Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
(Deemed to be University)
Maduravoyal, Chennai - 600 095. Tamilnadu. India.
(An ISO 9001 : 2015 Certified Institution)

Department of Electronics and Communication Engineering

B.Tech. Electronics and Communication Engineering

(Full Time)

Curriculum & Syllabus – 2018 Regulation

I SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/ R**	**C**
1	BEN18001	Technical English –I	Ty	1	0/0	2/0	2
2	BMA18001	Mathematics – I	Ty	3	1/0	0/0	4
3	BPH18001	Engineering Physics –I	Ty	2	0/1	0/0	3
4	BCH18001	Engineering Chemistry –I	Ty	2	0/1	0/0	3
5	BES18001	Basic Electrical & Electronics Engineering	Ty	2	0/1	0/0	3
6	BES18002	Basic Mechanical & Civil Engineering	Ty	2	0/1	0/0	3
PRACTICALS*							
1	BES18L01	Basic Engineering Workshop	Lb	0	0/0	2/0	1
2	BES18ET1	Orientation to Entrepreneurship & Project Lab	ETL	0	0/0	2/0	1

Credits Sub Total: 20

II SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SL r**	**P/R**	**C**
1	BMA18003	Mathematics – II	Ty	3	1/0	0/0	4
2	BPH18002	Engineering Physics –II	Ty	2	0/1	0/0	3
3	BCH18002	Engineering Chemistry – II	Ty	2	0/1	0/0	3
4	BES18003	Environmental Science*	Ty	NON CREDIT COURSE			
PRACTICALS*							
1	BEN18ET1	Communication Lab	ETL	1	0/0	2/0	1
2	BES18ET2	Basic Engineering Graphics	ETL	1	0/0	2/0	2
3	BES18L02	Integrated Physical Science Lab	Lb	0	0/0	2/0	1
4	BES18ET3	C Programming and Lab	ETL	1	0/0	2/0	2

Credits Sub Total: 16

TOTAL CREDITS: 36

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**	**L**	**T/ SL r**	**P/R**	**C**
1	BEC18001	Signals and Systems	Ty	3	1/0	0/0	4
2	BEC18002	Circuits and Networks	Ty	3	1/0	0/0	4
3	BEC18003	Digital Electronics	Ty	3	1/0	0/0	4
4	BEC18004	Solid State Devices	Ty	3	0/0	0/0	3
5	BCS18I01	C Programming with Linux	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEC18L01	Circuits And Devices Lab	Lb	0	0/0	3/0	1
2	BEC18L02	Digital System Design Lab	Lb	0	0/0	3/0	1
3	BCS18IL1	C Programming with Linux Lab	Lb	0	0/0	3/0	1

Credits Sub Total: 21

IV SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BMA18007	Probability and Random Process	Ty	3	1/0	0/0	4
2	BEC18005	Control Systems for Electronics	Ty	3	1/0	0/0	4
3	BEC18006	Electronic Circuits	Ty	3	0/0	0/0	3
4	BEC18007	Communication Theory	Ty	3	0/0	0/0	3
5	BHS18NC1/ BHS18NC2	The Indian Constitution* / The Indian Traditional Knowledge*	Ty	2	0/0	0/0	NC
PRACTICALS*							
1	BEC18ET1	Electrical Machines and PCB Design	ETL	1	0/1	3/0	3
2	BEC18L03	Electronic Circuits Lab	Lb	0	0/0	3/0	1
3	BEC18L04	Digital Simulation Lab	Lb	0	0/0	3/0	1
4	BEC18L05	Circuit Simulation Using P- Spice	Lb	0	0/0	3/0	1
5	BEC18TS1	Technical Skill 1	Lb	0	0/0	3/0	1
6	BEN18SK1	Soft Skill I (Career & Confidence Building)	ETL	0	0/0	3/0	1

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**	**L**	**T/ SL r**	**P/R**	**C**
1	BEC18008	Digital Signal Processing	Ty	3	1/0	0/0	4
2	BCS18I02	Computer Communication	Ty	3	0/0	0/0	3
3	BXX18EXX	Elective I	Ty	3	0/0	0/0	3
4	BXX18OEX	Open Elective I	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEC18ET2	Electromagnetic Waves and Transmission Lines	ETL	1	0/1	3/0	3
2	BEC18L06	Communication Lab- I	Lb	0	0/0	3/0	1
3	BEC18LXX	Lab Based on Elective	Lb	0	0/0	3/0	1
4	BCS18IL2	Computer Networks Lab	Lb	0	0/0	3/0	1
5	BEC18TS2	Technical Skill 2	Lb	0	0/0	3/0	1

Credits Sub Total : 20

VI SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/ R**	**C**
1	BEC18009	Digital Communication	Ty	3	1/0	0/0	4
2	BEC18010	Introduction to VLSI and Embedded System Design	Ty	3	0/0	0/0	3
3	BXX18EXX	Elective II	Ty	3	0/0	0/0	3
4	BXX18OEX	Open Elective II	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEC18ET3	Design and Implementation of Linear Integrated Circuits	ETL	1	0/1	3/0	3
2	BEC18L07	Communication Lab II	Lb	0	0/0	3/0	1
3	BEC18L08	VLSI and Embedded System Design Lab	Lb	0	0/0	3/0	1
4	BEN18SK2	Soft Skill II (Qualitative and Quantitative Skills)	ETL	0	0/0	3/0	1
5	BEC18L09	Mini Project/In plant Training/Industrial training	Lb	0	0	3/0	1
6	BEC18TS3	Technical Skill 3	Lb	0	0/0	3/0	1

Credits Sub Total: 21

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**	**L**	**T/ SLr**	**P/ R**	**C**
1	BEC18011	Digital Image Processing and its Applications	Ty	3	1/0	0/0	4
2	BXX18EXX	Elective III	Ty	3	0/0	0/0	3
3	BXX18EXX	Elective IV	Ty	3	0/0	0/0	3
4	BMG18003	Principles of Management	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEC18ET4	Internet of Things	ETL	1	0/1	3/0	3
2	BEC18L10	Microwave and Optical Communication Lab	Lb	0	0/0	3/0	1
3	BEC18L11	Open CV - Python for Digital Image Processing Lab	Lb	0	0/0	3/0	1
4	BEC18L12	Project Phase – I	Lb	0	0/0	3/3	2
5	BHS18FLX	Foreign Language	Lb	0	0/0	3/0	1
6	BXX18OLX	Open Lab	Lb	0	0/0	3/0	1

Credits Sub Total: 22

VIII SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18012	Wireless Networks	Ty	3	1/0	0/0	4
2	BEC18013	Cognitive Radio	Ty	3	0/0	0/0	3
3	BXX18EXX	Elective V	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BEC18L13	Project (Phase – II)	Lb	0	0/0	12/12	8

Credits Sub Total: 18

Credit Summary
Semester: 1 : 20
Semester: 2 : 16
Semester: 3 : 21
Semester: 4 : 22
Semester: 5 : 20
Semester: 6 : 21
Semester: 7 : 22
Semester: 8 : 18
Total Credits : 160

ELECTIVE I – Electronics Stream							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SL r**	**P/R**	**C**
1	BEC18E01	Microprocessor and Microcontroller	Ty	3	0/0	0/0	3
2	BEC18E02	Semiconductor devices and its Applications	Ty	3	0/0	0/0	3
3	BEC18E03	Basics of Robotics	Ty	3	0/0	0/0	3
4	BEC18E04	C++ and Data structures	Ty	3	0/0	0/0	3

ELECTIVE I – Communication Stream							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18E05	Antenna and Wave Propagation	Ty	3	0/0	0/0	3
2	BEC18E06	Telecommunication Switching System	Ty	3	0/0	0/0	3
3	BEC18E07	Real Time Operating Systems	Ty	3	0/0	0/0	3
4	BEC18E08	Audio Signal Processing	Ty	3	0/0	0/0	3

ELECTIVE II – Electronics Stream							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18E09	Intelligent Instrumentation	Ty	3	0/0	0/0	3
2	BEC18E10	Advanced Microprocessors	Ty	3	0/0	0/0	3
3	BEC18E11	Nano Electronics	Ty	3	0/0	0/0	3
4	BEC18E12	Computer Architecture	Ty	3	0/0	0/0	3

	ELECTIVE II – Communication Stream						
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18E13	Next Generation IP Networks	Ty	3	0/0	0/0	3
2	BEC18E14	Neural Networks and its Applications	Ty	3	0/0	0/0	3
3	BEC18E15	Optical Communication	Ty	3	0/0	0/0	3
4	BEC18E16	Radar and Navigational aids	Ty	3	0/0	0/0	3

ELECTIVE III – Electronics Stream							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18E17	Advanced Digital System	Ty	3	0/0	0/0	3
2	BEC18E18	Embedded System	Ty	3	0/0	0/0	3
3	BEC18E19	Quantum Computing	Ty	3	0/0	0/0	3
4	BEC18E20	Power Electronics	Ty	3	0/0	0/0	3

ELECTIVE III – Communication Stream							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18E21	High Speed Switching Architecture	Ty	3	0/0	0/0	3
2	BEC18E22	Information Coding Techniques	Ty	3	0/0	0/0	3
3	BEC18E23	Microwave Engineering	Ty	3	0/0	0/0	3
4	BEC18E24	Optical Network and Switching Techniques	Ty	3	0/0	0/0	3

ELECTIVE IV – Electronics Stream							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18E25	Device Modeling	Ty	3	0/0	0/0	3
2	BEC18E26	VLSI Technology	Ty	3	0/0	0/0	3
3	BEC18E27	Bio Medical Instrumentation	Ty	3	0/0	0/0	3
4	BEC18E28	Embedded Software Design	Ty	3	0/0	0/0	3

ELECTIVE IV – Communication Stream							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18E29	Spread Spectrum Communication	Ty	3	0/0	0/0	3
2	BEC18E30	Network Management	Ty	3	0/0	0/0	3
3	BEC18E31	Satellite Communication	Ty	3	0/0	0/0	3
4	BEC18E32	Operating Mobile Communication	Ty	3	0/0	0/0	3

	ELECTIVE V - Electronics Stream						
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18E33	Introduction to MEMS system design	Ty	3	0/0	0/0	3
2	BEC18E34	Analysis and Design of Analog IC's	Ty	3	0/0	0/0	3
3	BEC18E35	Cyber Physical System	Ty	3	0/0	0/0	3
4	BEC18E36	Digital Control System	Ty	3	0/0	0/0	3

	ELECTIVE V – Communication Stream						
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18E37	Electromagnetic Interference and Compatibility	Ty	3	0/0	0/0	3
2	BEC18E38	Advanced Concepts in Signal Processing	Ty	3	0/0	0/0	3
3	BEC18E39	Ultra Wide Band Communication	Ty	3	0/0	0/0	3
4	BEC18E40	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**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18CE1	Sensors and its Applications	Ty	3	0/0	0/0	3
2	BEC18CE2	Cryptography and Network Security	Ty	3	0/0	0/0	3

	Lab Based on Elective						
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SL r**	**P/R**	**C**
1	BEC18L14	Microprocessor and Microcontroller Lab	Lb	0	0/0	3/0	1
2	BEC18L15	Basics of Robotics Lab	Lb	0	0/0	3/0	1
3	BEC18L16	C++ and Data Structures Lab	Lb	0	0/0	3/0	1
4	BEC18L17	Antenna and Wave Propagation Lab	Lb	0	0/0	3/0	1
5	BEC18L18	Telecommunication Switching Systems Lab	Lb	0	0/0	3/0	1
6	BEC18L19	Audio Signal Processing Lab	Lb	0	0/0	3/0	1

	OPEN ELECTIVES						
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/ R**	**C**
1	BEC18OE1	Internet of things and its applications	Ty	3	0/0	0/0	3
2	BEC18OE2	Cellular mobile communication	Ty	3	0/0	0/0	3
3	BEC18OE3	Satellite and its applications	Ty	3	0/0	0/0	3
4	BEC18OE4	Fundamentals of sensors	Ty	3	0/0	0/0	3
5	BEC18OE5	Basics of microprocessors and microcontrollers	Ty	3	0/0	0/0	3
6	BEC18OE6	Industry 4.0 concepts	Ty	3	0/0	0/0	3

	OPEN LABS						
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEC18OL1	Sensors and IOT Lab	Lb	0	0/0	3/0	1
2	BEC18OL2	Robotics Control Lab	Lb	0	0/0	3/0	1
3	BEC18OL3	Basics of MATLAB	Lb	0	0/0	3/0	1

Subject Code :**BEN18001**	Subject Name :**TECHNICAL ENGLISH – I**	L	T/SLr	P/R	C
	Prerequisite : None	1	0/0	2/0	2

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

OBJECTIVES :

- Strengthen their vocabulary in both technical and business situations
- Get practice in functional grammar
- Learn the effective way of corresponding with officials
- Learn to give instructions, suggestions, and recommendations and comprehend and infer the information from the given passages.
- Train learners in organized academic and professional writing

COURSE OUTCOMES (Cos) : (3 – 5)
Students completing the course would be able to

CO1	Recall basic grammar, spelling and phonetics concept
CO2	Discuss ideas and concepts in groups
CO3	Interpret charts, diagrams, reports and advertisements.
CO4	Analyze and evaluate scientific and technical concepts for organized oral and written presentation
CO5	Apprise, argue and support using critical judgements on any given topic

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**	**3**	**1**	**1**	**1**	**1**	**3**	**1**	**3**
CO2	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**1**	**3**	**3**	**1**	**3**
CO3	**3**	**2**	**1**	**3**	**3**	**2**	**2**	**1**	**2**	**3**	**1**	**3**
CO4	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**3**	**2**	**3**	**1**	**3**
CO5	**1**	**2**	**2**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**3**

Cos/PSOs	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**1**	**1**	**1**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**1**	**1**	**1**
CO5	**3**	**1**	**1**	**1**

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

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program	Program Electives	Open Electives	Practical / Project	Internships /	Soft Skills
			√						

BEN18001	TECHNICAL ENGLISH - I	1 0/0 2/0 2

UNIT I VOCABULARYBUILDING 6 HRS

The concept of Word Formation-Root words and affixes from foreign languages and their use in English to form derivatives.-Homophones- Words often confused-Verbal analogy

UNIT II BASIC WRITING SKILLS 6 HRS

Using Idioms and phrases in sentences-Sentence structures: statements, interrogative and imperative-Use of Conditional/if' clauses in sentences-Importance of proper punctuation-Creating coherence with sentence markers-Organizing coherent paragraphs in essays

UNIT III IDENTIFYING COMMON ERRORS IN WRITING 6 HRS

Subject-verb agreement-Noun-pronoun agreement- Misplaced modifiers-Articles-Prepositions-Redundancies and Clichés

UNIT IV WRITING PRACTICE- NATURE AND STYLE OF TECHNICAL WRITING 6 HRS

Describing Gadgets- Defining Concepts-Classifying data-Comprehension-Essay Writing-Informal and Formal Letter Writing:

UNIT V ORAL COMMUNICATION AND INTERACTIVE LEARNING 6 HRS

(This unit involves interactive practice sessions in Language Lab)
Activities to develop knowledge in Word formation, Vocabulary and analytical thinking-Instructions and –Recommendations-Formal and Informal Registers in Speech-Listening and taking notes

Total no. of hours: 30

TEXT BOOKS:

1. Quest : A Textbook of Communication Skills, Vijay Nicole, 2017.
2. Pushkala, R, Padmasani Kannan S, Anuradha V, Chandrasena M Rajeswaran

SUGGESTED READINGS:

1. *Practical English Usage.* Michael Swan. OUP. 1995.
2. *Remedial English Grammar.* F.T. Wood. Macmillan.2007
3. *On Writing Well.*William Zinsser.Harper Resource Book. 2001
4. *Study Writing.* Liz Hamp-Lyons and Ben Heasly.Cambridge University Press. 2006.
5. *Communication Skills*. Sanjay Kumar and Pushp Lata.Oxford University Press. 2011.
6. *Exercises in Spoken English.* Parts.I-III. CIEFL, Hyderabad. Oxford University Press
7. Pronunciation in Use , Mark Hancock. Cambridge University Press. 2012

Subject Code :**BMA18001**	Subject Name :**MATHEMATICS – I**	L	T/SLr	P/R	C
	Prerequisite : None	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 :

- Apply the Basic concepts in Algebra
- Use the Basic concepts in Matrices
- Identify and solve problems in Trigonometry
- Understand the Basic concepts in Differentiation
- Apply the Basic concepts in Functions of Several variables

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

CO1	Demonstrate knowledge of basic concepts of Mathematics science & Engineering mathematics
CO2	Calculate the required parameters using basic mathematical theorem, laws and formulae
CO3	Apply mathematical techniques to solve problems
CO4	Examine the relevant methods, tools and techniques to provide solutions
CO5	Combine scientific & math principles, apply to real time problems for accurate results

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**	**1**	**2**	**2**	**1**	**1**	**3**	**3**	**1**	**3**
CO2	**3**	**3**	**1**	**2**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**3**
CO3	**3**	**3**	**2**	**2**	**3**	**2**	**1**	**1**	**2**	**3**	**1**	**2**
CO4	**3**	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**1**	**2**
CO5	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**1**

Cos/PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**1**	**1**	**1**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**1**	**1**	**1**
CO5	**3**	**1**	**1**	**1**

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	Practical / Project	Internships / Technical Skills	Soft Skills
	√								

BMA18001	MATHEMATICS – I	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 nθ, Cos nθ in powers of Sinθ and Cosθ – Expansion of Tan nθ – Expansions of $\text{Sin}^n\theta$ and $\text{Cos}^n\theta$ in terms of Sines and Cosines of multiples of θ – 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 no. of hours : 60

TEXT BOOKS:

1. Kreyszig E., *Advanced Engineering Mathematics (10 th ed.)*, John Wiley & Sons, (2011).
2. Veerarajan T., *Engineering Mathematics (for first year)*, Tata McGraw Hill Publishing Co., (2008).

REFERENCES:

1. *Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012).*
2. *John Bird, Basic Engineering Mathematics (5th ed.), Elsevier Ltd, (2010).*
3. *P.Kandasamy, K.Thilagavathy and K. Gunavathy, Engineering Mathematics Vol. I (4th Revised ed.), S.Chand& Co., Publishers, New Delhi (2000).*
4. *John Bird, Higher Engineering Mathematics (5th ed.), Elsevier Ltd, (2006).*

DEPARTMENT OF PHYSICS

Subject Code :**BPH18001**	Subject Name :**ENGINEERING PHYSICS -I**	L	T/SLr	P/R	C
	Prerequisite : None	2	0/1	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 :

- 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) : (3 – 5)

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 Outcomes with Program Outcomes (POs)

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

COs/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**1**	**1**	**1**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**1**	**1**	**1**
CO5	**3**	**1**	**1**	**1**

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

Category	Basic Sciences	Engg Sciences	Humanities & Social	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
	√								

BPH18001	ENGINEERING PHYSICS - I	2	0/1	0/0	3

UNIT I MECHANICS & PROPERTIES OF MATTER 9 HRS

Mechanics : Introduction- scalar and vector quantities - rigid body - moment of inertia - forces in nature - Newton's laws of motion - derivation of Newton's second law of motion - motion of rocket – dynamical concepts - kinematics - conservation of energy and momentum - conservative and non-conservative forces - mechanics of continuous media - friction and its applications.

Properties of Matter: Elasticity - stress, strain and Hook's law - Poisson's ratio - three moduli of elasticity - twisting couple on a wire - viscosity - flow of liquid through a narrow tube: Poiseuille's law - Ostwald`s viscometer - flow of blood in human body.

UNIT II SHM AND ACOUSTICS 9 HRS

SHM: Simple harmonic motion - differential equation of SHM - graphical representation of SHM - average kinetic energy of vibration - total energy of vibration - free and forced vibrations - damped and undamped vibrations - resonance - transverse wave on a string - law of transverse vibration of string - verification of the laws of transverse vibration of string - standing waves.

Acoustics : Fundamentals of acoustics - reverberation- reverberation time - factors affectinacoustics Ultrasonics -Production of ultrasonic waves - detection of ultrasonic waves - acoustic grating - application of ultrasonic waves.

UNIT III WAVE OPTICS 9 HRS

Huygen`s principle - interference of light - wavefront splitting and amplitude - airwedge - Newton`s rings - Michelson interferometer and its applications - Fraunhofer diffraction from a single slit - Rayleigh criterion for limit of resolution - diffraction grating and resolving power of a telescope.

UNIT IV ELECTROMAGNETIC THEORY 9 HRS

Electric field - coulomb`s law - alternating emf - rms and average value of an alternating current & voltage - resistors, capacitors and inductor - energy stored in a capacitor - LCR circuit & resonance – magnetism- definition - types - Biot Savart law - energy stored in a magnetic field - Domain theory - electromagnetic induction - self and mutual inductance - Faraday`s law of electromagnetic induction -Lenz law.

UNIT V LASER 9 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.

Total No of hours : 45

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, 1981

Subject Code :**BCH18001**	Subject Name :**ENGINEERING CHEMISTRY –I**	L	T/SLr	P/R	C
	Prerequisite : None	2	0/1	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 :

- Providing an insight into basic concepts of chemical thermodynamics.
- To create awareness about the water quality parameters, water analysis and softening of water from industrial perspective.
- Imparting fundamentals of emf, storage and fuel cells.
- Creating awareness about corrosion and its control methods.
- Introducing modern materials such as composites along with basic concepts of polymer chemistry and plastics.

COURSE OUTCOMES (Cos) : (1– 5)

Students completing this course were able to

CO1	Gain a clear understanding of the basic science as applied to engineering problems
CO2	Describe the ideas applied to demonstrate the competence through effective communication
CO3	Recall the information and analyze the health, ethical and engineering problems
CO4	Identify the environmental and societal issues and design solutions
CO5	Apply appropriate techniques by recognizing the need.

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**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**
CO2	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**2**
CO3	**3**	**2**	**2**	**1**	**2**	**3**	**1**	**3**	**1**	**1**	**1**	**3**
CO4	**3**	**1**	**1**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**3**
CO5	**3**	**1**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**3**

Cos/Pos	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**1**
CO2	**3**	**2**	**3**	**1**
CO3	**3**	**3**	**2**	**1**
CO4	**3**	**3**	**2**	**1**
CO5	**3**	**3**	**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	Practical / Project	Internships / Technical Skills	Soft Skills
	√								

BCH18001	ENGINEERING CHEMISTRY – I	2	0/1	0/0	3

UNIT I CHEMICAL THERMODYNAMICS 8 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), Van't Hoff equations.

UNIT II TECHNOLOGY OF WATER 9 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 and external conditioning – Lime soda, Zeolite, Demineralisation methods.Desalination processes-RO and Electrodialysis .Domestic water treatment.

UNIT III ELECTROCHEMISTRY AND ENERGY STORAGE DEVICES 10 HRS

Conductance – Types of conductance and its Measurement. Electrochemical cells – Electrodes and electrode potential, Nernst equation – EMF measurement and its applications. Types of electrodes-Reference electrodes-Standard hydrogen electrode- Saturated calomel electrode-Quinhydrone electrode – Determination of P^H using these electrodes. Reversible and irreversible cells– Fuel cells- H_2–O_2 fuel cell, Batteries-Lead storage battery,Nickel– Cadmium and Lithium-Battery.

UNIT IV CORROSION AND PROTECTIVE COATING 9 HRS

Introduction–Causes of Corrosion–Consequences- Factors affecting corrosion. Theories of corrosion-Chemical corrosion and Electrochemical corrosion. Methods of corrosion control – corrosion inhibitors, Sacrificial anode and Impressed current cathodic protection. Protective coatings- Metallic coatings-Chemical conversion coatings-paints-Constituents and functions.

UNIT V POLYMERS AND COMPOSITES 9 HRS

Monomers – Functionality – Degree of polymerization-Tacticity.Polymers – Classification, Conducting Polymers,Biodegradable polymers- Properties and applications.Plastics – Thermoplastics and thermosetting plastics,Compounding of plastics – Compression moulding, injection moulding and extrusion processes. Polymer composites-introduction-Types of composites-particle reinforced-fiber reinforced-structural composites-examples. Matrix materials, reinforcement materials-Kevlar, Polyamides, fiber glass, carbon fibers, ceramics and metals .

Total number of hours: 45

TEXTBOOKS:

1. S.Nanjundan&C.SreekuttanUnnithan, "Applied Chemistry", Sreelakshmi Publications, (2007)
2. Dr.R.Sivakumar and Dr.N.Sivakumar" Engineering Chemistry" Tata McGraw Hill Publishing Company Ltd, Reprint 2013.

REFERENCES:

1. *P.C. Jain & Monika Jain, "Engineering Chemistry", Dhanpat Rai publishing Co., (Ltd.) (2013).*
2. *J. C. Kuriacose& J. Rajaram, "Chemistry in Engineering & Technology", Tata Mc Graw Hill (1996).*
3. *B.R.Puri, L.R.Sharma&M.S.Pathania, "Principles of Physical Chemistry", Vishal publishing co., (2013).*

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Subject Code :**BES18001**	Subject Name :**BASIC ELECTRICAL & ELECTRONICS ENGINEERING**	L	T/SLr	P/R	C
	Prerequisite : None	2	0/1	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 :

- Understand the concepts of circuit elements, circuit laws and coupled circuits.
- Acquire knowledge on conventional &non-conventional energy production.
- Gain information on measurement of electrical parameters.
- Identify basic theoretical principles behind the working of modern electronic gadgets.
- Demonstrate digital electronic circuits and assemble simple devices.

COURSE OUTCOMES (Cos) : (3 – 5)

Students completing the course were able to

CO1	Interpret fundamental principles, laws and their practical applications.
CO2	Verify the concept of electric % magnetic circuits and interpret results
CO3	Analyze various sources of power & energy, generation methods & conservation
CO4	Identify & Apply schematic symbols and understand the working principles of electronic devices & instruments
CO5	Design analog & digital circuits using basic concept to solve 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**	**2**	**3**	**2**	**3**	**1**	**1**	**1**	**3**	**2**	**1**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**2**	**2**	**1**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**3**	**1**
CO4	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**3**	**2**	**1**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**1**

Cos/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**1**	**1**	**1**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**1**	**1**	**1**
CO5	**3**	**1**	**1**	**1**

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

Category	Basic Scien...	Engg Scien...	Humanities &	Program	Program Electi	Open Electives	Practical / Proje	Internships / Tech	Soft Skills
		√							

BES18001	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	2	0/1	0/0	3

UNIT I ELECTRIC CIRCUITS 9 HRS

Electrical Quantities – Ohms Law – Kirchhoff's Law – Series and Parallel Connections – Current Division and Voltage Division Rule - Source Transformation – Wye (Y) – Delta (Δ) , Delta (Δ) – Wye (Y) Transformation – Rectangular to Polar and Polar to Rectangular.

UNIT II MACHINES & MEASURING INSTRUMENTS 9 HRS

Construction & Principle of Operation of DC motor & DC Generator – EMF equation of Generator – Torque Equation of Motor – Construction & Principle of operation of a Transformer – PMMC – Moving Iron types of meter – Single Phase Induction Type Energy Meter.

UNIT III BASICS OF POWER SYSTEM 9 HRS

Generation of Electric Power (Thermal, Hydro, Wind and Solar) – Transmission & Distribution of Electric
Power – Types of Transmission & Distribution Schemes – Representation of Substation.

UNIT IV ELECTRON DEVICES 9 HRS

Passive Circuit Components-Classification of Semiconductor-PN Junction Diode-Zener diode-Construction and Working Principle –Applications--BJT-Types of configuration-JFET.

UNIT V DIGITAL SYSTEM 9 HRS

Number System – Binary, Decimal, Octal, Hexadecimal – Binary Addition Subtraction, Multiplication & Division– Boolean Algebra – Reduction of Boolean Expressions – Logic Gates - De-Morgan's Theorem , Adder – Subractor.

Total no of hours: 45

TEXT BOOKS:

1. D P Kothari, I J Nagrath, Basic Electrical Engineering, Second Edition, , Tata McGraw-Hill Publisher
2. A Course In Electrical And Electronic Measurements And Instrumentation,A.K. Sawhney, publisher DHANPAT RAI&CO
3. Text Book of Electrical Technology: Volume 3: Transmission, Distribution and Utilization,B.L.Theraja, A.K.Theraja, publisher S.CHAND
4. Morris Mano, M. (2002) Digital Logic and Computer Design. Prentice Hall of India
5. Millman and Halkias1991, Electronic Devices and Circuits , Tata McGraw Hill,

REFERENCE:

1. *R.Muthusubramanian, S.Salivahanan, K A Muraleedharan, Basic Electrical, Electronics and Computer Engineering, Second Edition, Tata McGraw-Hill publisher.*

Subject Code: **BES18002**	Subject Name: **BASIC MECHANICAL & CIVIL ENGINEERING**	L	T/SLr	P/R	C
	Prerequisite: None	2	0/1	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 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): (3 – 5)
Students completing the course were able to

CO1	Understand the construction and working principles of steam generators, IC engines and power plants.
CO2	Apply the knowledge of various concepts of Manufacturing processes.
CO3	Solve simple problems on Engineering mechanics
CO4	Identify the appropriate materials and their properties, used for construction purpose
CO5	Apply the knowledge of construction for various structural 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**	**1**	**1**	**1**	**2**	**2**	**3**	**3**	**3**	**1**	**3**
CO2	**3**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**1**	**2**
CO3	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**2**
CO4	**3**	**2**	**2**	**1**	**1**	**1**	**3**	**1**	**2**	**2**	**1**	**2**
CO5	**3**	**2**	**2**	**1**	**1**	**1**	**3**	**2**	**2**	**2**	**1**	**2**

Cos/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**1**	**1**	**1**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**1**	**1**	**1**
CO5	**3**	**1**	**1**	**1**

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

Category	Basic Sciences	Engg Sciences	Humanities & Social	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
		√							

BES18002	BASIC MECHANICAL & CIVIL ENGINEERING	2	0/1	0/0	3

UNIT I THERMAL ENGINEERING 9 HRS

Classification of internal combustion engine – 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.

UNIT II MANUFACTURING PROCESS 13 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. Basics of metal cutting operations – Working of lathe- parts-Operations performed. Drilling machine – Classification – Radial drilling machine - Twist drill nomenclature.

UNIT III MECHANICS 9 HRS

Stresses and Strains – Definition – Relationship – Elastic modulus – Centre of gravity – Moment of Inertia – Problems. (Simple Problems Only).

UNIT IV BUILDING MATERIALS AND CONSTRUCTION 7 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)

UNIT V ROADS, RAILWAYS, BRIDGES & DAMS 7 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 No. of hours: 45

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*

DEPARTMENT OF ENGINEERING SCIENCES

Subject Code :**BES18L01**	Subject Name :**BASIC ENGINEERING WORKSHOP**	L	T/SLr	P/R	C
	Prerequisite : None	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 :

- Familiarize the plumbing tools, fittings, carpentry tools, etc.
- Identify basic electrical wiring and measurement of electrical quantities.
- Identify Electronic components ,logic gates and soldering process
- Display simple fabrication techniques
- Execute a project independently and make a working model

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

CO1	Demonstrate fitting tools and carpentry tools, & Perform the process of Filing, Chipping, and Cutting.
CO2	Perform the process of fabrication of tray, cones and funnels, Tee Halving Cross, Lap Joint Martise& Joints
CO3	Demonstrate various types of wirings and other equipments.
CO4	Measure fundamental parameters using the 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**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**3**	**1**	**3**
CO2	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**2**
CO3	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**1**	**2**
CO4	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**2**
CO5	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Cos/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**2**	**3**
CO2	**3**	**3**	**2**	**1**
CO3	**3**	**3**	**1**	**1**
CO4	**3**	**3**	**1**	**1**

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

Category	Basic Sciences	Engg Sciences	Humanities & Social	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

BES18L01	BASIC ENGINEERING WORKSHOP	0	0/0	2/0	1

MEP PRACTICE

1. **FITTING :**
   Study of fitting tools and Equipments – Practicing, filing, chipping and cutting – making V-joints, half round joint, square cutting and dovetail joints.

2. **CARPENTRY:**
   Introduction – Types of wood – Tools – Carpentry processes – Joints – Planning practice – Tee Halving Joint – Cross Lap Joint – Maritse and Tenon Joint – Dovetail Joint

3. **SHEET METAL:**
   Study of tools and equipments – Fabrication of tray, cones and funnels.

CIVIL ENGINEERING PRACTICE

1. Study of Surveying and its equipments
2. Preparation of plumbing line sketches for water supply and sewage lines
3. Basic pipe connection using valves, laps, couplings, unions, reduces and elbows in house hold fittings

ELECTRICAL ENGINEERING PRACTICE

1. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
2. Measurement of energy using single phase energy meter.
3. Measurement of resistance to earth of an electrical equipment.
4. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
5. Fluorescent lamp wiring.
6. Stair case wiring

ELECTRONIC ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak- peak, rms period, frequency) using CRO
2. Soldering practice – Components Devices and Circuits – Using general purpose P

Subject Code : BES18ET1	**Subject Name : ORIENTATION TO ENTREPRENEURSHIP & PROJECT LAB**	L	T/SLr	P/R	C
	Prerequisite : None	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 :

- 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) : (3 – 5)
Students completing the course were able to

CO1	Develop a Business plan & improve ability to recognize business opportunity
CO2	Do a self analysis to build a entrepreneurial career.
CO3	Articulate an effective elevator pitch.
CO4	Analyze the local market environment & demonstrate the ability to find an attractive market
C05	Identify the required skills for entrepreneurship & develop

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**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**1**
CO2	**3**	**2**	**1**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**2**
CO3	**2**	**2**	**2**	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**1**	**1**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**3**	**2**	**2**	**3**	**2**
CO5	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**1**

Cos/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**3**	**1**
CO2	**3**	**1**	**3**	**1**
CO3	**3**	**1**	**3**	**1**
CO4	**3**	**1**	**3**	**1**
CO5	**3**	**1**	**3**	**1**

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

Category	Basic Science	Engg Science	Humanities & Social	Program core	Program Elective	Open Electives	Practical / Project	Interns hips / Techni cal	Soft Skills
							√		

BES18ET1	ENTREPRENEURSHIP & PROJECT LAB	0	0/0	2/0	1 (ETL)

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 –

UNITII 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.

Total no.of.Hours: 15

Subject Code : BMA18003	**Subject Name : MATHEMATICS – II**	L	T/SLr	P/R	C
	Prerequisite : None	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 :

- Understand the Basic concepts in Integration
- Identify the Basic concepts in Multiple integrals
- Use the Basic concepts in Ordinary Differential equations
- Apply the Basic concepts of Analytical Geometry
- Analyze the Basic concepts of Vector Calculus

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

CO1	Demonstrate knowledge of Basic concepts of Mathematics science & Engineering mathematics
CO2	Calculate the required parameters using basic mathematical theorems, laws and formulae
CO3	Analyze the problem, find solution & interpret the data
CO4	Examine the relevant methods, tools and techniques to provide solutions
CO5	Combine scientific & math principles, apply to real time problems for accurate results

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PO1 2**
CO1	**3**	**3**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**3**
CO2	**3**	**3**	**2**	**1**	**2**	**3**	**1**	**1**	**3**	**3**	**1**	**2**
CO3	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**1**	**3**	**3**	**1**	**2**
CO4	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**3**	**1**	**2**
CO5	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**3**	**1**	**2**

COs/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**1**	**1**	**1**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**1**	**1**	**1**
CO5	**3**	**1**	**1**	**1**

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

Category	Basic Sciences	Engg Sciences	Humaniti es &	Program core	Program Electives	Open Electives	Practical / Project	Internship s / Technical	Soft Skills
	√								

BMA18003	MATHEMATICS – II	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 HR

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 no. of hours: 60

TEXTBOOKS:

1. Kreyszig E., *Advanced Engineering Mathematics (10th ed.)*, John Wiley & Sons, (2011).
2. Veerarajan T., *Engineering Mathematics (for first year)*, Tata McGraw Hill Publishing Co., (2008).

REFERENCES:

1. *Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012).*
2. *John Bird, Basic Engineering Mathematics (5th ed.), Elsevier Ltd, (2010).*
3. *P.Kandasamy, K.Thilagavathy and K. Gunavathy, Engineering Mathematics Vol. I (4th Revised ed.), S.Chand& Co.,*

Publishers, New Delhi (2000).

4. *John Bird, Higher Engineering Mathematics (5th ed.), Elsevier Ltd, (2006).*

Subject Code : BPH18002	**Subject Name : ENGINEERING PHYSICS – II**	L	T/SLr	P/R	C
	Prerequisite : None	2	0/1	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 :

- 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) : (3 – 5)
Students completing the course were able to

CO1	Demonstrate skills necessary for conducting research related to content knowledge and laboratory skills.
CO2	Apply knowledge and concepts in advanced materials and devices.
CO3	Acquired Analytical, Mathematical skills for solving engineering problems.
CO4	Ability to design and conduct experiments as well as function in a multi-disciplinary teams.
CO5	Generate analytical thought to interpret results & place them within a broader context

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**1**
CO2	**3**	**3**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**1**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**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/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**1**	**1**	**1**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**1**	**1**	**1**
CO5	**3**	**1**	**1**	**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	Practical / Project	Internships / Technical	Soft Skills
	√								

BPH18002	ENGINEERING PHYSICS - II	2	0/1	0/0	3

UNIT I QUANTUM PHYSICS 9 HRS

Quantum free electron theory - deBroglie waves - derivation of deBroglie waves - Davisson and Germer experiment - uncertainty principle - electron microscope - scanning electron microscope - physical significance of wave function - Schrodinger wave equation and its applications - Fermi energy- effective mass - phonons - Fermi function-density of states - origin of bandgap in solids - 1D scattering of electrons in periodic potential.

UNIT II SEMICONDUCTORS 9 HRS

Introduction - properties of semiconductors - classification of semiconductor - effect of temperature in semiconductor - hole current - carrier concentration in intrinsic semiconductor (electron and hole density) - variation of Fermi energy level and carrier concentration with temperature in an intrinsic semiconductor - carrier transport - diffusion - drift - mobility - Hall effect - determination of Hall coefficient and its applications - diodes.

UNIT III LIGHT SEMICONDUCTOR INTERACTION 9 HRS

Types of electronic materials: metals, semiconductors and insulators - qualitative analysis of extrinsic semiconductor & its applications - optical transition in bulk semiconductors: absorption, spontaneous and stimulated emission - exciton and its types - traps and its types - colour centers and its types and importance - luminescence - classifications of luminescence based on excitation - optical loss and gain - Photovoltaic effect - Photovoltaic potential - spectral response - solar energy converters - solar cells.

UNIT IV OPTO ELECTRONIC DEVICES 9 HRS

Photodetectors - photoconductors - photodiodes principle, construction, working and characteristics - Phototransistors - Laser diodes - LED theory, construction and working - seven segment display, advantages of LED - LCD theory, construction and working.

UNIT V ENGINEERED MATERIALS 9 HRS

Classification of engineered materials - nano phase materials - its synthesis and properties - shape memory alloys and its applications - biomaterials - non linear materials - metallic glasses - metamaterials - homo and hetero junction semiconductors - semiconducting materials for optoelectronic devices - quantum wells, wires and dots.

Total no. of hours: 45

TEXT BOOKS:

(1) P.K. Palanisamy, Semiconductor Physics and Optoelectronics, Scitech Publications, 2010
(2) Jyoti Prasad Bandyopadhyay, Semicoductor Devices, S. Chand Publications, 2014
(3) Charles Kittal, Introduction to Solid State Physics, Wiley Publications, 2012.

REFERENCE BOOKS:

(1) S. Shubhashree, S. Bharathi Devi & S. ChellammalMadhusudanan, Engineering Physics, Sree Lakshmi Publications, 2004
(2) G. Senthil Kumar, N. Iyandurai, & G. Vijayakumar, Material Science, VRB Publishers, 2017
(3) R.Murugeshan&Kiruthigasivaprakash, Modern Physics, 14th edition, S. Chand & Co, 2008
(4) Pallab Bhattacharya, Semiconductor optoelectronic devices, second edition, Pearson Education, 2003
(5) V Rajendran & A. Marikani, Materials Science, Tata McGraw- Hill, New Delhi, 2004

Subject Code : BCH18002	**Subject Name :ENGINEERING CHEMISTRY – II**	L	T/SLr	P/R	C
	Prerequisite : None	2	0/1	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 :

- Imparting the basic concepts of phase rule and apply the same to one and two component systems.
- Introducing the chemistry of engineering materials such as cement, lubricants, abrasives, refractories, alloys and nano materials.
- To impart a sound knowledge on the principles of chemistry involving different application oriented topics
- Introducing salient features of fuels and combustion.
- To give an overview on modern analytical techniques

COURSE OUTCOMES (Cos) : (1 – 5)
Students completing the course were able to

CO1	Recall, predict the consequences and apply appropriate techniques.
CO2	Categorize the engineering materials and analytical tools through appropriate communication
CO3	Analyze the environmental dimension and identify ethical principles to design solution.
CO4	Recognize the essential information for continuing professional development
CO5	Apply relevant instrumentation techniques through basic science to solve complex 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**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**
CO2	**3**	**3**	**1**	**3**	**3**	**1**	**3**	**1**	**1**	**3**	**1**	**3**
CO3	**3**	**3**	**3**	**1**	**1**	**3**	**1**	**3**	**1**	**1**	**1**	**3**
CO4	**3**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**1**	**3**	**1**	**3**
CO5	**3**	**1**	**3**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**3**

Cos/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**3**	**1**
CO2	**3**	**1**	**3**	**2**
CO3	**3**	**2**	**3**	**1**
CO4	**3**	**1**	**3**	**1**
CO5	**3**	**1**	**3**	**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	Practical / Project	Internships /	Soft Skills
	√								

BCH18002	ENGINEERING CHEMISTRY – II	2 0/1 0/0 3

UNIT I PHASE EQUILIBRIA 8 HRS

Introduction – Definition of terms involved in phase rule. Derivation of Gibbs phase rule – Applications to one component system – water system. Binary system – Eutectic system – Pb – Ag system, Bi – Cd system .Thermal analysis – Cooling curves.

UNIT II MATERIAL CHEMISTRY 10 HRS

Cement – Manufacture, Chemistry of setting and hardening .Lubricants – Requirements of good lubricants, Mechanism, Properties of lubricants, Classification – Examples. Abrasives–Classification – Moh's scale-Hard and soft abrasives, Preparation of artificial abrasives (silicon carbide, boron carbide), Applications of abrasives. Refractories – Classification, Properties-Refractoriness, RUL, Porosity, Thermal spalling Alloys Classification of alloys – Purpose of making alloys - Ferrous and non-Ferrous alloys - Heat treatment Nano materials – properties, carbon nano tubes – properties, fabrication – carbon arc method, laser vapourization method.

UNIT III APPLIED CHEMISTRY 9 HRS

Soaps and detergents: Soaps – Saponification of oils and fats, manufacture of soaps, classification of soap – soft soap, medicated soap, herbal soap, shaving soap and creams.

Detergents – Anionic detergents – manufacture and applications, Comparison of soaps and detergents.

Rocket propellants and explosives: Rocket propellants – characteristics, solid and liquid propellants – dexamples. Explosives- Introduction, characteristics, classification, Oxygen balance , preparation, properties and uses of detonators, low explosives and high explosives, Dynamites, Gun cotton, Cordite.

Food adulterants- Common adulterants in different foods – milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses, sweetening agents and beverages, Contamination with toxic chemicals – pesticides and insecticides.

UNIT IV FUELS & COMBUSTION 9 HRS

Introduction to Fuels – classification – Calorific value – GCV, LCV.Solid Fuels–Coal-Proximate Analysis, Metallurgical Coke–Manufacture of Metallurgical Coke – Liquid Fuel–Refining of Petrol, Synthetic Petrol–Manufacturing Process–Hydrogenation of Coal, Polymerization, Cracking–Knocking–Octane Number–Leaded Petrol (or) Anti–knocking – Cetane Number–Ignition Lag–Gaseous fuels–CNG–LPG–Water Gas, Producer gas–Biogas- Combustion– Flue Gas analysis– Orsat's method.

UNIT V ANALYTICAL AND CHARACTERIZATION TECHNIQUES 9 HRS

Electron microscopes: Scanning electron microscope & Transmission electron microscope, instrumentation and applications Absorption and Emission Spectrum - Beer - Lambert's law. Visible and UV Spectroscopy – instrumentation – Block diagram - working. IR Spectroscopy – instrumentation - Block diagram – molecular vibrations – stretching and bending – H_2O, CO_2. –Characterization of some important organic functional groups. Chromatographic techniques – column, thin layer and paper.

Total number of hours: 45

TEXTBOOKS:

1. C. S.Unnithan, T. Jayachandran& P. Udhayakala, "Industrial Chemistry", Sreelakshmi Publications (2009).
2. Dr.R.Sivakumar and Dr.N.Sivakumar" Engineering Chemistry" Tata McGraw Hill Publishing Company Ltd, Reprint 2013.

REFERENCES:

1. *P.C. Jain & Monika Jain, "Engineering Chemistry", DhanpatRai publishing Co., (Ltd.) (2013).*
2. *B. R. Puri, L.R. Sharma &M.S.Pathania, "Principles of Physical Chemistry", Vishal publishing co., (2013).*

Subject Code : BES18003	**Subject Name : ENVIRONMENTAL SCIENCE (Non- Credited)**	L	T/SLr	P/R	C
	Prerequisite : None	-	-	-	-

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

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	To known about Environment and Ecosystem & Biodiversity
CO2	To clearly 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	To discover water conservation and watershed management
CO4	To identify its problems and concerns climate change, global warming, acid rain, ozone layer depletion etc.,
CO5	To explain family welfare programmesand 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	1	1	1	1	1	**3**	**3**	**2**	1	**1**	1	**2**
CO2	1	1	1	1	1	**2**	**3**	**1**	1	**2**	1	**2**
CO3	1	1	1	1	1	**2**	**3**	**2**	1	**1**	1	**2**
CO4	1	1	1	1	1	**2**	**3**	**2**	1	**2**	1	**2**
CO5	1	1	1	1	1	**2**	**3**	**1**	1	**2**	1	**2**

Cos/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**1**	**1**	**1**	**1**
CO2	**1**	**1**	**1**	**1**
CO3	**1**	**1**	**1**	**1**
CO4	**1**	**1**	**1**	**1**
CO5	**1**	**1**	**1**	**1**

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

Category	Basic Sciences	Engg Sciences	Humanities & Social	Program core	Program Elective	Open Electives	Practical / Project	Interns hips /	Soft Skills

BES18003	ENVIRONMENTAL SCIENCE

UNIT I ENVIRONMENT AND ECOSYSTEM

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

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

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

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

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

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.*

Department of Electronics and Communication Engineering

SubjectCode: BEN18ET1	Subject Name : COMMUNICATION LAB	L	T/SLr	P/R	C
	Prerequisite : None	1	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 :

The students should be able to

- Use appropriate vocabulary and structure for effective interpersonal and academic communication
- Interpret charts, diagrams, advertisements, etc.
- Participate in group discussions and present projects effectively
- Present project and ideas effectively
- Attend Interviews

COURSE OUTCOMES (Cos) : (3 – 5)

Students completing the course were able to

CO1	Use appropriate vocabulary and structure for effective interpersonal and academic communication
CO2	Interpret charts, diagrams, advertisements, etc.
CO3	Participate in group discussions and present projects effectively
CO4	Present project and ideas effectively
CO5	Attend Interviews

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	3	1	1	1	1	3	3	3
CO2	3	2	1	3	3	1	3	1	1	3	2	3
CO3	3	3	3	3	1	3	3	1	3	3	3	3
CO4	2	3	3	3	1	1	1	3	3	3	1	3
CO5	1	1	1	1	1	2	3	3	3	3	3	3

Cos/POs	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	1
CO2	3	1	1	1
CO3	3	1	1	1
CO4	3	1	1	1
CO5	3	1	1	1

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

Category	Basic Sciences	Engg Sciences	Humanities & Social	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

BEN18ET1	COMMUNICATION LAB	1 0 /0 2/0 1

UNIT I **6**

LISTENING AND SPEAKING - INFORMAL AND FORMAL CONTEXTS

UNIT I I **6**

INTERPRETATION OF CHARTS / DIAGRAMS - GROUP DISCUSSION

UNIT I II **6**

COMPEERING - ANCHORING - WELCOME SPEECH - VOTE OF THANKS

UNIT IV **6**

FORMAL PRESENTATION - POWER POINT PRESENTATION - POSTER PRESENTATION

UNIT V **6**

INTERVIEW

Total number of hours: 30

SUGGESTED READINGS:

1. *Practical English Usage. Michael Swan.OUP.1995*
2. *Remedial English Grammer. F.T.wood. Macmillan.2007*
3. *Study writing. Liz Hamp -Lyons and Ben Heasly. Cambridge University Press.2006.*
4. *Communication skills. Sanjay Kumar and Pushp Lata. Oxford University Press.2011.*
5. *Exercises in spoken English. Parts. I - III. CIEFL, Hyderabad. Oxford University Press*
6. *Pronunciation in use, Mark Hancock. Cambridge University Press. 2012*

DEPARTMENT OF MECHANICAL ENGINEERING

SubjectCode: BES18ET2	**Subject Name : BASIC ENGINEERING GRAPHICS**	L	T/SLr	P/R	C
	Prerequisite : None	1	0/0	2/0	2

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

OBJECTIVES:

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

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

CO1	Gain knowledge on Drawing standards and angle of projection
CO2	Draw projections of planes, solid, on planes of projection
CO3	Apply the knowledge of development to find lateral surface area of solids.
CO4	Visualize and draw Isometric and orthographic projections
CO5	Apply the knowledge of projection in Building drawing

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**	**1**	**3**	**3**	**1**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**3**	**3**	**1**	**3**
CO3	**3**	**3**	**3**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**2**
CO4	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**2**	**3**	**3**	**1**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**1**	**2**	**2**	**3**	**3**	**1**	**3**
Cos/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**								
CO1	**3**	**1**	**1**	**1**								
CO2	**3**	**1**	**1**	**1**								
CO3	**3**	**1**	**1**	**1**								
CO4	**3**	**1**	**1**	**1**								
CO5	**3**	**1**	**1**	**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	Practical / Project	Internships / Technical Skills	Soft Skills
						3	√		

BES18ET2	BASIC ENGINEERING GRAPHICS	1	0/0	2/0	2

CONCEPTS AND CONVENTIONS (Not for examination) **3 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 cyloids.

UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES **6 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 **6 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 one reference plane and perpendicular to the other.

UNIT III DEVELOPMMENT OF SURFACES AND ISOMETRIC PROJECTION **6 HRS**

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

UNIT IV ORTHOGRAPHICS PROJECTIONS **6 HRS**

Orthographic projection of simple machine parts – missing views

BUILDING DRAWING

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

UNIT V COMPUTER AIDED DRAFTING **3 HRS**

Introduction to CAD – Advantages of CAD – Practice of basic commands – Creation of simple components drawing using CAD software.

Total No. of hours: 30

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.

Department of Electronics and Communication Engineering

Subject Code :**BES18L02**	Subject Name : **INTEGRATED PHYSICAL SCIENCE LAB**	L	T/SLr	P/R	C
	Prerequisite : None	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 :

- Demonstrate the ability to make physical measurements & understand the limits of precision in measurements.
- Display the ability to measure properties of variety of electrical, mechanical, optical systems.
- To help learners measure conductivity and EMF using electrical equipment.
- To understand the analytical skills through chromatography &viscometry
- To familiarize the concepts of cheminformatics

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

CO1	Recognize the correctness and precision in the results of measurements.
CO2	Construct and compare the properties of variety of mechanical, optical, electrical and electronic systems.
CO3	Familiarizing the titration methods using conductometry & potentiometry
CO4	Developing the Research spirit through the knowledge of Cheminformatics & Analytical skills.

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**	**2**	**1**	**1**
CO2	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**1**
CO3	**3**	**3**	**2**	**3**	**3**	**1**	**1**	**1**	**3**	**1**	**1**	**1**
CO4	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**3**	**1**	**3**	**2**

Cos/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**1**	**1**	**1**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**1**	**1**	**1**

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

Category	Basic Sciences	Engg Sciences	Humanities & Social	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

BES18L02	INTEGRATED PHYSICAL SCIENCE LAB	0	0/0	2/0	1

LIST OF EXPERIMENTS

1. DETERMINATION OF COEFFICIENT OF VISCOSITY OF A GIVEN LIQUID BY POISEUILLE`S METHOD.
2. PARTICLE SIZE DETERMINATION USING LASER SOURCE.
3. DETERMINATION OF NUMERICAL APERTURE OF AN OPTICAL FIBER.
4. SPECTROMETER- REFRACTIVE INDEX/DISPERSIVE POWER/I-D CURVE.
5. POTENTIOMETER - RESISTANCE OF A WIRE.
6. TRANSISTOR CHARACTERISTICS - INPUT RESISTANCE, OUTPUT RESISTANCE AND GAIN.
7. STUDIES ON ACID-BASE CONDUCTOMETRIC TITRATION.
8. DETERMINATION OF REDOX POTENTIALS USING POTENTIOMETRY.
9. DETERMINATION OF R_FVALUES OF VARIOUS COMPONENTS USING THIN LAYER CHROMATOGRAPHY.
10. VISCOSITY STUDIES USING DIGITAL CAPILLARY VISCOMETER.
11. COMPUTE THE STRUCTURES OF THE GIVEN POLYMERS, DRUGS, BIOMOLECULES USINGCHEM DRAW.
12. STUDIES ON POTENTIAL ENERGY SURFACE OF THE GIVEN MOLECULES.
13. ESTIMATE NMR SPECTRA FROM A CHEM DRAW STRUCTURE.

DEPARTMENT OF COMPUTER SCIENCE

Subject Code : BES18ET3	**Subject Name : C PROGRAMMING AND LAB**	L	T/SLr	P/R	C
	Prerequisite : None	1	0/0	2/0	2

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

OBJECTIVES :

- Outline the basics of C Language.
- Apply fundamentals in C programming.
- Produce and present activities associated with the course**.**

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

CO1	Understand the concepts of C programming
CO2	Develop C Programs using basic programming constructs
CO3	Create Programs with arrays, structures, functions, pointers and file handling
CO4	Write diversified solutions for applications using C language

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**	**3**	**1**	**3**
CO2	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**3**	**3**	**1**	**3**
CO3	**3**	**3**	**3**	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**1**	**2**
CO4	**3**	**3**	**2**	**1**	**1**	**3**	**1**	**2**	**3**	**3**	**1**	**3**

Cos/POs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**1**	**1**	**1**
CO2	**3**	**1**	**1**	**1**
CO3	**3**	**1**	**1**	**1**
CO4	**3**	**2**	**1**	**1**

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

Category	Basic Sciences	Engg Sciences	Humanities & Social	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

BES18ET3	C PROGRAMMING AND LAB	1 0/0 2/0 2

UNIT I INTRODUCTION 6 HRS

Fundamentals, C Character set, Identifiers and Keywords, Data Types, Variables and Constants, Structure of a C Program, Executing a C Program.

UNIT II EXPRESSION AND STATEMENT 6 HRS

Operators, Types-Complex and Imaginary, Looping Statement-For, While, Do, Break, continue, Decision Statement-If, If else, Nested if, Switching Statement, Conditional Operator.

UNIT III ARRAYS AND FUNCTIONS 6 HRS

Defining an Array, Using Array elements as counters, Generate Fibonacci number, Generate Prime Numbers, Initializing Arrays, Multidimensional Arrays, Defining a Function, Function call -types of Function calls -Function pass by value -Function pass by reference, Write a Program in Recursive Function.

UNIT IV STRUCTURES AND POINTERS 6 HRS

Working with Structures -Introduction -Syntax of structures -Declaration and initialization -Declaration of structure variable -Accessing structure variables, Understanding Pointers -Introduction -Syntax of Pointer.

UNIT V STRINGS AND FILE HANDLING 6 HRS

Strings -Syntax for declaring a string -Syntax for initializing a string -To read a string from keyboard, Files in C -File handling functions -Opening a File closing a file --example: fopen, fclose -Reading data from a File- Problem solving in C

Total No .of hours: 30

1. **www.spoken-tutorials.org**
2. **http://www.learn-c.org/**

REFERENCES:

1. Stephen G. Kochen"Programming in C- A complete introduction to the C Programming Language. Third Edition, Sams Publishing -2004
2. Ajay Mital, " Programming in C: A Practical Approach", Pearson Publication-2010

LIST OF PROGRAMS

1. Write a program to check 'a' is greater than 'b' or less than 'b' Hint: use if statement.
2. Write another program to check which value is greater 'a', 'b' or 'c'. Hint: use else-if statement. (Take values of a, b, c as user inputs)
3. Write a Program to find the sum of the series: $x + X^3/3! + X^5/5! + \ldots\ldots\ldots\ldots\ldots X^n/n!$
4. Write a C Program to solve a Quadratic Equation by taking input from Keyboard
5. Write a C Program to arrange 20 numbers in ascending and descending Order. Input the Numbers from Keyboard
6. Write a C Program to Multiply a 3 x 3 Matrix with input of members from Keyboard
7. Write a program that takes marks of three students as input. Compare the marks to see which student has scored the highest. Check also if two or more students have scored equal marks.
8. Write a program to display records of an employee. Like name, address, designation, salary.
9. Write a C program; declare a variable and a pointer. Store the address of the variable in the pointer. Print the value of the pointer.
10. Write a C program to concatenate String 'best' and String 'bus'. Hint: strcat(char str1, char str2);
11. Explore the other functions in string library.
12. Write a program to create a file TEST. Write your name and address in the file TEST. Then display it on the console using C program.

SEMESTER – III

Subject Code: BEC18001	**Subject Name: SIGNALS AND SYSTEMS**	**T / L/ ETL**	L	T/SLr	P/R	C
	Prerequisite: Engineering Mathematics	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 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**	**1**	**2**	**1**	**1**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**	**2**	**2**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**	**2**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**2**
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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18001	SIGNALS AND SYSTEMS	3 1/0 0/0 4

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 10 Hrs

Continuous Time Signals (CT signals), Discrete Time Signals (DT Signals) – Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals – Periodic and aperiodic, Random Signals, CT Systems and DT Systems, Classification of Systems – Linear Time Invariant Systems(LTI).

UNIT II ANALYSIS OF C.T SIGNALS 12 Hrs

Fourier series Analysis, Spectrum of C.T. Signals, Fourier Transform and Laplace Transform – Properties of Fourier 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, Fourier and Laplace Transforms in Signal Analysis, State Equations and Matrix.

UNIT IV ANALYSIS OF D.T. SIGNALS 13 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 13 Hrs

Difference Equations, Block Diagram Representation, Impulse Response, 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. Roger E. Zeimer et al, "*Signals and Systems*": Continuous and Discrete, McMillan, 2nd Edition, 1990
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. *Simon Haykin and Barry Van Veen," Signals and Systems", John Wiley and Sons, Inc., 1999.*
3. *Robert A. Gabel and Richard A. Roberts,"Signals and Linear Systems", John Wiley, 3rd Edition, 1987.*

Subject Code: BEC18002	Subject Name : CIRCUITS AND NETWORKS	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Mathematical Knowledge, Basic Electrical Concepts	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 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	Understand the concept of circuits, network theorems and various circuit laws
CO2	Analyze and solve a given electrical networks using mesh and nodal analysis
CO3	Done their inferences to analyze circuits analysis in time domain and frequency domain
CO4	Demonstrate their skills in understanding the concept of various resonance and coupled circuits
CO5	Apply their understanding to derive the analyze the equations with respect to solving circuit transients.

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				

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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18002	CIRCUITS AND NETWORKS	3	1/0	0/0	4

UNIT I BASIC CIRCUIT CONCEPTS 12 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 12 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 12 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 12 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 12 Hrs

Mutual Inductance – Coefficient Of Coupling – Ideal Transformer – Analysis Of Multi Winding Couple Circuits – Single & Double Tuned Circuits – Critical Coupling.

Practical component P : Include case studies / application scenarios

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

Total Number of Hours: 60

Textbooks :

1. A.Sudhakar&ShyanmugamS.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. *Roy Choudhury, "Networks and Systems", New Age International Ltd, 1992*

Subject Code: BEC18003	Subject Name : DIGITAL ELECTRONICS	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Basic electronics and computer concepts	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 an conceptual understanding about Boolean algebra, demorgans theorem, simplification of Boolean expression, Karnaugh map and Quine Mcklusky methodology.
- To Design and implement logic gates, combinational logic circuits, PAL, PLA and FPGA.
- To Design and implement sequential logic circuits like Flip flops, counters and shift registers.
- To analyzer state diagram, state tables and its reduction and design and implement synchronous and asynchronous sequential circuits.
- To study different logic families and classify different types of memories.

COURSE OUTCOMES (COs) : (3- 5)

The Student will be able to

CO1	Apply Karnaugh map and Quine McCluskey methodology to simplify Boolean expressions.
CO2	Design and implement combinational logic circuits.
CO3	Explain the basic building blocks of sequential circuits and its applications.
CO4	Demonstrate the ability to design and implement synchronous and asynchronous sequential circuits
CO5	Compare the digital logic families and Classify different 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	2	3	1	3	2
CO2	3	3	3	2	3	3	2	2	3	1	3	2
CO3	3	3	3	2	3	3	2	2	3	2	3	2
CO4	3	3	3	2	3	3	2	2	3	2	3	2
CO5	3	2	3	2	2	3	2	2	2	1	3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18003	DIGITAL ELECTRONICS	3	1/0	0/0	4

UNIT I BOOLEAN ALGEBRA 12 Hrs

Boolean Algebra – De Morgan's Law - Simplifications of Boolean Expression – Sum of Products and Product of Sums – Karnaugh Map(up to 5 variables) – Quine McClusky Method of Simplification (Including Don't care conditions)

UNIT II COMBINATIONAL LOGIC 12 Hrs

Logic gates – AND, OR, NOT, NOR, NAND and EX-OR – Combinational Logic- Arithmetic Circuits – Half adder – Full adder, Half Subtractor - Decimal Adder – Excess 3 Adder – Code Converters – Multiplexer – Demultiplexer- Encoder – Decoder – Design of General Combinational Logic Circuit. PAL, PLA and FPGA.

UNITIII SEQUENTIAL LOGIC DESIGN 12 Hrs

Building Blocks Of Sequential Logic-Rs, JK, Master-Slave, D And T Flip-Flop, Design of Asynchronous and Synchronous Counters - Binary and BCD Counters - Shift Registers.

UNIT IV SEQUENTIAL MACHINES 12 Hrs

Basic Models Of Sequential Machines – Concept Of State Diagram - State Table – State Reduction - Design and Implementation of Synchronous Sequential Circuits. Design and Implementation of Asynchronous Sequential Circuits.

UNIT V LOGIC FAMILIES AND MEMORY DEVICE 12 Hrs

Characteristics of RTL, DTL, TTL, Families – Schottky, Clamped TTL, ECL, IIL –Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM

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

Reference Books:

1. *John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008*
2. *Jayadeepchakravarthy "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: BEC18004	Subject Name : SOLID STATE DEVICES	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Basics of Electrical and 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 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	Learnsemiconductor deviceslike 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	1	2	1	2	2	1	3	3	2	2	2
CO2	3	1	1	2	1	3	2	2	2	2	1	1
CO3	3	3	1	1	1	2	2	3	2	1	3	2
CO4	3	2	1	1	1	3	3	3	2	2	2	1
CO5	3	3	2	2	2	2	1	1	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	2	1	1				
CO2	3	2	2	2				
CO3	3	2	1	3				
CO4	3	2	2	3				
C05	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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18004	SOLID STATE DEVICES	3 0/0 0/0 3

UNIT I SEMICONDUCTOR DIODES 9 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.

UNIT II BJT & BIASING 9 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.

UNIT III FET & MOSFET 9 Hrs

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

UNIT IV POWER DEVICES

9 Hrs

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

UNIT V SMALL SIGNAL MODEL

9 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.

Practical component P : Include case studies / application scenarios

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

Total Number of Hours: 45

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,2013.*

Subject Code: BCS18I01	Subject Name : C PROGRAMMING WITH LINUX	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Programming and Multimedia lab	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 and develop well-structured programs using C language
- Problem solving through computer programming
- Familiarity of programming environment in Linux operating system
- Comfortably use basic UNIX/Linux commands from the command line.
- Be knowledgeable enough about basic UNIX/Linux shell scripting to be able to successfully read and write bash shell script.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Analyze the structure of C program, declaration of variables and usage of iterative and conditional statements.
CO2	Write C programs using arrays, strings and structures.
CO3	Apply Pointers to access arrays and Functions to process files.
CO4	Interpret basic hardware components and installation of Linux operating system
CO5	Design and implement basic Linux commands and Shell Programming

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	2	1	2	2	2	3
CO2	3	2	3	3	2	2	3	2	3	3	3	3
CO3	3	3	2	3	2	2	3	2	3	2	3	3
CO4	3	2	2	2	1	1	2	1	3	2	3	3
CO5	3	2	2	3	3	2	2	1	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	1	2	3	3				
CO2	1	2	3	3				
CO3	2	3	3	3				
CO4	2	3	3	2				
CO5	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓										

BCS18I01	C PROGRAMMING WITH LINUX	3 0/0 0/0 3

UNIT I BASICS OF C PROGRAMMING 9 Hrs

Introduction to programming paradigms – Structure of C program – C programming: Data Types – Storage classes – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions – Input/Output statements, Assignment statements – Decision making statements – Switch statement – Looping statements – Pre-processor directives – Compilation process

UNIT II ARRAYS, STRINGS AND STRUCTURES 9 Hrs

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays– String operations: length, compare, concatenate, copy – Selection sort, linear and binary search - Structure – Nested structures – Pointer and Structures – Array of structures.

UNIT III FUNCTIONS AND POINTERS 9 Hrs

Introduction to functions: Function prototype, function definition, function call, Built-in functions– Recursion– Pointers – Pointer operators –Array of pointers - Files – Types of file processing: Sequential access, Random access- Command line arguments

UNIT IV INTRODUCTION TO LINUX 9 Hrs

Introduction : Comparison of various operating systems, Advantages of Linux, Flavors of Linux, Installation notes, Linux Loader - file system concept, Concepts of devices, various kinds of hardware: Hard disk, floppy disk drivers , CD – ROM drives, Mouse, Memory devices, Printer devices.

UNIT V LINUX COMMANDSAND SHELL PROGRAMMING 9 Hrs

Linux commands and Utilities - Backup and Restore: Back up Strategies and Operations, Restoring files Introduction to Shell Programming: Basics, Control Statements, shell variables, filters, Interrupt, parsing options, file generation

Practical component P : Include case studies / application scenarios

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

Total Number of Hours: 45

Textbooks:

1. Balaguruswamy, E(1990) Programming in C(3rd ed.), Tata McGraw-Hill Publishing Company Limited.
2. Reema Thareja, “programming in C”, Oxford university press, second edition, 2016.
3. BillBall&DavidPittsRedHat “Linux7Unleashed”, TechmediaSAMSPublication.

Reference Books:

1. *Kernighan, B.W and Ritchie, D.M, “ The C programming language”, second edition, Pearson Education, 2006.*
2. *Byron Gottfried & Jitender Chhabra(2010), Programming with C (Schaum's Outlines Series), McGraw Hill Education.*
3. *K N King(2008), C Programming(2nd ed.), W. Norton & Company.*
4. *EviNemeth,GarthSnyder,ScottSeebass,TrentR.HeinUNIXSystemAdministrationHandbook (3rd. ed), PersonEducationAsia(LPE).*
5. *Mark G. Sobell(2013), Practical Guide to Linux Commands Editor, Pearson.*
6. *Goodlife(2006) , Running Linux(5th ed.), Om Books Publisher*

Subject Code: BEC18L01	Subject Name : CIRCUITS AND DEVICES LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Nil	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 apply the different networks theorems of circuit theory
- To understand the working principle of semiconductor devices and its operations.
- To illustrate the characteristics of power electronic devices, like SCR and UJT.
- To analyze the characteristics of MOSFET's and resonant circuits.
- To implement a miniproject based on above concepts.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Recognize the practical implementation of network theorems.
CO2	Illustrate and examine the characteristics of Diodes and Transistors.
CO3	Analyze the behavior of various Amplifiers and SCR circuits.
CO4	Design and implement a mini project based on the concepts of circuits and 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	3	2	2	2	2	2
CO2	3	3	3	3	3	2	3	2	2	2	1	2
CO3	3	3	3	3	3	2	3	2	2	2	2	2
CO4	3	3	3	3	3	2	2	2	2	2	1	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

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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L01	CIRCUITS & DEVICES LAB	0 0/0 3/0 1

LIST OF EXPERIMENTS

1 VERIFICATION OF SUPERPOSITION THEOREM, MPT, THEVENIN,NORTON

2 VERIFICATION OF NODAL& MESH ANALYSIS

3 CHARACTERISTICS OF P-N JUNCTION & ZENER DIODE

4 I/P & O/P CHARACTERISTICS OF BJT

5 CHARACTERISTICS OF JFET; FINDING β OF THE TRANSISTOR AND FIXED BIASING

6 BIASING OF TRANSISTOR IN CE MODE; BJT AMPLIFIER DESIGN CE MODE

7 BJT AMPLIFIER CB MODE AND CC MODE; JFET C.S. AMPLIFIER

8 UJT CHARACTERISTICS; SCR CHARACTERISTICS

9 MOSFET CHARACTERISTICS; STUDY OF RESONANT CIRCUITS

10 MINI PROJECT

References:

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

Subject Code: BEC18L02	Subject Name : DIGITAL SYSTEM DESIGN LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Electronics	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 implement various laws of Boolean algebra in SOP and POS forms.
- To implement combinational logic and sequential logic circuits.
- To use standard IC's in implementing digital circuits.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Practically implement of various laws of Boolean algebra in SOP and POS forms.
CO2	Implement various combinational logic circuits and code converters.
CO3	Design and implement different types of multiplexer and demultiplexers.
CO4	Design and implement various sequential circuits like flip-flops, counters and registers.
CO5	Using the standard IC's in implementing combinational and sequential logic 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	2	2	2	2	1	2
CO2	3	3	3	3	3	2	2	2	2	1	2	2
CO3	3	3	3	3	3	2	2	2	2	2	1	2
CO4	3	3	3	3	3	2	2	2	2	1	2	2
CO5	3	3	3	3	3	2	2	2	2	2	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	3	3	3	3
CO3	3	3	3	3
CO4	2	2	3	3
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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L02	DIGITAL SYSTEM DESIGN LAB	0 0/0 3/0 1

LIST OF EXPERIMENTS:

1. IMPLEMENTATION OF BOOLEAN FUNCTIONS USING LOGIC GATES –POS &SOP FORM.

2. IMPLEMENTATION OF MULTIBIT ADDERS & SUBTRACTORS (2 & 3 BITS).

3. DESIGN AND IMPLEMENTATION OF CODE CONVERTERS USING LOGIC GATES

i) BCD TO EXCESS-3 CODE AND VICE VERSA
ii) BINARY TO GRAY AND VICE-VERSA

4. DESIGN AND IMPLEMENTATION OF MAGNITUDE COMPARATOR (2-BIT).

5. MULTIPLEXER & DE MULTIPLEXER LOGIC CIRCUIT DESIGN

6. DESIGN AND IMPLEMENTATION OF FLIP FLOPS

7 .IMPLEMENTATION OF STUDY OF REGISTERS

8. CONSTRUCTION AND VERIFICATION OF COUNTERS.

9. IMPLEMENTATION OF COMBINATIONAL LOGIC FUNCTIONS USING STANDARD ICS

10. IMPLEMENTATION OF SEQUENTIAL LOGIC FUNCTIONS USING STANDARD ICS

References:

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

Subject Code: BCS18IL1	Subject Name : C PROGRAMMING WITH LINUX LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: 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 :

- To make student learn a programming language.
- To learn problem solving techniques.
- To learn basic understanding of LINUX commands & file systems to familiarize students with LINUX environment.
- To make student learn fundamentals of shell scripting and shell programming.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Develop conditional and iterative statements to execute basic c program.
CO2	Formulate C program that uses pointers to access arrays and structure
CO3	Construct C programs using built-in and user defined functions to solve problems.
CO4	Evaluate basic shell scripts on Linux operating system
CO5	Design generic application menu and handle Linux system calls.

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	3	2	3	3
CO2	3	3	3	3	3	2	2	2	3	2	3	3
CO3	3	3	3	3	3	2	2	2	3	2	2	2
CO4	2	2	3	3	3	2	3	2	3	1	2	3
CO5	2	2	3	3	2	3	2	2	3	1	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	2	3	3	3				
CO2	3	3	3	2				
CO3	2	3	3	3				
CO4	2	2	3	2				
CO5	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BCS18IL1	**C PROGRAMMING WITH LINUX LAB**	**0 0/0 3/0 1**

LIST OF EXPERIMENTS

1. PRIME TEST.
2. PALINDROME TEST.
3. FIBONACCI SERIES GENERATION.
4. ARMSTRONG NO TEST.
5. SOLVING QUADRATIC EQUATION.
6. USAGE OF CASE STRUCTURES.
7. MATRIX MULTIPLICATION.
8. RECURSION PROGRAM
9. SIMPLE SHELL PROGRAMMING.
10. MENU DRIVEN SHELL SCRIPT - SORT WITH VARIOUS OPTIONS.

References:

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

Department of Electronics and Communication Engineering

SEMESTER – IV

Subject Code: BMA18007	Subject Name: PROBABILITY AND RANDOM PROCESS	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Mathematics – I, Mathematics - 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 understand the basic concepts in probability and random process and its application in signal processing.

COURSE OUTCOMES (Cos) : (3- 5)
The student will be able to

CO1	Understand the Basic concepts in Probability
CO2	Understand the Basic concepts in Distribution
CO3	Understand the Basic concepts in Random process
CO4	Understand the Basic concepts in Correlation
CO5	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	1	1	1	1	1	1	1	2
CO2	3	3	2	3	1	1	1	1	1	1	1	2
CO3	3	3	2	3	1	1	1	1	1	1	1	2
CO4	3	3	2	3	1	1	1	1	1	1	1	2
CO5	3	3	2	3	1	1	1	1	1	1	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	1
CO2	2	3	2	1
CO3	2	3	2	1
CO4	2	3	2	1
CO5	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
	✓											

BMA18007	PROBABILITY AND RANDOM PROCESS	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 application 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 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.

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) Veerarajan T., "*Probability, Statistics and, Random Processes"*, Tata McGraw Hill Publishing Co., (2008).
2) Gupta S.C., Kapoor V.K., "*Fundamentals of Mathematical Statistics"*, S.Chand& Co., (2007).

Reference Books:

1. *Singaravelu, "Probability and Random Processes", Meenakshi Agency, (2017).*
2. *Richard Johnson A., "Miller & Freund's Probability and statistics for Engineers"(9th ed), Prentice Hall of India, (2016).*

Subject Code: BEC18005	Subject Name : CONTROL SYSTEMS FOR ELECTRONICS	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Network System	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 advance control system concepts using state variables.

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 for standard input functions
CO3	Perform analysis on margin for stability of the control systems
CO4	Explain the nature of stability for the given system using Characteristics equations.
CO5	Design compensators to obtain the required dynamic response of the system and understand the state variable analysis of 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	3	1	2	1	2	2	2	1
CO2	3	3	3	3	3	1	2	1	2	2	2	2
CO3	3	3	3	3	3	2	2	3	2	2	2	3
CO4	3	3	3	3	3	3	3	1	2	2	2	3
CO5	3	3	3	3	3	1	3	3	3	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	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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18005	CONTROL SYSTEMS FOR ELECTRONICS	3 1/0 0/0 4

UNIT I SYSTEM REPRESENTATION 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.

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 - P, PI, PID Controllers.

UNIT III FREQUENCY RESPONSE 12 Hrs

Frequency Response - Bode plot - Polar plot - Constant M and N circles - Determination of Closed Loop Response from Open Loop Response - Correlation between Frequency Domain and Time Domain Specifications.

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.

UNIT V COMPENSATORS AND STATE SPACE ANALYSIS 12 Hrs

Lag, Lead and Lag-Lead Compensators- State Space Analysis - State Space Formulation -State Variables - Phase variables and Canonical Variables –Concept of Controllability &Observabliity.

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.

Reference Books:

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: BEC18006	Subject Name: ELECTRONIC CIRCUITS	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: 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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18006	ELECTRONIC CIRCUITS	3	0/0	0/0	3

UNIT I RECTIFIER & POWER SUPPLY **9 Hrs**

Half & Full Wave Rectifies – Filters – Shunt, Inductor, LC Section & Ripple Factor, π filters, Calculation for C, L and LC Filters – Voltage Regulators – Zener – Series Voltage Regulator – Shunt Voltage Regulator – SMPS- IC Voltage Regulators.

UNIT II AMPLIFIERS **9 Hrs**

Amplifiers – Frequency Response of RC Coupled Amplifiers – Frequency Response of Emitter follower, Gain Band Width Product – FET - Amplifier at Low and High Frequency Cascaded Amplifiers

UNIT III FEED BACK AMPLIFIER & OSCILLATORS **9 Hrs**

Four Basic Type of Feedback – Effect of Feedback on Amplifier Performance-Examples of Different types of Feedback Amplifiers-Voltage Series & Shunt Feedback, Current Series & Shunt Feedback – Condition for Oscillation Barkhaushen Criteria – LC Oscillators – Hartley & Colpitts – RC Oscillators – Wein Bridge, RC Phase Shift, Crystal Oscillator.

UNIT IV MULTIVIBRATORS **9 Hrs**

Collector Coupled & Emitter Coupled Astable Multivibrator, – Mono Stable, BistableMultivibrator– TriggeringMethods – Storage Delay and Calculation of Switching Time - Schmitt Trigger Circuits, Speed up Capacitor in Switching – UJT based Relaxation Oscillator.

UNIT V POWER AMPLIFIER **9 Hrs**

Classification – Class A, B, C & AB, Class B-push pull – Class B Complementary Symmetry, Class S, and Power sections Classifications, Efficiency, Distortion in Amplifiers-Tuned Amplifiers.

Practical component P : Include case studies / application scenarios

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

Total Number of Hours: 45

Textbooks :

1. Mohammed. H. Rashid, "*Micro Electronic Circuits, Analysis and Design*", Thomson Learning
2. David. A. Bell, "*Solid state Pulse Circuits*", Prentice Hall India, 4th Edition, 2000.
3. Angsumansarkar, "*Solid State Microelectroni and Optoelectronic Devices*", University press,2012.

Reference Books:

1. *MillmanTaub ,"H Pulse Digital & Switching waveform ", Tata McGraw Hill International, 2001*
2. *Jacob Millman, Cristas C. Halkias," Integrated Electronics", Tata McGraw Hill., Edition 1991.*

Subject Code: BEC18007	Subject Name : COMMUNICATION THEORY	T / L/ ETL	L	T/SLr	P/R	C
	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

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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18007	**COMMUNICATION THEORY**	**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 CONTINUOUSMODULATION 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 -Shannon limit - BSC -Discrete memory less channels - 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: BHS18NC1	Subject Name : THE INDIAN CONSTITUTION	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: NIL	Ty	2	0/0	0/0	NC

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 provideanoverview of thehistoryofthemakingofIndianConstitution
CO2	To understandthepreambleandthebasic structures oftheConstitution
CO3	To Know the fundamentalrights, dutiesandthedirectiveprinciplesof 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	Practical / Project	Internships / Technical Skill	Soft Skills			
			✓									

BHS18NC1	**THE INDIAN CONSTITUTION**	**2**	**0/0**	**0/0**	**NC**

UNIT 1 **3 Hrs**

THE HISTORYOFTHEMAKINGOF INDIANCONSTITUTION, PREAMBLE ANDTHE BASICSTRUCTURES

UNIT 2 **3 Hrs**

FUNDAMENTALRIGHTSAND DUTIES , DIRECTIVE PRINCIPLESOF STATE POLICY

UNIT 3 **3 Hrs**

LEGISLATURE, EXECUTIVE AND JUDICIARY

UNIT 4 **3 Hrs**

EMERGENCYPOWERS

UNIT 5 **3 Hrs**

SPECIAL PROVISIONS FOR JAMMU ANDKASHMIR, NAGALANDAND OTHERREGIONS, AMENDMENTS

Total no.of Hrs: 15

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 Press, NewDelhi, 2008.*
2. *GranvilleAustin,TheIndianConstitution:CornerstoneofaNation,OxfordUniversityPress, Oxford, 1966.*
3. *Zoya Hassan, E. Sridharan andR. Sudarshan (eds), India's Living Constitution: Ideas, Practices, Controversies,Permanent Black, NewDelhi, 2002.*
4. *SubhashC.Kashyap,OurConstitution,NationalBookTrust, NewDelhi, 2011.*

Subject Code: BHS18NC2	Subject Name : THEINDIAN TRADITIONAL KNOWLEDGE	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: NIL	Ty	2	0/0	0/0	NC

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	Practical / Project	Internships / Technical Skill	Soft Skills			
			✓									

BHS18NC2	**THEINDIAN TRADITIONAL KNOWLEDGE**	**2**	**0/0**	**0/0**	**NC**

UNIT I **3 Hrs**

HISTORICAL BACKGROUND: TKS DURING THE PRE- COLONIAL AND COLONIAL PERIOD, INDIAN TRADITIONAL KNOWLEDGE SYSTEM

UNIT II **3 Hrs**

TRADITIONAL MEDICINE, TRADITIONAL PRODUCTION AND CONSTRUCTION TECHNOLOGY

UNIT III **3 Hrs**

HISTORY OF PHYSICS AND CHEMISTRY, TRADITIONAL ART AND ARCHITECTURE AND VASTUSHASHTRA, ASTRONOMY AND ASTROLOGY

UNIT IV **3 Hrs**

ORIGIN OF MATHEMATICS, AVIATION TECHNOLOGY IN ANCIENT INDIA, CRAFTS AND TRADE IN ANCIENT INDIA

UNIT V **3 Hrs**

TKS AND THE CONTEMPORARY WORLD, TKS AND THE INDIAN UNION, TKS AND IT REVOLUTION.

Total no. of Hrs: 15

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: BEC18ET1	Subject Name : ELECTRICAL MACHINES AND PCB DESIGN	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Basic Electrical and Electronic Circuits	ETL	1	0/1	3/0	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 different types of AC machines.

- To understand and analyze the working of various special machines.
- To give an introduction to different types of electronic components and instruments.
- To give an understanding of different stages in PCB design process.
- To analyze how components are assembled and tested in PCB.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Analyze the principle and working of different types of AC machines.
CO2	Interpret the working and applications of various special machines
CO3	Identify the need for different types of electronic components and instruments.
CO4	Formulate the process of designing PCB layout
CO5	Assemble and test different components in PCB's

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO 1	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	2	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	3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18ET1	ELECTRICAL MACHINES AND PCB DESIGN	1 0/1 3/0 3

UNIT I AC MACHINES 9 Hrs

Transformers - Principle of Operation of single phase Transformer – EMF Equation- Auto Transformers – Three Phase Transformers – Constructional Details. Induction motors- Construction Details - Types – Principle of Operation – Torque Equation. Synchronous machines -Construction of Synchronous machines – Classification - Induced EMF Equation

UNIT II SPECIAL MACHINES 9 Hrs

Principle of operation-Universal Motor – Switched Reluctance Motor – Permanent magnet Stepper Motor and Variable Reluctance stepper motor – DC and AC Servo Motor – Tachogenerator - Linear Induction Motor.

UNIT IIII NTRODUCTION TO BASICS OF ELECTRONIC COMPONENTS AND INSTRUMENTS 9Hrs

Study of electronic components: passive: -R,L,C –Types of R,L,C-Analysis of Colour code in R,C :Active: –Diode, BJT, FET,MOSFET :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: Solder practice.

UNIT IV PCB DESIGN PROCESS 9Hrs

Conception Level Introduction: Specifying Parts, Packages and Pin Names, Libraries and Checking foot prints of the components, Partlist, Netlist, Making Netlist Files, Placing Parts, Routing Traces, Modifying Traces, Mounting Holes, Adding Text, PCB Layout, DRC, Pattern Transfer.

UNIT V ASSEMBLING AND TESTING 9Hrs

Identifying the components and its location on the PCB, soldering of active and passive components, Testing the assembled circuit for correct functionality.

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. S. K. Bhattacharya, "*Electrical Machines"*, TMH Publications N. Delhi.

2.Kothari.D.P and Nagrath.I.J., "*Electrical Machines*", Tata McGraw Hill Publishing Co.Ltd, New Delhi, 5th edition 2002.

References:

1. *Orcad User manual.*
2. Raghbir Singh Khandpur, "Printed Circuit Boards: Design, Fabrication, and Assembly", (McGraw-Hill Electronic Engineering-2006)
3. Dr. MurugeshKumar.K. "DC Machines & Transformers", Vikas Publishing House Pvt Ltd.,2nd edition 2003.
4. Deshpande M. V., "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi, 2011.
5. Department Laboratory Manual.

Subject Code: BEC18L03	Subject Name : ELECTRONIC CIRCUITS LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Electronic Circuits	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 be able to design, implement different types of rectifier circuits.
- To be able to design different types of voltage regulators.
- To be able to design different amplifiers and oscillatory circuits.
- To be able to design power amplifier and study its characteristics.
- To be able to design tuned amplifier and analyze its behavior.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Recall the knowledge on different types of rectifier and examine the effect of filter characteristics.
CO2	Analyze the characteristics of voltage regulators and feedback amplifier circuits.
CO3	Demonstrate the characteristics of Wave form Generators.
CO4	Experiment Amplifiers and evaluate its characteristics.

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	3	2	2
CO2	3	3	3	3	3	2	2	2	2	3	1	2
CO3	3	3	3	3	3	2	2	2	2	2	2	1
CO4	3	3	3	3	3	2	2	2	2	2	1	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				

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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L03	ELECTRONIC CIRCUITS LAB	0 0/0 3/0 1

LIST OF EXPERIMENTS

1. RECTIFIERS – HALF WAVE, FULL WAVE WITHOUT FILTER
2. FWR WITH SHUNT, L AND Π FILTERS
3. VOLTAGE REGULATOR-SERIES & SHUNT
4. RC COUPLED AMPLIFIER (WITH FEEDBACK)
5. FEEDBACK CIRCUITS(VOLTAGE SERIES FEEDBACK; VOLTAGE SHUNT FEEDBACK)
6. SCHMITT TRIGGER
7. MULTI VIBRATORS, MONOSTABLE, ASTABLE, BISTABLE
8. LC OSCILLATORS
   a) HARTLEY OSCILLATOR
   b) COLPITTS OSCILLATOR
9. AUDIO OSCILLATORS
   a) WEIN BRIDGE OSCILLATOR
   b) RC PHASE SHIFT OSCILLATOR
10. CLASS A – POWER AMPLIFIER
11. CLASS B – POWER AMPLIFIER
12. TUNED AMPLIFIER

References:

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

Department of Electronics and Communication Engineering

Subject Code: BEC18L04	Subject Name : DIGITAL SIMULATION LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Signals and Systems,Control System	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	3	3	2	2	1	1	1	1	1
CO2	3	2	1	3	3	2	2	1	1	1	1	1
CO3	3	2	2	3	3	2	2	3	2	2	2	2
CO4	3	3	2	3	3	2	2	3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Subject Code: BEC18L05	Subject Name : CIRCUIT SIMULATION USING P-SPICE	T / L/ ETL	L	T/SLr	P/R	C

BEC18L04	DIGITAL SIMULATION LAB	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

References:

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

	Prerequisite: Circuit theory and electronic devices and circuits	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 implement the various electrical and electronics circuits using PSPICE.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Apply PSPICE for designing amplifiers.
CO2	Demonstrate their skills in designing multivibrator circuit.
CO3	Analysethe filters 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	3	3	3	2	2	1	2	3	1	2
CO2	3	3	3	3	3	2	2	2	2	2	3	2
CO3	3	3	3	3	3	2	2	1	1	2	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L05	CIRCUIT SIMULATION USING P-SPICE	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. CHARACTERISTICS OF BJT.
2. VERIFICATION OF SUPERPOSITION AND MPT THEOREMS.
3. FREQUENCY ANALYSIS OF RC COUPLED AMPLIFIER
4. FREQUENCY ANALYSIS OF JFET AMPLIFIER
5. MONOSTABLEMULTIVIBRATOR CIRCUITS.
6. ASTABLEMULTIVIBRATOR CIRCUITS
7. SUMMER, SUBTRACTOR.
8. DIFFERENTIATOR, INTEGRATOR.
9. LPF, HPF FILTERS
10. BPF, BRF FILTERS.

References:

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

Subject Code: BEC18TS1	Subject Name : TECHNICAL SKILL- 1	T / L/ ETL	L	T/SLr	P/R	C
		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: 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	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

Subject Code: BEN18SK1	Subject Name : SOFT SKILL – I CAREER & CONFIDENCE BUILDING	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: None	ETL	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 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	Practical / Project	Internships / Technical Skill	Soft Skills			
									✓			

BEN18SK1	**SOFT SKILL – I CAREER & CONFIDENCE BUILDING**	**0**	**0/0**	**3/0**	**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

Subject Code: BEC18008	Subject Name : DIGITAL SIGNAL PROCESSING	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Signals System	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	Evaluate Multi rate samplings techniques for system design.
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	1	2	2
CO2	3	3	3	3	3	2	2	1	2	2	1	2
CO3	3	3	3	3	3	2	1	1	1	1	2	1
CO4	3	3	3	3	3	1	2	1	2	1	2	2
CO5	3	3	3	2	2	2	1	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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18008	DIGITAL SIGNAL PROCESSING	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 – Limit cycle oscillations-Zero- Input Limit cycle oscillations- Overflow Limit cycle oscillations- Signal Scaling.

UNIT IV MULTIRATE SIGNAL PROCESSING **12 Hrs**

Multirate Signal Processing- Interpolation - Decimation - Single and Multistage Realization - Filter Bank Implementation - Applications-Sub Band Coding.

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. Sanjitk.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",1st edition Thomson Learning 2006*
3. *Johnny R.Johnson,"Introduction to Digital Signal Processing",Minthprinting,September 2001.*
4. *M.D.Srinath,P.K.Rajasekaran,R.Vishwanathan "Introduction to Statistical Signal ProcessingWithApplication",Prentice-Hall of India Pvt.Ltd.,New Delhi,1999.*
5. *B.Venkataramani, M.Bhaskar, "Digital Signal Processors, Architecture, Programming and Application", Tata McGraw Hill, New Delhi, 2003.*

Department of Electronics and Communication Engineering

Subject Code: BCS18I02	Subject Name : COMPUTER COMMUNICATION	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication System	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	Define 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	1	2
CO2	3	3	1	1	2	1	1	1	1	1	2	1
CO3	2	2	2	1	3	2	2	2	1	1	1	3
CO4	3	1	2	2	2	2	2	2	2	1	1	3
CO5	3	2	1	2	1	3	2	1	2	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	Practical / Project	Internships / Technical Skill	Soft Skills	Inter disciplinary		
										✓		

BCS18I02	COMPUTER COMMUNICATION	3 0/0 0/03

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

Textbooks :

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: BEC18ET2	Subject Name : ELECTROMAGNETIC WAVES AND TRANSMISSION LINES	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Engineering Physics, Vector Calculus	ETL	1	0/1	3/0	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 fundamental ideas in electrostatics and magneto statics.
- To learn the behavior of time varying fields and flow of electromagnetic power.
- To learn the behavior of transmission lines and to match the impedance in a cascaded stage.
- To study the characteristics of waveguide.

COURSE OUTCOMES (COs) : (3- 5)

The Students will able to

CO1	Analyze the behavior of electric field and magnetic field and determine its parameters
CO2	solve complex electrostatic and magneto static problems using behavioral study
CO3	Familiarize with transmission lines concept and various losses associated with it.
CO4	Identify different impedance matching for guided wave transmission
CO5	Interpret the different types of waveguides and the behavior of TE & TM waves

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	3	2	1	2	2	2
CO2	3	3	3	3	2	2	3	1	1	2	2	1
CO3	3	3	3	3	2	3	3	2	2	2	2	3
CO4	3	3	3	3	2	2	3	1	1	2	2	3
CO5	3	2	1	2	2	2	3	1	3	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	1	3
CO3	3	3	2	3
CO4	3	3	1	3
CO5	1	1	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	Practical / Project	Internships / Technical Skill	Soft Skills	Inter disciplinary		
				✓								

BEC18ET2	ELECTROMAGNETIC WAVES AND TRANSMISSIONLINES	1	0/1	3/03

UNIT I ELECTROSTATICS AND MAGNETOSTATICS 9 Hrs

Fundamental Postulates of Electrostatics in free space, Coulomb's law, Determination of Electric field, Gauss's law and its applications, Electric potential, Electric Flux Density and Dielectric constant, Boundary Conditions for Electrostatic fields, Determination of Capacitance and Electrostatic Energy,
Fundamental Postulates of Magneto statics in free space, Vector Magnetic Potential, Biot-Savart's law and its applications, Scalar Magnetic Potential, Magnetic Field Intensity and Relative Permeability, Boundary Conditions for Magneto static fields, Determination of Inductance and Magneto static Energy, Determination of magnetic Force and Torque.

Lab Experiments

- Electrical field and potential inside the parallel plate capacitor
- Capacitance and inductance of transmission lines
- Simulation of electric field and potential inside capacitors
- Magnetic field outside a straight conductor
- Magnetic field of coils
- Magnetic force on a current carrying conductor
- Inductance of transmission lines

UNIT II TIME-VARYING FIELDS AND ELECTROMAGNETIC POWER 9 Hrs

Faraday's Law of Electromagnetic Induction, Maxwell's Equations (Integral and Differential Form), Wave Equations for a source-free region, Poynting vector and Poynting theorem.

Lab Experiments

- Electromagnetic induction
- E.M wave radiation and propagation

UNIT III TRANSMISSION LINE THEORY 9 Hrs

General Theory of Transmission Lines –The transmission line, A General Solution – The Infinite Line – Wavelength, Velocity of propagation – Waveform Distortion – The Distortion-less line – Loading and– Input and transfer Impedance – Open and short circuited lines – Reflection loss .
Transmission lines equations at radio frequencies – Line of Zero dissipation – Voltage and Current on the dissipation-less line – Standing waves, Nodes, Standing wave ratio – Input impedance of the dissipation-less line – Power and impedance measurement on lines.

Lab Experiments

- Study of open and short circuited lines
- Measurement of SWR, impedance and power

UNIT IV IMPEDANCE MATCHING AND GUIDED WAVES 9 Hrs

Impedance matching: Quarter Wave Transformer – Impedance matching by Single and Double Stub – Smith chart-Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – Characteristics of TE and TM Waves – Transverse Electromagnetic waves – Velocities of propagation – Component uniform plane waves between parallel planes – Attenuation of TE and TM waves in parallel plane guides

Lab Experiments

- Impedance matching by quarter wave transformer and smith chart
- Study of characteristics of te and tm waves

UNIT V RECTANGULAR AND CIRCULAR WAVEGUIDES 9 Hrs

Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides-Impossibility of TEM waves in waveguides - Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular guides

Lab Experiments

- Study of rectangular waveguides
- Study of circular waveguides

Total Number of Hours: 45

Textbooks:

1. David K.Cheng, "*Field and Wave Electromagnetics*", McGraw Hill Inc., Third Edition, Malaysia, 1995
2. William H. Hayt& John A.Buck, "*Engineering Electromagnetics*",Tata Mc-Graw-Hill 7th Edition 2005.
3. Y.Mallikarjunareddy, "Eletromagnetic waves and transmission lines", Universities press, Edition 2015.
4. J.D. Ryder "*Networks, Lines and Fields*", PHI, New Delhi, 2003.
5. E.C. Jordan and K.G. Balmain "*Electro Magnetic Waves and Radiating System*", PHI, New Delhi, 2003.
6. Umesh Sinha " *Transmission lines and networks*", Sathya prakashan ,2010

Reference Books:

1. *John D Kraus, "Electromagnetics", Tata McGraw Hill Book Co., New York, Third Edition, 1989.*
2. *Joseph AEdminister, "Theory and Problems of Electro Magnetics", Schaum's Outline Series Tata McGraw Hill, New York, 1986*
3. *Mathew N. O. Sadiku, "Elements of Electromagnetics", Oxford International Student Edition, Fourth Edition*
4. *David J.Griffiths, "Introduction to Electrodynamics", Pearson Education Limited 2014.*
5. *S.P.Seth, "Elements of Electromagnetic Fields", Dhanpat Rai & Co. David K. Cheng,"Field and Waves in Electromagnetism", Pearson Education, 1989.*
6. *Ramo, Whineery and Van Duzer: "Fields and Waves in Communication Electronics", John Wiley, 2003.*
7. *David M. Pozar: "Microwave Engineering", 2nd Edition – John Wiley.*
8. *G.S.N Raju: "Electromagnetic Field Theory and Transmission Lines", Pearson Education, First edition 2005.*

Department of Electronics and Communication Engineering

Subject Code: BEC18L06	Subject Name : COMMUNICATION LAB - I	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Signals & Systems, 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 :

- 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	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

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	Practical / Project	Internships / Technical Skills	Soft Skills			
							✓					

BEC18L06	COMMUNICATION LAB - I	0 0/0 3/0 1

LIST OF EXPERIMENTS

DSP PROCESSOR IMPLEMENTATION

1. FIR & IIR FILTERS IMPLEMENTATION
2. MULTIRATE SIGNAL PROCESSING
3. ADAPTIVE FILTER
4. FAST FOURIER TRANSFORMS

MEASUREMENT ON SIGNAL PARAMETERS IN TIME DOMAIN & FREQUENCY DOMAIN

5. DETERMINATION OF THE PHASE DIFFERENCE BETWEEN TWO SIGNALS (DERIVED FROM THE SAME SOURCE (SAY 1 KHZ SQUARE WAVE SIGNAL) USING TWO DIFFERENT PATHS, ONE OF WHICH CONTAINS A DELAY UNIT) USING CRO AND A PHASE DETECTOR CIRCUIT.
6. DETERMINATION OF THE FREQUENCY OF UNKNOWN SIGNALS: USING CRO AND LISSAJOUS PATTERNS.

ANALOG COMMUNICATION LAB

7. DESIGN AND TESTING OF AMPLITUDE MODULATION AND DEMODULATION.
8. DESIGN AND TESTING OF FREQUENCY MODULATION AND DEMODULATION.
9. DESIGN AND TESTING OF PRE-EMPHASIS.
10. DESIGN AND TESTING OF NARROW FREQUENCY MODULATION.

References:

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

Subject Code: BCS18IL2	Subject Name : COMPUTER NETWORKS LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: C++ and Data structures 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, 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	3	3	3	3	3	3	2
CO2	3	3	3	2	3	3	3	2	3	3	2	2
CO3	3	3	3	3	3	2	2	1	3	3	2	3
CO4	3	3	3	3	3	1	2	1	3	3	2	3
CO5	3	3	3	3	3	3	1	3	2	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	2	3	3
CO3	3	3	3	3
CO4	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BCS18IL2	**COMPUTER NETWORKS LAB**	**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++

8. WRITE A PROGRAM FOR ERROR DETECTING CODE USING CRC-CCITT (16BIT)
9. WRITE A PROGRAM FOR DISTANCE VECTOR ALGORITHM TO FIND SUITABLE PATH FOR TRANSMISSION
10. WRITE A PROGRAM FOR SIMPLE RSA ALGORITHM TO ENCRYPT AND DECRYPT THE DATA
11. WRITE A PROGRAM FOR HAMMING CODE GENERATION FOR ERROR DETECTION/CORRECTION

References:

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

Subject Code: BEC18TS2	**Subject Name : TECHNICAL SKILL -2**	**T / L/ ETL**	L	T/SLr	P/R	C
		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: 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**	**PO 11**	**PO1 2**
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	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

Subject Code: BEC18009	Subject Name : DIGITAL COMMUNICATION	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication System, Probability and Random Process, Mathematics-I	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	2	2	2	2	3	1	1	1	2	2	1
CO2	3	3	3	3	2	3	1	1	1	2	2	1
CO3	3	2	2	3	3	3	2	3	2	2	3	3
CO4	3	3	3	3	3	2	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	1	1				
CO2	3	1	1	2				
CO3	3	3	1	2				
CO4	3	3	1	1				
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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18009	DIGITAL COMMUNICATION	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 TECHNIQUES 12 hrs

Coherent Binary Modulation Techniques, Coherent Quadrature Modulation Techniques, NonCoherent Binary Modulation Techniques, Power Spectra, Bandwidth Efficiency, Bit versus Symbol Error Probabilities

UNIT IV ERROR CONTROL CODING 12 hrs

Need for Coding, Types of 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: BEC18010	Subject Name : INTRODUCTION TO VLSI AND EMBEDDED SYSTEM DESIGN	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Digital Electronics and Data Structures	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 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) : (3- 5)

The students will be able to

CO1	Gain sound knowledge in the basics CMOS Circuits.
CO2	Analysis and design of different combinational circuits.
CO3	Identify the techniques involved in the analysis and synthesis of sequential 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	1	1	1	1	1	1	1	1
CO2	3	3	3	3	1	1	1	1	1	1	1	1
CO3	3	3	3	3	1	1	1	1	1	1	1	1
CO4	3	2	3	2	1	1	1	1	1	1	1	1
CO5	3	1	3	2	1	1	1	1	1	1	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	3	3	2	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	3	3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18010	INTRODUCTION TO VLSI AND EMBEDDED SYSTEM DESIGN	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 & VERILOG PROGRAMMING 9 Hrs

VHDL background – VHDL requirement, Elements of VHDL, operators, Basic concepts in VHDL, Structural modeling, Behavioral modeling and Dataflow modeling in VHDL and Simple programs, Verilog HDL – Basic concepts – Gate Level modeling, Dataflow modeling and Behavioral modeling – Simple programs.

UNIT V PIC MICROCONTROLLER 9 Hrs

Introduction - PIC16F877 Micro controller overview, Special Function Registers, I/O Ports, Timers, Oscillators, Capture/ Compare and PWM module, Serial communication module, Analog module and Instruction set.

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. ZainalabedinNavabi, " *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: BEC18ET3	Subject Name : DESIGN AND IMPLEMENTATION OF LINEAR INTEGRATED CIRCUITS	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Electronic Circuits	ETL	1	0/1	3/0	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 learn the design of comparators, signal generators and timers.
- To design active filters and PLL.
- To learn the concepts of IC regulators and Data converters.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Recall and express the basics of linear IC's.
CO2	Analyze and experiment various applications of diode and rectifier using op-amp.
CO3	Demonstrate comparators and signal generators using op-amp.
CO4	Design and illustrate the characteristics of active filters and PLL.
CO5	Experiment 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	2	2	2
CO2	3	3	3	3	3	3	3	2	2	2	2	1
CO3	3	3	3	3	3	2	2	2	2	2	1	2
CO4	3	3	3	3	3	3	2	2	1	2	2	1
CO5	3	3	3	3	3	2	2	1	1	2	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	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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18ET3	DESIGN AND IMPLEMENTATION OFLINEAR INTEGRATED CIRCUITS	1	0/1	3/0	3

UNIT I INTRODUCTION TO INTEGRATED CIRCUITS 9 Hrs

Integrated circuit and its classification, Introduction to Operational amplifier, Ideal Op-Amp , DC & AC Characteristics, Slew rate and methods of improving slew rate, CMRR, PSRR, Frequency Response and Compensation techniques.

Lab Experiments:

- Measure input bias current, input offset current, input offset voltage of the given op-amp
- Design voltage follower to measure slew rate.
- Measure cmrr for a given circuit and compare measured value with calculated value

UNIT II APPLICATIONS OF OPAMP IC741 9 Hrs

Inverter and Non-Inverter - Summer and Subtractor – Multiplier and Divider – Differentiator and Integrator – Instrumentation Amplifier – AC Amplifier – Op- Amp Circuits using Diodes, Precision Rectifier – Clipper and Clamper – Sample and Hold Circuit – Log and Antilog Amplifiers.

Lab Experiments:

- Design an inverting and non inverting amplifier for required gain using ic741
- Design and realize adder and subtractor using ic741.
- Design integrator and differentiator using ic741.
- Design clipper and clamper circuit using ic741.

UNIT III COMPARATORS AND SIGNAL GENERATORS 9 Hrs

Applications of Comparators – Regenerative Comparators (Schmitt Trigger) – Square Wave Generator (AstableMultivibrator) – Monostable Multivibrator –Triangular Wave Generator – Saw Tooth Wave Generator – Sine Wave Generators.

Lab Experiments:

- Design schmitt trigger using ic741 for given values of utp & ltp
- Design monostable multivibrator for required pulse width using ic741.
- Design astablemultivibrator for required frequency and duty cycle using ic741

UNIT IV ACTIVE FILTERS AND PLL 9 Hrs

RC Active Filters: Low pass – High pass – Band pass – Band reject – Notch – First order , Second order Filters– Switched Capacitor Filters – Counter Timers.PLL Basic Principles – Phase Detector and Comparator: Analog and Digital Voltage Controlled Oscillator – Low pass Filter - PLL – Applications of PLL

Lab Experiments: (PSPICE)

- Design & obtain frequency response of first order hpf & lpf filters
- Design & obtain frequency response of notch, bpf & brf filters

UNIT V IC REGULATORS AND DATA CONVERTERS: 9 Hrs

IC voltage regulators: Introduction, Fixed voltage regulators, SMPS, current limiting and current foldback techniques using IC723.

DAC/ADC Techniques – Integrating DAC /ADC Specifications, High Speed A/D Converters

Lab Experiments: (PSPICE)

- Design a voltage regulator for a given voltage.
- Calculate line, load regulation for a voltage regulator using ic723
- Construct a 4-bit r-2r ladder type dac
- Set up a 4-bit successive approximation type adc and study its performance

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, PHI.*

Subject Code: BEC18L07	Subject Name : COMMUNICATION LAB II	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Digital Communication, Communication 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 :

- 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	2	3	3	3	2	3	3	2	3
CO2	3	3	3	2	3	3	3	2	3	2	2	3
CO3	3	3	3	2	2	3	3	1	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L07	**COMMUNICATION LAB II**	**0 0/0 3/0 1**

LIST OF EXPERIMENTS

1. DESIGN AND TESTING OF PULSE AMPLITUDE MODULATION & DEMODULATION.
2. DESIGN AND TESTING OF PULSE WIDTH MODULATION & DEMODULATION.
3. DESIGN AND TESTING OF PULSE POSITION MODULATION & DEMODULATION.
4. DESIGN AND TESTING OF ASK, FSK AND PSK
5. STUDY OF LINE CODING AND DECODING TECHNIQUES
6. STUDY OF SAMPLING
7. STUDY OF PULSE CODE MODULATION
8. DESIGN & TESTING OF EYE PATTERN
9. BLOCK/HAMMING CODES.
10. PN SEQUENCE GENERATOR.
11. DELTA MODULATION AND TIME DIVISION MULTIPLEXING

References:

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

Subject Code: BEC18L08	Subject Name : VLSI AND EMBEDDED SYSTEM DESIGN LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Introduction of VLSI&embedded system design	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	2	3	2	2	2	2	3	2	2
CO2	3	2	3	3	3	1	1	2	2	2	3	2
CO3	3	3	3	3	3	2	3	3	2	3	3	3

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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L08	**VLSI AND EMBEDDED SYSTEM DESIGN LAB**	**0 0/0 3/0 1**

LIST OF EXPERIMENTS

SIMULATION OF DIGITAL CIRCUITS USING XILINX

1. DESIGN AND TESTING OF ADDER AND SUBTRACTOR
2. DESIGN AND TESTING OF MULTIPLEXER, DEMULTIPLEXER, ENCODER, DECODER.
3. DESIGN AND TESTING OF MAGNITUDE COMPARATOR WITH 4/8 BITS.
4. DESIGN AND TESTING OF JK, D, T AND SR FLIP FLOPS, AND REGISTERS
5. DESIGN AND TESTING OF SYNCHRONOUS & ASYNCHRONOUS COUNTERS.
6. DESIGN AND TESTING OF SHIFT REGISTERS (RIGHT / LEFT).

INTERFACING WITH PIC MICROCONTROLLER

7. ADC INTERFACE WITH LM35.
8. STEPPER MOTOR INTERFACE
9. TRAFFIC LIGHT CONTROLLER INTERFACE
10. DC MOTOR INTERFACE
11. LCD DISPLAY INTERFACE.
12. LED INTERFACE

References:

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

Subject Code: BEN18SK2	Subject Name : SOFT SKILLS – II QUALITATIVE AND QUANTITATIVE SKILLS	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Soft Skills - I	ETL	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 : 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	PO 7	PO 8	PO9	PO1 0	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	Practical / Project	Internships / Technical Skill	Soft Skills			
									✓			

BEN18SK2	**SOFT SKILLS – II** **QUALITATIVE AND QUANTITATIVE SKILLS**	**0 0/0 3/0 1**

UNIT 1 Logical Reasoning I

Logical Statements – Arguments – Assumptions – Courses of Action.

UNIT 2 Logical Reasoning II

Logical conclusions – Deriving conclusions from passages – Theme detection.

UNIT 3 Arithmetical Reasoning I

Number system – H.C.F & L.C.M – Problem on ages – Percentage – Profit & Loss – Ratio & Proportion – Partnership.

UNIT 4 Arithmetical Reasoning II

Time & Work – Time & Distance – Clocks – Permutations & Combinations – Heights & Distances – Odd man out and Series.

UNIT 5 Data Interpretation

Tabulation – Bar graphs – Pie graphs – Line graphs.

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: BEC18L09	Subject Name : MINI PROJECT / INPLANT TRAINING INDUSTRIAL TRAINING	T / L/ ETL	L	T/S Lr	P/R	C
		Lb	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	PO 5	PO 6	PO 7	PO8	PO 9	PO1 0	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	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

Subject Code: BEC18TS3	Subject Name : TECHNICAL SKILL - 3	T / L/ ETL	L	T/SLr	P/R	C
		L	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 : 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	PO 1	PO 2	PO3	PO4	PO 5	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	Practical / Project	Internships / Technical Skill	Soft Skills			
								✓				

Subject Code: BEC18011	Subject Name : DIGITAL IMAGE PROCESSING AND ITS APPLICATIONS	T / L/ ETL	L	T/SLr	P/R	C
	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

OBJECTIVES :

- 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	3	2	3	1	3	2	3	2	3	3
CO2	3	3	2	2	3	3	2	2	3	2	3	1
CO3	3	3	3	2	2	3	2	2	2	3	3	3
CO4	2	3	3	3	3	2	2	1	2	1	2	3
CO5	1	2	3	3	3	2	2	1	2	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	2	3	1	3
CO3	2	3	3	3
CO4	2	3	3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18011	**DIGITAL IMAGE PROCESSING AND ITS APPLICATIONS**	**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 – Imaging geometry, discrete image mathematical characterization.

UNIT II IMAGE TRANSFORMS 12 Hrs

Two dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFTDiscrete cosine transform and KL transform.-Discrete Short time Fourier TransformWavelet Transform- Discrete wavelet Transform- and its application in Compression

UNIT III IMAGE ENHANCEMENT 12 Hrs

Spatial Domain: Basic relationship between pixels- Basic Gray level Transformations – Histogram Processing – Smoothing spatial filters- Sharpening spatial filters. 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 12Hrs

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.*

Department of Electronics and Communication Engineering

Subject Code: BMG18003	Subject Name: **PRINCIPLES OF MANAGEMENT**	Ty/Lb / ETL	L	T / S.Lr	P/ R	C
	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 enable the students to study the evolution of Management and types of business organization.
- To enable the students to understand the nature of planning and its process and decision making steps and process.
- To enable the students to understand the nature and purpose of organizing types of organization authority and its types and Human Resource Management and its concepts.
- To understand the foundation of individual and group behaviour and various motivational theories, techniques, job satisfaction concepts and communication theories.
- To understand the concept of controlling its system and processes.

COURSE OUTCOMES (COs) : (3- 5)

CO1	To know the evolution of management, types of business organization, Organizational culture and environment and trends and issues in management.
CO2	Ilustrate the planning and processes associates with tools and decision making steps.
CO3	Examine the concept of organizing, HR and its concepts.
CO4	Analyze individual, group behavior and related concepts.
CO5	Evaluate system and process of controlling techniques.

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	2	2	3	3	3	3	3	3	3
CO2	2	3	2	3	1	3	3	3	3	3	3	3
CO3	2	2	2	3	2	3	3	2	3	2	2	3
CO4	1	2	2	3	1	2	2	2	3	3	3	3
CO5	2	2	2	3	2	2	2	2	3	3	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	3	3	3			
CO2	2	3	2	2			
CO3	2	3	3	1			
CO4	2	3	3	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	Practical / Project	Internships / Technical Skill	Soft Skills	Management Science		
										√		

BMG18003	PRINCIPLES OF MANAGEMENT	3 0/0 0/0 3

UNIT-I INTRODUCTION **9 HRS**

Management: Importance – Definition – Nature and Scope of Management Process – Role and Functions of a Manager – Levels of Management – Development of Scientific Management and other Schools of thought and approaches.

UNIT-II PLANNING **9 HRS**

Planning: Nature – Importance – Forms – Types – Steps in Planning – Objectives – Policies – Procedures and Methods – Natures and Types of Policies – Decision –making – Process of Decision – making – Types of Decision.

UNIT-III ORGANIZATION **9 HRS**

Organisation: Types of Organisations – Organisation Structure – Span of Control and Committees – Departmentalisation – Informal Organisation.

UNIT-IV DECENTRALISATION **9 HRS**

Authority – Delegation – Decentralisation – Difference between Authority and Power – Responsibility – Recruitment – Sources, Selection, Training – Direction – Nature and Purpose.

UNIT-V COORDINATION AND CONTROL **9 HRS**

Co-ordination – Need, Type and Techniques and requisites for excellent Co-ordination – Controlling – Meaning and Importance – Control Process.

Total No of Hours: 45

Text books:

1.C.B.Gupta, Management Theory & Practice -Sultan Chand & Sons - New Delhi.
2. L.M.Prasad, Principles & Practice of Management - Sultan Chand & Sons - New Delhi.
3. P.C. Tripathi &P.N Reddy, Principles of Managements - Tata Mc.Graw Hill - New Delhi.

Reference Books:

1. Weihrich and Koontz, Management – A Global Perspective.
2. N.Premavathy, Principles of Management - Sri Vishnu Publication - Chennai.
3. J.Jayasankar, Business Management - Margham Publication - Chennai.

Subject Code: BEC18ET4	Subject Name : INTERNET OF THINGS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Sensor, Linux Basics	ETL	1	0/ 1	3/ 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 basic of IoT and M2M.
- To study IoT with Cloud environment.
- To design IoT systems with Python and study physical devices.

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

CO1	Describe the fundamentals about IoT
CO2	Use the IoT concepts and its application
CO3	Design IoT systems with Cloud environment.
CO4	Articulate design of IoT devices using Python software.
CO5	Develop new applications with Raspberry Pi and Intel Galileo Arduino board.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO 4	PO 5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	2	2	2	3	3
CO2	3	3	3	3	3	3	2	2	2	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	3	2	2	3	3	2
CO5	3	3	3	3	3	3	2	3	2	3	3	2

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	3	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18ET4	INTERNET OF THINGS	1	0/1	3/0	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 AND M2M 9 Hrs

Home Automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health and Life style – Introduction to M2M – Difference between IoT to M2M –SDN and NFV for IoT.

UNIT III IoT SYSTEM MANAGEMENT AND CLOUD 9 Hrs

Need for IoT System Management - SNMP – NETCONF – YANG – NETOPEER – IoT design methodology - Case study for IoT System – WAMP –AutoBahn for IoT – Xively – Django- Amazon Web for IoT – SkyNet IoT.

UNIT IV IoT SYSTEMS – LOGICAL DESIGN USING PYTHON 9 Hrs

Introduction – Installing Python – Python Data types and data structures – Control flow – Functions – Modules – Packages – File Handling – Data / Time Operations – Classes – Python packages of Interest for IoT.

UNIT V IoT PHYSICAL DEVICES 9 Hrs

Raspberry Pi – Linux on Raspberry Pi -Raspberry Pi Interfaces – Programming Raspberry Pi with Python – Arduino boards – Other IoT devices – Data analytics for IoT –Intel Galileo Arduino board Specification (with simple programs).

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: BEC18L10	Subject Name : MICROWAVE AND OPTICAL COMMUNICATION LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Microwave Engineering, Optical communication	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	2	3	2	3	3	3	2	2	3	3	3
CO2	3	2	3	2	3	3	3	2	2	2	3	3
CO3	3	2	3	2	3	3	3	3	2	2	3	3

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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L10	**MICROWAVE AND OPTICAL COMMUNICATION LAB**	**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

References:

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

Subject Code: BEC18L11	Subject Name : OPEN CV-PYTHON FOR DIGITAL IMAGE PROCESSING LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Digital Image 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
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.
CO4	Apply the knowledge primarily obtained by studying examples and cases in the field of biomedical imaging to other engineering disciplines
CO5	Independently work in OpenCV software using python programming

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	3	3	2	2
CO2	3	3	3	3	3	2	2	2	3	3	2	2
CO3	3	3	3	3	3	2	2	2	3	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L11	**Open CV-PYTHON FOR DIGITAL IMAGEPROCESSING LAB**	**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 OPENCV
11. HISTOGRAMS IN OPENCV
12. IMAGE TRANSFORMS IN OPENCV
13. FEATURE DETECTION AND DESCRIPTION
14. CAMERA CALIBRATION AND 3D RECONSTRUCTION

References:

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

Subject Code: BEC18L12	Subject Name : PROJECT PHASE - I	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: NIL	Lb	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Subject Code: BHS18FLX	Subject Name: FOREIGN LANGUAGE	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: NIL	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 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	Practical / Project	Internships / Technical Skill	Soft Skills			
			✓									

Subject Code: BEC18012	Subject Name : WIRELESS NETWORKS	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Computer 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

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	1	1	1	2	2	1	3
CO2	3	3	3	3	2	2	2	3	1	1	3	3
CO3	3	3	3	3	3	2	2	3	2	2	1	3
CO4	3	3	3	3	3	2	2	3	3	3	3	3
CO5	3	3	2	2	1	1	1	1	2	2	1	3

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	Practical / Project	Internships / Technical ...	Soft Skills			
				✓								

BEC18012	WIRELESS NETWORKS	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., vol 12, no 1,2005.*

Subject Code: BEC18013	Subject Name : COGNITIVE RADIO	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication Theory	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	1	2	1	1
CO2	3	1	2	3	2	3	2	3	1	1	2	1
CO3	2	1	3	1	2	2	2	1	1	2	1	1
CO4	2	3	2	3	2	3	3	1	1	3	3	1
CO5	3	1	2	1	3	3	1	2	2	3	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	2	1	3				
CO2	3	3	2	3				
CO3	3	3	1	3				
CO4	3	1	3	3				
CO5	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18013	COGNITIVE RADIO	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 III INTRODUCTION 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:

4. *Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, “Cognitive Radio Networks - From Theory to Practice”, Springer Series: Analog Circuits and Signal Processing, 2009.*
5. *J. Mitola, “Cognitive Radio: An Integrated Agent Architecture for software defined radio”, Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.*
6. *Simon Haykin, “Cognitive Radio: Brain –empowered wireless communications”, IEEE Journal on selected areas in communications, Feb 2005.*
7. *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.*
8. *Joseph Mitola, “Software Radio Architecture: A Mathematical Perspective” IEEE Journal on Selected Areas in Communication, Vol. 17, No. 4, April 1999.*
9. *HasariCelebi ,Huseyin Arslan, “Enabling location and environment awareness in cognitive radios”, Elsevier Computer Communications, January 2008.*

Subject Code: BEC18L13	Subject Name : Project Phase - II	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: NIL	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

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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Subject Code: BEC18E01	Subject Name : MICROPROCESSOR AND MICROCONTROLLER	T / L/ ETL	L	T/SLr	P/R	C
	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 study the architecture, addressing modes, and assembly language program of 80386 microprocessor.
- To understand the concepts of different peripherals and their applications
- To learn the functions of 8051 microcontroller and ARM processor and their applications.

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	Hone their inferences to develop a hardware using 8051 microcontroller
CO4	Demonstrate their skills in writing an ALP in 8051 to do real time applications
CO5	Apply their understanding to do a project to develop an application using ARM 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	2	3	2	2	3	1	1	2	2	2	1
CO2	3	3	3	3	3	3	1	2	2	3	2	2
CO3	2	2	2	1	3	3	2	3	3	3	3	2
CO4	3	3	2	3	3	2	2	3	2	2	1	3
CO5	3	2	3	2	3	3	3	3	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	2	2	3	2
CO3	3	3	3	3
CO4	3	2	3	3
CO5	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	Practical / Project	Internships / Technical Club	Soft Skills			
					✓							

BEC18E01	**MICROPROCESSOR AND MICROCONTROLLER**	**3**	**0/0**	**0/0**	**3**

UNIT I INTEL 8 BIT, 16 BIT& 32 BIT MICROPROCESSORS **9 Hrs**

Introduction to 8085 & 8086 microprocessors – Instruction sets – Advanced 80386 Architecture, Addressing modes – Data types of 80386 – Real address mode of 80386 – Segmentation , paging , Salient features of PENTUM.

UNIT II PERIPHERALS INTERFACING **9 Hrs**

Interfacing serial I/O(8251)-Parallel I/O(8255) –Keyboard and display controller (8279)-ADC/DAC Interfacing-Timer (8253).Programmable Interrupt Controller (8259), DMA controller, Applications of 8085

UNIT III 8051 MICROCONTROLLER **9 Hrs**

8051 Microcontroller hardware I/O pins, Ports and circuits-External memory –Counters and Timers-Serial Data I/O –Interrupts.

UNIT IV 8051 PROGRAMMING AND APPLICATIONS **9 Hrs**

8051 Instruction set –Addressing Modes –Assembly Language Programming -8051 interfacing LCD, ADC, Sensors, Stepper motors, Motors, Keyboard and DAC

UNIT V 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

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. Krishna Kant, "*Microprocessors and Microcontrollers, Architecture,programming and system design using 8*
2. *085, 8086, 8051 and 8096*",PHI 2007.
2. Douglas V Hall, "*Microprocessor and Interfacing, Programming and hardware*",TMH, 2006.
3.R.S. Gaonkar,"*Microprocessor Architecture Programming and Application, with 8085",* Wiley Eastern Ltd., New Delhi, 2013.

References:

1. *Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay "The 8051Microcontroller and Embedded Systems", Second Edition, Pearson Education 2008.*
2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC",Delmar Publishers, 2007.
3. A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, TMH, 2007.
4. Steve furber "ARM Systems on chip Architecture", Second Edition Addison Wesley trade computer publication,2000.
5.John .B.Peatman"Design with PIC Microcontrollers" ,Pearson Education, 3rd Edition, 2004

Department of Electronics and Communication Engineering

Subject Code:	Subject Name : Semiconductor devices and its applications	T / L/ ETL	L	T/SLr	P/R	C
BEC18E02	Prerequisite: 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 and utilize them for various applications with a 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	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	1	1	1	1	2	1	1
CO2	2	1	2	3	2	1	1	1	1	2	1	1
CO3	2	1	1	2	2	2	2	1	2	2	2	2
CO4	2	1	1	2	2	2	2	1	2	2	2	2
CO5	2	2	3	3	2	1	2	3	3	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	1
CO2	2	3	2	1
CO3	1	1	3	2
CO4	1	1	3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E02	**SEMICONDUCTOR DEVICES AND ITS APPLICATIONS**	**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: BEC18E03	Subject Name : BASICS OF ROBOTICS	T / L/ ETL	L	T/SLr	P/R	C
	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

OBJECTIVES :

- 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.
- To discuss about the various end effectors and manipulators.
- To develop a path planning and programming of robots.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Identify the importance of robotics in today and future goods production.
CO2	Describe the robot configuration and transmission systems.
CO3	Manipulate the electronic and pneumatic manipulators.
CO4	Investigate with the typical robot.
CO5	Implement specialized software and working of mobile robot.

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	2	3	3	3	3
CO3	3	3	3	3	3	3	2	2	3	3	3	3
CO4	3	3	3	3	3	2	3	3	3	2	3	3
CO5	2	2	2	3	3	2	3	3	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	2
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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E03	BASICS OF ROBOTICS	3	0/0	0/0	3

UNIT I INTRODUCTION **9 Hrs**

Specifications of Robots- Classifications of robots – Work envelope - Flexible automation versus Robotic technology – Applications of Robots- robot kinematics and dynamics -Positions, Orientations and frames, Mappings: Changing descriptions from frame to frame, Operators: Translations, Rotations and Transformations - Transformation Arithmetic - D-H Representation - Forward and inverse Kinematics of Six Degree of Freedom Robot Arm – Robot Arm dynamics

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

Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor - pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link - Rod systems - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws.

UNIT III MANIPULATORS **9 Hrs**

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic manipulators.

UNIT IV ROBOT END EFFECTORS **9 Hrs**

Classification of End effectors – Tools as end effectors. Drive system for grippers-Mechanical adhesive-vacuum, magnetic-grippers. Hooks&Scoops. Gripper force analysis and gripper design. Active and passive grippers.

UNIT V PATHPLANNING & PROGRAMMING **9 Hrs**

Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion – straight line motion-Robot languages -.computer control and Robot software.

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.

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

Subject Code: BEC18E04	Subject Name : C++ AND DATA STRUCTURES	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Programming and Multimedia lab	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 different object oriented programming concepts
- To understand the different methods of organizing large amounts of data
- To efficiently implement the different data structures
- To learn the systematic way of solving problems
- To efficiently implement solutions for specific problems
- Get to know about the trending programming technologies.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describethe use of control statements operators and developments of functions usnig C++
CO2	Analyze the concepts of constructors, destructors to create and destroy objects and focus on the types of inheritance and templates
CO3	Illustrate the operations of stacks ,queue and use of linked list to implement insertion and deletion .
CO4	Identify different tree algorithms to represent nodes connected by edges
CO5	Apply searching and sorting design mechanism in data structures to solve 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	3	2	2	1	2	2	2	3	3
CO2	3	3	3	3	3	2	2	1	3	2	3	3
CO3	3	3	3	3	3	2	2	1	3	3	3	3
CO4	3	3	3	3	3	2	2	1	2	3	3	3
CO5	3	3	3	3	3	2	2	1	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E04	**C++ AND DATA STRUCTURES**	**3 0/0 0/0 3**

UNIT I INTRODUCTION TO OOPS 9 Hrs

Object Oriented Concepts – Basics of C++ Environment. Definition – Data Members – Function Members – Control Statements-Overloading Operators – Functions – Friends – Class derivation – Virtual Functions – Abstract Base Classes.

UNIT II CLASSES, INHERITANCE & TEMPLATES 10 Hrs

Constructor – Default constructors – Copy Constructors – Destructors – Static members –Constant Members – Free Store Operators- Multiple Inheritances- Exception Handling – Streams - Class Templates – Function Templates

UNIT III LINEARDATA STRUCTURES 9 Hrs

Stacks, Queues & Lists Implementation and Application Singly linked list – Doubly linked lists

UNIT IV NON LINEAR DATA STRUCTURES 9 Hrs

Trees – Binary Trees – Binary Search Tree – Tree Traversals – AVL Trees

UNIT V SEARCHING AND SORTING 8 Hrs

Searching – Linear search-Binary Search. Sorting- Insertion sort, Bucket sort, Heap sort, Merge sort, Quick sort.

Practical component P : Include case studies / application scenarios

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

Total Number of Hours: 45

Textbooks:

1. Balagurusamy.E, "*Object oriented programming with C++*", Tata McGraw-Hill publishing company limited, Addison Wesley
2. E.Horowitz, S.Sahani&S.Rajasekharan, "*Fundamentals of data structure in C++*", Computer science press.
3. Stanley B.Lippman, "*The C++ Primer*", Addison Wesley Publishers, 4th Edition, 2005.

Reference Books:

1. *Weiss Mark Allen. "Data Structures and Algorithms Analysis in C", Pearson Education, 2/e, 1997*
2. *E.Horowitz, S.Sahani&S.Rajasekharan, "Computer Algorithms", Galgotia 1999.*
3. *Gary J. Bronson, "Object Oriented Program Development using C++", Thomson Learning, 4th Edition 2005.*
4. *Brett D. McLaughlin, Gary Pollice, David West Head "First Object-Oriented Analysis & Design", O'Reilly Media, 2007.*
5. *Gilberg&Forugan, "Data Structures: A Pseudo Code Approach using C++ ", Thomson Learning 1st Edition, 2002.*
6. *Gary J. Bronson, "Object oriented program development using Java", Thomson Learning, 2nd Revised Edition 2005.*

ELECTIVES LIST 1- COMMUNICATION STREAM

Subject Code: BEC18E05	Subject Name :Antenna and Wave Propagation	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: EMF, TLWG	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	2	2	1	2	2
CO2	3	3	3	3	3	3	2	2	2	2	2	2
CO3	3	3	3	3	3	2	2	2	2	1	2	2
CO4	3	3	3	3	3	2	2	2	2	1	2	2
CO5	3	3	3	3	3	2	2	3	2	1	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	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E05	**ANTENNA AND WAVE PROPAGATION**	**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: BEC18E06	Subject Name : Telecommunication Switching System	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Computer 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 get knowledge about the telecommunication industry, its services theoretical basics about the performance and operation in telecom 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	1	1
CO2	1	3	1	3	3	1	1	1	1	1	1	1
CO3	3	3	3	3	1	1	1	1	1	1	1	1
CO4	1	3	3	3	1	1	1	1	1	1	1	1
CO5	1	3	3	3	3	1	1	1	1	1	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	1
CO3	3	2	3	2
CO4	3	3	2	3
CO5	3	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E06	TELECOMMUNICATION SWITCHING SYSTEM	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: BEC18E07	Subject Name : REAL TIME OPERATING SYSTEMS	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Operating Systems 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 :

- 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 embeddd 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	1	1	2
CO2	2	3	3	3	3	2	1	1	2	3	2	2
CO3	1	3	3	2	3	1	1	1	3	3	1	2
CO4	1	3	3	3	3	2	1	1	2	2	1	2
CO5	2	2	3	3	3	1	1	1	2	2	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	1	1	2	2				
CO2	1	2	3	1				
CO3	1	2	2	1				
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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E07	**REAL TIME OPERATING SYSTEMS**	**3**	**0/0**	**0/0**	**3**

UNIT I EMBEDDED SYSTEM FUNDAMENTALS **9 Hrs**

Introduction, Characteristics of embedded systems and challenges in system design –Design issues in embedded real-time systems, critical performance issues in embedded real-time systems.

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**

Tasks & 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, savingpower.

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.*

Department of Electronics and Communication Engineering

Subject Code: BEC18E08	Subject Name : Audio Signal Processing	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Signals and Systems	T	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	Speculate 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	2	3	3	3	3	2	3	3	3
CO2	3	3	3	3	3	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	3	2	3	3	3
CO4	3	3	3	3	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	2	3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E08	**Audio Signal Processing**	**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 9 Hrs

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 9 Hrs

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 2 - ELECTRONICS STREAM

Subject Code: BEC18E09	Subject Name : INTELLIGENT INSTRUMENTATION	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Electronic 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

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 equipment are using PLC.

COURSE OUTCOMES (COs) : (3- 5)

The student will be able to

CO1	Learn to 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	3	3	3
CO2	3	3	3	3	3	3	3	2	2	3	2	2
CO3	3	1	1	2	3	3	2	1	3	3	3	3
CO4	3	3	3	2	2	2	3	1	2	3	3	3
CO5	3	3	3	2	2	2	3	1	2	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	1	3	3
CO2	3	3	3	3
CO3	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E09	**INTELLIGENT INSTRUMENTATION**	**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 GENERATOR 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.*

Department of Electronics and Communication Engineering

Subject Code: BEC18E10	Subject Name : Advanced Microprocessors	T / L/ ETL	L	T/SLr	P/R	C
	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 introduce the programming techniques using MASM, DOS and BIOS function calls.
- To introduce the architecture programming and interfacing of 16 bit microcontrollers.
- To introduce the concepts and architecture of RISC processor

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Explain the generalized architecture of advanced microprocessor
CO2	Develop algorithm/ program of advanced microprocessor or a particular task.
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	2	1	2	1	3	3	1	3
CO2	3	3	3	3	2	2	1	2	3	3	3	3
CO3	3	3	2	2	1	1	2	2	1	3	2	3
CO4	3	3	3	3	1	1	3	1	2	2	3	2
CO5	3	3	3	3	1	1	1	1	3	3	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1
CO2	3	3	1	1
CO3	3	2	2	1
CO4	3	1	2	2
CO5	3	1	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E10	ADVANCED MICROPROCESSORS	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 INTEL X86 ASSEMBLY LANGUAGE PROGR 9 Hrs

Implementation of Strings, Procedures, Macros, BIOS and DOS Services using X86 Assembly Language Programming, Memory and I/O Interfacing, Analog Interfacing and Industrial Control.

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 860 Family. The Motorola M88000 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

REFERENCES:

1. *Daniel Tabak, “Advanced Microprocessors”, McGraw Hill, 1995.*
2. Douglas V. Hall, “Microprocessors and Interfacing – Programming Hardware”, McGraw Hill, 1992.
3. W.A. Tribel& A. Singh, “The 68000 and 68020 Microprocessors – Architecture, Software and Interfacing Techniques”, Prentice hall of India, 1991
4. Rifiquzzaman, “Microprocessors – Theory and Applications: Intel and MotorolaPrentice Hall, 1992.
5. 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: BEC18E11	Subject Name :NANO ELECTRONICS	T / L/ ETL	L	T/SLr	P/R	C
	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 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	2	3
CO2	3	3	3	3	3	3	2	3	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	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E11	NANO ELECTRONICS	3 0/0 0/0 3

UNIT I INTRODUCTION TO NANOELECTRONICS 9 Hrs

Microelectronics towards biomolecule electronics-Particles and waves- Wave-particle duality- Wave mechanics- Schrödinger wave equation- Wave mechanics of particles: – Atoms and atomic orbitals- Materials for nanoelectronics- Semiconductors- Crystal lattices: Bonding in crystals- Electron energy bands- Semiconductor heterostructures- Lattice-matched and pseudomorphic heterostructures- Inorganic-organic heterostructures- Carbon nanomaterials: nanotubes and fullerenes

UNIT II FABRICATION AND MEASUREMENT TECHNIQUES 9 Hrs

Growth, fabrication, and measurement techniques for nanostructures- Bulk crystal and heterostructure growth- Nanolithography, etching, and other means for fabrication of nanostructures and nanodevices- Techniques for characterization of nanostructures- Spontaneous formation and ordering of nanostructures- Clusters and nanocrystals- Methods of nanotube growth- Chemical and biological methods for nanoscale fabrication- Fabrication of nano-electromechanical systems

UNIT III PROPERTIES 9 Hrs

Dielectrics-Ferroelectrics-Electronic Properties and Quantum Effects-Magneto electronics – Magnetism and Magneto transport in Layered Structures-Organic Molecules – Electronic Structures, Properties, and Reactions-Neurons – The Molecular Basis of their Electrical Excitability-Circuit and System Design- Analysis by Diffraction and Fluorescence Methods-Scanning Probe Techniques

UNIT IV NANO STRUCTURE DEVICES 9 Hrs

Electron transport in semiconductors and nanostructures- Time and length scales of the electrons in solids- Statistics of the electrons in solids and nanostructures- Density of states of electrons in nanostructures- Electron transport in nanostructures-Electrons in traditional low-dimensional structures- 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 LOGIC DEVICES AND APPLICATIONS 9 Hrs

Logic Devices-Silicon MOSFETs-Ferroelectric Field Effect Transistors-Quantum Transport Devices Based on Resonant Tunneling-Single-Electron Devices for Logic Applications-Superconductor Digital Electronics-Quantum Computing Using Superconductors-Carbon Nanotubes for Data Processing-Molecular Electronics

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. SupriyoDatta,“Lessons from Nanoelectronics: A New Perspective on Transport”, World Scientific2012
3. George W. Hanson,“Fundamentals of Nanoelectronics”, Pearson 2009

REFERENCES:

4. *Korkin, Anatoli; Rosei, Federico (Eds.), “Nanoelectronics and Photonics”,Springer 2008*
5. *Mircea Dragoman, Daniela Dragoman, “Nanoelectronics: principles and devices”, CRC Press 2006*
6. *Karl Goser, Peter Glösekötter, Jan Dienstuhl,“Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices“, Springer 2004*
7. *W. R. Fahrner, Nanotechnology and Nan electronics: Materials, Devices, Measurement Techniques(SpringerVerlag Berlin Heidelberg 2005)*
8. *Mark A. Reed, TakheeLee,“Molecular nanoelectronics”, American Scientific Publishers 2003*
9. Jaap Hoekstra, “Introduction to Nanoelectronic Single-Electron Circuit Design”, Pan Stanford Publishing 2010

Subject Code: BEC18E12	Subject Name : Computer Architecture	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Computer Fundamentals	T	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.

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	1	2	1	1	1	2	1	2
CO2	1	2	2	2	1	1	1	1	1	2	1	2
CO3	1	1	1	2	1	1	1	3	2	2	3	1
CO4	1	1	3	3	1	2	2	2	2	3	2	1
CO5	1	1	1	1	1	1	1	1	2	3	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	2
CO2	1	2	2	2
CO3	1	2	3	1
CO4	1	1	3	1
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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E12	COMPUTER ARCHITECTURE	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.

Subject Code: BEC18E13	**Subject Name :NEXT GENERATION IP NETWORKS**	**T / L/ ETL**	L	T/SLr	P/R	C
	Prerequisite:	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**	**PSO 4**				
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	Practical / Project	Internships / Technical Skills	Soft Skills			
					✓							

BEC18E13	**NEXT GENERATION IP NETWORKS**	**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:

4. *http://www.faqs.org/rfcs/(Unit I, II, III)*
5. *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)*
6. *http://www.icir.org/floyd/red.html (Unit V)*

Department of Electronics and Communication Engineering

Subject Code: BEC18E14	Subject Name : NEURAL NETWORKS AND ITS APPLICATIONS	T / L/ ETL	L	T/SLr	P/R	C
	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 study the various neural network algorithms and its application in pattern recognition.

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

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	Train BPN algorithm.

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	3	2	3
CO2	3	3	2	2	1	1	1	1	2	3	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	3	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	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E14	NEURAL NETWORKS AND ITS APPLICATIONS	3	0/0	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 CASE STUDY **9 Hrs**

Implementation of BPN Algorithm in a Computer Language - Application of Neural Networks for Pattern Recognition - Data Comparison - Hopfield Networks for an n-bit A/D Converter

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.

References:

1. *Martin T. Hagan, Howard B. Demuth "Neural Networks Design",2nd Edition, Martin Hagan, 2014*
2. *Simon Haykin, "Neural Networks and Learning Machines" -3/E - Pearson/ Prentice Hall 2009*

Subject Code: BEC18E15	Subject Name : OPTICAL COMMUNICATION	T / L/ ETL	L	T/SLr	P/R	C
	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 elements of optical fiber transmission link, types of fibers, Slicing and connectors.
- To understand the different kind of loss and system design consideration.
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers.
- To learn the fiber optical receivers such as PIN, APD diodes, noise performance in photo detector, receiver operation and configuration.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Analyze the various optical laws and its properties
CO2	Explain any types of fibers.
CO3	Describe studys optical system design by losses in fiber.
CO4	Compare newer technique for designing optical sources
CO5	Design efficient optical detectors considering the 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	2	2	3	2	1	3	2	3
CO2	3	2	1	2	2	1	2	3	2	3	3	3
CO3	3	1	1	3	2	1	2	1	1	3	2	2
CO4	3	1	1	3	2	1	2	1	1	3	2	2
CO5	3	3	3	3	3	1	2	3	3	3	3	3

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

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

Category	Basic Sciences	Engineering Sciences	Humanities and Social	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E15	OPTICAL COMMUNICATION	3	0/0	0/0	3

UNIT I I OPTICS **9 Hrs**

Reflection-Refraction – Diffraction – Laws of Reflection – Laws of Refraction – Critical Angle- Total Internal Reflection –Focusing, Imaging –Basics of Mirrors and Lenses – Chromatic and Spherical Telescopes

UNIT II OPTICAL FIBERS **9 Hrs**

The General System – Evolution of Fiber Optical System – Elements of an Optical Fiber Transmission Link – Cylindrical Fiber – Single Mode Fibers and Multimode Fibers - Fiber Splicing and Connectors

UNIT III OPTICAL LOSSES AND DESIGN **9 Hrs**

Absorption Losses, Scattering Losses – Bending Losses – Core and Cladding Losses – Signal Distortion in SM Fibers - Point to Point Links – System Design Consideration — Line Power Budget – Rise Time Budget.

UNIT IV OPTICAL SOURCES **9 Hrs**

Direct and Indirect Band Gap Material – LED Structures - LED Power and Efficiency – Modulation – Laser Diodes Structures and Radiation Pattern – Single Mode Lasers – Modulation of Laser Diodes.

UNIT V OPTICAL DETECTORS **9 Hrs**

PIN and APD Diodes – Photo Detector Noise, SNR, Detector Response Time, Avalanche Multiplication Noise – Comparison of Photo Detectors – Fundamentals Receiver Operation – FET Pre-amplifiers

Practical component P: Include case studies / application scenarios

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

Total Number of Hours: 45

Textbooks:

1. Gerd Keiser, "*Optical Fiber Communication System*", McGraw Hill, International, Singapore 3rd ed., 2000.
2. John M. Senior, "*Optical Fiber Communication principles and practice*", Prentice Hall of India private limited, 1996.
3. Rajiv Ramaswami and Kumar N. Sivarajan, "*A Practical Perspective*", Harcourt Asia Ptv Ltd., Second Edition, 2004.

Reference Books:

1. *J. Gower, "Optical communication system", Prentice Hall of India, 2001.*
2. *Govind P. Agrawal "Fiber-Optic Communication Systems", Wiley India 3rd Edition*
3. *C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks: Concept, Design and Algorithms", Prentice Hall of India, Ist Edition, 2002. 54*
4. *P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.*
5. *Biswanath Mukherjee, "Optical WDM Networks", Springer Series, 2006.*
6. *https://ocw.mit.edu/courses/mechanical-engineering/2-71-optics-spring-2009/lecture-slides/*

Subject Code: BEC18E16	Subject Name :Radar and Navigational Aids	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Engineering Physics	T	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	1	2
CO2	2	3	2	1	1	1	1	1	1	3	1	3
CO3	1	2	2	2	2	2	2	2	2	3	2	1
CO4	1	2	2	2	2	2	2	2	2	3	2	1
CO5	1	1	1	1	1	2	1	1	1	3	1	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E16	RADAR AND NAVIGATIONAL AIDS	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

Subject Code: BEC18E17	**Subject Name : Advanced Digital System**	**T / L/ ETL**	L	T/SLr	P/R	C
	Prerequisite: Digital Electronics	T	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

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**	**3**	**2**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**1**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E17	ADVANCED DIGITAL SYSTEM	3 0/0 0/03

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: BEC18E18	Subject Name : Embedded System	T / L/ ETL	L	T/SLr	P/R	C
	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.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the architecture of 8051 and 68HC11 microcontroller.
CO2	Write simple programs using assembly & C language.
CO3	Comprehend the principle of embedded software development
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	1	1	1	1	2	2	1	1	1	2	1	2
CO2	2	3	2	2	3	1	1	1	3	2	2	2
CO3	2	2	3	3	3	1	1	1	3	2	2	2
CO4	1	3	3	3	3	1	2	2	2	2	2	2
CO5	1	2	3	3	3	2	2	2	3	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	2
CO2	1	2	2	1
CO3	1	2	3	2
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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E18	EMBEDDED SYSTEM	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

Programming of PIC Micro Controllers- Architecture of PIC Micro Controllers - Instruction Set of PIC Micro Controllers. Simple Assembly language and C Program for PIC Microcontroller

UNIT III SOFTWARE DEVELOPMENT 9 Hrs

Software Development: - Quality Programming, Memory Allocation, Self-Documenting Code, Abstraction, Modular Software Development Device Drivers, Threads Recursion

UNIT IV INTERUPPTS AND MEASUREMENTS 9 Hrs

Interfacing method: Blind Cycle Counting Synchronization, Gadfly Synchronization, Printer Interfacing Interrupt Synchronization: Reentrant programming, FIFO Queue, 6811 Interrupts Polled Versus Vectored Interrupts Timing Generation and Measurements: MC8811 Input Capture, Period Measurements, 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. Jonathan.W.Valvano, “Embedded Microcomputer system”, Brooks/COLE Thomson learning series
2. John B Peatman “Design with PIC Microcontroller” Latest Edison

References:

1. *Jonathan.W.Valvano, “Embedded Microcomputer system”, Brooks/COLE Thomson learning series*
2. John B Peatman “Design with PIC Microcontroller” Latest Edison.
3. MykePredko TMH. “Programming and customizing the Microcontroller”

Subject Code: BEC18E19	Subject Name : QUANTUM COMPUTING	T / L/ ETL	L	T/ SLr	P/ R	C
	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 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	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E19	**QUANTUM COMPUTING**	**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: BEC18E20	Subject Name : Power Electronics	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Solid State Devices	T	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	2	2	2	1	2
CO2	3	2	3	3	2	2	2	2	1	2	1	2
CO3	3	3	3	2	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	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E20	POWER ELECTRONICS	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.*
2. Lander,W., “Power Electronics”, McGraw Hill and Company, Third Edition, 1993. 3. P.S. Bimbhra, “Power Electronics”, Khanna Publishers, 3rd Edition, 1999.

ELECTIVE 3 – COMMUNICATION STREAM

Subject Code: BEC18E21	**Subject Name : High Speed Switching Architecture**	**T / L/ ETL**	L	T/SLr	P/R	C
	Prerequisite: Computer 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

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**	**3**	**2**	**2**
CO2	**3**	**3**	**3**	**3**	**2**	**1**	**3**	**3**	**3**	**1**	**3**	**1**
CO3	**2**	**3**	**2**	**1**	**1**	**1**	**2**	**2**	**3**	**2**	**1**	**3**
CO4	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**1**	**3**	**1**	**1**	**3**
CO5	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**2**	**3**	**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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E21	HIGH SPEED SWITCHING ARCHITECTURE	3 0/00/0 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. *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
3. Christopher Y Metz, “Switching protocols & Architectures”, McGraw Hill Professionals publishing, NewYork.1998.

Subject Code: BEC18E22	Subject Name : INFORMATION CODING TECHNIQUES	T / L/ ETL	L	T/SLr	P/R	C
	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	3	3	2	2	2	1	2	1
CO2	3	3	3	3	3	2	2	3	1	2	1	1
CO3	3	3	3	3	3	3	3	2	1	2	3	2
CO4	3	3	3	3	2	3	2	2	2	3	2	1
CO5	3	3	3	2	2	3	2	2	2	2	2	1

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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E22	INFORMATION CODING TECHNIQUES	3 0/0 0/0 3

UNIT I INFORMATION ENTROPY FUNDAMENTALS 9 Hrs

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 9 Hrs

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 9 Hrs

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

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 – Introduction to JPEG standards.

UNIT V AUDIO AND VIDEO CODING 9 Hrs

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: BEC18E23	Subject Name : MICROWAVE ENGINEERING	T / L/ ETL	L	T/SLr	P/R	C
	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 microwave measurements.

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	Develop the concepts of microwave transistors in the fabrication of RF circuits.
CO5	Anallyze the parameters of transmission lines in microwave 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	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	Practical / Project	Internships / Technical Skills	Soft Skills			
					✓							

BEC18E23	MICROWAVE ENGINEERING	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.

UNIT II MICROWAVE GENERATORS 10 Hrs

Limitations of Conventional Tubes at Very High Frequencies – Velocity – Modulated Tubes, Two – 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 .

UNIT III MICROWAVE SOLID-STATE DEVICES 9 Hrs

Varactor Diodes, Manley – Rowe Relations, Low Noise Parametric Amplifiers – Transferred – 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.

UNIT IV MICROWAVE CIRCUITS 8 Hrs

Small – Signal Equivalent Circuits, High-Frequency Applications, Performance Criteria and Limitations of BJTs and FETs – HEMTs – Fabrication Techniques.

UNIT V MICROWAVE MEASUREMENTS 9 Hrs

Slotted - Line Techniques – Measurements of Wavelength – Measurement of Low and High VSWR – 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.

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)

Reference Books:

1. *D.M. Pozer, "Microwave Engineering", Addison – Wesley, 1998.*
2. *R.E. Collins: "Foundations for Microwave Engineering", IEEE Press Second Edition (2002) David K. Cheng," Field and Waves in Electromagnetism", Pearson Education, 1989.*

Subject Code: BEC18E24	Subject Name : Optical Network and Switching Techniques	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Optical 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 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	1	1	3	1	1	1	1	1	1	1	3
CO2	3	3	1	1	1	1	3	1	1	1	3	1
CO3	1	3	3	1	1	3	1	1	1	3	1	1
CO4	1	3	3	1	3	1	3	1	1	3	1	3
CO5	3	1	1	3	1	1	3	1	1	1	1	3

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

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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E24	OPTICAL NETWORK AND SWITCHINGTECHNIQUES	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:

4. *John M. Senior , "Optical Fiber Communication", Second Edition, Pearson Education, 2007.*
5. *Ramaswami, Sivarajan and Sasaki "Optical Networks", Morgan Kaufmann, 2009.*
6. *J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3 rd Edition, 2008.*
7. *J.Gower, "Optical Communication System", Prentice Hall of India, 2001.*
8. *Uyless Black, " Optical Network: Third Generation Transport System",Pearson Education, Ist edition,2002.*
9. Rajiv Ramaswamy and Kumar N.Sivarajan, "Optical Networks – A Practical Persepctive", Morgan Kauffman, 2004

Subject Code: BEC18E25	Subject Name : Device Modeling	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Solid State Devices	T	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

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	2	3	2	3	2
CO2	3	3	3	3	3	2	3	3	2	2	3	3
CO3	3	3	3	3	3	1	3	2	3	1	3	3
CO4	3	3	3	3	3	2	3	3	3	2	3	3
CO5	3	3	3	3	3	2	3	3	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	3	3
CO3	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E25	**DEVICE MODELING**	**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: BEC18E26	Subject Name : VLSI Technology	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Solid State Devices	T	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 transistor & its layout.
CO2	Interpret the interconnection resistance & capacitance & their extraction.
CO3	Learn the distribution of clock signals in a chip.
CO4	Illustrate VLSI implementation of FLC and study about testing techniques.
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	1	3	2	3	3	3	3
CO2	3	3	2	3	3	2	3	2	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3
CO4	3	3	3	3	3	3	3	1	3	2	3	3
CO5	3	3	3	3	3	3	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E26	**VLSI TECHNOLOGY**	**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, Advanced CMOS fabrication technologies, layout design rules-Introduction-Full – custom Mask Layout design – 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 9Hrs

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 9Hrs

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: BEC18E27	Subject Name : Biomedical Instrumentation	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Measurement and Instrumentation, Control Systems	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E27	**BIOMEDICAL INSTRUMENTATION**	**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*

Subject Code:	Subject Name : Embedded Software Design	T / L/ ETL	L	T/SLr	P/R	C
BEC18E28	Prerequisite: Basic C Programming	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	Applying 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	1	1	2	1	1	1	1	1	2
CO2	1	2	2	2	3	1	1	1	1	2	3	2
CO3	1	3	2	3	3	1	1	1	1	2	2	1
CO4	1	3	3	3	3	1	1	2	3	2	2	2
CO5	1	2	3	3	3	2	2	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E28	**Embedded Software Design**	**3 0/0 0/0 3**

UNIT I Introduction to embedded system and data representation **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.

UNIT II Programming in C and assembly Language **9 Hrs**

Integer data types – useful typedefs and defines - manipulating bits in memory and I/O ports – Accessing memory – mapped I/O devices – structures -variant access – programming in assembly – register usage conventions – addressing options – instruction sequencing – procedure call and return – parameter passing – retrieving parameters .

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.

REFERENCES:

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. David E. Simon, “An Embedded Software Primer”, Pearson Education, 2003.

Department of Electronics and Communication Engineering

ELECTIVE 4 – COMMUNICATION STREAM

Subject Code: BEC18E29	Subject Name : Spread Spectrum Communication	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication Theory, Digital Communication	T	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	2	2	1	1	3	2	2	3	2	2
CO2	3	3	2	3	2	3	3	2	2	2	3	2
CO3	3	3	3	3	3	3	2	3	2	3	2	3
CO4	3	3	3	3	2	2	2	1	2	3	3	3
CO5	3	3	3	3	3	3	3	2	3	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	3	2	2
CO3	3	3	3	3
CO4	2	3	3	2
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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E29	**SPREADSPECTRUM COMMUNICATION**	**3**	**0/0**	**0/0**	**3**

UNIT – I INTRODUCTION 9 Hrs

Communication in the presence of pulse noise jamming - Low probability detection scheme - Director Sequence Spread Spectrum (DSSS) and Frequency Hop Spread Spectrum Systems and examples of Spread Spectrum Systems

UNIT – II PERFORMANCE CHARACTERIZATION OF DIGITAL DATA TRANSMISSION 9 Hrs

Detection of binary signals in AWGN - Quadrature multiplexed signaling schemes - Signaling through band limited channels - Equalization of digital data transmission system - Realization imperfections – Degradations in performance.

UNIT – III SPREAD SPECTRUM SYSTEMS 9 Hrs

Direct sequence spread spectrum methods employing BPSK, QPSK and MSK - Frequency Hop spread spectrum methods - Coherent slow frequency Hop technique - Non coherent slow and fast frequency Hop spread spectrum techniques - Hybrid DS/FH spread spectrum - Complex envelope representation of spread spectrum systems.

UNIT – IV BINARY SHIFT REGISTER SEQUENCES FOR SPREAD SPECTRUM SYSTEMS 9 Hrs

Definition - PN sequence generator fundamentals - Maximal length sequences - Properties, Power spectrum and Polynomial tables for maximal length sequences - Gold codes - Rapid Acquisition systems - Non-linear code generators.

UNIT – V SYNCHRONIZATION OF SPREAD SPECTRUM SYSTEMS: 9 Hrs

Optimal tracking of wideband signals - Early-late tracking loops - Code tracking loops for FHSS - Optimum synchronization techniques - Multiple dwell and sequential detectors - Synchronization using a matched filter - Synchronization by estimating the received spreading code.

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.

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: BEC18E30	Subject Name : Network Management	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Computer Networks	T	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	1	1	3
CO2	3	3	1	1	3	1	1	1	1	1	1	1
CO3	3	3	1	3	3	1	1	1	1	1	1	1
CO4	1	3	1	3	1	1	2	1	1	1	1	1
CO5	1	3	3	1	1	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E30	NETWORK MANAGEMENT	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 OSI NETWORK MANAGEMENT 9Hrs

OSI Network management model – Organizational model – Information model, communication model. Abstract Syntax Notation – Encoding structure, Macros Functional model CMIP / CMIS

UNIT – III INTERNET MANAGEMENT (SNMP) 9Hrs

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
2.Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management", Eastern

REFERENCES:

1. *Mani Subramaniyan, "Network Management Principles and Practice", Addison Wesly.Newyork 2000*
2.Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management", Eastern
3. Economy Edition IEEE, Press, New Delhi-1999
4. Salah Aiiarous, Thomas Plevayk, "Telecommunications Network Management Technologies and Implementations", eastern Economy Edition IEEE press, New Delhi. 1998

Subject Code: BEC18E31	Subject Name :Satellite Communication	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication Systems	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	1	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	1	2	3	1	2
CO5	3	3	3	2	3	2	2	1	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	3	3	3	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	3	3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E31	SATELLITE COMMUNICATION	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. A. 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: BEC18E32	Subject Name :Operating Mobile Communication	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: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 make the students learn the concepts of basic cellular communication
- To learn about the various propagation models
- To develop mobile applications and design a M2M communication

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describe basic wireless systems and standards
CO2	Discuss cellular concepts in designing a mobile communication system
CO3	Explain various propagation models and multipath fading channels
CO4	Apply the OS fundamentals to develop native applications
CO5	Design a M2M communication for latest IOS 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	1	2	1	1	1	1	1	2
CO2	1	3	3	3	1	1	2	2	1	2	2	1
CO3	3	1	3	1	2	1	1	1	2	1	2	1
CO4	1	3	3	3	3	1	2	1	1	2	1	2
CO5	2	3	3	3	3	2	1	2	2	1	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	2	2
CO2	3	3	2	1
CO3	3	3	1	1
CO4	3	2	2	2
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	Practical / Project	Internships / Technical Skills	Soft Skills			
					✓							

BEC18E32	OPERATING MOBILE COMMUNICATION	3 0/0 0/0 3

UNIT I INTRODUCTION TO WIRELESS SYSTEMS AND STANDARDS 9Hrs

Introduction to wireless communication: Evolution of mobile communications, mobile radio systems-Examples, trends in cellular radio and personal communications. 2G, EDGE, 3G, 4G (LTE) and 5G, VoIP, Wi-Fi and Bluetooth, Wireless Networks and Standards, WLL, Blue tooth. AMPS, GSM, IS-95 and DECT

UNIT II CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS 9Hrs

Cellular Concept: Frequency reuse, channel assignment, hand off, Interference and system capacity, tracking and grade of service, Improving Coverage and capacity in Cellular systems.

UNIT III MOBILE RADIO PROPAGATION 9Hrs

Free space propagation model, reflection, diffraction, scattering, link budget design, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Impulse model, Small scale Multipath measurements, parameters of Mobile multipath channels, types of small scale fading, statistical models for multipath fading channels.

UNIT IV OPERATING SYSTEM 9Hrs

Different OS Platforms - Windows, Android, iOS; Process for Software OS installation – Requirements for testing - Native applications – Secured environment

UNIT V M2M Communication 9Hrs

Low Power and Battery Operated IOT Communication, Bluetooth Low Energy (BLE), Zigbee, Z-Wave, LoRa, Narrow Band-Internet Of Things(NB-IOT), Cat-M/LTE-M

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.S.Rappaport, “Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.
2. ArashHabibi Lashkari, Mohammadreza Moradhaseli,“ Mobile Operating Systems and Programming : Mobile Communications “VDM Verilag Dr. Müller (July 7, 2011),

REFERENCES:

1.*R. Blake, “ Wireless Communication Technology”, Thomson Delmar, 2003.*
2. W.C.Y.Lee, "Mobile Communications Engineering: Theory and applications, Second Edition, McGraw-Hill International, 1998.
3. Stephen G. Wilson, “Digital Modulation and Coding”, Pearson Education, 2003.
4. https://www.iotforall.com/cellular-iot-explained-nb-iot-vs-lte-m/

Subject Code: BEC18E33	Subject Name : Introduction to MEMS System Design	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Electronic Circuits	T	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E33	INTRODUCTION TO MEMS SYSTEM DESIGN	30/0 0/03

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: BEC18E34	Subject Name : Analysis and Design of Analog Ic's	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Solid State Devices	T	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 design and analyze various analog circuits using op-amps and IC's

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Know the operating principle of linear ICs.
CO2	Analyze the frequency response of operational amplifier
CO3	Illustrate the concepts for design of analog multiplier and PLL.
CO4	Examine MOS amplifiers
CO5	Design a switched capacitor filter.

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	3	2	2
CO2	3	3	3	3	3	3	2	2	3	2	2	1
CO3	3	3	3	3	3	3	3	2	2	2	2	2
CO4	3	3	3	3	3	2	3	3	1	2	2	2
CO5	3	3	3	3	2	3	3	2	2	1	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	2	2
CO3	3	3	3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E34	ANALYSIS AND DESIGN OF ANALOG IC'S	3 0/00/03

UNIT I CIRCUIT CONFIGURATION FOR LINEAR IC 13 Hrs

Current Sources, Analysis of Difference Amplifiers with Active load, Supply and Temperature Independent Biasing Technique Voltage References.

UNIT II OPERATIONAL AMPLIFIERS 10 Hrs

Analysis of Operational Amplifier Circuits, Slew Rate Model and High Frequency Analysis, Operational Amplifier Noise Analysis.

UNIT III ANALOG MULTIPLIER AND PLL 10 Hrs

Analysis of four Quadrant and Variable Trans-conductance Multiplier, Voltage Controlled Oscillator, Closed loop Analysis of PLL.

UNIT IV MOS ANALOG ICS 6 Hrs

Design of MOS Operational Amplifier, MOS Power Amplifier.

UNIT V MOS SWITCHED CAPACITOR FILTERS 6 Hrs

Design Techniques for Switched Capacitor Filter.

Practical component P : Include case studies / application scenarios

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

Total Number of Hours: 45

Textbooks:

1. BehazadRazavi, "Principles of Data Conversion System Design", S.Chand& Company Ltd, 2000.
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. *Roy chowdhary, "Linear integrated circuit"*

Subject Code: BEC18E35	Subject Name :Cyber Physical System	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Basic 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 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 CPS in control system.
CO4	Apply formal methods for safety of CPS.
CO5	Deploy secures 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	1	2
CO2	1	3	3	3	3	1	1	1	2	1	1	1
CO3	3	1	3	3	1	1	1	2	1	1	2	1
CO4	1	3	3	3	1	2	1	1	1	1	1	2
CO5	1	1	1	1	1	1	1	1	1	2	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	1	3	1	2
CO3	3	1	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E35	CYBER PHYSICAL SYSTEM	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 9 Hrs

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. 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: BEC18E36	Subject Name : Digital Control System	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Control System	T	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E36	Digital Control System	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.*

Subject Code: BEC18E37	Subject Name : Electromagnetic Interference and Compatibility	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Electromagnetic fields	T	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 :

1. To understand EMI Sources, EMI problems and their solution methods in PCB level / Subsystem and system level design.
2. 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	1	2	1	3
CO2	3	2	1	2	2	2	2	2	1	3	1	2
CO3	2	2	3	2	2	3	2	3	2	3	3	2
CO4	1	2	3	3	3	2	2	2	1	3	2	2
CO5	2	2	3	2	2	2	2	2	2	2	1	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E37	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	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: BEC18E38	Subject Name : Advanced Concepts in Signal Processing	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Digital Signal Processing	T	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	Study the basics 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.
CO5	Learn interpolation, decimation & 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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E38	ADVANCED CONCEPTS IN SIGNAL PROCESSING	3 0/0 0/03

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 f 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: BEC18E39	Subject Name : ULTRA WIDE BAND COMMUNICATION	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Optical 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	1	1	3	3	2	1	3	2	1	3	2	3
CO2	1	1	3	2	2	1	2	3	1	3	3	3
CO3	3	3	3	3	2	1	2	1	1	3	2	2
CO4	3	3	3	3	2	1	2	1	1	1	1	1
CO5	3	3	3	3	3	1	2	3	3	1	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	2	2
CO2	1	3	3	2
CO3	2	3	1	1
CO4	2	3	1	2
CO5	1	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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E39	ULTRA WIDE BAND COMMUNICATION	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 MC - UWB RECEIVER DESIGN 9 Hrs

I CarrierInterferometry(CI) UWB Receivers- Frequency Hopped(FH) UWB Receivers - OFDM - UWB Receivers - Spectral Encoded UWB Communication System - Methods of Improving Range of UWB using RAKE Receivers - Overview of UWB Simulation techniques.

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 Ben Allen (Editor), Mischa Dohler (Editor), Ernest Okon (Editor), Wasim Malik (Editor), Anthony Brown (Editor), David Edwards

Subject Code: BEC18E40	Subject Name : UNDER WATER ACOUSTIC SIGNAL PROCESSING	T / L/ ETL	L	T/SLr	P/R	C
	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 for detecting submarines
CO5	Perceive the architecture of ADSP 218x and TMS 320c541x

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	2	2	2	3
CO2	3	3	3	3	3	3	3	3	2	2	2	3
CO3	3	3	3	3	3	3	3	3	2	2	2	3
CO4	3	3	3	3	3	3	3	3	2	2	2	3
CO5	3	1	1	1	1	1	1	1	1	1	1	1

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	1	1	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	Practical / Project	Internships / Technical Skills	Soft Skills			
					✓							

BEC18E40	**UNDERWATER ACOUSTIC SIGNAL PROCESSING**	**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.*

Subject Code: **BEC18CE1**	**Subject Name : Sensors and its Applications**	**T / L/ ETL**	L	T/SLr	P/R	C
	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

OBJECTIVE :

- To equip the students with fundamentals of sensors, types, characteristics, properties and its applications.

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

CO1	Elaborate the concepts of sensor and its characteristics
CO2	Interpret the sensor properties and principles sensors
CO3	Distinguish the working of different types of sensors
CO4	Analyze and implement sensors in diverse networks
CO5	Integrate 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**	**1**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**
CO2	**1**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**2**	**3**	**2**	**1**	**2**	**1**	**2**	**2**	**2**	**1**
CO4	**1**	**1**	**3**	**3**	**3**	**1**	**2**	**1**	**2**	**2**	**2**	**1**
CO5	**1**	**1**	**3**	**3**	**3**	**1**	**3**	**1**	**2**	**2**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18CE1	SENSOR AND ITS APPLICATIONS	3 0/0 0/0 3

UNIT I SENSOR FUNDAMENTALS AND CHARACTERISTICS 9 Hrs

Basic Sensor Technology - Sensor Systems - Sensor Characteristics - Signals, and Systems - Sensor Classification - Transfer Function - Span (Full-Scale Input) - Full-Scale Output – Accuracy- Calibration - -Calibration Error –Hysteresis – Nonlinearity - Saturation

UNIT II SENSOR PROPERTIES AND PRINCIPLES 9 Hrs

Repeatability - Dead Band – Resolution -Special Properties - Output Impedance - Excitation .- Dynamic Characteristics - Environmental Factors – Reliability- Electric Charges, Fields, and Potentials - Capacitance – Magnetism – Induction – Resistance - Piezoelectric Effect- Mechanical Elements - Thermal Elements - Electrical Elements - Application Characteristic - Uncertainty

UNIT III NANO SENSORS 9 Hrs

Temperature Sensors, Smoke Sensors, Sensors for aerospace and defense: Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, Nano-cutting tools, Integration of sensor with actuators and electronic circuitry Biosensors.

UNIT IV SYSTEM AND SENSOR NETWORKS 9 Hrs

Measurement Techniques to Improve the Accuracy of Smart Sensor Systems
Implementation of Neural Net in Continuous Analog Circuitry A Demonstration System for a New Time-Triggered Sensor Network

UNIT V APPLICATIONS 9 Hrs

Mobility Monitoring Using Mobile Telephony A Combined Sensor Incorporating Real-Time DSP for the Imaging of Concrete Reinforcement and Corrosion Visualization, Optimization of Erbium-Doped Fiber Lasers and Their Sensor Applications The Development of a Robust, Autonomous Sensor Network Platform for Environmental Monitoring

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. 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. *Ian Sinclair , “ Sensors and Transducers” eBook ISBN: 9780080516998*
2. *Hardcover ISBN: 9780750649322Kourosh Kalantar – Zadeh, Benjamin Fry, “Nanotechnology-*
3. *Enabled Sensors”, Springer,*
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.*
6. *Vijay.K.Varadan, Linfeng Chen, Sivathanupillai, “Nanotechnology Engineering in Nano and Biomedicine”, John Wiley & Sons, 2010.*

Subject Code: BEC18CE2	Subject Name : CRYPTOGRAPHY AND NETWORK SECURITY	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Computer 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	1	3	3	2	3
CO2	3	3	3	3	3	3	1	2	2	3	3	3
CO3	3	3	3	3	2	3	1	2	3	3	2	3
CO4	3	2	3	3	3	3	2	2	1	3	2	3
CO5	3	3	3	3	3	3	2	3	3	3	3	2

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	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18CE2	**CRYPTOGRAPHY AND NETWORK SECURITY**	**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.*

Department of Electronics and Communication Engineering

LAB BASED ON ELECTIVES

Subject Code: BEC18L14	**Subject Name :Microprocessor and Microcontroller Lab**	**T / L/ ETL**	L	T/SLr	P/R	C
	Prerequisite: Microprocessor and Microcontroller	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 introduce the basic concepts of microprocessor and to develop students in the assembly language programming skills, applications of microprocessor and microcontroller

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Write assembly language programming in 8085 and 8086 microprocessor
CO2	Interface peripherals with 8086 microprocessor
CO3	Understand the 8051 ALP and implement stepper motor control using the concepts.

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**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L14	**Microprocessor and Microcontroller Lab**	**0 0/0 3/0 1**

8086 MICROPROCESSOR:

1. BASIC ARITHMETIC AND LOGICAL OPERATIONS (8085 & 8086)
2. AVERAGE OF N NUMBERS
3. SORTING AND SEARCHING
4. SQUARE AND SQUARE ROOT OF A GIVEN NUMBER
5. CODE CONVERSION
6. BLOCK MOVEMENT OF DATA

INTERFACING WITH 8086 MICROPROCESSOR:

1. WAVE FORM GENERATION USING 8255 PPI
2. KEYBOARD AND DISPLAY INTERFACE
3. MATRIX DISPLAY
4. TRAFFIC LIGHT CONTROLLER
5. ADC AND DAC INTERFACING
6. SERIAL PORT COMMUNICATION

8051 MICROCONTROLLER

1. BASIC ARITHMETIC AND LOGICAL OPERATIONS
2. SQUARE AND SQUARE ROOT OF A GIVEN NUMBER
3. 2'S COMPLEMENT OF A GIVEN NUMBER
4. AVERAGE OF N NUMBERS
5. STEPPER MOTOR CONTROL

References:

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

Department of Electronics and Communication Engineering

Subject Code: BEC18L15	Subject Name : BASICS OF ROBOTICS LAB	T / L/ ETL	L	T/SLr	P/R	C
	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.

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

CO1	Identify the configurations of various types of robots.
CO2	Understanding the components of robots like arms, linkages, drive systems and end effectors.
CO3	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	2	2	3	3	3	2	2	3	2	2	3	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3
CO3	3	3	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	3	3	3

3/2/1 indicates Strength of Corr3elation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L15	**BASICS OF ROBOTICS LAB**	**0 0/0 3/0 1**

LIST OF EXPERIMENTS

1. SIMPLE 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. INTERFACING SWITCH TO TURN ON BAR GRAPH LEDS. (IMPLEMENTING A "PUSH TO ON" INDICATOR)
8. LCD INTERFACING TO DISPLAY ALPHANUMERIC CHARACTERS.
9. LCD INTERFACING TO DISPLAYING INTEGER VALUES ON THE LCD.
10. GENERATION OF DELAY USING TIMER AND TURNING 'ON' THE BUZZER
11. INDICATION OF THE VALUE OF COUNTER ON LCD
12. DC MOTOR INTERFACING

References:

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

Subject Code: BEC18L16	Subject Name : C++ AND DATA STRUCTURES LAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: 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 :

- To implement different oops concepts practically.
- To implement stacks and queues programmatically.
- To implement different types of linked lists.
- To implement different tree concepts.
- To perform sorting using various types of algorithms.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Develop basic C++ programs to access arrays using control statements
CO2	Construct code using functions and initialize objects using constructor destructor
CO3	Formulate programs to implement stack and queue using array and pointers
CO4	Write programs to execute single and double linked list
CO5	Create various sorting and tree traversal algorithms to solve 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	3	3	2	2	3	3	2	2	3
CO2	3	3	3	3	3	2	2	2	3	2	2	3
CO3	3	3	3	3	3	2	2	2	3	2	2	3
CO4	3	3	3	3	3	3	2	2	3	2	2	2
CO5	3	3	3	3	3	3	2	2	3	2	2	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	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L16	**C++ and Data Structures Lab**	**00/0 3/0 1**

LIST OF EXPERIMENTS

1. IMPLEMENTATION OF CONTROL STATEMENTS
2. IMPLEMENTATION OF ARRAYS (SINGLE AND MULTI-DIMENSIONAL)
3. IMPLEMENTATION OF CONSTRUCTOR AND DESTRUCTOR
4. IMPLEMENTATION OF OVERLOADING FUNCTIONS.
5. CONCEPT OF INHERITANCE
6. IMPLEMENTATION OF STACK (USING ARRAYS AND POINTERS)
7. IMPLEMENTATION OF QUEUE (USING ARRAYS AND POINTERS)
8. SINGLE LINKED LIST
9. DOUBLY LINKED LIST
10. BINARY TREE TRAVERSALS
11. BINARY SEARCH TREE
12. QUICK SORT
13. HEAP SORT
14. MERGE SORT

References:

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

Department of Electronics and Communication Engineering

Subject Code: BEC18L17	Subject Name :Antenna & Wave Propagation Lab	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Antenna & Wave Propagation	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 analyze study and plot the radiation patterns of different categories of antennas used in various telecommunications based applications.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Analyze and plot the radiation pattern of simple dipole, half wave dipole and folded dipole antenna.
CO2	Discuss and plot the radiation pattern of 5 element Yagi Uda, log periodic helical antennas..
CO3	Describe and plot the radiation of and different types of antenna array parabolic antenna and analyze various types of parabolic reflectors with their feed systems antenna array.

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	2	2	1	2	2
CO2	2	3	3	3	3	1	1	2	2	2	1	1
CO3	3	3	3	2	3	1	1	1	1	1	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	3	3	2	1
CO3	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L17	**ANTENNA & WAVE PROPOGATION LAB**	**0 0/0 3/0 1**

LIST OF EXPERIMENTS

1. TO STUDY AND PLOT THE RADIATION PATTERN OF SIMPLE DIPOLE ANTENNA.

2. TO STUDY AND PLOT THE RADIATION PATTERN OF HALF WAVE DIPOLE ANTENNA.

3. TO STUDY AND PLOT THE RADIATION PATTERN OF FOLDED DIPOLE ANTENNA.

4. TO STUDY AND PLOT THE RADIATION PATTERN OF 5 ELEMENT YAGI UDA ANTENNA.

5. TO STUDY AND PLOT THE RADIATION PATTERN OF LOG PERIODIC ANTENNA.

6. TO STUDY AND PLOT THE RADIATION PATTERN OF HELICAL ANTENNA.

7. TO STUDY AND PLOT THE RADIATION PATTERN OF CUT PARABOLIC ANTENNA WITH SIMPLE DIPOLE FEED.

8. TO STUDY VARIOUS TYPES OF PARABOLIC REFLECTORS AND THEIR FEED SYSTEMS.

9. TO STUDY AND PLOT THE RADIATION PATTERN OF BROAD SIDE ANTENNA ARRAY.

10. TO STUDY AND PLOT THE RADIATION PATTERN OF END FIRE ANTENNA ARRAY.

References:

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

Department of Electronics and Communication Engineering

Subject Code: BEC18L18	Subject Name : Telecommunication Switching Systems Lab	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication 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

OBJECTIVE :

- To motivate the students about the practical applications of telecommunication switching systems

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Demonstrate the operation of EPABX system
CO2	Analyze the different modulation and multiple access techniques
CO3	Develop a program to digitize audio signals

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	2	1	1	1	1	1	2
CO2	2	2	2	3	3	1	2	2	2	2	2	3
CO3	2	2	3	3	3	2	2	3	1	2	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	2
CO2	2	3	2	3
CO3	1	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L18	**Telecommunication Switching Systems Lab**	**0 0/0 3/0 1**

STUDY OF EPABX SYSTEM AND ITS FEATURES.

1. TO PERFORM PCM.
2. TO PERFORM SIMULATION OF FDMA
3. TO WRITE AND ANALYZE TRAFFIC MEASUREMENT.
4. TO STUDY ,PERFORM SOUND ,SPEECH ,DIALER AND KEY BOARD MATRIX SECTION OF TELEPHONE
5. TO STUDY, PERFORM VOLTAGE DROPPER, LINE IN/PROTECTOR AND RINGER SECTION OF TELEPHONE.
6. TO IMPLEMENT A BASIC SWITCHING SYSTEM USING SIMULINK.
7. SIMULATION OF TIME SLOT INTERCHANGE ALGORITHM
8. TO PERFORM DIGITIZATION OF SPEECH SIGNAL BY WRITING PROGRAM IN SCILAB / MATLAB.
9. TO STUDY AND PERFORM TDM PCM

References:

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

Subject Code: BEC18L19	Subject Name : Audio Signal Processing Lab	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication Laboratory	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 give students a hands on experience in audio processing and its usage in real time scenarios.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Using MATLAB estimate pitch and harmonic noise ratio in audio signals
CO2	Apply Fourier transform and Chroma features for analyzing audio signals.
CO3	Examine the enhancement of speech signal using microphone arrays.
CO4	Tabulate the results for audio signal experiments using statistical method

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	1	2	2	2	2	2	2	2
CO2	3	3	2	3	1	2	2	2	2	2	2	2
CO3	3	3	2	3	2	2	2	2	2	2	2	2
CO4	3	3	1	3	1	2	1	2	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	2	2
CO3	3	3	2	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	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L19	**Audio Signal Processing Lab**	**0 0/0 3/0 1**

1. BASICS OF MATLAB
2. PITCH ESTIMATION AND HARMONIC TO NOISE RATIO ESTIMATION
3. SHORT-TIME FOURIER TRANSFORM AND CHROMA FEATURES
4. SPEECH ANALYSIS
5. SPEECH ENHANCEMENT USING MICROPHONE ARRAYS
6. STATISTICAL METHODS FOR AUDIO EXPERIMENTS

References:

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

Department of Electronics and Communication Engineering

OPEN ELECTIVES LIST

Subject Code: BEC18OE1	**Subject Name : Internet of Things and its Applications**	**T / L/ ETL**	L	T/SLr	P/R	C
	Prerequisite:: Internet of Things	T	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**	**PO 3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO 8**	**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**	**2**	**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	Practical / Project	Internships / Technical Skills	Soft Skills			
						✓						

BEC18OE1	**INTERNET OF THINGS AND ITS APPLICATIONS**	**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.*

Department of Electronics and Communication Engineering

Subject Code: BEC18OE2	Subject Name : Cellular Mobile Communication	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication system, Computer 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 :

- 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	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

BEC18OE2	**CELLULAR MOBILE COMMUNICATION**	**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 9 Hrs

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.*
4. *Dharma P. Agarwal," Introduction to wireless and Mobile systems", Thomson Learning, II Edition, 2006*

Subject Code: BEC18OE3	Subject Name : Satellite and its Applications	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Satellite 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 basics of spacecraft subsystem
- To understand the operation of domestic satellite system
- To apply the principle of satellite in remote sensing technology

COURSE OUTCOMES (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

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	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

3/2/1 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	Practical / Project	Internships / Technical Skills	Soft Skills			
						✓						

BEC18OE3	SATELLITE AND ITS APPLICATIONS	3 0/0 0/0 3

UNIT I ELEMENTS OF ORBITAL MECHANICS 9 Hrs

Kepler's laws of planetary motion - Newton's laws of gravitation- Orbital Equation- Orbital Elements- Orbital Perturbation; Tracking and Orbital Determination- Orbital Correction / Control

UNIT IIELEMENTS OF SATELLITE SYSTEM 9 Hrs

Space Environment- Spacecraft Configuration- Spacecraft Subsystem- Payload- Reliability Consideration – Spacecraft Integration and Testing.

UNIT III DOMESTIC SATELLITE SYSTEMS AND LAUNCH VEHICLES 9 Hrs

The INSAT System- International System: INTELSAT- IMMARSAT- Satellite Based Personal Communication- LEO- MEO- GEO Systems- PSLV and GSLV

UNIT IVEARTH 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 VAPPLICATIONS OF SATELLITES 9 Hrs

Satellite Broadcasting- Satellite TV Systems.Remote sensing satellites - satellite remote sensing in various important 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 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. A. 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 Systems Design Principles" Macmillan Press Ltd.Second Edition 2003.
4. http://www.ceinsys.com/blog/applications-of-satellite-imagery-remote-sensing-data/

Department of Electronics and Communication Engineering

Subject Code: BEC18OE4	Subject Name : Fundamentals of Sensors	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: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 :

- 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	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

BEC18OE4	FUNDAMENTALS OF SENSORS	30/0 0/0 3

UNITI SENSOR FUNDAMENTALS **9 Hrs**

Basic Sensor Technology - Sensor Systems - Sensor Characteristics - Signals, and Systems - Sensor Classification

UNITII SENSOR CHARACTERISTICS **9 Hrs**

Transfer Function - Span (Full-Scale Input) - Full-Scale Output – Accuracy- Calibration --Calibration Error –Hysteresis – Nonlinearity - Saturation

UNITIII SENSOR PROPERTIES **9 Hrs**

Repeatability - Dead Band – Resolution -Special Properties - Output Impedance - Excitation .- Dynamic Characteristics - Environmental Factors - Reliability

UNITIV PHYSICAL PRINCIPLES OF SENSING **9 Hrs**

Electric Charges, Fields, and Potentials - Capacitance – Magnetism – Induction – Resistance - Piezoelectric Effect -

UNITV SENSOR ELEMENTS **9 Hrs**

Mechanical Elements - Thermal Elements - Electrical Elements - Application Characteristic - Uncertainty

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

REFERENCE BOOK:

1) Ian Sinclair , “ Sensors and Transducers” eBook ISBN: 9780080516998 Hardcover ISBN: 9780750649322

Subject Code: BEC18OE5	Subject Name : Basics of Microprocessor and Microcontroller	T / L/ ETL	L	T/SLr	P/R	C
	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 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	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						
Approval												

BEC18OE5	**BASICS OF MICROPROCESSOR AND MICROCONTROLLER**	**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 IV8051 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: BEC18OE6	Subject Name : Industry 4.0 Concepts	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Sensors	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	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical skill	Soft Skills			
						✓						

BEC18OE6	**INDUSTRY 4.0 CONCEPTS**	**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" , Createspace*Independent Pub (US)

OPEN LAB

Subject Code: BEC18OL1	**Subject Name : Sensors and IoT Lab**	**T / L/ ETL**	L	T/SLr	P/R	C
	Prerequisite: Inernet of Things	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	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18OL1	SENSORS AND IOT LAB	0 0/0 3/01

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.

References:

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

Subject Code: BEC18OL2	Subject Name : Robotics Control Lab	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: Robotics	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	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18OL2	**ROBOTICS CONTROL LAB**	**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

References:

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

Subject Code: BEC18OL3	Subject Name : Basics of MATLAB	T / L/ ETL	L	T/SLr	P/R	C
	Prerequisite: 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 :

- 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		H	M	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18OL3	BASICS OF MATLAB	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

References:

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