Edition

REFERENCE BOOKS:

1. *Batten G. L., “Programmable Controllers”, McGraw Hill Inc., Second Edition*
2. *Krishna Kant, “Computer Based Industrial Control”, PHI*
3. *M. Chidambaram, “Computer Control of Process”, Narosha Publishing*
4. *P. K. Srivstava, “Programmable Logic Controllers with Applications”, BPB Publications*
5. *Webb J. W, “Programmable Controllers”, Merrill Publishing Company, 1988*

ELECTIVE I - COMMUNICATION STREAM

Subject Code:	Subject Name :ANTENNA AND WAVE PROPAGATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E04	Prerequisite: Mathemitics II, Solid State Physics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study Antenna Parameters.
- To study Radiation Resistance, Antenna Efficiency Measurement.
- To study Antenna Arrays.
- To study different types Antennas
- To study Radio wave propagation.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Understand the knowledge about antenna basics.
CO2	Write about the radiation from a current element.
CO3	Analyze the antenna arrays.
CO4	Explain various types of antenna.
CO5	Describe various types of radio wave propagation.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2					
CO2	3	3	3	3	3	3	2					
CO3	3	3	3	3	3	2	2					
CO4	3	3	3	3	3	2	2					
CO5	3	3	3	3	3	2	2					

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	
CO2	3	3	2	
CO3	3	3	2	
CO4	3	3	2	
CO5	3	3	2	

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name :ANTENNA AND WAVE PROPAGATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E04	Prerequisite: Mathemitics II, Solid State Physics	Ty	3	0/0	0/0	3

UNIT I ANTENNA BASICS **9 Hrs**

Antenna Parameters – Gain, Directivity, Effective Aperture Polarization, Beam width, Balun, Ground System, Top loading, monopole and Half wave dipole antenna, Short linear antenna, Beam solid angle, Antenna Temperature.

UNIT II RADIATION PRINCIPLE AND ANTENNA TERMINOLOGIES **9 Hrs**

Principle of Radiation, pattern, Antenna Terminologies – Reciprocity Theorem, Friss Formula, Slot Antennas, SWR (Standing Wave Radiators)

UNIT III ANTENNA ARRAYS **9 Hrs**

Arrays – Two Element Arrays – Uniform Linear Array – Broadside Array – End fire array – Principle of Pattern Multiplication – Binomial Arrays.

UNIT IV SPECIAL ANTENNA **9 Hrs**

Dish Antenna – Helical Antenna, Biconical Antenna, Microstip Patch Antenna, Turnstile Antenna, Yagi – uda antenna, Loop Antenna, Antenna Low and Medium Frequencies.

UNIT V WAVE PROPAGATION **9 Hrs**

Wave Propagation - Surface Wave Propagation , Structure of the Ionosphere, Space Wave Propagation- Determination of Critical Frequencies - Maximum Usable Frequency - Effect of Earth's Magnetic Field - Fading - Super Refraction - Scatter Propagation.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Constantine A.Balanis, "*Antenna theory analysis and design*" JohnWiley , 2nd Edition 2007.
2. G.S.V. Raju, "*Antenna wave propagation*", pearson education, 2004.
3. R.E. Collins, "*Antenna and Radio wave propagation*".

REFERENCE BOOKS:

1. *John D. Kraus, Ronald J Marhefka. "Antenna for all Appplications" Tata McGraw Hill 3nd Edition, 2007.*
2. *A.R.Harish, M. Sachidanada, "Antenna and wave propagation", Oxford university press,2007.*
3. *W.L.Stutzman and G.A. Thiele, "Antenna analysis and design", John willey,2000.*

Subject Code:	Subject Name : TELECOMMUNICATION SWITCHING SYSTEM	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E05	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the working of simple telephone networks.
- To establish the significance of network parameters in traffic engineering.
- To demonstrate the transmission of data in networks

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describe and apply the fundamentals of telecommunication systems and associated technologies.
CO2	Understand and explain the reasons for switching and the relative merits of the various modes of switching.
CO3	Analyze and design systems related to traffic engineering.
CO4	Analyze the internal design and operation of telephone networks with regard to key signaling systems used in telecommunication networks.
CO5	Understand and analyze the switching techniques used in data networks.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	1	1	1		1	1	
CO2	1	3	1	3	3	1		1		1	1	
CO3	3	3	3	3	1	1						
CO4	1	3	3	3	1	1	1		1			
CO5	1	3	3	3	3	1	1		1			2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3		2
CO2	3	3		1
CO3	3	2	2	2
CO4	3	3	1	3
CO5	3	3	1	2

H/M/L indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : TELECOMMUNICATION SWITCHING SYSTEM	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E05	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

UNIT I Introduction 9 Hrs

Evolution of Telecommunications, Simple Telephone Communication, Manual switching system, major telecommunication Networks, Strowger Switching System, Crossbar Switching.

UNIT II Switching Concepts 9 Hrs

SPC-its categorization, Enhanced Services, Two stage networks, Three stage networks, n-stage networks Time multiplexed Space Switching, Time Multiplexed time switching, combination Switching, Three stage combination switching, n-stage combination switching.

UNIT III Traffic Engineering 9 Hrs

Network Traffic load and parameters, Grade of service and blocking probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay systems.

UNIT IV Telephone Networks 9 Hrs

Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Transmission Systems, Numbering Plan, Charging Plan, Signaling Techniques, In channel signaling, common channel signaling, Cellular mobile telephony.

UNIT V Data Networks 9 Hrs

EPABX system – block diagram, working – Data transmission in PSTN, data rates in PSTNs – ISO – OSI reference model – Motivation for ISDN – Networks and protocol architecture, ISDN standards, broadband ISDN, voice data integration.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Thiagarajan Vishwanathan, “Telecommunication Switching Systems and Networks”; PHI Publications.
2. J. E. Flood, “Telecommunications Switching, Traffic and Networks”, PearsonEducation.
3. B.Forouzan “Data Communications and Networking”, Pearson Education.

REFERENCE BOOKS:

1. *John C. Bellamy, “Digital Telephony”, Third Edition; Wiley Publications.*
2. *Andy Valder,”Understanding Telecommunication Networks”,IET press*

Subject Code:	Subject Name : AUDIO SIGNAL PROCESSING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E06	Prerequisite: Signals and Systems, Digital Signal processing	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To study the basic concepts of speech and audio.
- To study the analysis of various M-band filter banks for audio coding
  To learn various transform coders for audio coding.
  To study the speech processing methods in time and frequency domain.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Determine the natures of speech generation and modeling..
CO2	Analyze various transforms and m – band filter bank for audio coding.
CO3	Understand different audio coding and transform coders.
CO4	Estimate various speech parameters with suitable techniques.
CO5	Apply linear prediction coding tool to analyze speech.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	3	3	2	3		3
CO2	3	3	3	3	1	2	3	3	2	1		3
CO3	3	3	3	3	1	2	3	3	2	1		3
CO4	3	3	3	3	1	3	3	3	2	1		3
CO5	3	3	3	3	1	3	3	3	2	3		3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	2	1	3	3
CO4	3	3	2	3
CO5	3	2	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : AUDIO SIGNAL PROCESSING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E06	Prerequisite: Signals and Systems,Digital Signal processing	Ty	3	0/0	0/0	3

UNIT I MECHANICS OF SPEECH AND AUDIO 9 Hrs

Introduction - Review Of Signal Processing Theory-Speech production mechanism – Nature of Speech signal – Discrete time modeling of Speech production – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features. Absolute Threshold of Hearing - Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking- Non simultaneous Masking - Perceptual Entropy - Basic measuringphilosophy -Subjective versus objective perceptual testing - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.

UNIT II TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS 9 Hrs

Introduction -Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters- Tree- Structured QMF and CQF M-band Banks - Cosine Modulated "Pseudo QMF" M-band Banks - Cosine Modulated Perfect Reconstruction (PR) M-band Banks and the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Preecho Control Strategies.

UNIT III AUDIO CODING AND TRANSFORM CODERS 9Hrs

Lossless Audio Coding-Lossy Audio Coding- ISO-MPEG-1A,2A,2A Advanced, 4Audio Coding - Optimum Coding in theFrequency Domain - Perceptual Transform Coder -Brandenburg-Johnston Hybrid Coder - CNET Coders - Adaptive Spectral Entropy Coding -Differential Perceptual Audio Coder - DFT Noise Substitution -DCT with Vector Quantization -MDCT with Vector Quantization.

UNIT IV TIME AND FREQUENCY METHODS FOR SPEECH PROCESSING 9Hrs

Time domain parameters of Speech signal – Methods for extracting the parameters: Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods HOMOMORPHIC SPEECH ANALYSIS:Cepstral analysis of Speech – Formant and Pitch Estimation – HomomorphicVocoders.

UNIT V LINEAR PREDICTIVE ANALYSIS OF SPEECH 9 Hrs

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – lattice formation and solutions – Comparison of different methods – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Digital Audio Signal Processing, Second Edition, UdoZölzer, A John Wiley& sons Ltd Publicatioons
2. Applications of Digital Signal Processing to Audio And Acoustics Mark Kahrs, Karlheinz Brandenburg, Kluwer Academic Publishers New York, Boston, Dordrecht, London, Moscow.

REFERENCE:

1. *Digital Processing of Speech signals – L. R. Rabiner and R.W. Schaffer - Prentice Hall – 1978*

ELECTIVE II - ELECTRONICS STREAM

Subject Code:	Subject Name : INTELLIGENT INSTRUMENTATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E07	Prerequisite: Electrical and Instrumentation Engineering	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Introduce students to the use of various electrical/electronic instruments, their construction, applications, principles of operation, standards and units of measurements .Basic measurement and transducers concepts
- Provide students with opportunities to develop basic skills in the design of electronic equipments using PLC.

COURSE OUTCOMES (COs) : (3- 5)

The student will be able to

CO1	Learn the concepts of transducers.
CO2	Understand the basic design techniques of signal generators and analyzers.
CO3	Gain knowledge about Instrumentation standard protocols.
CO4	Use various laboratory instruments like cathode ray oscilloscope, function generators and analyze various patterns.
CO5	Develop basic skills in designing of computer controlled instrumentation.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	2	1	1	2	3		2	
CO2	3	3	3	3	3	3	3	2	2		2	
CO3	3	1	1	2	3	3	2	1	3		2	
CO4	3	3	3	2	2	2	3	1	2		2	
CO5	3	3	3	2	2	2	3	1	2		2	

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	
CO2	3	3	3	
CO3	3	2	3	
CO4	3	3	2	
CO5	3	3	3	

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : INTELLIGENT INSTRUMENTATION	Ty / Lb/ ETL/IE	L	T/SL r	P/R	C
EBEC22E07	Prerequisite: Electrical and Instrumentation Engineering	Ty	3	0/0	0/0	3

UNIT I TRANSDUCERS **9 Hrs**

Transducer definition, classification, and performance characteristics. Potentiometer and its types, loading effect, sensitivity, piezo-resistive, equivalent circuits, charge and voltage sensitivity. Measurements, Instrumentation, Errors in Measurements, Calibration and Standard.

UNIT II SIGNAL GENERATORS AND SIGNAL ANALYZERS **9 Hrs**

A.F. Generator, Pulse Generator, AM / FM Signal Generator, Function Generator, Sweep Frequency Generator, Wave Analyzers, Spectrum Analyzers, Logic Analyzer, Distortion Analyzers, Network Analyzer.

UNIT III INSTRUMENTATION STANDARD PROTOCOLS **9 Hrs**

Definition of protocol, HART Protocol: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Foundation Field bus H1: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet.

UNIT IV DATA DISPLAY AND RECORDING SYSTEM **9 Hrs**

CRO, Single Beam, Dual Trace, Double Beam CRO, Digital Storage and Analog Storage Oscilloscope, Sampling Oscilloscope, Power Scope, Curve Tracer, Analog, Digital Recorders and Printers – Case Study on Lissajous Pattern.

UNIT V COMPUTER CONTROLLED TEST SYSTEM **9 Hrs**

Programmable logic controllers (PLC) Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, high speed counter, PLC design, study of at least one industrial PLC.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Rangan C.S. "*Instrumentation Devices and Systems*", Tata McGraw Hill, 1998.
2. Sandeep Redkar, "Foundation Fieldbus control system", Rockwell Automation,2010,
3. A. K. Shawney "*Electronics and Electrical Instrumentation*", Tata McGraw Hill, 1975.

REFERENCE BOOKS:

1. *Bouwels A.J., "Digital Instrumentation", McGraw Hill, 1986.*
2. *Barney .C, "Intelligent Instrumentation ", Prentice Hall of India, 1985.*
3. *Oliver and Cage, "Electronic Measurements and Instruments and Instrumentation", McGraw Hill, 1975.*
4. *Deobelin, "Measurements Systems", McGraw Hill, 1990.*
5. *Cooper, "Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 1988.*

Subject Code:	Subject Name : ADVANCED MICROPROCESSORS	Ty /Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E08	Prerequisite: Microprocessor and Microcontrollers	Lb	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To introduce the concepts in internal programming model of Intel family of microprocessors.
- To learn the functions of ARM processor and their applications To introduce the architecture programming and interfacing of 16 bit microcontrollers.
- To introduce the concepts and architecture of RISC processor

COURSE OUTCOMES (COs) :

The Students will be able to

CO1	Explain the generalized architecture of advanced microprocessor
CO2	Apply their understanding to do a project to develop an application using ARM processor.
CO3	Appreciate the microprocessor based system design
CO4	Analyze the MOTOROLA MC 68000 family
CO5	Describe about the various RISC processors

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2		1			3	3	1	3
CO2	3	2	3	2	3	3			3	2	3	3
CO3	3	3	2	2		1			1	3	2	3
CO4	3	3	3	3		1			2	2	3	2
CO5	3	3	3	3		1			3	3	1	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1
CO2	3	2	2	3
CO3	3	2	2	1
CO4	3	1		2
CO5	3	1		2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : ADVANCED MICROPROCESSORS	Ty /Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E08	Prerequisite: Microprocessor and Microcontrollers	Lb	3	0/0	0/0	3

UNIT I THE INTEL X86 FAMILY **9 Hrs**

The Intel X86 Family Architecture, 32 bit Processor Evolution Systems Connections and Timing, Instruction and Data Formats, Instruction set of X86 Processors, Addressing Modes.

UNIT II INTRODUCTION TO ARM PROCESSOR **9 Hrs**

ARM Architecture –ARM programmer's model- ARM development tools-memory hierarchy-ARM assembly language programming-Simple Examples-Architectural support for operating system- ARM instruction Set-Embedded ARM Applications

UNIT III SYSTEM DEVELOPMENT **9 Hrs**

Microprocessors Based System Design, TMS 320 Series DSP Based Signal Processing, Microcontroller 8096, architecture, addressing mode and system design.

UNIT IV THE MOTOROLA MC 68000 FAMILY **9 Hrs**

The MC 68000 Architecture, CPU Registrars, Data Formats, Addressing Modes, Instruction Set and Assembler Directors, Memory Management Instruction and Data, Caches, Exception Processing.

UNIT V RISC PROCESSORS **9 Hrs**

RISC vs CISC, RISC Properties and Evaluation, Advanced RISC Microprocessors, DEC ALPHA, The Power PC family.The SUN SPARC Family, the MIPS RX 100 Family, the Intel 960 Family. The Motorola M88110 Family, HP Precision Architecture.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. B.B. Bery, "The Intel Microprocessors 8086 / 8088, 80186 / 80188, 80286, 80386, 80486, PENTIUM, and PENTIUM Processors", Prentice Hall, 1997.
2. K Udayakumar, B.S. Uma Shankar, "Advanced Microprocessors and IBM PC Assembly Language Programming", Tata McGraw Hill, 1996
3. Andrew N.Sloss, Dominic Symes and Chris Wright " ARM System Developer"s Guide : Designing and Optimizing System Software" , First edition, Morgan Kaufmann Publishers, 2004

REFERENCES:

1. *Daniel Tabak, "Advanced Microprocessors", McGraw Hill, 1995.*
2. *Douglas V. Hall, "Microprocessors and Interfacing – Programming Hardware", McGraw Hill, 1992.*
3. *Steve furber "ARM Systems on chip Architecture", Second Edition Addison Wesley trade computer publication,2000.*
4. *W.A. Tribel& A. Singh, "The 68000 and 68020 Microprocessors – Architecture, Software and Interfacing Techniques", Prentice hall of India, 1991*
5. *Rifiquzzaman, "Microprocessors – Theory and Applications: Intel and MotorolaPrentice Hall, 1992.*
6. *Kenneth J. Ayala, "The 8051 Microcontroller, Architecture, Programming and Application", Penram International Publishing (India), 1996.6. John Peatman, "Design with Microcontrollers", McGraw Hill International, 1988*

Subject Code:	Subject Name : NANO ELECTRONICS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E09	Prerequisite: Engineering Physics, Solid State Physics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn and understand basic concepts of Nano electronics.
- To know the techniques of fabrication and measurement.
- To gain knowledge about Nanostructure devices and logic devices.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Introduce the concepts in nanoparticles
CO2	Demonstrate fabrication and characterization techniques
CO3	Describe the properties of Nano materials
CO4	Categorize the Nano structure devices
CO5	Understand and explain the principle and application of Nano devices.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	3	3	3	1	3	1	3
CO2	3	3	3	3	3	3	2	2	3	3	3	3
CO3	3	3	3	3	3	3	3	2	1	3	2	3
CO4	3	3	3	3	3	3	3	3	2	3	2	3
CO5	3	3	3	2	3	3	3	3	3	3	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name :NANO ELECTRONICS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E09	Prerequisite: Engineering Physics, Solid State Physics	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO NANOELECTRONICS 9 Hrs

Nano-scale electronics; Foundation of nano-electronics- Size & Scale Units Scaling Atoms, Molecules, Clusters and Supramolecules; Wave mechanics- Schrödinger wave equation; Chemical Bonds (types and strength).

UNIT II SYNTHESIS AND MEASUREMENT TECHNIQUES 9 Hrs

Nanomaterial Synthesis- Sol-gel methods, Mechanical methods: ball milling, mechanical attrition, Thin films methods: chemical vapor deposition, physical vapor deposition; Characterization techniques for nanomaterials and nano structures – FTIR, XRD, AFM, SEM, TEM, Analysis by Diffraction and Fluorescence Methods-Scanning Probe Techniques

UNIT III NANO MATERIALS & ITS PROPERTIES 9 Hrs

Classifications of nanomaterials - Zero dimensional, one-dimensional and two dimensional nanostructures; Carbon nanomaterials: nanotubes and fullerenes; Properties- Dielectrics-Ferroelectrics-Electronic Properties and Quantum Effects- Magneto transport in Layered Structures-Organic Molecules – Electronic Structures, Properties, and Reactions.

UNIT IV NANO STRUCTURE DEVICES 9 Hrs

Density of states of electrons in nanostructures- Electron transport in nanostructures- Electrons in quantum wells, Electrons in quantum wires, Electrons in quantum dots; Nanostructure devices- Resonant- tunneling diodes- Field-effect transistors- Single-electron-transfer devices- Potential-effect transistors- Light-emitting diodes and lasers- Nano-electromechanical system devices- Quantum-dot cellular automata

UNIT V APPLICATIONS OF NANOELECTRONICS 9 Hrs

Nanosensors- Nanoelectronics in Diagnostics applications, Environmental, Agriculturaland Food, Nanoelectronics for energy systems- batteries, solar cells.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, "Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications", Cambridge University Press 2011
2. Supriyo Datta,"Lessons from Nanoelectronics: A New Perspective on Transport", World Scientific2012
3. George W. Hanson,"Fundamentals of Nanoelectronics", Pearson 2009

REFERENCES:

1. *Korkin, Anatoli; Rosei, Federico (Eds.), "Nanoelectronics and Photonics",Springer 2008*
2. *Mircea Dragoman, Daniela Dragoman, "Nanoelectronics: principles and devices", CRC Press 2006*
3. *Karl Goser, Peter Glösekötter, Jan Dienstuhl,"Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices",*
4. *Springer 2004*
5. *W. R. Fahrner, Nanotechnology and Nan electronics: Materials, Devices, Measurement Techniques(SpringerVerlag Berlin Heidelberg 2005)*
6. *Mark A. Reed, Takhee Lee,"Molecular nanoelectronics", American Scientific Publishers 2003*
7. *Jaap Hoekstra, "Introduction to Nanoelectronic Single-Electron Circuit Design", Pan Stanford Publishing 2010.*

Subject code:	Subject Name : COMPUTER ARCHITECTURE AND PARALLEL PROCESSING	Ty /Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E10	Prerequisite: Microprocessor and Microcontroller	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To enable the students to familiarize about hardware design basic structure and behavior of the various functional modules of the computer.
- To learn parallel processing memory techniques.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the basic operation of a computer system
CO2	Demonstrate the arithmetic and logic operations in a computer system
CO3	Remember the working of control unit in a pipelined dataflow
CO4	Interpret the principle of data parallelism for multicore process.
CO5	Classify different types of memory and I/O based techniques in a computer system.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	2		2			1	2	1	2
CO2	1	2	2	2		1			1	2	1	2
CO3	1	1	1	2		1			2	2	3	1
CO4	1	1	3	3		2			2	3	2	1
CO5	1	1	1	1		1			2	3	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	2
CO2	1	2		2
CO3	1	2	2	1
CO4	1	1	1	1
CO5	1	2		2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject code:	Subject Name : COMPUTER ARCHITECTURE AND PARALLEL PROCESSING	Ty /Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E10	Prerequisite: Microprocessor and Microcontroller	Ty	3	0/0	0/0	3

UNIT I OVERVIEW & INSTRUCTIONS **9 Hrs**

Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes.

UNIT II ARITHMETIC OPERATIONS **9 Hrs**

ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Subword parallelism.

UNIT III PROCESSOR AND CONTROL UNIT **9 Hrs**

Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions.

UNIT IV PARALLELISM **9 Hrs**

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware multithreading – Multicore processors

UNIT V MEMORY AND I/O SYSTEMS **9 Hrs**

Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

Practical component P: Include case studies / application scenarios
Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOK:

1. David A. Patterson and John L. Hennessey, "Computer organization and design", Morgan Kauffman / Elsevier, Fifth edition, 2014.

REFERENCES:

1. *V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", VI th edition, Mc Graw-Hill Inc, 2012.*
2. *William Stallings "Computer Organization and Architecture" , Seventh Edition , Pearson Education, 2006.*
3. *Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.*
4. *Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata McGraw Hill, New Delhi, 2005.*
5. *John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata Mc Graw Hill, 1998.*

ELECTIVE II – COMMUNICATION STREAM

Subject Code:	Subject Name : INTERNET OF THINGS AND ITS APPLICATIONS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E11	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study basics of IoT.
- To study IoT with Cloud environment.
- To study IoT applications.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Explore basics concepts of technology of IoT
CO2	Understand different IoT domains.
CO3	Manage system data in cloud environment
CO4	Interface embedded system with IoT
CO5	Learn new applications based on IoT.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	3	2	2	2	3	3
CO2	3	2	2	3	3	2	2	2	2	2	3	3
CO3	3	2	3	3	3	2	2	2	2	2	3	3
CO4	3	3	2	3	3	2	2	2	2	2	3	3
CO5	3	2	3	3	3	2	2	2	3	2	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	2	3
CO3	3	3	2	3
CO4	3	3	2	3
CO5	2	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : INTERNET OF THINGS AND ITS APPLICATIONS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E11	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO INTERNET OF THINGS **9 Hrs**

Definition and Characteristics of IoT – Things in IoT – IoT Protocols – Logical Design of IoT – IoT enabling technologies – IoT Levels.

UNIT II DOMAIN SPECIFIC IoT **9 Hrs**

Home Automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health and Life style–SDN and NFV for IoT.

UNIT III IoT SYSTEM MANAGEMENT AND CLOUD **9 Hrs**

Need for IoT System Management - SNMP – NETOPEER – IoT design methodology - Xively – Django-Amazon Web for IoT – SkyNetIoT.

UNIT IV IoT PHYSICAL DEVICES **9 Hrs**

Raspberry Pi - Raspberry Pi Interfaces – Arduino boards – Other IoT devices –Intel Galileo Arduino board Specification.

UNIT V IoT APPLICATIONS **9 Hrs**

Applications based on IoT - Smart Cities -Smart Home and Buildings -Smart Energy and the Smart Grid - Smart Health- Smart Transportation and Mobility

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. ArshdeepBahga.Vijaymadisetti, "*Internet of things – A hands- on approach*" , Universities press, First Editon, 2015.
2. Adrian McEwen and Hakim Cassimally, "*Designing the Internet of Things*", Wiley, First edition 2014.
3. C HillarGastn, "*Internet of Things with Python*",Packt publishing, first edition ,2016.

REFERENCE BOOKS:

1. *Dominique D. Guinard and Vlad M. Trifa "Building the Web of Things With examples in Node.js and Raspberry Pi",June 2016 ISBN 9781617292682*
2. *CharalamposDoukas, "Building Internet of Things with the Arduino" ISBN/EAN13:1470023431 / 9781470023430*
3. *Gastón C. Hillar, "Internet of Things with Python", May 2016 , PACKT Publishing limited.*
4. *Marco Schwartz "Internet of Things with the Raspberry Pi: Build Internet of Things Projects Using the Raspberry Pi Platform", Kindle Edition.*

Subject Code:	Subject Name :NEXT GENERATION IP NETWORKS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E12	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To have a complete understanding of IPV6 architecture
- To learn the key features of IPV6
- To know the techniques for avoiding network congestion

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the key features of IPV6 architecture
CO2	Analyze the transmission and security of IPV6 protocol
CO3	Interpret the advantages of IPV6 over other networks
CO4	Develop a wireless network architecture
CO5	Apply their ideas for controlling and avoiding network congestion

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	3	3	3	1	1	1	1	1	2
CO2	1	1	1	3	1	3	1	1	1	1	1	1
CO3	1	3	1	1	3	1	2	1	3	1	1	1
CO4	1	1	1	1	1	3	1	1	1	2	1	1
CO5	1	1	1	3	1	1	1	1	1	3	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1
CO2	2	1	3	1
CO3	1	3	1	1
CO4	2	1	3	1
CO5	1	3	1	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name :NEXT GENERATION IP NETWORKS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E12	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

UNIT I IP V6 ADRESSING 9 Hrs

Next Generation Networks-Overview-IP V6 Specification-Addressing Architecture-Address Allocation Management-Unicast Address Allocation-Global Unicast Address Format-Testing Address Allocation-Multicast Addressing-Reversed IP V6 Subnet any cast addresses.

UNIT II IP V6 TRANSMISSION AND SECURITY 9Hrs

Internet Control Message Protocol-Hop-by-Hop Options-Header Compression-Packet Tunneling-Domain Name System-Transition Mechanisms-Routing-Renumbering-IP Privacy-Security Architecture for the Internet Protocol-IP Authentication Header-IP Encapsulation Security Payload-IP Authentication using Keyed MD5-The ESP DES-CBC Transform.

UNIT III IP V6 OVER DIFFERENT NETWORKS 9 Hrs

IP V6 over Ethernet Networks-IP V6 over FDDI Networks-IP V6 over Token ring Networks- IP V6 over ARCnet Networks- IP V6 over PPP- IP V6 over NBMA Networks- IP V6 over ATM Networks.

UNIT IV WIRELESS IP NETWORK ARCHITECTURES 9 Hrs

3GPP Packet Data Networks, Network architecture, Protocol Reference Model, Packet Data Protocols, Bearers, and connections for Packet Services, Packet Data Protocol (PDP) Context, Steps for a Mobile to Access 3GPP Packet-Switched Services, User Packet Routing and Transport, Configuring PDP Addresses on Mobile Stations, GPRS Attach Procedure, Access to MWIF Networks, Session Management.

UNIT V NETWORK CONGESTION CONTROL AND AVOIDANCE 9 Hrs

Introduction-Queue Management-Scheduling-Types of flows-Queue Management Techniques: RED-FRED-SRED-PI Controller-REM- E-RED Scheduling Algorithms: Fair Queing-CFS.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. RFC 2373, -IP V6 Addressing Architecture, RFC 1881-IPv6 Address Allocation Management, (Unit I)
2. RFC 2463-Internet Control Message Protocol, RFC 2402-IP Authentication Header (Unit II)
3. RFC 2497-Transmission of IPv6 Packets over ARCnet Networks, RFC-2492-IPv6 over ATM Networks (Unit III)

REFERENCES:

1. *http://www.faqs.org/rfcs/(Unit I, II, III)*
2. *JYH-CHENG CHEN, TAO ZHANG,"IP-Based Next Generation Wireless Networks (Systems, Architectures and Protocols)", by John Wiley & Sons, Published by John Wiley & Sons, Inc., Hoboken, New Jersey.2004. (Unit IV)*
3. *http://www.icir.org/floyd/red.html (Unit V)*

Subject Code:	Subject Name : NEURAL NETWORKS AND ITS APPLICATIONS	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBEC22E13	Prerequisite: Digital Electronics	Ty	3	0	0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to: To study the various neural network algorithms and its application in pattern recognition.

COURSE OUTCOMES (COs) :

CO1	Describe the basic concepts of artificial neural networks.
CO2	Explain about BPN and BAM
CO3	Implement the concept of simulated annealing and CPN
CO4	Interpret the concepts of SOM and ART.
CO5	**Describe** Deep learning.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	1	1	1	1	2	2	3
CO2	3	3	2	2	1	1	1	1	2	2	1	2
CO3	3	3	3	3	3	2	2	2	3	2	3	2
CO4	3	2	3	3	2	1	1	1	1	2	2	2
CO5	3	3	3	3	2	1	2	1	1	1	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	3
CO2	1	2	3	1
CO3	3	2	3	1
CO4	1	1	3	2
CO5	1	2	1	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : NEURAL NETWORKS AND ITS APPLICATIONS	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBEC22E13	Prerequisite: Digital Electronics	Ty	3	0	0	3

UNIT I INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS **9 Hrs**

Neuro – Physiology – General Processing Element – ADALINE – LMS Learning Rule – MADALINE – Perception Networks

UNIT II BPN AND BAM **9 Hrs**

Back Propagation Network – Updating of Output and Hidden Layer Weights – Application of BPN – Associative Memory – Bi-Directional Associative Memory - Hopfield Memory – Traveling Sales Man Problem

UNIT III SIMULATED ANNEALING AND CPN **9 Hrs**

Annealing, Boltzmann Machine – Learning – Application – Counter Propagation Network – Architecture – Training – Application.

UNIT IV SOM AND ART **9 Hrs**

Self-Organizing Map – Learning Algorithm – Feature Map Classifier – Applications – Architecture of Adaptive Resonance Theory – Pattern Matching in ART Network. Neocognitron: Architecture of Neocognitron – Data Processing and Performance of Architecture of Spacio – Temporal Networks for Speech Recognition

UNIT V DEEP LEARNING **9 Hrs**

Deep Feed Forward network, regularizations, training deep models, dropouts, Training Deep Neural Networks using Back Propagation-Setup and initialization issues, vanishing and exploding Gradient problems, Gradient- Descent Strategies

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Laurence Fausett, “Fundamentals of Neural Networks: Architecture, Algorithms and Applications”, Prentice Hall, 1994.
2. J.A. Freeman and B.M.Skapura, “Neural Networks, Algorithms Applications and Programming Techniques”, Addison-Wesley, 1990.
3. CharuC.Aggarwal “Neural Networks and Deep learning” Springer International Publishing, 2018

REFERENCE BOOKS:

1. *Martin T. Hagan, Howard B. Demuth “Neural Networks Design”,2 ndEdition, Martin Hagan, 2014*
2. *Simon Haykin, “Neural Networks and Learning Machines” -3/E - Pearson/ Prentice Hall 2009*

Subject Code:	Subject Name : RADAR AND NAVIGATIONAL AIDS	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E14	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To become familiar with fundamentals of RADAR
- To gain in-depth knowledge about the different types of RADAR and their operations
- Need for signal detection in RADAR and various detection techniques
- To become familiar with RADAR navigation techniques

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Distinguish the various types of radar
CO2	Understand the operation of high frequency signal generators.
CO3	Identify the targeted radar signals in noise
CO4	Analyze the propagation of radar waves and formation of clutter
CO5	Exhibit the different navigational aids

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	1		1	1		2
CO2	2	3	2	1	1	1	1		1			
CO3	1	2	2	2	2	2	2	2	2	2	1	
CO4	1	2	2	2	2	2	2	2	2	2	1	1
CO5	1	1	1	1	1	2		1	1	2		2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2
CO2	2	3	2	3
CO3	1	3	2	1
CO4	1	2	2	2
CO5	1	2	3	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name :RADAR AND NAVIGATIONAL AIDS	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E14	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

UNIT I RANGE AND TYPES OF RADAR **9 Hrs**

Range Parameters, Pulsed Radars, Signal to Noise Ratio, Integration of Pluses Beam Parameters, System Losses and Propagation Effects MTI; CW and Pulse-Doppler Radar, Delay Lines Tracking Radar, Mono pulse, Sequential, Simultaneous, Conical Scan and Monopulse Trackers, Beacons.

UNIT II TRANSMITTERS, RECEIVERS AND ANTENNA **9 Hrs**

Klystron, Magnetron, TWT Amplifiers and Oscillators, Crossed Fields Devices, Parabolic Cassegrainian, Coefficient, Squares Antennas, Radomes, Feeds, Receivers, Performance Figures, Displays Scope and PPI Duplexers.

UNIT III DETECTION OF RADAR SIGNALS IN NOISE **9 Hrs**

MF, Correlation Detection, Detector Characteristics, Automatic Detection, CFAR Receiver, Pulse Compression and Classification of Targets with Radar.

UNIT IV PROPAGATION OF RADAR WAVES AND CLUTTER **9 Hrs**

Plane Earth and Spherical Earth Problem, Refraction and Diffraction, GTD Analyzers, Surface and Sea Clutter, Detection of Targets, Effects of Weather on Radar.

UNIT V RADAR TOPICS AND NAVIGATIONAL AIDS **9 Hrs**

Synthetic Aperture, Over the Horizon Radar, ARSR, ASR, Bistatic and Monostatic Radars, LORAN, ILS, GCA, Direction Finder, VOR Concepts, Airborne Doppler Navigation.

Practical component P: Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. M.I. Skoinik “Introduction to Radar Systems:, McGraw Hill 1981.
2. N.S. Nagaraja, Elements of Electronic Navigation Systems, 2nd Edition, TMH, 2000.

REFERENCES:

1. *F.E. Terman, “Electronics and Radio Engineering” McGraw Hill*
2. *Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004*
3. *J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004*

ELECTIVE III – ELECTRONICS STREAM

Subject Code:	Subject Name : ADVANCED DIGITAL SYSTEM	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E15	Prerequisite: Digital Electronics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To enable the students the ability to design complex sequential circuits
- To equip the students with the ability to detect and correct faults using various algorithms
- To analyze the architecture of new emerging programmable logic devices.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Analyze and design synchronous sequential circuits.
CO2	Interpret the designing techniques of an asynchronous sequential circuit.
CO3	Experiment faults and apply testing algorithms for its functionality
CO4	Evaluate the principles of programmable devices for design of sequential circuit.
CO5	Exhibit the operating of emerging programmable logic devices.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2		2	2	2	2
CO2	3	3	3	3	3	3	2		1	2		1
CO3	3	3	3	3	3	2	3		2		2	2
CO4	3	3	3	3	3	3	2		2	3	3	2
CO5	3	2	2	3	3	3	3		2	3	2	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	3	3	3	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : ADVANCED DIGITAL SYSTEM	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E15	Prerequisite: Digital Electronics	Ty	3	0/0	0/0	3

UNIT I SEQUENTIAL CIRCUIT DESIGN 9 Hrs

Analysis of Clocked Synchronous Sequential Networks (CSSN), Modeling of CSSN, State Stable Assignment and Reduction, Design of CSSN, Design of Iterative Circuits, ASM Chart, ASM Realization, Design of Arithmetic circuits for Fast adder- Array Multiplier.

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 9 Hrs

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits.

UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS 9 Hrs

Fault Table Method – Path Sensitization Method – Boolean Difference Method – Kohavi Algorithm – Tolerance Techniques – The Compact Algorithm – Practical PLA's – Fault in PLA – Test Generation – Masking Cycle – DFT Schemes – Built-in Self Test.

UNIT IV SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES 9 Hrs

Programming Techniques -Re-Programmable Devices Architecture- Function blocks, I/O blocks, Interconnects, Realize combinational, Arithmetic, Sequential Circuit with Programmable Array Logic; Architecture and application of Field Programmable Logic Sequence.

UNIT V NEW GENERATION PROGRAMMABLE LOGIC DEVICES 9 Hrs

Fold back Architecture with GAL, EPLD, EPLA, PEEL, PML; PROM – Realization State Machine using PLD – FPGA – Xilinx FPGA – Xilinx 2000 - Xilinx 3000

Practical component P: Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Donald G. Givone, "Digital principles and Design", Tata McGraw Hill 2002.
2. Stephen Brown and ZvonkVranesic, "Fundamentals of Digital Logic with VHDL Deisgn", Tata McGraw Hill, 2002

REFERENCES:

1. *Donald G. Givone, "Digital principles and Design", Tata McGraw Hill 2002.*
2. *Stephen Brown and ZvonkVranesic, "Fundamentals of Digital Logic with VHDL Deisgn", Tata McGraw Hill, 2002*
3. *MarkZwolinski, "Digital System Design with VHDL", Pearson Education, 2004*
4. *Parag K Lala, "Digital System design using PLD", BS Publications, 2003*
5. *John M Yarbrough, "Digital Logic applications and Design", Thomson Learning, 2001.*
6. *Nripendra N Biswas, "Logic Design Theory", Prentice Hall of India, 2001.*
7. *Zvikohavi, "Finite and switching automatic theory," publications*?

Subject Code:	Subject Name : EMBEDDED SOFTWARE DESIGN	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E16	Prerequisite: C Programming and Ms Office Tools	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- Toimplement software design for an embedded system using C and assembly level programs

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the concept of basic embedded system
CO2	Write a simple program using C and assembly
CO3	Differentiate the methods of IO programming using interrupts
CO4	Apply scheduling methods for multi-threaded programming
CO5	Demonstrate the principle of shared memory and memory management

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1			2	1	1				2
CO2	1	2	2	2	3	1	1	1		2	3	2
CO3	1	3	2	3	3	1	1	1	1	2		
CO4	1	3	3	3	3	1	1	2	3		2	
CO5	1	2	3	3	3	2	2	3		2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1
CO2	2	2	3	1
CO3	1	2	3	1
CO4	2	2	3	2
CO5	1	1	3	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : EMBEDDED SOFTWARE DESIGN	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E16	Prerequisite: C Programming and Ms Office Tools	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO EMBEDDED SYSTEM AND DATA REPRESENTATION& ARM PROCESSOR 9 Hrs

Embedded system-Design goals for embedded software- Real time and multi-tasking-Embedded processors and languages-Building an embedded application-Data Representation-Fixed precision binary numbers-Binary representation of Integers and real numbers-ASCII and BCD number.

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3 MCU.

UNIT II EMBEDDED PROGRAMMING 9 Hrs

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing

UNIT III INPUT OUTPUT PROGRAMMING 9 Hrs

I/O instructions – synchronization, transfer rate and latency – polled waiting loops – interrupt driven I/O-interrupt service routine-Buffers and queues –ISR in assembly and C – Non-maskable interrupts - Software interrupts – Exceptions - direct memory access –comparison of methods .

UNIT IV CONCURRENT SOFTWARE AND SCHEDULING 9 Hrs

Foreground/background systems - Multi threaded programming – shared resources and critical sections – thread states – pending threads – context switching – round-robin scheduling – priority-based scheduling – assigning priorities – deadlock –watchdog timers.

UNIT V MEMORY MANAGEMENT AND SHARED MEMORY 9 Hrs

Objects in C – scope – lifetime –automatic allocation – static allocation – Dynamic allocation- recognizing shared objects – reentrant functions – read only data – accessing shared memory.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Daniel W. Lewis, “Fundamentals of embedded software where C and assembly meet”, Pearson Education, 2002.
2. Steve Heath, “Embedded system design”, Elsevier, 2003.
3. Marilyn Wolf, ―Computers as Components - Principles of Embedded Computing System Design‖, Third Edition ―Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
4. Jane W.S. Liu, Real Time Systems‖, Pearson Education, Third Indian Reprint, 2003.

REFERENCES:

1. *Lyla B.Das, ―Embedded Systems : An Integrated Approach‖ Pearson Education, 2013.*
2. *Jonathan W.Valvano, ―Embedded Microcomputer Systems Real Time Interfacing‖, Third Edition Cengage Learning, 2012.*
3. *David. E. Simon, ―An Embedded Software Primer‖, 1st Edition, Fifth Impression, AddisonWesley Professional, 2007.*
4. *Raymond J.A. Buhr, Donald L.Bailey, ―An Introduction to Real-Time Systems- From Design to Networking with C/C++‖, Prentice Hall, 1999.*
5. *C.M. Krishna, Kang G. Shin, ―Real-Time Systems‖, International Editions, Mc Graw Hill 1997*
6. *K.V.K.K.Prasad, ―Embedded Real-Time Systems: Concepts, Design & Programming‖, Dream Tech Press, 2005*
7. *Sriram V Iyer, Pankaj Gupta, ―Embedded Real Time Systems Programming‖, Tata Mc Graw Hill, 2004.*

Subject Code:	Subject Name : QUANTUM COMPUTING	Ty / Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22E17	Prerequisite: Mathematics I, Engineering Physics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To understand the building blocks of a quantum computer.
- To understand the principles, quantum information and limitation of quantum operations formalizing.
- To understand the various quantum algorithms.

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Demonstrate the importance of quantum computing and superposition states.
CO2	Explain Quantum operators and its applications.
CO3	Build quantum circuits with the knowledge of various quantum gates.
CO4	Apply the concept of different quantum algorithms and have the insight of QKD.
CO5	Identify Quantum errors and correct it using Quantum error correcting codes.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	2	1	2	2	1	2	3
CO2	3	3	2	2	1	1	1	2	2	1	2	3
CO3	3	3	3	2	3	1	1	2	2	2	3	3
CO4	2	2	2	3	3	1	1	2	2	2	2	2
CO5	3	3	3	2	3	2	2	2	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	2	3
CO4	3	3	2	3
CO5	3	3	2	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : QUANTUM COMPUTING	Ty / Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22E17	Prerequisite: Mathematics I, Engineering Physics	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9 Hrs**

Introduction to Quantum Computing- Power of Quantum Computing- Quantum Information- Quantum Computers. The Wave and the Corpuscular Nature of Light Photon Behavior, State Description, Measurement in Multiple Bases, Superposition States – The Superposition probability Rule.

UNIT II QUANTUM MECHANICS **9 Hrs**

Quantum Postulates – State space, Evolution, Quantum Measurement, Distinguishing Quantum states, Projective measurements, POVM measurements -Quantum Mechanics-Hilbert Space-Linear Operators Tensor and Outer Products-Quantum Operators- Application Quantum mechanism: Super dense Coding - Double Silt Experiments.

UNIT III QUBITS AND QUANTUM GATES **9 Hrs**

Qubits, Bloch Sphere Representation-Rotation Operation-The Measurement of a Single Qubits-A Pair of Qubits- Bell States- Qubits as Spin Half- Integer Particles- Qubits as Polarized Photon-Entanglement, Exchange of Information / Teleportation – Quantum Coping Circuit - The Non-Cloning Theorem-Quantum Gates – Universal Quantum Gate Gates – Matrix Representation – Quantum Circuits- Single and Multiple Qubit Controlled Operations.

UNIT IV QUANTUM ALGORITHM **9 Hrs**

Turing Machine - Quantum Parallelism-Deutsch's Problem, Deutsch – Jozsa Algorithm -QFT(Quantum Fourier Transform)-Short's Factoring Algorithm-Simon's Algorithm-Quantum Search Algorithm- Quantum key distribution - Mathematical Models of Quantum Computers - Introduction Different implementations of quantum computer.

UNIT V QUANTUM ERROR CORRECTION **9 Hrs**

Quantum error correction and simple examples – The Three Qubit flip code, Three Qubit Phase flip code, The Shor Code - Brief Introduction to Quantum Computing Software - Quantum error-correcting codes:Error models, Criteria for a good code: reversible operations.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Dan C. Marinescu, Gabriela M. Marinescu, "*Approaching Quantum Computing*", Pearson Education 2008-09.
2. M.A. Neilson and I.L .Chuang "*Quantum computing and Quantum information"*, Cambridge University Press,2009.
3. Vishal Sahani "*Introduction to Quantum Computing*", TATA McGraw-Hill Publishing Company Limited.

REFERENCE BOOKS:

1. *A.Yu.Kitaev, A.H.Shen, M.N.Vyalyi, "Classical and Quantum Computation", American Mathematical Society.*
2. *Mark.M.Wilde, "Quantum information theory" Cambridge university press.*
3. *J.A.Jones, "Quantum information, computation and communication" Cambridge University Press.*
4. *Scott Aaronson, "Quantum computing since Democritus", Cambridge University Press 2013.*

Subject Code:	Subject Name : POWER ELECTRONICS	T y/ Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E18	Prerequisite: Analysis of Solid State Devices	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study about power electronic circuits for voltage and current control and protection.
- To learn the switching characteristics of transistors and SCRs. Series and parallel functions of SCRs, Programmable triggering methods of SCR.
- To learn controlled rectification AC supplies.
- To study of converters and inverters.
- To learn about motor control, charges, SMPS and UPS.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the operation of power electronic devices.
CO2	Apply the triggering of SCR for natural and forced commutation.
CO3	Design phase controlled convertors using power diodes.
CO4	Develop different types of inverters and choppers.
CO5	Apply the concepts of power electronics in industries and HVDC system.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	2	2	1	2	2	1	2
CO2	3	2	3	3	2	2	2	2	1	2	1	2
CO3	3	3	3	3	3	1	2	1	1	2	2	1
CO4	2	3	3	3	1	1	1	1	1	2	1	2
CO5	3	3	3	3	1	1	1		1	2	1	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	2	3	2	2
CO3	3	2	2	1
CO4	3	3	2	1
CO5	3	2	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : POWER ELECTRONICS	T y/ Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E18	Prerequisite: Analysis of Solid State Devices	Ty	3	0/0	0/0	3

UNIT I POWER ELECTRONIC DEVICES 9 Hrs

Characteristics of Power Devices – Characteristics of SCR – Two Transistor Model of SCR,Characteristics of TRIAC, BJT, MOSFET, IGBT, GTO both Static and Switching Characteristics – Protection of Thyristors against Over Voltage – Over Current, dv/dt and di/dt.

UNIT II TRIGGERING & COMMUTATION TECHNIQUES 9 Hrs

Turn on Circuits for SCR – Triggering with Single Pulse & Train of Pulses – Triggering with Microprocessor – Different Techniques of Commutation – Natural and Forced Commutation – Series & Parallel Operations.

UNIT III PHASE CONTROLLED CONVERTERS 9 Hrs

Converters – Single Phase – Three Phase – Half Controlled and Fully Controlled Rectifiers with R, RL and RLE Loads – Waveforms of Load Voltage and Line Current – Harmonic Factor, Power Factor, Ripple Factor, Distortion Factor – Operation with Freewheeling Diode – Effect of Source Inductance – Dual Converter.

UNIT IV INVERTERS & CHOPPERS 9 Hrs

Voltage and Current Source Inverters, Resonant, Series Inverter – Basic Series Inverter, Modified, Improved – PWM Techniques – Single Phase AC Choppers with R and RL Load – Half Wave and Full Wave – DC Choppers – Various Classes of Operation – Buck, Boost and Buck – Boost Type Choppers – Merits and Applications.

UNIT V AC VOLTAGE CONTROLLERS & INDUSTRAIL APPLICATIONS 9 Hrs

Single-Phase and Three-Phase AC Voltage Controllers - Sequence Control of AC Voltage Regulators.Cycloconverters – Single-Phase and Three-Phase Cycloconverters, SMPS & UPS – Static Compensators – HVDC Transmission System.

Practical component P: Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Rashid, M.H., “Power Electronics - Circuits Devices and Applications”, Prentice Hall of India, 3 rd Edition, 2004.
2. Singh.M.D and Kanchandani, “Power Electronics”, Tata McGraw Hill & Hill publication Company Ltd, New Delhi, 2002.

REFERENCES:

1. *Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., “Thyristorised Power Controllers”, Wiley Eastern Limited, 1986.*
3. *Lander,W., “Power Electronics”, McGraw Hill and Company, Third Edition, 1993. 3. P.S. Bimbhra, “Power Electronics”, Khanna Publishers, 3rd Edition, 1999.*

ELECTIVE III – COMMUNICATION STREAM

Subject Code:	Subject Name : HIGH SPEED SWITCHING ARCHITECTURE	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E19	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To equip the students with the concepts of high speed switching techniques in ATM networks
- To understand the significance of quivering in ATM Modules.
- To compare the features of different high speed switching systems.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describe the basic concepts of High speed switching newtwork
CO2	Interpret the switching concepts and LAN switching technology
CO3	Classify blocking & non – blocking architecture.
CO4	Operate quivering methods in ATM switches.
CO5	Explain addressing model & switching topologies.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	2	1	1		2	2	2
CO2	3	3	3	3	2	1	3	3	1		3	
CO3	2	3	2	1	1	1	2	2		1		
CO4	3	3	3	3	1	2	1	1				
CO5	3	3	3	2	1	2	2	2	1	2	3	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1
CO2	3	3	3	2
CO3	3	2	3	1
CO4	3	3	1	1
CO5	2	1	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : HIGH SPEED SWITCHING ARCHITECTURE	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E19	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

UNIT I HIGH SPEED NETWORK 9 Hrs

Introduction-LAN, WAN, Network evolution through ISDN to B-isdn, Transfer mode and control of B-ISDN, SDH multiplexing structure, ATM standard, ATM Adaption layers

UNIT II LAN SWITCHING TECHNOLOGY 9 Hrs

Switching concepts, Switch forwarding techniques, Switch path control, LAB switching, cut through forwarding, Store and forward, Virtual LANS

UNIT III ATM SWITCHING ARCHITECTURE 9 Hrs

Switch models, blocking networks-Basic-and-enhanced banyan networks, sorting networks merge sorting, Re-arrange able networks-full-and-partial connection networks, Non-blocking networks-Recursive network construction, comparison of non-blocking network, Switches with deflection routing-shuffle switch, Tandem banyan

UNIT IV QUEUES IN ATM SWITCHES 9 Hrs

Internal Queuing-Input, Output and shared queuing multiple queuing networks Combined input, Output and shared queuing-performance analysis of Queued Switches

UNIT V IP SWITCHING 9 Hrs

Addressing model, IP Switching types-flow driven and topology driven solutions, IP over ATM address and next hop resolution, Multicasting, Ipv6 over ATM

Practical component P: Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Ranier Handel, Manfred N Huber, Stefan Schroder, “ATM Networks- concepts protocols applications”, 3rd Edition, Addison Wesley, New York, 1999
2. AchillePattavina, “Switching Theory: Architecture and performance in broadband ATM Networks”, John Wiley & Sons Ltd., New York. 1998

REFERENCES:

1. *Christopher Y Metz, “Switching protocols & Architectures”, McGraw Hill Professionals publishing, NewYork.1998.*

Subject Code:	Subject Name : INFORMATION CODING TECHNIQUES	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E20	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To have a complete understanding of error–control coding.
- To understand encoding and decoding of digital data streams.
- To introduce methods for the generation of these codes and their decoding techniques.
- To have a detailed knowledge of compression and decompression techniques.
- To introduce the concepts of multimedia communication.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Recognize the various coding theorems in information theory
CO2	Interpret the digital modulation techniques in digital coding
CO3	Analyze the different coding methods and apply it for error correction
CO4	Demonstrate the different compression techniques
CO5	Develop a code for audio/video signals

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	2	2	2	3	3	2
CO2	3	3	3	3	3	2	2	1	2	3	3	3
CO3	3	3	3	3	3	3	1	1	2	3	3	3
CO4	3	3	3	3	2	3	1	2	2	3	3	3
CO5	3	3	3	2	2	3	1	2	2	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	2	1
CO4	3	3	2	2
CO5	3	3	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : INFORMATION CODING TECHNIQUES	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E20	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

UNIT I INFORMATION ENTROPY FUNDAMENTALS 9Hrs

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II DATA AND VOICE CODING 9Hrs

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive sub band coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders,LPC).

UNIT III ERROR CONTROL CODING 9Hrs

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutionalcodes.

UNIT IV COMPRESSION TECHNIQUES 9 Hrs

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – IntroductiontoJPEGstandards.

UNIT V AUDIO AND VIDEO CODING 9Hrs

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Simon Haykin, "Communication Systems", John Wiley and Sons, 4th Edition, 2001.
2. Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002; Chapters: 3, 4, 5.

REFERENCES:

1. *Mark Nelson, "Data Compression Book", BPB Publication 1992.*
2. *Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995.*

Subject code:	Subject Name : OPTICAL NETWORK AND SWITCHING TECHNIQUES	Ty / Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22E21	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn basic elements of optical communication
- To understand networks and switching techniques

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the basic elements of optical fiber.
CO2	Understand the concept of switching network in OSI layer. .
CO3	Explain all types of optical networks.
CO4	Analyze multiple access methods in WDM.
CO5	Understand the all optical switches.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	3	1	1	1	1	1	1	1	2
CO2	3	3	2	2	1	2	3	3	1	3	2	2
CO3	1	3	3	1	1	3	1	1	1	3	1	1
CO4	1	3	3	1	3	1	3	2	1	3	1	2
CO5	3	2	1	3		1	3	1	1	2	1	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1
CO2	3	2	1	2
CO3	2	3	2	2
CO4	1	3	2	2
CO5	3	2	1	2

3/2/1 indicates Strength of Correlation 3- High,2- Medium,-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject code:	Subject Name : OPTICAL NETWORK AND SWITCHING TECHNIQUES	Ty / Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22E21	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9 Hrs**

Optical communication – Basics of sources, transmitters, Modulators, Optical fiber, photo detectors, and receivers – Switching in networks – circuit switched – Packet switched – cell switched – Virtual circuit switched – Burst switched (fast circuit switched) – Transmission /Asynchronous – synchronous.

UNIT II SWITCHING NETWORKS **9 Hrs**

Layering in packet switched networks – motivation – commonly used abstraction: Physical layer – Data link layer – Network layer – Transport layer – Application layer – Layering in circuit switched networks – Physical layer – Multiplexing standards – Signaling – CAS, CCS, SS7 concept – Data plane – management plane – control plane – concept.

UNIT III OPTICAL TRANSMITTER AND RECEIVERS **9 Hrs**

First generation networks – SDH/SONET – Computer interconnections – ESCON – Fiber channel – HIPPI – FDDI – ATM –DQDB – Components – description – Mode locked laser (for ps pulses) – Tunable filters – multiplexers – De-multiplexers – Tunable wavelength convertors – Optical amplifiers.

Fiber – EDFA – SOA – Tunable transmitters – Tunable receivers – Dispersion compensating fibers – Multiplexing techniques – SDM – TDMA – WDMA (OFDMA) – DWDM – SCM – CDMA – Protocols for single channel broadcast networks – ALOHA, CSMA/CD – Problems with CSMA/CD – Definition of high speednetwork.

UNIT IV MULTIPLE ACCESS METHODS **9 Hrs**

Classifications of multiple access methods – Random access – Reserved access – Scheduled access – Multichannel multiple access protocols – Desirable characteristics of protocol – Scalability – Fairness – TTTR – TTFR – FTTR – FTFR – Problem of wavelength stability – Multi hop WDM network – Shuffle net – MSN – Wavelength routed networks – Mesh – Ring – Traffic grooming problem – IP over optical framework – ASON – MpeS – Burst switched network (buffer less networks).

UNIT V OPTICAL SWITCHES **9 Hrs**

All –optical circuit switches – All–optical packet switches – Broadcast and select – Wavelength routed – Spaced switch based – Discussion on various switch architectures – Packet buffering techniques: Travelling type – Recirculating type: Protection and restoration – Restoration mechanism: Restoration timing issues – Path protection- Span protection – P –cycles.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Gerd Keiser, "Optical Fiber Communication" Mc Graw -Hill International, 4 th Edition., 2010.
2. Hussein T.Mouftah and Jaafar M.H.Elmirghani, " Photonic Switching Technology – Systems and Networks ",IEEE Press, New York -10016-5997,ISBN – 0-7803-4707-2.
3. C.Siva Rama Murthy and Mohan Gurusamy, " WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi –2002.

REFERENCE BOOKS:

1. *John M. Senior , "Optical Fiber Communication", Second Edition, Pearson Education, 2007.*
2. *Ramaswami, Sivarajan and Sasaki "Optical Networks", Morgan Kaufmann, 2009.*
3. *J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3 rd Edition, 2008.*

Subject Code:	Subject Name : PHOTONICS	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E22	Prerequisite: Engineering Physics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To become familiar with fundamentals of RADAR
- To gain in-depth knowledge about the different types of RADAR and their operations
- Need for signal detection in RADAR and various detection techniques
- To become familiar with RADAR navigation techniques

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Distinguish the various types of Electromagnetic Optics
CO2	Discuss the guided wave and fiber optics
CO3	Summarize the Semiconductor Optics
CO4	Analyze the dectection of light, acousto and electro optics
CO5	Understand the optical fiber communication

Mapping of Course Outcomes with Program Outcomes (POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2			2		2
CO2	2		2	2		2	3	3		3		3
CO3		2	2	2	2	2	2	2	2	3	2	
CO4		2	2	2	2	2	2	2	2	3	2	
CO5	3				3	2	3			3		2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	2	2	2	3
CO3	1	2	2	1
CO4	1	2	2	2
CO5	3	2	3	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : PHOTONICS	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E22	Prerequisite: Engineering Physics	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION 9 Hrs

Electromagnetic Optics: electromagnetic theory of light, electromagnetic waves in vacuum & dielectric media, absorption and dispersion, pulse propagation in dispersive media, Meta materials

Polarization Optics: polarization of light, reflection and refraction, optics of anisotropic media, Optics of liquid crystals, polarization devices.

UNIT- II GUIDED WAVE AND FIBER OPTICS 9 Hrs

Guided wave Optics: electromagnetic waves in dielectric layered media, photonic crystals, waveguides, resonators, plasmonics.

Fiber Optics: electromagnetic waves in fiber, Attenuation and dispersion, photonic crystal fibers.

UNIT- III SEMICONDUCTOR OPTICS 9 Hrs

Semiconductor Optics: quantization of electromagnetic field, quantum states of light, photon statistics, interaction of photons with charge carriers, light emitting diodes, laser diodes, microcavity lasers.

UNIT- IV DECTECTION OF LIGHT, ACOUSTO AND ELECTRO OPTICS 9 Hrs

Detection of light: theory of photo detection, phdetectors, photodiodes, avalanche photodiodes, noise in photo detectors.

Acousto and Electro Optics: interaction of light and sound, acousto-optic devices, Principles of electro optics, electro optics of anisotropic media, electro optics of liquid crystals

UNIT- V SPECIAL FIBER OPTIC AND SENSORS 9 Hrs

Special fibres- polarization maintaining fibres, holey fibre, PC fibres, DC Flattened and dispersion shifted fibre.

Fibre optic sensors- advantages of FOS, intensity modulated sensors, interferometric sensors, rotation sensors, bio sensors. Optical communication – advantages, modulation, time division and wave length multiplexing.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOK:

1. Optical Electronics by A.K. Ghatak, K. Thyagarajan (Cambridge University Press)

REFERENCES:

1. *Principles of Opticsby Max Born, Emil Wolf (Cambridge University Press) Fundamentals of Photonics by Saleh&Teich (Wiley-Interscience)*

ELECTIVE IV – Electronics Stream

Subject Code:	Subject Name : DEVICE MODELING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E23	Prerequisite: Analysis of Solid State Devices	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To understand passive devices and structures
- To understand the integrated BJT and MOS devices
- To implement solid state circuits using SPICE modeling

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Discuss the types and structures of resistors & capacitors in IC.
CO2	Criticize the dynamic & static behavior of integrated diodes.
CO3	Learn different models of integrated BJT.
CO4	Study the modeling of MOSFETS &their characteristics.
CO5	Analyze the small signal & large signal modeling of devices using SPICE.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	2	3		3	2	3	
CO2	3	3	3	3	3	2	3	3		2	3	
CO3	3	3	3	3	3	1		2	3		3	
CO4	3	3	3	3	3	2	3	3		2		
CO5	3	3	3	3	3	2			3	2		

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3
CO2	3	3		3
CO3	3	2	1	3
CO4	3	3		3
CO5	3	3	1	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : DEVICE MODELING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E23	Prerequisite: Analysis of Solid State Devices	Ty	3	0/0	0/0	3

UNIT I INTEGRATED PASSIVE DEVICES 9 Hrs

Types and Structures of Resistors and Capacitors in Monolithic Technology – Dependence of Model Parameters on Structure.

UNIT II INTEGRATED DIODES 9 Hrs

Junction and Schottky Diodes in Monolithic Technologies – Static and Dynamic Behavior – Small and Large Signal Models – SPICE Models.

UNIT III INTEGRATED BIPOLAR TRANSISTOR 9 Hrs

Types and Structures in Monolithic Technologies – Basic Model (Eber Moll_-Cunmel – Poon Model – Dynamic Model, Parasitic Effects – SPICE Model –Parameter Extraction.

UNIT IV INTEGRATED MOS TRANSISTOR 9 Hrs

n-MOS and p-MOS Transistor – Threshold Voltage -Threshold Voltage Equations – MOS Device Equations – Basic DC Equations Second Order Effects – MOS Models Small Signal AC Characteristics – MOSFET SPICE Model Level 1,2,3,4

UNIT V SPICE MODELLING 9 Hrs

Advanced Concepts of Large Signal & Low Signal Modeling

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Daniel Foty, "MOSFET Modeling with Spice" prentice hall, 1997.
2. Neil Weste and Kamran Eshranghian "Principles of CMOS VLSI Design, A System Perspective", "Addition – Wesley, 1993.

REFERENCES:

1. *Jacob Millman& Arvin Millman, "Micro Electronics", McGraw Hill (Second Edi) 1987.*
2. *M. Satyagi, John Wiley "Introduction to Semi-conductor materials and devices", New Edition.*

Subject Code:	Subject Name : VLSI TECHNOLOGY	Ty / Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22E24	Prerequisite: Analysis of Solid State Devices/Digital Electronics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :
To enable the students to understand various design flow in VLSI and their applications in fuzzy systems

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Study the fabrication of CMOS transistors & its layout design rles.
CO2	Interpret the interconnection resistance & capacitance & their extraction&estimation.
CO3	Learn the distribution of clock signals in a chip, henceforth the system timing.
CO4	Illustrate VLSI implementation of FLC, testing techniquesand the CAD automation for the same.
CO5	Design different types of adders and multiplier.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2						3	3
CO2	3	3	2	3	3						1	3
CO3	3	3	3	2	3						1	3
CO4	3	3	3	3	3						1	3
CO5	3	3	3	3	3						3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	3	2	3
CO3	3	3	3	3
CO4	3	3	2	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : VLSI TECHNOLOGY	Ty / Lb/ ETL/IE	L	T/S Lr	P/ R	C
EBEC22E24	Prerequisite: Analysis of Solid State Devices/Digital Electronics	Ty	3	0/0	0/0	3

UNIT I VLSI DESIGN FLOW 9 Hrs

Design hierarchy concepts of regularity, modularity & locality VLSI Design styles - CMOS Fabrication Technology- Introduction, Fabrication Process flow- basic steps, CMOS n-well process,p-well process,twin tub process, layout design rules-Introduction–CMOS Layout design rules – CMOS inverter Layout design – Layout of CMOS NAND & NOR gates – Complex CMOS Logic gates

UNIT II PARASITIC EXTRACTION & PERFORMANCE ESTIMATION FROM PHYSICAL STRUCTURE 9 Hrs

Introduction – Reality with inter connection –MOSFET capacitances-interconnect capacitance estimation – interconnect resistance estimation

UNIT III CLOCK SIGNALS & SYSTEM TIMING 9 Hrs

On chip clock generation & distribution using ring & pierce crystal oscillator – non – overlapping clock signals and gate level implementation – H-tree clock distribution N/W – clock skew reduction – Zero – Skew clock routing N/W- Clock distribution N/W for DEC alpha µp chips

UNIT IV TESTABILITY OF INTEGRATED SYSTEMS-VLSI FOR FUZZY LOGIC SYSTEMS 9 Hrs

Design constraints – Testing – The rule of ten – terminology – Failures in CMOS – Combinational Logic Testing – Practical Ad-Hoc DFT guidelines – Scan design techniques- Integrated implementations of FLC, Digital implementation of FLC's, Analog implementation of FLC's, Mixed digital / analog implementations of Fuzzy systems, CAD automation for FLC DESIGN, NN implementing fuzzy systems.

UNIT V ARITHMETIC FOR DIGITAL SYSTEMS 9 Hrs

Introduction – notation systems – Principles of generation & propagation – 1 bit full adder – Enhancement Techniques for Adders – multi operand – Adders – Multiplication – Addition and Multiplication in Galois Fields GF(2n)

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Cheng., SZE., "VLSI Technology"., Prentice Hall of India,
2. Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design Systems and Circuits", Prentice Hall of India Pvt Ltd., 1993.

REFERENCES:

1. *Cheng., SZE., "VLSI Technology"., Prentice Hall of India,*
2. *Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design Systems and Circuits", Prentice Hall of India Pvt Ltd., 1993.*
3. *Horspool., Gorman., "The ASIC Handbook", Tata McGraw Hill Publications., 1999*
4. *Randall .L. Geiger and P. E. Allen, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Company, 1990*

Subject Code:	Subject Name : BIOMEDICAL INSTRUMENTATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E25	Prerequisite: Electrical and Instrumentation Engineering	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study the methods of recording various bio potentials
- To study how to measure biochemical and various physiological information
- To understand the working of units which will help to restore normal functioning
- To understand the use of radiation for diagnostic and therapy
- To understand the need and technique of electrical safety in Hospitals

COURSE OUTCOMES (COs) :

The students will able to

CO1	Enable the students to develop knowledge of how instruments work in the various department and laboratories of a hospital and thereby recognize their limitations.
CO2	Interpret technical aspects of medicine.
CO3	Familiarize students with various medical equipment's and their technical aspects. Understand medical diagnosis and therapy.
CO4	Introduce students to the measurements involved in some medical equipment's.
CO5	Understanding the problem and ability to identify the necessity of equipment's to a specific problem.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	3	3	3	3	1	3	3
CO2	1	1	1	2	1	3	3	2	3	1	2	2
CO3	1	2	1	2	1	3	3	3	3	2	3	2
CO4	1	1	1	1	2	3	3	3	3	2	2	2
CO5	1	2	2	1	2	3	3	3	3	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	3	2
CO2	1	2	3	1
CO3	1	2	3	2
CO4	3	2	3	3
CO5	3	2	3	2

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : BIOMEDICAL INSTRUMENTATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E25	Prerequisite: Electrical and Instrumentation Engineering	Ty	3	0/0	0/0	3

UNIT I BASIC PHYSIOLOGY **9 Hrs**

Cells and their Structures – Transport of Ions Through Cell Membrane – Resting and Excited State – Trans membrane Potential – Action Potential – Bio-Electric Potential – Nervous System – Physiology of Muscles – Heart and Blood Circulation – Respiratory System – Urinary System.

UNIT II BASIC TRANSDUCER PRINCIPLES AND ELECTRODES **9 Hrs**

The Transducer Principles – Active Transducers – Passive Transducers – Transducer for Bio-Medical Application – Electrode Theory- Bio-Potential Electrode – Bio-Chemical Transducer.

UNIT III CARDIOVASCULAR SYSTEM **9 Hrs**

The Heart and Cardiovascular System – Blood Pressure – Characteristics of Blood Flow – Heart Sounds - Electro Cardiograph – Measurements of Blood Pressure – Measurement of Blood Flow and Cardiac O/P Plethysmography – Measurements of Heart Sounds

UNIT IV X-RAY AND RADIOISOTOPE INSTRUMENTATION: **9 Hrs**

X-ray Imaging Radiography – Fluoroscopy – Image Intensifiers – Angiography - Medical use of Radioisotopes – Beta Radiations – Detectors – Radiation Therapy.

UNIT V BIO-TELEMETRY **9 Hrs**

Introduction to Bio-Telemetry – Physiological Parameters Adaptable to Bio-Telemetry – The Components of Bio-Telemetry Systems – Implantable Units – Applications of Telemetry in Patient Care – Application of Computer in Bio-Medical Instrumentation, Anatomy of Nervous System – Measurement from the Nervous System – EEG – EMG.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. M. Arumugam, "*Bio-medical Instrumentation*" – Anuradha Agencies Publishers, 1992.
2. Khandpur," *Handbook on Biomedical Instrumentation*" – Tata McGraw Hill Co Ltd., 1989.

REFERENCES:

1. *Leusis Cromwell Fred, J. Werbell and Erich A.pfraffer, "Biomedical instrumentation and Measurements" – Prentice Hall of India, 1990.*
2. *Joseph J. Carr and John M. Brown, "Introduction to Biomedical equipment Technology", John Wiley and Sons, New York, 1997*

ELECTIVE IV – COMMUNICATION STREAM

Subject Code:	Subject Name : SPREAD SPECTRUM COMMUNICATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E26	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- Toenable the students to learn the concepts of spread spectrum systems and their performance metrics

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describe the basic principles of DSSS & FHSS.
CO2	Performance analysis on the spread spectrum modulation formats.
CO3	Observe the various typeof spread spectrum modulation formats.
CO4	Recognize the difference & benefits of spreading codes.
CO5	Estimate the spreading code acquisition and tracking circuits.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	2	2	1	2	1	1
CO2	3	3	3	3	2	2	2	2	1	2	1	1
CO3	3	3	3	3	2	2	2	2	1	2	1	1
CO4	3	3	3	3	2	2	2	2	1	2	1	1
CO5	3	3	3	3	2	2	2	2	1	2	1	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	3	3	2	1
CO3	3	3	2	1
CO4	2	3	2	1
CO5	3	3	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : SPREAD SPECTRUM COMMUNICATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E26	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION 9 Hrs

Fundamental concepts of Spread spectrum systems, Pseudo noise sequences, Director Sequence Spread Spectrum (DSSS) and Frequency Hop Spread Spectrum Systems and Code Division multiple acess

UNIT II PERFORMANCE CHARACTERIZATION OF DIGITAL 9 Hrs

Systems communications models – Performance of spread spectrum signals in jamming environments– spread spectrum systems performances with forward error correction

UNIT III SPREAD SPECTRUM SYSTEMS 9 Hrs

Direct sequence spread spectrum methods employing BPSK, QPSK and MSK - Frequency Hop spread spectrum methods - Hybrid direct sequence/frequency hop spread spectrum. Complex envelop representation of spread spectrum signals.

UNIT IV BINARY SHIFT REGISTER SEQUENCES FOR SPREAD SPECTRUM SYSTEMS 9Hrs

Sequence generator fundamentals, Maximum length sequences. Gold and Kasami codes, Nonlinear Code generators

UNIT V SYNCHRONIZATION OF SPREAD SPECTRUM SYSTEMS: 9 Hrs

Diversity reception in fading channels, Cellular radio concept, CDMA cellular systems, Examples of CDMA cellular systems. Multicarrier CDMA systems.CDMA standards.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Ziemer, R.E & Peterson, R.L., "Digital Communication and Spread Spectrum Systems", Mac millan Publishing Co., 1985.
2. Holms, J.K., "Coherent Spread Spectrum systems", Wiley Interscience, 1982.
3. R. L. Peterson, R. E. Zeimer and D. E. Borth, “Introduction to Spread Spectrum Communications”, Pearson, 1995.
4. J. D. Proakis and M. Salehi, “Digital Communication”, McGraw Hill, 2008

REFERENCES:

1. *Ziemer, R.E & Peterson, R.L., "Digital Communication and Spread Spectrum Systems", Mac millan Publishing Co., 1985.*
2. *Holms, J.K., "Coherent Spread Spectrum systems", Wiley Interscience, 1982.*
3. *Dixon, R.C., "Spread Spectrum Systems", Wiley Interscience, 1976.*
4. *Charles E Cook.,etal, "Spread-Spectrum Communications", IEEE Press, Inc, New York,*

Subject Code:	Subject Name : NETWORK MANAGEMENT	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E27	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To enable the students learn the concepts of managing the various categories of networks and analyzes its performance.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the fundamentals of various network topologies.
CO2	Discuss cellular concepts in designing a mobile communication system
CO3	Analyze different models of SNMP and their working.
CO4	Appreciate & analyze the diverse functions of broad band network management.
CO5	Analyze the different applications of network management.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	3		1	1	1	1		3
CO2	3	3	1	1	3		1		1	1		1
CO3	3	3	1	3	3		1		1			
CO4	1	3	1	3	1	1	2		1		1	
CO5	1	3	3	1	1	1	1	1	1		1	

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	1
CO2	1	3	1	1
CO3	1	3	1	2
CO4	3	1	2	3
CO5	1	3	1	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : NETWORK MANAGEMENT	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E27	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

UNIT I FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY 9Hrs

Network Topology, LAN, Network node components – Hubs, Bridge, Gateways, Switches, WAN, ISDN – Transmission Technology, communication protocols and standards

UNIT II NETWORK MANAGEMENT 9 Hrs

ISO Network Management Functions, Network Management Protocols,Network Management Tools, Wireless Network Management,Policy-based Network Management

UNIT III INTERNET MANAGEMENT (SNMP) 9 Hrs

SNMP-Organizational model – system Overview, The information model, communication model-Functional model, SNMP proxy server, Management information, protocol remote monitoring

UNIT IV BROADBAND NETWORK MANAGEMENT 9 Hrs

Broadband networks and services, ATM Technology-VP, VC, ATM Packet, Integrated service, ATMLAN emulation, Virtual LAN. ATM Management Information base, Role of SNMD and ILMI in ATM Management, M1, M2, M3, M4 Interface. ATM Digital Exchange Interface Management

UNIT V NETWORK MANAGEMENT APPLICATIONS 9 Hrs

Configuration management, Fault management, performance management, Event Correlation Techniques security Management Service Level Management

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Mani Subramaniyan, “Network Management Principles and Practice”, Addison Wesly.Newyork 2000

REFERENCES:

4. 1..*Lakshmi G. Raman, “Fundamentals of Telecommunication Network Management”, Eastern*
5. *Economy Edition IEEE, Press, New Delhi-1999*
3. *Salah Aiiarous, Thomas Plevayk, “Telecommunications Network Management Technologies and Implementations”, eastern Economy Edition IEEE press, New Delhi. 1998*

Subject Code:	Subject Name : SATELLITE COMMUNICATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E28	Prerequisite: Analog Communication, Digital communication	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Overview of satellite systems in relation to other terrestrial systems
- Study of satellite orbits and launching.
- Study of earth segment and space segment components
- Study of satellite access by various users.
- Study of DTH and compression standards.

COURSE OUTCOMES (COs) :
The students will be able to

CO1	Recognize various element of orbital Mechanics
CO2	Interpret various multiple access and switching techniques.
CO3	Illustrate the concepts involved in satellite link design
CO4	Analyze the principles, concepts and operation of satellite communication systems
CO5	Examine the various process of earth station design.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	2	2		2	1	2
CO2	3	3	3	2	3	2	2	3	3	3	3	3
CO3	3	3	3	3	2	2	2	1	2	3	2	2
CO4	3	3	3	3	2	2	1		2	3		2
CO5	3	3	3	2	3	2	2		3	2		3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2
CO2	3	3	2	2
CO3	3	3		2
CO4	3	3		2
CO5	3	3	2	

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name :SATELLITE COMMUNICATION	Ty / Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E28	Prerequisite: Analog Communication, Digital communication	Ty	3	0/0	0/0	3

UNIT I ELEMENTS OF ORBITAL MECHANICS **9 Hrs**

Equation, Orbital Elements, Orbital Perturbation, Tracking and Orbital Determination, Orbital Correction Control.

ELEMENTS OF COMMUNICATION SATELLITE DESIGN

Space Environment, Spacecraft Configuration, Spacecraft Subsystem, Payload, Reliability Consideration Spacecraft Integration and Testing.

UNIT II MULTIPLE ACCESS TECHNIQUES **9 Hrs**

FDM – FM – FDMA, TDMA, SSMA / CDMA, RANDOM MULTIPLE Access Techniques; Packet Switching and Packet Satellite Networks Satellite on Board Processing and Switching.

UNIT III SATELLITE LINK DESIGN **9 Hrs**

Types of System: BSS, Performance Requirements and Standards for Telephony, TV and DATA, Performance Impairments, Noise, Interference, Inter modulation, Design of Typical Satellite Links.

UNIT IV DOMESTIC SATELLITE SYSTEMS **9 Hrs**

The INSAT System, International System, INTELSAT, IMMARSAT, Satellite Based Personal Communication LEO, ICO, GEO Systems.

UNIT V EARTH STATION DESIGN **9 Hrs**

Earth Station Configuration, Site Selection, Antenna and Tracking Systems, Receiver and Transmitter Subsystems, Terminal Equipment: Telephone / Video Interface, Rearward Links, Miscellaneous Facilities Like Echo Suppressor, FM Digitizers, Ground Station Measurements, Elements of Frequency Co-ordination and Control, VSAT Networks and Terminals – Satellite Broadcasting, Satellite TV Systems.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. T. Pratt and C.W. Bostian, "*Satellite Communication*" – John Wiley & Son, 1986.
2. Abdul Namith, “Satellite *Communication*"-Lakshmi Publications.

REFERENCES:

1. *B.N. Agarwal, "Design of Geosynchronous Spacecraft" – Prentice Hall, 1986.*
2. *D. Roddy, "Satellite Communication" – Prentice Hall, 1989*
3. *M. Richharia,“Satellite Communication SystemsDesign Principles”, Macmillan Press Ltd. Second Edition 2003.*

Subject Code:	Subject Name : NEXT GENERATION COMMUNICATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E29	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn the Basics of 5G and Beyond Wireless communication
- To provide a basic understanding of the key technologies and enablers of 5G beyond communication systems
- To study 5G wireless channel models

COURSE OUTCOMES (COs) : (3- 5)

Upon the completion of the course the students will be able to

CO1	Distinguish the major cellular communication standards
CO2	Understand the 5G techniques
CO3	Analyze various modulation and multiplexing techniques
CO4	Demonstrate the key enablers of 6G Communication
CO5	Apply Machine Learning in 5G Wireless Communications

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	1	1		1	1	1	1
CO2	2	1	2	2	3	1	1		1	1	1	1
CO3	2	3	3	3	3	1			1			
CO4	2	3	3	3	3	1						2
CO5	2	3	3			1						1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2
CO2	3	3	1	2
CO3	3	3		3
CO4	3	3		3
CO5	3	3		3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Elective	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : NEXT GENERATION COMMUNICATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E29	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO FUNDAMENTALS OF WIRELESS COMMUNICATION 9Hrs

Evolution of cellular systems-Requirements, goals, and vision of the next generation wireless communication systems- Fading-Digital modulations-Performance Metrics

UNIT II KEY CONCEPTS IN 5G 9 Hrs

Small cells: Past, present, and future trends of cellular networks coverage and capacity of small cell networks-Interference management, D2D architecture Towards IoT Spectrum sharing.Massive MIMO: Point-to-point MIMO, Virtual MIMO (relaying), multiuser MIMO MassiveMIMO, propagation channel model, channel estimation, uplink and downlink data transmission-capacity bounds- achievable rate- energy and spectral efficiency trade-off

UNIT III mmWAVE TECHNOLOGY AND MULTIPLE ACCESS TECHNIQUES 9 Hrs

Applications-Radiowave propagation-Physical layer design and algorithms- mmWaveMIMO challenges-channel modeling- channel estimation- Beamforming.Multiple access techniques: OFDM, filter banks, GFDM, OTFS, NOMA

UNIT IV TRANSITION TO 6G 9 Hrs

Wireless energy harvesting-Machine learning, visible light communication, Intelligent reflecting surface (IRS)- Extremely Large Aperture Massive MIMO- Energy-rate trade-off- Simultaneous wireless information and power transfer (SWIPT)- time-switching- power splitting- Wireless powered communication networks -Outage probability and throughput.

UNIT V APPLICATIONS OF MACHINE LEARNING 9 Hrs

Channel modeling and estimation Spectrum sensing and sharing Resource allocation (NOMA, mmWave massive MIMO).

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. R. Vannithamby and S. Talwar, Towards 5G: Applications, Requirements and Candidate Technologies., John Willey & Sons, West Sussex, 2017.
2. Manish, M., Devendra, G., Pattanayak, P., Ha, N., 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology

REFERENCES:

1. *1.T. S. Rappaport, R. W. Heath Jr., R. C. Daniels, and J. M. Murdock, Millimeter Wave Wireless Communication., Pearson Education, 2015.*
2. *2.M. Vaezi, Z. Ding, and H. V. Poor,, Multiple Access techniques for 5G Wireless Networks and Beyond., Springer Nature, Switzerland, 2019*

Subject Code:	Subject Name : COGNITIVE RADIO	Ty / Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E30	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To enable the student to understand the evolving paradigm of cognitive radio communication and the enabling technologies for its implementation.
- To enable the student to understand the essential functionalities and requirements in designing software defined radios and their usage for cognitive communication.
- To expose the student to the evolving next generation wireless networks and their associated challenges

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describe the basics of the software defined radios.
CO2	To learn the hardware and software architecture of software defined radio
CO3	Design the wireless networks based on the cognitive radios
CO4	To understand cognitive radio architecture
CO5	Explain the concepts behind the wireless networks and next generation networks

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	3	1	3	1		2		
CO2	3	1	2	3	2	3	2	3	1		2	
CO3	2	1	3	1	2	2	2	1	1	2		
CO4	2	3	2	3	2	3	3	1		3	3	
CO5	3	1	2	1	3	3	1	2	2	3		

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2		3
CO2	3	3	2	3
CO3	3	3		3
CO4	3		3	3
CO5	3	2		3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : COGNITIVE RADIO	Ty / Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E30	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO SDR **9 Hrs**

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications, Antenna for Cognitive Radio.

UNIT II SDR ARCHITECTURE **9 Hrs**

Essential functions of the software radio, architecture goals, quantifying degrees of Programmability, top level component topology, Computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

UNIT IIIINTRODUCTION TO COGNITIVE RADIOS **9 Hrs**

Making radio self-aware, the cognition cycle, organization of cognition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios – concepts, architecture, design considerations.

UNIT IV COGNITIVE RADIO ARCHITECTURE **9 Hrs**

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide, act phases; knowledge representation, design rules.

UNIT V NEXT GENERATION WIRELESS NETWORKS **9 Hrs**

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Alexander M. Wyglinski, MaziarNekovee, and Y. Thomas Hou, “Cognitive Radio Communications And Networks - Principles And Practice”, Elsevier Inc., 2010.
2. E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, “Principles of Cognitive Radio”, Cambridge University Press, 2013.
3. Kwang-Cheng Chen and Ramjee Prasad, “Cognitive Radio Networks”, John Wiley & Sons Ltd., 2009.

REFERENCES:

1. *Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, “Cognitive Radio Networks - From Theory to Practice”, Springer Series: Analog Circuits and Signal Processing, 2009.*
2. *J. Mitola, “Cognitive Radio: An Integrated Agent Architecture for software defined radio”, Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.*
3. *Simon Haykin, “Cognitive Radio: Brain –empowered wireless communications”, IEEE Journal on selected areas in communications, Feb 2005.*
4. *Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, “NeXt generation /dynamic spectrum access / cognitive radio wireless networks: A Survey” Elsevier Computer Networks, May 2006.*
5. *Joseph Mitola, “Software Radio Architecture: A Mathematical Perspective” IEEE Journal on Selected Areas in Communication, Vol. 17, No. 4, April 1999.*
6. *HasariCelebi ,Huseyin Arslan, “Enabling location and environment awareness in cognitive radios”, Elsevier Computer Communications, January 2008.*

ELECTIVE V - Electronics Stream

Subject Code:	Subject Name : INTRODUCTION TO MEMS SYSTEM DESIGN	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E31	Prerequisite: Electrical and Instrumentation Engineering	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To enable the students to learn the basic concepts of MEMS design and their applications

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Be familiar with concepts of MEMS, sensors and fabricate techniques.
CO2	To analyze different properties of MEMS, systems.
CO3	To understand and analyze electrostatic design properties of MEMS.
CO4	To analyze and understand different issues related to design of MEMS circuit and system.
CO5	Will be exposed to the optical and RF based MEMS system.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	1	3	1	1	1	1	1	1	2
CO2	3	1	3	3	1	1	1	1	1	1	1	2
CO3	3	1	3	3	1	1	1	1	1	1	1	1
CO4	3	1	3	1	3	1	1	1	1	1	1	2
CO5	1	3	1	3	1	1	3	1	1	1	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	1	3	2	2
CO3	3	3	2	2
CO4	3	2	2	2
CO5	3	3	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : INTRODUCTION TO MEMS SYSTEM DESIGN	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E31	Prerequisite: Electrical and Instrumentation Engineering	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO MEMS 9Hrs

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro fabrication

UNIT II MECHANICS FOR MEMS DESIGN 9 Hrs

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.

UNIT III ELECTRO STATIC DESIGN 9Hrs

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. Bi stable actuators.

UNIT IV CIRCUIT AND SYSTEM ISSUES 9Hrs

Electronic Interfaces, Feedback systems, Noise, Circuit and system issues, Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Modeling of MEMS systems, CAD for MEMS.

UNIT V INTRODUCTION TO OPTICAL AND RF MEMS 9 Hrs

Optical MEMS, - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Memes – design basics, case study – Capacitive RF MEMS switch, performance issues.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOK:

1. Stephen Santuria, “Microsystems Design”, Kluwer publishers, 2000.
2. NadimMaluf, “An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000
3. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC pressBaco Raton, 2000.

REFERENCES:

1. *Stephen Santuria, “Microsystems Design”, Kluwer publishers, 2000.*
2. *NadimMaluf, “An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000*
3. *Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC pressBaco Raton, 2000.*
4. *Tai Ran Hsu, “MEMS & Micro Systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.*

Subject Code:	Subject Name : ANALYSIS AND DESIGN OF ANALOG IC's	Ty /Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E32	Prerequisite: Analysis of Solid State Devices, Linear Integrated circuits	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To know the fundamentals of Analog Design and current mirrors
- To illustreste the operstions of Op –amp and noise.
- To unerstsnd the working principle of Analog multiplier and PLL.
- To design MOS analog Ic's and the working of switched capacitor filters.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Know the general operating principle of analog ICs.
CO2	Analyze the characteristics of poles with nodes,source followers and Noise
CO3	Illustrate the concepts for design of analog multiplier and PLL
CO4	Examine MOS amplifiers
CO5	Design MOS switched capacitor filters.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	3	2	2	1	3	2
CO2	3	3	3	3	3	3	2	1	3	1	3	1
CO3	3	3	3	3	3	3	3	1	3	1	2	2
CO4	3	3	3	3	3	2	3	1	2	1	2	2
CO5	3	3	3	3	2	3	3	1	2	1	1	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	2	3
CO3	3	3	2	2
CO4	3	3	2	2
CO5	3	3	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : ANALYSIS AND DESIGN OF ANALOG IC's	Ty /Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E32	Prerequisite: : Analysis of Solid State Devices, Linear Integrated circuits	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS 9 Hrs

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascade current mirrors- Active current mirrors- Large and Small signal analysis- Common mode properties.

UNIT II OPERATIONAL AMPLIFIERS AND NOISE 9 Hrs

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascade stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth

UNIT III ANALOG MULTIPLIER AND PLL 9 Hrs

Analysis of four Quadrant and Variable Trans-conductance Multiplier, Phase Locked Loops-Simple PLL- Charge pump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

UNIT IV MOS ANALOG ICS 9 Hrs

Design of MOS Operational Amplifier, MOS Power Amplifier. CMOS Operational Amplifier: Introduction and analysis of Cascade Amplifier and Telescopic Cascade Amplifier. Design of CMOS op-amps, Compensation of op-amps, Design of Two stage op-amps, Cascade op-amps.

UNIT V SWITCHED CAPACITOR CIRCUITS 9 Hrs

General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator- Switched Capacitor Common mode feedback.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Behzad Razavi, ―Design of Analog CMOS Integrated Circuits‖, Tata McGraw Hill, 2001, 33rd re-print, 2016.
2. Grey and Meyer, "Analysis and Design of Analog Ics." Wiley International, 1996.

REFERENCES:

1. *Kenneth R.Laker, Willy M.C.Sansen, William M.C.Sansen, "Design of Analog Integrated Circuits and Systems", McGraw Hill, 1994*
2. *Grey, Wolley, Brodersen, "Analog MOS Integrated Circuits", IEEE Press, 1989.*
3. *Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009*

Subject Code:	Subject Name : CYBER PHYSICAL SYSTEM	T y/ Lb/ETL/ IE	L	T/S Lr	P/R	C
EBEC22E33	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To make them learn the basics of cyber physical system.
- To implement a cyber-physical system for automated control.
- To develop safety and secure methods for CPS.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the basics of cyber physical system.
CO2	Design a dynamic stable control system.
CO3	Implement a CPS in control system.
CO4	Apply formal methods for safety of CPS.
CO5	Deploya secured environment for CPS.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	1	1	2	1	1	1		2
CO2	1	3	3	3	3	1	1	1	2			
CO3	3	1	3	3	1	1		2	1		2	
CO4	1	3	3	3	1	2		1		1	1	2
CO5	1	1	1	1	1	1	1	1		2		1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	1	3	1	2
CO3	3		2	3
CO4	1	3	1	2
CO5	3	3	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name :CYBER PHYSICAL SYSTEM	T y/ Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E33	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO CPS 9 Hrs

Basic Principles of Design and validation – Industry 4.0 – IoT Implications – Processors, Sensors and Actuators – Wireless HART, CAN ,Automotive Ethernet-RTOS

UNIT II AUTOMATED CONTROL DESIGN 9 Hrs

Dynamic System and Stability – Controller Design Techniques – CLFs, MLFs under slow switching - Performance under Packet drop and noise

UNIT III CPS IMPLEMENTATION 9Hrs

Mapping of features to software to ECUs –Effect of scheduling – Bus Latency – sense and actuation faults on control performance-network congestion-Control, Bus and Network Scheduling

UNIT IV FORMAL METHODS FOR SAFETY 9 Hrs

Advanced Automata based Modeling and Analysis – Introduction, Timed and Hybrid Automata, Trajectories and zenoness, and formal analysis, CPS software–weakest Pre-conditions and bounded model checking

UNIT V SECURE DEPLOYMENT 9 Hrs

Secure Task Mapping and Partitioning – State Estimation for attack detection – Case Study –Automated Lighting and AC control in green buildings

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Rajeev Alur, “Principles of Cyber Physical Systems “ , MIT Press@2015,ISBN:0262029111 9780262029117
2. Marwedel, Peter”Embedded System Design Embedded Systems Foundations of Cyber-Physical Systems, and the Internet of Things”SpringerISBN 978-3-319-56045-8

REFERENCES:

1. *1. Rolf Dreschler, Ulrich Kuhne, “Formal Modeling and Verification of Cyber Physical System”,.*
2. *DhandaP.Rawat, Joel JPC Rodrigues, Ivan StojMenovic “ Cyber Physical Systems : From Theory to Practice”, CRC Press,2016*

Subject Code:	Subject Name : DIGITAL CONTROL SYSTEM	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E34	Prerequisite: Control Systems Engineering	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To introduce the components of digital control system
- To provide knowledge on pulse transfer functions and their analysis
- To introduce stability concepts in discrete domain
- To educate on tuning of PID controllers in discrete domain
- To introduce state variable analysis in discrete domain

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Acquire knowledge of digital control system concepts.
CO2	Discuss the transient and steady state response of control system.
CO3	Analyze stability of digital control system.
CO4	Design digital controllers using appropriate compensation technique.
CO5	Test the controllability and observability of a given system.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	1	1	3	2	2	3
CO2	3	3	3	2	3	2	2	1	3	2	3	2
CO3	3	3	3	3	3	1	3	2	3	1	3	1
CO4	3	3	3	3	3	2	2	2	3	2	3	2
CO5	3	3	3	3	2	3	3	2	3	2	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : DIGITAL CONTROL SYSTEM	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E34	Prerequisite: Control Systems Engineering	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION 9 Hrs

Introduction to digital control – Sampling Process – Sample and Hold Circuit – Zero and First Order hold – Z-Transform – Inverse Z- Transform – Region of convergence – Initial and Final Value Theorem

UNIT II PULSE TRANSFER FUNCTION AND TIME RESPONSE 9 Hrs

Block diagram reduction methods – Reduction Rules- Multi-loop – MIMO Systems – Signal Flow Graph-steady state error – error transfer functions- Error Constants-Time-Domain Analysis of Second Order Systems-Time Response

UNIT III STABILITY 9 Hrs

Introduction-Jury Stability Test- Schur-Cohn stability Test- Bilinear transformation- Stability by Pole Location – Root locus method- Bode Plot- Nyquist Plot.

UNIT IV DIGITAL PID CONTROLLER 9 Hrs

Cascade Compensation- Digital Lag Lead Compensator by Bode method- Design of P,PI and PID Controller- Ziegler's- Nichols Method, Cohen-Coon Method

UNIT V STATE SPACE ANALYSIS 9 Hrs

Realization of Pulse Transfer Function- Diagonalisation- discretization of Continuous time systemsState Transition Matrix- Solution of Discrete-time state equations- Controllability and Observability

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. V.I.George and C.P.Kurien, Digital Control System, Cengage Learning, 2012.
2. B.C.Kuo, Digital Control System, 2nd Edition, Oxford University Press, 2010.
3. M.SamiFadali, Antonio Visioli, Digital Control Engineering Analysis and Design, Academic Press, 2013.

REFERENCES:

1. *M.Gopal, 'Digital Control and State Variable Methods', Tata McGraw Hill, 3rd Edition, 2009.*
2. *C.M. Houpis, G.B.Lamount, 'Digital Control Systems- Theory, Hardware, Software', International Student Edition, McGraw Hill Book Co., 1985.*
3. *KannanM.Moddgalya, Digital Control, Wiley India, 2007.*
4. *C.L.Philips and J.M.Pan, "Feedback Control System, Pearson, 2013.*

ELECTIVE V – Communication Stream

Subject Code:	Subject Name : ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	Ty/ Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E35	Prerequisite:Field and Wave Electromagnetics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To understand EMI Sources, EMI problems and their solution methods in PCB level / Subsystem and system level design.
- To measure the emission Immunity level from different systems to couple with the prescribed EMC standards

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Remember the sources of EMI and its standards
CO2	Understand the coupling principles in EMI
CO3	Test the EMI measurements and its calibration
CO4	Interpret the control and isolation of various parts of EMI
CO5	Design PCBs for various applications in EMI control

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	2	1	2	2	3		2		3
CO2	3	2	1	2	2	2	2	2		3		2
CO3	2	2	3	2	2	3	2	3	2	3	3	2
CO4	1	2	3	3	3	2	2	2		3	2	2
CO5	2	2	3	2	2	2	2	2	2	2		2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	2
CO2	2	3	2	2
CO3	2	3	2	2
CO4	2	3	2	1
CO5	2	2	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	Ty/ Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E35	Prerequisite: Field and Wave Electromagnetics	Ty	3	0/0	0/0	3

UNIT I EMI ENVIRONMENT 9 Hrs

Sources of EMI, Conducted and Radiated EMI, Transient EMI, EMI-EMC Definitions and Units of Parameters.Units of Specification, Civilian Standards Military Standards.

UNIT II EMI COUPLING PRINCIPLES 9 Hrs

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, and Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply Coupling.

UNIT III EMI MEASUREMENTS 9 Hrs

EMI Test Instruments Systems. EMI Test, EMI Shielded Chamber, Open Area Test Site, TEM Cell Antennas, Conductors Sensors / Injectors / Couplers. Military Test Method and Procedures, Calibration Procedures.

UNIT IV EMICONTROL TECHINQUES 9 Hrs

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

UNIT V EMI DESIGN OF PCBs 9 Hrs

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning Motherboard Design and Propagation Delay Performance Models.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. V.P. Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, 1996.
2. Clayton R. Paul – Introduction to Electromagnetic compatibility – Wiley & Sons – 1992

REFERENCES:

1. *Bernhard Keiser.”Principles of Electromagnetic Compatibility”, Artech House, #rd Ed, 1986.*
2. *Henry W. Ott, “Noise Reduction Techniques in Electronic Systems”, John Wiley and Sons, Newyork, 1988.*

Subject Code:	Subject Name : ADVANCED CONCEPTS IN SIGNAL PROCESSING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E36	Prerequisite: Digital Signal Processing	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- The student learns important theorems and algorithms related to random signal processing.
- The student knows estimation, prediction and filtering concepts & techniques.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Analyze the characterstics of random signal processing.
CO2	Learn different types of spectrum estimators & their models.
CO3	Understand the concept of predictive filters.
CO4	Design different types of adaptive filters for different applications
CO5	Learn multirate signal processing& implementation of filter banks.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	3	2	2	3	2	3	1
CO2	3	3	3	3	3	3	3	2	3	1	1	2
CO3	3	3	3	2	3	3	3	3	2	3	2	2
CO4	3	3	3	3	3	2	2	3	2	3	3	2
CO5	3	3	3	3	3	2	3	3	3	3	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	2	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : ADVANCED CONCEPTS IN SIGNAL PROCESSING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E36	Prerequisite: Digital Signal Processing	Ty	3	0/0	0/0	3

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9 Hrs

Discrete Random Process, Expectation, Variance, Co-Variance, Scalar Product, Energy of Discrete SignalParseval's Theorem, Wiener Khintchine Relation-Power Spectral Density –Periodogram – Sample AutocorrelationSum Decomposition Theorem, Spectral Factorization Theorem – Discrete Random Signal Processing by Linear Systems-Simulation of White Noise – Low Pass Filtering of White Noise.

UNIT II SPECTRUM ESTIMATION 9 Hrs

Non-Parametric Methods-Correlation Method – Co-Variance Estimator – Performance Analysis of Estimators – Unbiased, Consistent Estimators – Periodogram Estimator – Barlett Spectrum Estimation – Welch Estimation – Model based Approach – AR, MA, ARMA Signal Modeling – Parameter Estimation using Yule-Walker Method.

UNIT III LINEAR ESTIMATION AND PREDICTION 9 Hrs

Maximum likelihood criterion-efficiency of estimator – Least mean squared error criterion – Wiener filter – Discrete Wiener Hoff equations – Recursive estimators-Kalman filter – Linear prediction, prediction error-whitening filter, inverse filter – Levinson recursion, Lattice realization, and Levinson recursion algorithm for solving Teoplitz system of equations.

UNIT IV ADAPTIVE FILTERS 9 Hrs

FIR adaptive filters – Newton's steepest descent method-adaptive filter based on steepest descent method – Widrow Hoff LMS adaptive algorithm – Adaptive channel equalizations – Adaptive echo chancellor – Adaptive noise cancellation – RLS adaptive filters –Exponentially weighted RLS – sliding window RLS – Simplified IIR LMS adaptive filter

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9 Hrs

Mathematical description of change of sampling rate – Interpolation and Decimation –continuous time model – Direct digital domain approach -Decimation by an integer factor – Interpolation by an integer factor – single and multistage realization - Poly phase realization – Application to sub band coding – Wavelet transform and filter bank implementation of wavelet expansion of signals.

Practical component P: Include case studies / application scenarios
Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., New York, 1996
2. Sopocles J. Orfanidis, "Optimum Signal Processing", McGraw Hill, 1990.

REFERENCES:

1. *Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., New York, 1996*
2. *Sopocles J. Orfanidis, "Optimum Signal Processing", McGraw Hill, 1990. .*
3. *John G. Proakis, Dimitris G. Manolais, "Digital Signal Processing", Prentice Hall of India, 1995*

Subject Code:	Subject Name : ULTRA WIDE BAND COMMUNICATION	Ty /Lb/ETL /IE	L	T/S Lr	P/R	C
EBEC22E37	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the basic operation of UWB system
- To design a UWB transmitter and receiver
- To study about the characteristics of UWB antennas

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the operation of Ultra Wide Band Systems
CO2	Learn the properties of UWB antennas
CO3	Design a UWB transmitter
CO4	Design a UWB receiver
CO5	Develop a multi-carrier UWB receiver

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3	3	2		3	2		3	2	3
CO2			3	2	2		2	3		3	3	3
CO3	3	3	3	3	2		2			3	2	2
CO4	3	3	3	3	2		2					
CO5	3	3	3	3	3		2	3	3			

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1		3	2	2
CO2		3	3	2
CO3	2	3		
CO4	2	3		2
CO5		3	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : ULTRA WIDE BAND COMMUNICATION	Ty /Lb/ ETL/IE	L	T/S Lr	P/R	C
EBEC22E37	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO UWB SYSTEMS **9 Hrs**

Overview of UWB - UWB Concept - UWB Signals: Impulse (I) and Multi-Carrier (MC) Signals, Uniqueness of UWB Systems; I-UWB System Model; MC-UWB System Model. Advantages of UWB Systems - Challenges in UWB Systems - Single Band Vs. Multi Band - Applications of UWB Systems - Regulatory, Legal & Other Controversial Issues.

UNIT II INTERFERENCE, COEXISTENCE & UWB ANTENNAS **9 Hrs**

Interference of UWB on NB: UWB Pulse Model - Effect of NB Receive Filter - BER Analysis - Time-Hopped Case - Aggregate of UWB Interference Modeling: Received Power - Asymptotic PDF of Aggregate Noise - Amplitudes: Aggregated PDF - Bernoulli and Poisson Models - Interference Analysis: NB on UWB, UWB on UWB - Basic Properties of UWB Antennas.

UNIT III UWB TRANSMITTER DESIGN **9 Hrs**

IUWB Signal Generators: Avalanche Pulse Generators - Step Recovery Diode Pulse Generators- Tunnel Diode Pulsars - Pulse Circuits Suitable for Integrated Circuits – Modulators- I-UWB Transmitters: TH-PPM and TH(A-PAM) UWB Signals - OOC-PPM UWB Signals - DSUWB Signals - TR UWB System-MC-UWB Transmitters: CI-UWB Signals - FH-UWB Systems - OFDM-UWB Systems - Spectral Encoded UWB Communication System.

UNIT IV IUWB RECEIVER DESIGN **9 Hrs**

System Model- Threshold/Leading Edge Detection - Correlation Detection (CD) Receivers - RAKE Receivers - Multi-User Detection (MUD) UWB Receivers- Hybrid RAKE IMUD Receivers - Auto Correlation TR UWB Receivers- Synchronization and Timing Issues - Digital I-UWB Implementation.

UNIT V UWB COMMUNICATION STANDARDS AND ADVANCED TOPICS **9 Hrs**

standardization in wireless personal area networks – DS-UWB proposal – MB-OFDM UWB proposal – IEEE proposals for UWB channel models – UWB ad-hoc and sensor networks – MIMO and Space-time coding for UWB systems – Self interference in high data-rate UWB communications – Coexistence of DS-UWB with WIMAX.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Jeffrey H. Reed, "An Introduction to UWB Communication Systems, Prentice Hall, 2005.
2. Robert Aiello and Anuj Batra, "UWB Systems: Technologies and Applications", Newnes- Elsevier, 2006.
3. FaranakNekoogar, "UWB Communications: Fundamentals and Applications", Prentice Hall, 2005.

REFERENCES:

1. *Ultra Wideband Antennas: Design, Methodologies, and Performance BY (Author), Marco Antonio Peyrot-Solis (Author), HildebertoJardón Aguilar*
2. *Design of CMOS RFIC Ultra-Wideband Impulse Transmitters and Receivers Book by Cam Nguyen and Meng Miao 3.Ultra-Wideband Antennas and Propagation: For Communications, Radar and Imaging 1st Editionby BenAllen (Editor), Mischa Dohler (Editor), Ernest Okon (Editor), Wasim Malik (Editor), AnthonyBrown (Editor), David Edwards*

Subject Code:	Subject Name : UNDER WATER ACOUSTIC SIGNAL PROCESSING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E38	Prerequisite: Digital Signal Processing	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the basic operation of Under Water Acoustics
- To study the characteristics of SONAR System
- To apply the principles of signal processing for practical solutions

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Analyze the propagation of sound in water
CO2	Discuss the source and characteristic of Ambient noise in sea.
CO3	Evaluate the noise, resolution and bandwidth of a signal under water
CO4	Analyze the characteristic of sonar systems
CO5	Perceive the architecture of ADSP 218x and TMS 320c541x Processors

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2					2
CO2	3	3	3	3	3	3	2					2
CO3	3	3	3	3	3	3	2					2
CO4	3	3	3	3	3	3	2					2
CO5	3	3	3	3	3	3	2					2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : UNDER WATER ACOUSTIC SIGNAL PROCESSING	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E38	Prerequisite: Digital Signal Processing	Ty	3	0/0	0/0	3

UNIT I FUNDAMENTALS OF UNDERWATER ACOUSTICS 9 Hrs

The Ocean acoustic environment, measuring sound level, Sources and receivers, relevant units, sound velocity in sea water, typical vertical profiles of sound velocity, Sound propagation in the Ocean-characteristic sound propagation paths-deep water and shallow water, Range dependent environment. Sound attenuation in sea water, Bottom Loss, Surface bottom and volume scattering, Snell's law for range dependent ocean.

UNIT II AMBIENT NOISE IN THE SEA 9 Hrs

Sources of ambient noise-introduction, different frequency bands of ambient noise, process of surface noise generation, shallow water, variability of ambient noise, spatial coherence of ambient noise, directional characteristics of ambient noise, intermittent sources of noise- biological & non biological (rain, earthquakes, explosions and volcanoes).

UNIT III SIGNALS, FILTERS AND RANDOM FUNCTIONS 9 Hrs

Fourier representations, filters and noise, digital filter design techniques, temporal resolution and bandwidth of signals, signal to noise power ratio, Estimates of auto-covariance, power spectrum, cross covariance and cross spectrum.

UNIT IV CHARACTERISTICS OF SONAR SYSTEMS 9 Hrs

Sonar systems, active and passive sonar equations, transducers and their directivities, Sensor array characteristics-array gain, receiving directivity index, beam patterns, shading and super directivity, adaptive beam forming.

UNIT V DSP PROCESSORS 9 Hrs

Architecture of ADSP 218x, Architecture of TMS 320C541X.

CASE STUDY:

1. Signal processing of ocean ambient noise data.
2. Beam forming of vertical linear array data.

Practical component P: Include case studies / application scenarios
Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Principles of Underwater Sound by Robert J Urick
2. Acoustical Oceanography : Principles and Applications by Clay &Medwin

REFERENCES:

1. *Ambient noise in the sea by Robert J.Urick*
2. *Fundamental of ocean acoustics by L.M.Brekhovskikh and Yu.P.Lysanov*
3. *Sonar signal processing by Richard O.Nielsen 6. DAP processor manuals.*

COMMON ELECTIVE FOR BOTH STREAMS

Subject Code:	Subject Name : CRYPTOGRAPHY AND NETWORK SECURITY	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E39	Prerequisite: Comminication Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study the various cryptographic algorithms, firewall.
- To study Integrity, Authentication.
- To study about wireless network security concepts.

COURSE OUTCOMES (COs) :

The students will be able to

CO1	Identify different types of attacks secured information transmission.
CO2	Encrypt and decrypt messages using different cryptographic.
CO3	Verify message using digital signature and manage secret key.
CO4	Have a clear knowledge on network security, web security and firewalls.
CO5	Test and identify the various security attack issues in wireless systems.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	2	1	2	3	3	2	3
CO2	3	3	3	3	3	3	1	2	2	3	3	3
CO3	3	3	3	3	2	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	2	3	1	3	3	3
CO5	2	3	3	3	3	3	2	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	3	2	1
CO3	3	3	2	2
CO4	3	1	1	3
CO5	3	3	3	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : CRYPTOGRAPHY AND NETWORK SECURITY	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E39	Prerequisite: Comminication Networks	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION ON SECURITY **9 Hrs**

Security Goals, Types of Attacks: Passive attack, active attack, attacks on confidentiality, attacks on Integrity and availability. Security services and mechanisms, Techniques: Cryptography, Steganography, Revision on Mathematics for Cryptography.

UNIT II SYMMETRIC & ASYMMETRIC KEY ALGORITHMS **9 Hrs**

Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers, Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, Principle of asymmetric key algorithms, RSA Key distribution.

UNIT III INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT **9 Hrs**

Message Integrity, Hash functions: SHA, Digital signatures: Digital signature standards. Authentication Entity Authentication: Biometrics, Key management Techniques, Introduction to Quantum Cryptography.

UNIT IV NETWORK SECURITY, FIREWALLS AND WEB SECURITY **9 Hrs**

Introduction on Firewalls, Types of Firewalls, Firewall Configuration and Limitation of Firewall. IP Security Overview, IP security Architecture, authentication Header, Security payload, security associations, Key Management. Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature

UNIT V WIRELESS NETWORK SECURITY **9 Hrs**

Security Attack issues specific to Wireless systems: Worm hole, Tunneling, DoS WEP for Wi-Fi network, Security for 4G networks: Secure Ad hoc Network, Secure Sensor Network

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Behrouz A. Fourouzan , "*Cryptography and Network security*" Tata McGraw- Hill, 2008
2. William Stallings, *"Cryptographyand Network security: principles and practice*", 2nd Edition, Prentice Hall of India, New Delhi, 2002
3. Atul Kahate , "*Cryptography and Network security*", 2nd Edition, Tata McGraw- Hill, 2008

REFERENCES:

1. *R.K.Nichols and P.C. Lekkas ,""Wireless Security", Mc Graw-Hill Professional, New York, NY, USA, 2001*
2. *H. Yang et al., "Security in Mobile Ad Hoc Networks: Challenges and Solution", IEEE Wireless Communications, Feb. 2004.*
3. *Securing Ad Hoc Networks, IEEE Network Magazine, vol. 13, no. 6, pp. 24-30, December 1999.*

Subject Code:	Subject Name : INTRODUCTION TO ARTIFICIAL INTELLIGENCE	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E40	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand an overview of AI principles and approaches
- To develop a basic understanding of building blocks of AI
- To design and implement an AI System

COURSE OUTCOMES (COs) : (3- 5)

Upon the completion of the course the students will be able to

CO1	Understand the basics of AI
CO2	Analyze the different forms of Logic
CO3	Demonstrate the capability of reasoning
CO4	Illustrate the problem solving by using different algorithms
CO5	Exhibit the different knowledge Representation methods

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1					2			2	1	1
CO2	1	3		3	3	3	2			2		2
CO3	2	3	3	2	3	3	3			2		
CO4	2	3	3	2	3	3	3	2		2		
CO5	2	2	2	1	3	3	1	2		3		

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3		3	1
CO2	3		3	1
CO3	3	2	3	1
CO4	3	2	3	1
CO5	3		3	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Elective	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : INTRODUCTION TO ARTIFICIAL INTELLIGENCE	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E40	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO AI **9 Hrs**

Overview of AI application areas: game playing, automated reasoning and theorem proving, expert systems, natural language understanding, planning and robotics, machine learning and Alan Turing Test.

UNIT II LOGIC **9 Hrs**

Symbol and sentences, the semantics of the Propositional Calculus & Predicate Calculus.Inference Rules and Theorem Proving. Axioms, Literals, Horn clause & Clausal forms

UNIT III REASONING **9 Hrs**

Inductive, Deductive, Abductive and Default reasoning. More examples on Resolution proof.

UNIT IV PROBLEM SOLVING **9 Hrs**

Structures and strategies for state space search. Algorithms for Heuristic search, Heuristic evaluation functions

UNIT V KNOWLEDGE REPRESENTATION **9 Hrs**

Knowledge representation Techniques; conceptual graphs; structured representations; frames, scripts; issues in knowledge representation: hierarchies, inheritance, exceptions.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Artificial Intelligence - A New Synthesis by Nils J. Nilsson, Morgan Kaufmann Publishers.
2. Artificial Intelligence: Strategies and techniques for complex problems solving by George Luger, Addison-Wesley, 2003.

REFERENCES:

1. *Artificial Intelligence - A Modern Approach by Stuart Russell & Peter Norvig, Prentice Hall.*

Subject Code:	Subject Name : MACHINE LEARNING	Ty /Lb/ ETL/IE	L	T/SLr	P/ R	C
EBEC22E41	Prerequisite: Probability and Random Process	Ty	3	0/0	0/ 0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand issues and challenges in machine learning.
- To choose data based on model selection and model complexity.
- To develop a system that aids the process of decision-making.

COURSE OUTCOMES (COs) : (3- 5)

Upon the completion of the course the students will be able to

CO1	Understand the basics of machine learning
CO2	Apply the concept of probability in learning
CO3	Demonstrate the reduction of dimensionality in a problem statement
CO4	Implement the different methods of decision making for a complex problem
CO5	Integrate the machine learning models and statistical tools for making decisions

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	1	1	1			1		1
CO2	2	3	3	3	1	3	1			1		1
CO3	2	3	3	3	1	3	1			1		1
CO4	2	3	3	3	1	2	1		2	2	1	1
CO5	2	3	3	3	1	1	1		2	2	1	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	1
CO2	2	3	3	1
CO3	2	3	3	2
CO4	2	3	3	2
CO5	2	3	3	2

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Elective	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : MACHINE LEARNING	Ty /Lb/ ETL/IE	L	T/SLr	P/ R	C
EBEC22E41	Prerequisite: Probability and Random Process	Ty	3	0/0	0/ 0	3

UNIT I: INTRODUCTION **9 Hrs**

Introduction to Machine Learning- Supervised Learning, Unsupervised Learning and Reinforcement Learning.

UNIT II PROBABILITY BASICS **9 Hrs**

Linear Algebra - Statistical Decision Theory – Regression & Classification - Bias – Variance - Linear Regression - Multivariate Regression

UNIT III DIMENSIONALITY REDUCTION **9 Hrs**

Dimensionality Reduction Subset Selection - Shrinkage Methods - Principal Components Regression - Linear Classification - Logistic Regression - Linear Discriminant Analysis Optimization - Classification - Separating Hyperplanes Classification

UNIT IV DECISION MAKING **9 Hrs**

Artificial Neural Networks (Early Models, Back Propagation, Initialisation,Training and Validation) - Parameter Estimation (Maximum Likelihood Estimation, Bayesian Parameter Estimation) - Decision Trees - Evaluation Measures - Hypothesis Testing - Ensemble Methods - Graphical Methods

UNIT V CLUSTERING METHODS **9 Hrs**

Clustering - Gaussian Mixture Models - Spectral Clustering - Learning Theory - Reinforcement Learning.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. The Elements of Statistical Learning: Data Mining, Inference and Prediction by T.Hastie, R.Tibshirani, J.Friedman, 2e, Springer Series in Statistics.
2. Pattern Recognition and Machine Learning(Information Science and Statistics) by Christopher M.Bishop, Addison-Wesley, 2003.

REFERENCES:

1. *Machine Learning: An Algorithmic Perspective by Stephen Marsland,2e, Chapman and Hall/CRC..*

Subject Code:	Subject Name : FUZZY LOGIC AND SYSTEMS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E42	Prerequisite: Mathematics I & II	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To introduce the basic principles of fuzzy logic.
- To make the student familiar with the various fuzzy sets and relations.
- To develop a deep understanding of fuzzy system

COURSE OUTCOMES (COs) : (3- 5)

Upon the completion of the course the students will be able to

CO1	Understand the significance of membership functions for different applications
CO2	Analyze the arithmetic operations in Fuzzy sets.
CO3	Illustrate the role of fuzzy relations in an ANFIS system
CO4	Understand the fundamental concepts of fuzzy rules and reasoning
CO5	Identify the working of models of fuzzy inference system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	1			2	1	1
CO2	3	3	3	3	3	2	1			2	1	1
CO3	3	3	2	2	3	2						2
CO4	3	2	3	3	3	2			1			2
CO5	3	3	3	3	3	2				2	1	

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	1	3	1
CO2	3	1	3	1
CO3	3	1	3	
CO4	3	1	3	
CO5	3	1	3	

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : FUZZY LOGIC AND SYSTEMS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E42	Prerequisite: Mathematics I & II	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO FUZZY LOGIC 9 Hrs

Introduction to Fuzzy sets-Fuzzy Logic-Membership Functions-Set Theoretic Operations-.Fuzzy Systems and its Applications

UNIT II FUZZY SETS AND ARITHMETIC 9 Hrs

Fuzzy Set Properties-Distance between Fuzzy Sets-Arithmetic Operations on Fuzzy Numbers-Complement T-norm and S-norm for Fuzzy Sets-Parameterized T-form and .S-form

UNIT III FUZZY RELATION 9 Hrs

Fuzzy Relation and its Operations-Projections-Cylindrical Extensions-Properties of Fuzzy Relations-Fuzzy Tolerance and Equivalence Relations

UNIT IV FUZZY RULES AND INFERENCE SYSTEM 9 Hrs

Linguistic Hedges-Negation-Connectives-Concentration and Dilation, Contrast Intensification of Fuzzy Sets-Orthogonality of Fuzzy Sets-Fuzzy Rules and Reasoning

UNIT V FUZZY INFERENCE SYSTEM 9 Hrs

Mamdani Fuzzy Model-Larsen Fuzzy Model-Tsukamoto Fuzzy Model-TSK Fuzzy Model-Fuzzifiers and Defuzzifiers-ANFIS Architecture.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Ross.T.J, “Fuzzy Logic with Engineering Applications”, John Wiley and Sons.
2. Jang,Sun and Mizutani,, “Neuro Fuzzy and Soft Computing”, Prentice Hall of India

Subject Code:	Subject Name : INTRODUCTION TO DISCRETE MATHEMATICS	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBEC22E43	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- To understand the Basic concepts in Truth Table, Mathematical Logic and Inference Theory
- To understand the Basic concepts in Mathematical Induction and Recurrence relations
- To understand the Basic concepts in Group theory, Rings and Fields
- To understand the Basic concepts in Finite Automata, Finite state machine.
- To understand the Basic concepts in Graph theory

COURSE OUTCOMES (COs) :

CO1	To understand the Basic concepts in Logic and Predicate calculus
CO2	To understand the Basic concepts in Combinatorics
CO3	To understand the Basic concepts in Group theory
CO4	To understand the Basic concepts in Automata
CO5	To understand the Basic concepts in Graph theory

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	1	1	1	2	1	1	3
CO2	3	2	1	2	1	2	1	2	2	1	1	3
CO3	2	3	1	3	2	2	2	1	1	2	1	3
CO4	3	3	1	2	1	2	2	1	1	2	1	2
CO5	2	3	1	2	1	2	2	1	1	2	2	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	2
CO2	1	2	1	3
CO3	1	2	1	2
CO4	2	3	1	3
CO5	1	3	1	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
	✓								

Subject Code:	Subject Name : : INTRODUCTION TO DISCRETE MATHEMATICS	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBEC22E43	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I LOGIC **9 Hrs**

Statements – Truth Table – Connectives – Normal Forms – Predicate Calculus – Inference Theory.(Qualitative approach)

UNIT II COMBINATORICS **9 Hrs**

Mathematical Induction – Pigeon Hole Principle – Principle of Inclusion and Exclusion – Recurrence Relations – Generating Functions.(Qualitative approach)

UNIT III GROUPS **9 Hrs**

Basic Concepts – Groups – Subgroups – Homomorphism – Kernel – Cosets – Lagrange's theorem - Group Homomorphisms – Rings and Fields (Definitions and simple theorems and problems).(Qualitative approach)

UNIT IV AUTOMATA **9 Hrs**

Finite Automata – Regular grammar – Introduction – Context free grammar – Introduction to Turing machine – Finite state machine – Introduction – Language Recognition.(Qualitative approach)

UNIT V GRAPHS **9 Hrs**

Introduction to Graphs – Terminology – Matrix representation of Graphs: Incidence matrix, Adjacency matrix – Graph Isomorphism – Connectivity – Euler and Hamiltonian Paths (simple theorems and problems). (Qualitative approach)

Total Number of Hours: 45

REFERENCE BOOKS:

1. *Veerarajan T., Discrete Mathematics, Tata McGraw Hill Publishing Co., (2008).*
2. *Tremblay J.P., Manohar R., Discrete Mathematical structures with applications to Computer science, Tata McGraw Hill Publishing Co., (2008).*
3. *Kolman, Busby, Ross, Discrete Mathematical Structures, Pearson, (2014).*
4. *Kenneth Rosen, Discrete Mathematics and its applications (SIE), Tata McGraw Hill Publishing Co., (2007).*

Subject Code:	Subject Name : WIRELESS SENSOR NETWORKS	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBEC22E44	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- To understand issues and challenges in machine learning
- To choose data based on model selection and model complexity

COURSE OUTCOMES (COs) :

CO1	Understand the basics of wireless sensor networks and its applications.
CO2	Learn the routing protocols for ad hoc wireless networks.
CO3	Analyze the routing protocols for optimizing the design of sensor networks.
CO4	
CO5	Integrate the machine learning models and statistical tools for making decisions

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	2	2	2	2	2
CO2	3	3	3	3	3	3	3	2	2	2	2	2
CO3	3	3	3	3	3	3	3	2	2	2	2	2
CO4	3	3	3	3	3	3	3	2	2	2	2	2
CO5	3	3	3	3	3	3	3	2	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	3
CO2	3	3	2	3
CO3	3	3	3	2
CO4	3	3	3	2
CO5	2	1	1	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : WIRELESS SENSOR NETWORKS	Ty/Lb/ ETL/IE	L	T/ S.Lr	P/R	C
EBEC22E44	Prerequisite: Communication Networks	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTION AND OVERVIEW OF WIRELESS SENSOR NETWORKS 9 Hrs

Introduction, Brief Historical Survey of Sensor Networks, and Background of Sensor Network Technology, Ah-Hoc Networks, Applications of Wireless Sensor Networks: Sensor and Robots, Reconfigurable Sensor Networks, Highway Monitoring, Military Applications, Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Another Taxonomy of WSN Technology, Basic Sensor Network Architectural Elements, Home Control, Medical Applications.

UNIT II ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9 Hrs

Designing issues, classification of routing protocols, table driven routing protocols, on demand routing protocol, Hybrid routing protocol, Hierarchical routing protocols. Multicast routing in Ad Hoc wireless networks: Operations and classification of multicast routing protocols, Tree based multicast routing protocol, Mesh based multicast routing protocol.

UNIT III SYSTEM ARCHITECTURE AND DESIGN ISSUES 9 Hrs

Design Constraints for Routing in Wireless Sensor Networks, Classification of Routing Protocols in Wireless Sensor Networks-Hierarchy Role of Nodes in the Network, Data Delivery Model, Optimization Techniques for Routing in Wireless Sensor Networks, Application of the Optimization Techniques: Routing Protocols

UNIT IV ROUTING PROTOCOLS FOR WIRELESS SENSOR NETWORKS 9 Hrs

Introduction, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Networks Network Scale and Time-Varying Characteristics, Resource Constraints, Sensor Applications Data Models, Routing Strategies in Wireless Sensor Networks: WSN Routing Techniques, Flooding and Its Variants, Sensor Protocols for Information via Negotiation, Low-Energy Adaptive Clustering Hierarchy, Power-Efficient Gathering in Sensor Information Systems, Directed Diffusion, Geographical Routing.

UNIT V TRANSPORT LAYER SECURITY PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9 Hrs

Designing issues, classification of transport layer solutions, feedback-based TCP, TCP bus, Ad Hoc TCP, Security in Ad hoc wireless networks, Issues and challenges in security provisioning, Key management, Secure routing in Ad hoc wireless networks. Quality of Service: Issues and challenges in providing QoS in Ad Hoc wireless networks, classification of QoS solutions.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. The Elements of Statistical Learning: Data Mining, Inference and Prediction by T.Hastie, R.Tibshirani, J.Friedman, 2e, Springer Series in Statistics.
2. Pattern Recognition and Machine Learning(Information Science and Statistics) by Christopher M.Bishop, Addison-Wesley, 2003.

Subject Code:	Subject Name : DATABASE MANAGEMENT SYSTEMS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E45	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
- To develop an understanding of essential DBMS concepts such as: database security, integrity, and concurrency.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the fundamental concepts and techniques of DBMS
CO2	Analyze routine requisite for edifice, maintain, and querying databases.
CO3	Represent diverse indexing approach in different database systems
CO4	Evaluate a directory on base of adequate scheme.
CO5	Design and development of advanced database management systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	3	3		1			2	1		2
CO2	2	2	3	3	3	2			3	1		3
CO3	2	2	3	3	3	2			3	1		3
CO4	2	2	3	3	3	2			2	1		3
CO5	2	2	3	3	3	2			3	1	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	3	3	3
CO3	2	2	3	3
CO4	2	2	3	3
CO5	2	2	3	3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : DATABASE MANAGEMENT SYSTEMS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E45	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I FUNDAMENTALS OF DATABASE **9 Hrs**

Introduction - Purpose of database systems -Uses of DBMS- Advantages and Disadvantages of DBMS – Data Abstraction -Data models – Instances and schemas – Data Independence – DDL – DML – Database user-Database Languages

UNIT II RELATIONAL APPROACH **9 Hrs**

ER model — Basic Structure – Entity sets- keys– various operations – relational database design – problems in the relational database design – Normalization, Normal forms -Relational Algebra- Tuple Relational Calculus-Domain Relational Calculus- Query Languages -SQL-Embedded SQL

UNIT III FILE STRUCTURE, INDEXING & HASHING **9 Hrs**

File and system structure – Overall system structure – file transaction – data dictionary – indexing and hashing basic concepts and B+ tree Indices - static and dynamic hash functions.

UNIT IV OBJECT ORIENTED RELATIONAL DATABASE TECHNOLOGY **9 Hrs**

Concepts for Object Oriented Data Model – Object Oriented Database Languages -Persistent Programming Language-Object Relational Databases. System Implementation techniques: Query Processing-Transaction Processing-Concurrency Control-Recovery System.

UNIT V ENHANCED DATA MODELS FOR ADVANCED APPLICATIONS **9 Hrs**

Database System Architecture- Client Server System-Centralized Systems-Parallel Systems-Distributed Database System

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Abraham, Silberschatz. Henry, F. K.. Sudharshan, S. (2013) Database System Concepts (6th ed.) Tata McGraw Hill, New Delhi.
2. Fundamentals of Database System By Elmasari & Navathe, 7th Edition, 2018, Pearson Education

REFERENCE BOOKS:

1. *Ramez, E. Shamkant, B. Navathe (2008) Fundamentals of database systems (5th ed.), Pearson Education*
2. *Date, C. J, (2012) An Introduction to Database Systems (8th ed.), Pearson EducatioN*
3. *A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", fifth Edition McGraw-Hill*
5. *Rob, Coronel, "Database Systems", Seventh Edition, Cengage Learning*

Subject Code:	Subject Name : THEORY OF COMPUTATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E46	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To give an overview of the theoretical foundations of computer science from the perspective of formal languages
- To illustrate finite state machines to solve problems in computing
- To explain the hierarchy of problems arising in the computer sciences.
- To familiarize Regular grammars, context frees grammar.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Formulate automata, regular expression for any pattern
CO2	Write Context free grammar for any construct.
CO3	Design Turing machines for any language.
CO4	Propose computation solutions using Turing machines.
CO5	Derive whether a problem is decidable or not.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2			2	2		2
CO2	3	3	3	3	2	2			2	2		2
CO3	3	3	3	3	2	2			3	2		2
CO4	3	3	3	3	2	2			3	2		2
CO5	3	3	3	3	2	2			3	2		2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	3	3	3
CO3	2	2	3	3
CO4	2	2	3	3
CO5	2	2	3	3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
					✓				

Subject Code:	Subject Name : THEORY OF COMPUTATION	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22E46	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I AUTOMATA FUNDAMENTALS 9 Hrs

Introduction to formal proof — Additional forms of Proof — Inductive Proofs –Finite Automata — Deterministic Finite Automata — Non-deterministic Finite Automata — Finite Automata with Epsilon Transitions

UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9 Hrs

Regular Expressions — FA and Regular Expressions — Proving Languages not to be regular — Closure Properties of Regular Languages — Equivalence and Minimization of Automata

UNIT IIICONTEXT FREE GRAMMAR AND LANGUAGES 9 Hrs

CFG — Parse Trees — Ambiguity in Grammars and Languages — Definition of the Pushdown Automata — Languages of a Pushdown Automata — Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata..

UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES 9 Hrs

Normal Forms for CFG — Pumping Lemma for CFL — Closure Properties of CFL — Turing Machines — Programming Techniques for TM.

UNIT V UNDECIDABILITY 9 Hrs

Non Recursive Enumerable (RE) Language — Undecidable Problem with RE — Undecidable Problems about TM — Post?s Correspondence Problem, The Class P and NP.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOK:

1. J.E.Hopcroft, R.Motwani and J.D Ullman, ―Introduction to Automata Theory, Languages and Computations‖, Second Edition, Pearson Education, 2003.

REFERENCES:

1. *1.H.R.Lewis and C.H.Papadimitriou, ―Elements of the theory of Computation‖, Second Edition, PHI, 2003.*
2. *J.Martin, ―Introduction to Languages and the Theory of Computation‖, Third Edition, TMH, 2003*
3. *Micheal Sipser, ―Introduction of the Theory and Computation‖, Thomson Brokecole, 1997*

OPEN ELECTIVES

OPEN ELECTIVES

Subject Code:	Subject Name : INTERNET OF THINGS AND ITS APPLICATIONS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE1	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study basics of IoT.
- To study IoT with Cloud environment.
- To study IoT applications.

COURSE OUTCOMES (COs) : (3- 5)
The students will be able to

CO1	Explore basics concepts of technology of IoT
CO2	Understand different IoT domains.
CO3	Manage system data in cloud environment
CO4	Interface embedded system with IoT
CO5	Learn new applications based on IoT.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	3	2	2	2	3	3
CO2	3	2	2	3	3	2	2	2	2	2	3	3
CO3	3	2	3	3	3	2	2	2	2	2	3	3
CO4	3	3	2	3	3	2	2	2	1	2	3	3
CO5	3	2	3	3	3	2	2	2	1	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	2	3
CO3	3	3		3
CO4	3	3	2	3
CO5	2	3	1	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
						✓			

Subject Code:	Subject Name : INTERNET OF THINGS AND ITS APPLICATIONS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE1	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO INTERNET OF THINGS 9 Hrs

Definition and Characteristics of IoT – Things in IoT – IoT Protocols – Logical Design of IoT – IoT enabling technologies – IoT Levels.

UNIT II DOMAIN SPECIFIC IoT 9 Hrs

Home Automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health and Life style–SDN and NFV for IoT.

UNIT III IoT SYSTEM MANAGEMENT AND CLOUD 9 Hrs

Need for IoT System Management - SNMP – NETOPEER – IoT design methodology - Xively – Django-Amazon Web for IoT – SkyNetIoT.

UNIT IV IoT PHYSICAL DEVICES 9 Hrs

Raspberry Pi - Raspberry Pi Interfaces – Arduino boards – Other IoT devices –Intel Galileo Arduino board Specification.

UNIT V IoT APPLICATIONS 9 Hrs

Applications based on IoT - Smart Cities -Smart Home and Buildings -Smart Energy and the Smart Grid - Smart Health- Smart Transportation and Mobility

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. ArshdeepBahga.Vijaymadisetti ,“ Internet of things – A hands- on approach ” , Universities press, First Editon, 2015.
2. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”,Wiley,First edition 2014.
3. C HillarGastn, “Internet of Things with Python”,Packt publishing, first edition ,2016.

REFERENCE BOOKS:

1. *Dominique D. Guinard and Vlad M. Trifa “Building the Web of Things With examples in Node.js and Raspberry Pi”,June 2016 ISBN 9781617292682*
2. *CharalamposDoukas, “Building Internet of Things with the Arduino” ISBN/EAN13:1470023431 / 9781470023430*
3. *Gastón C. Hillar, “Internet of Things with Python”, May 2016 , PACKT Publishing limited.*
4. *Marco Schwartz “Internet of Things with the Raspberry Pi: Build Internet of Things Projects Using the Raspberry Pi Platform”, Kindle Edition.*

Subject Code:	Subject Name : CELLULAR MOBILE COMMUNICATION	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE2	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

It deals with the fundamental cellular radio concepts such as frequency reuse and hand off.
It presents different ways to radio propagation models and predict the large scale effects of radio propagation in many operating environment.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Interpret basic concepts in mobile communication.
CO2	Apply the concepts in establishing a PSTN.
CO3	Recognize basic concepts in cellular technology.
CO4	Analyze different propagation models for improving system coverage.
CO5	Examine the latest wireless systems and standards.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	3	3	1	3	1	2
CO2	3	3	3	1	2	2	2	3	2	2	2	2
CO3	3	3	3	3	3	3	1	1	3	3	2	3
CO4	3	3	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	2	3	2	3	3	3	3	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	3	3	2	2
CO3	3	3	3	3
CO4	3	3	2	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
						✓			

Subject Code:	Subject Name : CELLULAR MOBILE COMMUNICATION	Ty /Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE2	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO MOBILE COMMUNICATION 9 Hrs

History and Evolution of mobile radio system – Types of mobile wireless system/services – Paging, cellular, WLL , FTTH, Wi-Fi, and Future trends in Personal wireless system.

UNIT II PSTN TECHNOLOGY 9 Hrs

Difference between simplex, half-duplex and duplex transmissions – basic understanding of telephone set – history and evolution of Central Exchange Switching – Operator Switch Boards (PBX) – intraoffice and interoffice calls – Extended Area Service (EAS) – circuit switching, packet switching & TDM switching – DTMF signaling – dial register – in band & out-of-band signaling.

UNIT III CELLULAR CONCEPT 9Hrs

Structure of a cell – Basic cellular terminologies – Principle of Frequency Reuse – Principle of Channel assignment and its types – Types of channel interference – Different types of handoff strategies

UNIT IV INTERFERENCE AND MOBILE RADIO COMMUNICATION 9 Hrs

Interferences in Cellular Systems – Methods to improve cell coverage - Free space propagation model, reflection, diffraction, scattering, link budget design, Outdoor Propagation models and Indoor propagation models

UNIT V WIRELESS SYSTEMS AND STANDARDS 9 Hrs

GSM, IS-95, DECT, AMPS, GPRS, UMTS, WLAN, WPAN, WMAN, Ultra Wideband communications, 4G/LTE and beyond 4G.Telecom standards and wireless standards.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Marion Cole, “Introduction to Telecommunications: Voice, Data and Internet”, Pearson Education, 2nd edition, 2008.
2. Anu A. Gokhale, “Introduction to Telecommunications”, Delmar, 2nd edition, 2005.
3. T.S. Rappaport, "Wireless Communication, Principle and Practice", Prentice Hall, NJ, 1996
4. Roy Blake," Wireless Communication technology", Thomson Learning, 1st Edition 2001

REFERENCES:

1. *Pete Moulton, Jason Moulton, “The Telecommunication Survival Guide”, Pearson Education, 2001.*
2. *Roger L. Freeman, “Telecommunication System Engineering”, Wiley-India, 4th edition, 2004.*
3. *W.C.Y.Lee, “Mobile Communication Engineering”, (2/e), McGraw- Hill, 1998.Dharma P. Agarwal," Introduction to wireless and Mobile systems", Thomson Learning, II Edition, 2006*

SubjectCode:	Subject Name : SATELLITE TECHNOLOGY AND REMOTE SENSING SYSTEMS	Ty / Lb/ETL /IE	L	T/SLr	P/R	C
EBEC22OE3	Prerequisite: None	Ty	2	0/0	1/1	3

L: Lecture T:Tutorial S. Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL: Theory/Lab/ Embedded Theory and Lab

OBJECTIVES:
To learn the basics of space craft subsystem
To understand the operation of domestic satellite system
To apply the principle of satellite in remote sensing technology

COURSEOUTCOMES(COs):
The students will be able to

CO1	Understand the principle of orbital mechanics
CO2	Understand the elements of satellite system
CO3	Analyze the various domestic satellite systems
CO4	Apply the concepts in designing earth station
CO5	Appraise the applications of satellites in remote sensing

MappingofCourse OutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	1	3	1	1	1	2	3	1
CO2	3	3	1	1	1	1	3	1	3	1	1	2
CO3	3	1	1	1	1	2	1	3	1	3	1	1
CO4	3	1	3	1	2	1	1	1	1	1	1	3
CO5	3	1	1	3	1	1	1	1	2	1	1	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	1
CO2	3	3	1	1
CO3	3	1	2	2
CO4	1	3	1	3
CO5	3	1	1	3

3/2/1indicatesStrengthofCorrelation 3-High, 2-Medium,1-Low

Category	BasicSciences	Engg . Sciences	Humanities & SocialSciences	Programcore	ProgramElectives	OpenElectives	InterDisciplinary	Skill Component	Practical/ Project
						✓			

SubjectCode:	Subject Name : SATELLITE TECHNOLOGY AND REMOTE SENSING SYSTEMS	Ty / Lb/E TL/I E	L	T/S L r	P/ R	C
EBEC22OE3	Prerequisite: None	Ty	2	0/0	1/1	3

UNIT I ELEMENTS OF ORBITAL MECHANICS AND FUNDAMENTALS OF REMOTE SENSING 9 Hrs

Kepler‘s laws of planetary motion - Newton‘s laws of gravitation- Orbital Equation- Orbital Elements- Orbital Perturbation;TrackingandOrbitalDetermination-OrbitalCorrection/Control – Components of remote sensing – , Energy sources and radiation principles, electromagnetic radiation, (EMR) –EMR spectrum, active and passive remote sensing – platforms - black body radiation - Planck’s law – Stefan-Boltzmann law.

UNIT II TYPES OF SATELLITES AND ELEMENTS OF SATELLITE SYSTEM 9 Hrs

Satellites - classification – based on orbits – sun synchronous and geo synchronous – based on purpose – earth resource satellites, communication satellites, weather satellites, spy satellites Space Environment- Spacecraft Configuration- Spacecraft Subsystem- Payload- Reliability Consideration –Spacecraft Integration and Testing.

UNIT III DOMESTIC SATELLITE SYSTEMS AND LAUNCH VEHICLES AND FUNDAMENTALS OF MICROWAVE SENSING 9 Hrs

The INSAT System- International System: INTELSAT-IMMARSAT- Satellite Based Personal Communication-LEO-MEO-GEO Systems-PSLV and GSLV, - radar – speckle - back scattering – side looking airborne, radar – synthetic aperture radar – radiometer – geometrical characteristics

UNIT IV EARTH STATION DESIGN 9 Hrs

Earth Station Configuration- Receiver and Transmitter Subsystems- Terminal Equipment: Telephone/ Video Interface-Echo Suppressor-FM Digitizers-Elements of Frequency Co-ordination and Control.

UNIT V APPLICATIONS OF SATELLITES 9 Hrs

Satellite Broadcasting- Satellite TV Systems. Remote sensing satellites - satellite remote sensing in variousimportant areas- such as environmental issues- agriculture- forestry- urban issues and water management –usage of satellite data models in remote sensing- analysis of data from various climate zones and applications in research and society.

Practical component : Include case studies/application scenarios

Research component: Future trends/research areas/Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. T.PrattandC.W. Bostian,"Satellite Communication"John Wiley&Son-1986.
2. A.AbdulNamith,—Satellite Communication" Lakshmi Publications.
3. John Jensen - Remote Sensing of the Environment: An Earth Resource Perspective (Prentice Hall Series in Geographic Information Science- 2006

REFERENCES:

1. *B.N.Agarwal,"Designof Geosynchronous Spacecraft",prentice Hall- 1986.*
2. *D.Roddy, "Satellite Communication",PrenticeHall- 1989.*
3. *M.Richharia“SatelliteCommunicationSystemsDesignPrinciples”MacmillanPressLtd.SecondEdition 2003.*

http://www.ceinsys.com/blog/applications-of-satellite-imagery-remote-sensing-data/

Subject Code:	Subject Name : FUNDAMENTALS OF SENSORS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE4	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Tounderstandbasic fundamentals of sensor.
- To study sensor characteristics.
- To understand sensor properties of elements.

COURSE OUTCOMES (COs) :
The students will be able to

CO1	Interpret basics of sensors.
CO2	Recognize sensor characteristics.
CO3	Demonstrate sensor properties.
CO4	Explain principles of sensing.
CO5	Study various sensor elements.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	2	1	2	1	1	2	2	2
CO2	3	2	2	3	2	1	2	1	2	2	2	2
CO3	3	2	2	2	2	2	2	1	2	2	2	3
CO4	2	2	2	2	2	1	1	2	1	2	2	3
CO5	2	2	2	2	2	1	1	2	1	2	2	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	2	2	3
CO3	3	3	2	3
CO4	3	3	2	3
CO5	2	2	3	3

3/2/1 indicatesM Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
						✓			

Subject Code:	Subject Name : FUNDAMENTALS OF SENSORS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE4	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I SENSOR FUNDAMENTALS 9 Hrs

Basic Sensor Technology – Classification of sensors, Physical properties sensed by the sensors-heat, pressure, flow, current & voltage, presence, distance, position and speed.

UNIT II SENSOR CHARACTERISTICS 9 Hrs

Transfer Function - Span (Full-Scale Input) - Full-Scale Output – Accuracy- Calibration --Calibration Error –Hysteresis – Nonlinearity - Saturation

UNIT III DIFFERENT TYPES OF SENSORS 9 Hrs

Proximity Sensor, Pressure Sensor, Temperature Sensor, Humidity sensor, Tilt Sensor, Smoke and Gas sensor, Touch sensor, Infrared sensor, ultrasonic sensor & Light sensor

UNIT IV OTHER SENSING TECHNOLOGIES 9 Hrs

Accelerometer and Gyroscope sensor, Hall effect Sensors, Positional Detectors, Potentiometer sensors, Vision and Imaging Sensors/ Detectors, LIDAR sensor, PIR Sensor and Color Sensor

UNIT V APPLICATION 9 Hrs

Automotive, Manufacturing, Aviation, Medical and Health care, Marine, Robotics, Hazard Detection and AI-enabled internet of things.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXTBOOKS:

1. Jacob Fraden, “Handbook Of Modern Sensors Physics, Designs, And Applications”
2. Jon S. Wilson,” Sensor Technology Handbook

REFERENCEBOOKS:

1. *Ian Sinclair , “ Sensors and Transducers” eBook ISBN: 9780080516998Hardcover ISBN: 9780750649322*

Subject Code:	Subject Name : MICROPROCESSOR BASED SYSTEM DESIGN	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE5	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study the architecture, addressing modes, and assembly language program of 8085 microprocessor.
- To understand the concepts of different peripherals and their applications
- To learn the functions of 8051 microcontroller.

COURSE OUTCOMES (COs) :

The students will be able to

CO1	Write assembly language program in 8085 and 8086 and understand the design of advanced processors.
CO2	Show their ability to interface peripherals with microprocessors
CO3	Done the inferenceof advanced peripheral with 8085.
CO4	Demonstrate their skills in writing an ALP in 8051.
CO5	Apply their understanding to do a project to develop an application using8085.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	3	1	1	1	2	2	1
CO2	3	3	3	3	3	3	1	2	1	2	2	2
CO3	2	2	2	2	3	3	2	3	1	2	3	2
CO4	3	3	3	3	3	1	2	3	1	2	1	3
CO5	3	2	1	2	2	2	3	1	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	3	3	1	1
CO3	2	3	1	2
CO4	3	2	1	2
CO5	1	1	2	3

H/M/L indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
						✓			

Subject Code:	Subject Name : MICROPROCESSOR BASED SYSTEM DESIGN	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE5	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT-I 8085 CPU 9 Hrs

Internal Architecture of 8085 microprocessor – Instruction set – Addressing modes – 8085 interrupts – Timing diagram – Assembly level programming.

UNIT II PHERIPHERALS INTERFACING 9 Hrs

USART (8251) – Programmable interval timer (8353/8254) programmable peripheral interface (8255) – CRT controller (8275/6845) – Floppy disk controller (8272).

UNIT III ADVANCED PHERIPHERALS INTERFACING 9 Hrs

Programmable DMA controller (8257) – Programmable Interrupt controller (8259) – Keyboard display interface (8279) – ADC/DAC interfacing.

UNIT IV 8051 MICROCONTROLLER 9 Hrs

8051 Microcontroller hardware and Architecture –I/O pins, Ports and circuits–Counters and Timers-Serial Data I/O – Interrupts - 8051 Instruction set – Addressing Modes –Assembly Language Programming.

UNIT V 8085 APPLICATIONS 9 Hrs

Typical application of 8085 – Stepper motor controls – Traffic light controls – waveform generation – Analog interfacing and industrial control – Microcomputer based system with seven segment displays and switches.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Ramesh s. Gaonkar, Microprocessor Architecture Programming and Applications with 8085. Fourth edition, Penram international publishing 2000.
2. Douglas V. Hall, microprocessor and interfacing, programming and hardware, Tata McGraw Hill, second edition 1999.

REFERENCES:

1. *A.K.Ray and K.M.Burchandi,"Intel Microprocessors Architecture Programming and Interfacing" McGraw Hill International edition, 2000.*
2. *Kenneth Jayala, "The 8051 Microcontroller Architecture Programming andAapplication" ,2nd edition ,Penram International publishers (India), New Delhi,1996.*
3. *M.RafiQuazzaman, "Microprocessors Theory and Applications", Intel and Motorola prentice Hall of India Pvt. Ltd., New Delhi, 2003*

Subject Code:	Subject Name : INDUSTRY 4.0 CONCEPTS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE6	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:
Students will demonstrate an understanding of the fundamentals of the core areas in Industry 4.0.
Students will gain deep insights into how smartness is being harnessed in industries

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Understand the opportunities and challenges in the fourth industrial revolution.
CO2	Describe, discuss and relate IoT techniques adopted for an industry.
CO3	Demonstrate the importance of various technologies involved in enabling industry 4.0.
CO4	Analyze the power of Cloud Computing in a networked economy.
CO5	Interpret technologies available in IoT.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	3	3	3	3	3	2	3	3
CO2	3	2	2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3	3	3
CO5	2	2	3	3	3	3	3	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3
CO2	2	2	3	3
CO3	3	3	3	3
CO4	2	2	3	3
CO5	2	2	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
						✓			

Subject Code:	Subject Name : INDUSTRY 4.0 CONCEPTS	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OE6	Prerequisite: None	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO INDUSTRY 4.0 9 Hrs

The various Industrial Revolutions – Digitalization and the Networked Economy – Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 – The Journey so far: Developments in USA, Europe, China and other countries – Comparison of Industry 4.0 Factory and Today's Factory – Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

UNIT II ROAD TO INDUSTRY 4.0 9 Hrs

Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services – Smart Manufacturing – Smart Devices and Products – Smart Logistics – Smart Cities – Predictive Analytics

UNIT III TECHNOLOGIES FOR ENABLING INDUSTRY 4.0 9 Hrs

Cyber physical systems – Robotic Automation and Collaborative Robots – Support System for Industry 4.0 – Mobile Computing – Related Disciplines – Cyber Security.

UNIT IV RESOURCES 9 Hrs

Resource- based view of a firm – Data as a new resource for organizations – Harnessing and sharing knowledge in organizations – Cloud Computing Basics – Cloud Computing and Industry 4.0 – Smart Factories

UNIT V IIOT TECHNOLOGIES 9 Hrs

Industry 4.0 laboratories –IIoT Reference Architecture – Designing Industrial Internet Systems – Examining the Middleware Transport Protocols – IIoT WAN Technologies and Protocols - Securing the Industrial Internet.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Alp Ustundag and Emre Cevikcan, "*Industry 4.0: Managing the Digital Transformation*", Springer Series in Advanced Manufactruing.
2. Alasdair Gilchrist, "*Industry 4.0: The Industrial Internet of Things*", Apress Publications.

REFERENCE:

1. *Rajesh Agnihotri and Samuel New, "Industry 4.0 Data Analytics" , CreatespaceIndependent Pub (US)*

OPEN LAB

OPEN LAB

Subject Code:	Subject Name : SENSORS AND IoT LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OL1	Prerequisite: None	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To design experiments based on sensor with IOT.
- To design experiments based on IOT with cloud environment.

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Implement C source code to interface sensors with IOT.
CO2	Design simple projects using different typessensors.
CO3	Interface sensor date with cloud environment.
CO4	Implement using sensors an application.
CO5	Design new applications using different sensors.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	2	1	2	2	3	3
CO2	3	2	2	3	3	1	2	1	2	2	3	3
CO3	3	2	3	3	3	1	2	1	2	2	3	3
CO4	3	2	2	3	3	2	2	1	2	2	3	3
CO5	3	2	3	3	3	1	2	1	2	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	2	3
CO3	3	3	2	3
CO4	3	3	1	3
CO5	3	3	1	3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
						✓			

Subject Code:	Subject Name : SENSORS AND IoT LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OL1	Prerequisite: None	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. To Familiarize With Intel Galileo Gen2 Board and Understand the Procedure of Creation and Compilation of C Source Code. (Pre-Loaded Examples)
2. Write a Code to Control the Brightness of Led Usingintel Galileo Gen 2 Board.
3. To Write C Source Code to Interface temperature Sensor With Intel Galileo Gen 2 and Display the temperature on Serial Monitor.
4. To Write C Source Code to Interface Humidity Sensor With Intel Galileo Gen 2 and Display the temperature on Serial Monitor.
5. Interface Motion Sensor, With Intel Galileo Gen 2 To Give alert When Motion Is Detected.
6. To Write C Source Code to Interface Sound Detector With Intel Galileo Gen.
7. To Write C Source Code to Interface Accelerometer With Intel Galileo Gen 2 and display the Values In Serial Monitor.
8. To Write C Source Code to Perform Gas Sensor Interfacing With Intel Galileo Gen2 Board.
9. To Interface a Flame and Smoke Sensor With Intel Galileo Gen 2 in Cloud Service.
10. Design a Smart Lighting System Using Light Sensor, Motion Sensor and Indicate the Status Of The Light in Cloud Service.

Total Number of Hours: 45

***REFERENCES*:**

1. *Lab manual, Department of ECE, DR.MGR UNIVERSITY.*

Subject Code:	Subject Name : ROBOTICS CONTROL LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OL2	Prerequisite: None	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the different robotic configurations and their subsystems.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Built simple robots using motor driver IC and sensor module.
CO2	Apply programming knowledge to interface various devices with arduino.
CO3	Design robots using timer and delay
CO4	Develop and measure the performance of robots.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2	2	3	2	1	2
CO2	3	3	3	3	3	1	2	2	3	1	2	2
CO3	3	3	3	2	3	2	2	1	3	2	2	2
CO4	3	3	3	3	3	1	2	2	3	1	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	3	2	3
CO3	3	2	2	3
CO4	3	2	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
						✓			

Subject Code:	Subject Name : ROBOTICS CONTROL LAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OL2	Prerequisite: None	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Robot circuit
2. Build a light-tracking robot
3. Simple insect robot
4. Line follower robot
5. Two-legged walking robot
6. Robot control using 555 timer
7. Study of AVR studio and code debugging
8. Interfacing switch to turn on bar graph leds. (implementing a “push to On” indicator)
9. LCD interfacing to display alphanumeric characters.
10. LCD interfacing to displaying integer values on the lcd.
11. Generation of delay using timer and turning ‘on’ the buzzer
12. Indication of the value of counter on lcd
13. DC motor interfacing
14. PWM control of the DC motor

Total Number of Hours: 45

***REFERENCES*:**

1. *Lab manual, Department of ECE, DR.MGR UNIVERSITY.*

Subject Code:	Subject Name : BASICS OF MATLAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OL3	Prerequisite: None	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Be familiar with the MATLAB GUI and basic tool boxes
- Be exposed to vector and matrix operations
- Be familiar with arithmetic, logical and relational operations on matrix

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Adopt the MATLAB GUI and basic tool boxes
CO2	Identify vector and matrix operations
CO3	Illustrate withprogramming arithmetic, logical and relational operations on matrix

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	2	2	3	3	3	2
CO2	3	2	3	2	3	1	2	1	3	3	3	2
CO3	3	2	3	3	3	2	2	2	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Inter Disciplinary	Skill Component	Practical / Project
						✓			

Subject Code:	Subject Name : BASICS OF MATLAB	Ty / Lb/ ETL/IE	L	T/SLr	P/R	C
EBEC22OL3	Prerequisite: None	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Introduction to SDK of MATLAB
2. Basic syntax and scalar arithmetic operations and calculations
3. Working with formulas
4. Arithmetic operations in matrix data
5. Matrix operations (inverse, transpose)
6. Reading an image file
7. Reading from and writing to a text file
8. Introduction to toolboxes
9. Data visualization and plotting
10. Relational operators in data
11. Logical operation in data
12. Loops in MATLAB
13. Computing Eigen value for a matrix
14. Random number generation - Monte carlo methods

Total Number of Hours: 45

***REFERENCES*:**

1. *Lab manual, Department of ECE, DR.MGR UNIVERSITY.*