CURRICULUM AND SYLLABUS

(R2018)

B–FACT: Bharath -**F**lexible **A**ccommodative **C**hoice Based Credit System For **T**echnology

(Applicable to the batches admitted from July 2018)

B.Tech –ELECTRONICS AND COMMUNICATION ENGINEERING (FULL TIME)

I – VIII SEMESTERS

SEMESTER I								
Sl. No.	**Course Code**	**Category**	**Course Title**	**Contact Period**	**L**	**T**	**P**	**C**
THEORY								
1	U18HSEN101	HS	Communicative English	4	2	0	2	3
2	U18BSMA101	BS	Engineering Mathematics - I	4	3	1	0	4
3	U18BSPH101	BS	Waves and Optics	3	3	0	0	3
4	U18BSCH101	BS	Engineering Chemistry	3	3	0	0	3
5	U18ESEE101	ES	Basic Electrical and Electronics Engineering	3	0	0	3	3
6	U18BSBT101	BS	Biology for Engineers	2	2	0	0	2
PRACTICAL								
7	*U18BSPH2L2	BS	Wave Optics and Semi Conductor Physics Lab	3	0	0	3	0
8	*U18BSCH2L4	BS	Chemistry Lab	3	0	0	3	0
9	U18ESME1L2	ES	Workshop/Manufacturing Practices Laboratory	5	1	0	4	3
10	U18ESEE1L3	ES	Basic Electrical and Electronics Engineering Practices Laboratory	3	0	0	3	1.5
ACTIVITY BASED COURSES								
11	U18MCAB203	MC	Yoga	2	0	0	2	0
12	U18MCAB204	MC	Physical health – NCC	2	0	0	2	0
Total				37	14	1	22	22.5

***Laboratory Classes will be conducted on alternative weeks for Physics and Chemistry. The Lab Practical Examinations will be held only in the second semester (including the first semester experiments).**

SEMESTER II								
Sl. No.	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18HSEN201	HS	Technical English	3	2	1	0	3
2	U18BSMA201	BS	Engineering Mathematics II	4	3	1	0	4
3	U18BSPH202	BS	Semi Conductor Physics	3	3	0	0	3
4	U18BSCH201	BS	Environmental Sciences	3	3	0	0	3
5	U18ESCS101	ES	Problem Solving and Python Programming	3	3	0	0	3
6	U18ESME101	ES	Engineering Graphics & Design	5	1	0	4	3
PRACTICAL								
7	*U18BSPH2L2	BS	Wave Optics and Semi Conductor Physics Lab	3	0	0	3	1.5
8	*U18BSCH2L4	BS	Chemistry Lab	3	0	0	3	1.5
9	U18ESCS1L1	ES	Problem Solving and Python Programming Lab	3	0	0	3	1.5
ACTIVITY BASED COURSES								
10	U18MCAB101	MC	Physical health – Sports & Games	2	0	0	2	0
11	U18MCAB102	MC	Gardening & Tree Plantation	2	0	0	2	0
			Total	34	15	2	17	23.5

***Laboratory Classes will be conducted on alternative weeks for Physics and Chemistry. The Lab Practical Examinations will be held only in the second semester (including the first semester experiments).**

SEMESTER III								
Sl. No	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18BSMA301	BS	Transforms and Partial Differential equation	4	3	1	0	4
2	U18PCEC301	PC	Signals and Systems	4	3	1	0	4
3	U18PCEC302	PC	Digital System design	3	3	0	0	3
4	U18PCEC303	PC	Electronic Devices	3	3	0	0	3
5.	U18PCEC304	PC	Network Theory	3	3	0	0	3
6	U18HSEC301	HS	Professional Ethics	3	3	0	0	3
PRACTICAL								
7	U18PCEC3L1	PC	Electronic devices Lab	2	0	0	2	1
8	U18PCEC3L2	PC	Digital System design lab	2	0	0	2	1
ACTIVITY BASED COURSES								
9	U18MCAB305	MC	Culture- Learning an art form	2	0	0	2	0
10	U18MCAB306	MC	Culture – Intangible Cultural, heritage (festivals, Food ways, Local games)	2	0	0	2	0
			Total	28	18	2	8	22

SEMESTER IV								
Sl. No	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18BSMA404	BS	Probability and Stochastic Process	4	3	1	0	4
2	U18PCEC401	PC	Analog and Digital Communication	3	3	0	0	3
3	U18PCEC402	PC	Analog Circuits	3	3	0	0	3
4	U18PCEC403	PC	Microcontrollers	3	3	0	0	3
5.	U18PCEC404	PC	Electromagnetic Waves	3	3	0	0	3
6	U18ESCS401	ES	Object Oriented Programming and Data Structures	3	3	0	0	3
7	U18MCTH502	MC	Universal Human Values	2	2	0	0	0
8	U18HSBA401	HS	Organizational Behavior	3	3	0	0	3
PRACTICAL								
9	U18PCEC4L1	PC	Analog and Digital communication Lab	2	0	0	2	1
10	U18PCEC4L2	PC	Microcontrollers Lab	2	0	0	2	1
11	U18PCEC4L3	PC	Analog Circuits Lab	2	0	0	2	1
ACTIVITY BASED COURSES								
11	U18MCAB407	MC	Literature & Media – Literature, Cinema & Media	2	0	0	2	0
12	U18MCAB408	MC	Literature & Media – Group Reading of Classics	2	0	0	2	0
			Total	34	23	1	10	25

SEMESTER V								
Sl. No	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18PCEC501	PC	Digital Signal Processing	4	3	1	0	4
2	U18PCEC502	PC	Transmission lines and waveguides	4	3	1	0	4
3	U18PCEC503	PC	Antennas and Propagation	4	3	1	0	4
4	U18PCEC504	PC	Microwave theory and techniques	4	3	1	0	4
5.		PE	Professional Elective-I	3	3	0	0	3
6	U18MCTH401	MC	Constitution of India	2	2	0		0
PRACTICAL								
8	U18PCEC5L1	PC	Digital Signal Processing	2	0	0	2	1
9	U18PCEC5L2	PC	Microwave Engineering Lab	2	0	0	2	1
ACTIVITY BASED COURSES								
10	U18MCAB509	MC	Social Services – Social Awareness	2	0	0	2	0
11	U18MCAB510	MC	Social Services – NSS	2	0	0	2	0
			Total	29	17	4	8	21

SEMESTER VI								
S.NO	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18PCEC601	PC	Control System	4	3	1	0	4
2	U18PCEC602	PC	Computer Network	3	3	0	0	3
3	U18PCEC603	PC	Biomedical Instrumentation	3	3	0	0	3
4		PE	Professional Elective-II	3	3	0	0	3
5.		OE	Open Elective-I	3	3	0	0	3
PRACTICAL								
7	U18PCEC6L1	PC	Computer Networks Lab	2	0	0	2	1
8	U18PCEC6L2	PC	Electronic Measurement Lab	2	0	0	2	1
9	U18EEEC6L3	EE	Electronic Design Project	4	0	0	4	2
ACTIVITY BASED COURSES								
10	U18MCAB611	MC	Self-Development – Spiritual, Mindfulness & Meditation	2	0	0	2	0
11	U18MCAB612	MC	Self-Development - religion and Inter-faith	2	0	0	2	0
			Total	28	15	1	2	20

SEMESTER VII								
Sl. No.	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18PCEC701	PC	Embedded Systems	3	3	0	0	3
2		PE	Professional Elective-III	3	3	0	0	3
3		PE	Professional Elective-IV	3	3	0	0	3
4		PE	Professional Elective- V	3	3	0	0	3
5		PE	Professional Elective-VI	3	3	0	0	3
6	U18MCTH603	MC	Essence of Indian Knowledge Tradition	2	2	0	0	0
PRACTICAL								
7	U18EEEC7P1	EE	Project Stage-I	6	0	0	6	3
ACTIVITY BASED COURSES								
8	U18MCAB713	MC	Behavioral and interpersonal skills	2	0	0	2	0
9	U18MCAB714	MC	Nature – Nature club	2	0	0	2	0
			Total	27	17	0	10	18

SEMESTER VIII								
S. No	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1		OE	Open Elective- II	3	3	0	0	3
2		OE	Open Elective- III	3	3	0	0	3
3		OE	Open Elective-IV(MOOC)	2	2	0	0	2
PRACTICAL								
4	U18EEEC8P2	EE	Project Stage-II	18	0	0	18	9
ACTIVITY BASED COURSES								
5	U18MCAB815	MC	Innovation – Project based – Sc., Tech, Social, Design & Innovation	2	0	0	2	0
			Total	28	8	0	20	17

Total No of Credits in the Programme: 169

Total No of Contacts in the Programme: 245

LIST OF PROFESSIONAL ELECTIVES

Professional Elective –I

S. NO	Course Code	Specialization	Course Title		L	T	P	C
1	U18PEEC011	Communication Engineering	Information Theory and Coding		3	0	0	3
2	U18PEEC012	Signal processing	Speech and Audio Processing		3	0	0	3
3	U18PEEC013	Networking	Cellular Mobile Communication		3	0	0	3
4	U18PEEC014	VLSI design	FPGA and System on Chip Design		3	0	0	3
5	U18PEEC015	Embedded system	Design of Semiconductor Memories		3	0	0	3
6	U18PEEC016	Signal processing	Mixed Signal Design		3	0	0	3

Professional Elective –II

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC021	Communication Engineering	Error Correcting Codes	3	0	0	3
2	U18PEEC022	Networking	Wireless Communication Networks	3	0	0	3
3	U18PEEC023	Networking	Wireless Sensor Networks	3	0	0	3
4	U18PEEC024	Embedded system	ASIC Design	3	0	0	3
5	U18PEEC025	VLSI design	Testing and Verification of Electronic Circuits	3	0	0	3
6	U18PEEC026	Signal processing	Statistical Signal Processing	3	0	0	3

Professional Elective –III

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC031	Communication Engineering	Cognitive radio	3	0	0	3
2	U18PEEC032	Communication Engineering	Ultra-wideband Communication	3	0	0	3
3	U18PEEC033	Networking	Broadband Network	3	0	0	3
4	U18PEEC034	Networking	Network Services	3	0	0	3
5	U18PEEC035	Embedded Systems	Internet of Things and Machine learning	3	0	0	3
6	U18PEEC036	VLSI design	System Modeling and Design	3	0	0	3
7	U18PEEC037	Signal Processing	Adaptive Signal Processing	3	0	0	3

Professional Elective -IV

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC041	Communication Engineering	Cryptography and Network Security	3	0	0	3
2	U18PEEC042	Networking	Routing Protocols	3	0	0	3
3	U18PEEC043	Embedded Systems	Robotics and Automation	3	0	0	3
4	U18PEEC044	VLSI Design	Nano Electronics	3	0	0	3
5	U18PEEC045	Signal Processing	Wavelets	3	0	0	3
6	U18PEEC046	Signal Processing	Pattern Recognition and Neural Networks	3	0	0	3

Professional Elective -V

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC051	Communication Engineering	Satellite Communication	3	0	0	3
2	U18PEEC052	Networking	High Performance Communication and Networks	3	0	0	3
3	U18PEEC053	Embedded System	Real Time Systems	3	0	0	3
4	U18PEEC054	VLSI design	Digital Hardware Design	3	0	0	3
5	U18PEEC055	Signal Processing	Medical Image Processing	3	0	0	3
6	U18PEEC056	Signal processing	Digital Image & Video Processing	3	0	0	3

Professional Elective -VI

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC061	Communication Engineering	RF Communication Circuits	3	0	0	3
2	U18PEEC062	Communication Engineering	Telecom Networks	3	0	0	3
3	U18PEEC063	Networking	Wireless Adhoc Networks	3	0	0	3
4	U18PEEC064	Embedded system	Embedded C and LINUX	3	0	0	3
5	U18PEEC065	VLSI design	High Speed Electronics	3	0	0	3
6	U18PEEC066	Signal processing	Multimedia Compression and Communication	3	0	0	3

LIST OF OPEN ELECTIVES COMMON TO ALL B.Tech PROGRAMMES ALL THE COURSES WITH L=3, T=0, P=0 & C=3

1. U18oeBA001 Sociology
2. U18OEBA002-Lean Six Sigma
3. U18OEBA003-Cyber Law and Ethics
4. U18OEBA004-Economic Policies in India
5. U18OEBA005-Management Information System
6. Total Engineering Quality Management
7. U18OEBA007-Industrial Psychology
8. U18OEBA008-Entrepreneurship Development and IPR
9. U18OEBA009-Intellectual Property Rights
10. U18OEBA010-Engineering Economics and Cost Analysis
11. U18OEEN001- Soft Skills and Interpersonal Communication
12. U18OEEN002-Indian Writing in English
13. U18OEEN003-Creative Writing
14. U18OEEN004- Proficiency in English and Accent Training
15. U18OEMA001-Cryptography
16. U18OEMA002-Finite Automata Theory / Formal Languages
17. U18OEMA003-Linear Programming
18. U18OECE001 - Metro Systems and Engineering
19. U18OECE002-Pollution Regulations
20 U18OECE003-Road Safety
21. U18OECE004- Infrastructure Development
22. U18OECE005- Project Safety Management
23. U18OECE006- Environment, Health and Safety in Industries
24. U18OEME001-Design for Manufacturing and Assembly
25. U18OEME002Industrial Safety
26. U18OEME003-Refrigeration and Cryogenics
27. U18OEME004- Product Design and Development
28. U18OEAU001-Electric and Hybrid Vehicles
29. U18OEAU002-Intelligent Transportation System
30. U18OEAU003-Vibration and Noise Control
31. U18OEAU004-Automotive Sensors and Applications
32. U18OEMT001-MEMS and Nano Technology
33. U18OEMT002-Non-Destructive Testing
34. U18OEMT003-Bio Mechatronics
35. U18OEMT004-Artificial Intelligence for Robotics
36. U18OEAE001-Industrial Aerodynamics
37. U18OEAE002- Elements of Aeronautics and Astronautics
38. U18OEAE003- Unmanned Aerial Vehicle

39. U18OEAE004- Introduction to Avionics
40. U18OEAE005-Rocket Propulsion
41. U18OEEE001-Green Technologies
42. U18OEEE002-Electrical Safety and Quality Assurance
43. U18OEEE003-Energy Conservation Techniques
44. U18OEEE004-PLC and SCADA for Industrial
45. U18OEEC-001-Communication Systems
46. U18OEEC-002-VLSI circuits
47. U18OEEC-003-Image Processing Techniques
48. U18OEEC-004-Communication Networks
49. U18OEEC-005-An Introduction to DSP
50. U18OEEC-006-Basics of IoT
51. U18OEBM001-Medical Radiation Safety Engineering
52. U18OEBM002-Medical Waste Management
53. U18OEBM003-Quality Control in Healthcare
54. U18OEBM004-Wearable Technology
55. U18OEEI001-Analytical Methods and Instrumentation
56. U18OEEI002-Introduction to process Data Analytics
57. U18OEEI003-Reliability and Safety in Process industries
58. U18OEEI004-Multi sensor data fusion
59. U18OEBT001- Bioprocess Economics & Plant Design
60. U18OEBT002-Brewing technology
61. U18OEBT003-Biomining
62. U18OEBT004-Industrial Safety Engineering
63. U18OEAC001-Geo- informatics for Precision Farming
64. U18OEAC002-Livestock and poultry management
65. U18OEAC003-Extension methodologies and transfer of Agricultural Technologies
66. U18OEAC004-Soil and Water Conservation Engineering
67. U18OEIT001-Block Chain Technology
68. U18OEIT002-Semantic Web
69. U18OEIT003-Entrepreneurship Development
70. U18OEIT004-Ethical Hacking Techniques
71. U18OECS004-Mobile Application Development
72. U18OECS005-System Modelling and Simulation
73. U18OECS006-Web Programming
74. U18OECS007-Virtual Reality
75. U18OECS008- E Commerce
76. U18OEGE001-Metagenomics and Epigenomics
77. U18OEGE002-Molecular Genetics and Genomics
78. U18OEGE003-Principles of Molecular cell biology

CURRICULUM AND SYLLABUS

(R2018)

B–FACT: Bharath -**F**lexible **A**ccommodative **C**hoice Based Credit System For **T**echnology

(Applicable to the batches admitted from July 2018)

B.Tech –ELECTRONICS AND COMMUNICATION ENGINEERING (FULL TIME)

I – VIII SEMESTERS

SEMESTER I								
Sl. No.	**Course Code**	**Category**	**Course Title**	**Contact Period**	**L**	**T**	**P**	**C**
THEORY								
1	U18HSEN101	HS	Communicative English	4	2	0	2	3
2	U18BSMA101	BS	Engineering Mathematics - I	4	3	1	0	4
3	U18BSPH101	BS	Waves and Optics	3	3	0	0	3
4	U18BSCH101	BS	Engineering Chemistry	3	3	0	0	3
5	U18ESEE101	ES	Basic Electrical and Electronics Engineering	3	0	0	3	3
6	U18BSBT101	BS	Biology for Engineers	2	2	0	0	2
PRACTICAL								
7	*U18BSPH2L2	BS	Wave Optics and Semi Conductor Physics Lab	3	0	0	3	0
8	*U18BSCH2L4	BS	Chemistry Lab	3	0	0	3	0
9	U18ESME1L2	ES	Workshop/Manufacturing Practices Laboratory	5	1	0	4	3
10	U18ESEE1L3	ES	Basic Electrical and Electronics Engineering Practices Laboratory	3	0	0	3	1.5
ACTIVITY BASED COURSES								
11	U18MCAB203	MC	Yoga	2	0	0	2	0
12	U18MCAB204	MC	Physical health – NCC	2	0	0	2	0
Total				37	14	1	22	22.5

***Laboratory Classes will be conducted on alternative weeks for Physics and Chemistry. The Lab Practical Examinations will be held only in the second semester (including the first semester experiments).**

SEMESTER II								
Sl. No.	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18HSEN201	HS	Technical English	3	2	1	0	3
2	U18BSMA201	BS	Engineering Mathematics II	4	3	1	0	4
3	U18BSPH202	BS	Semi Conductor Physics	3	3	0	0	3
4	U18BSCH201	BS	Environmental Sciences	3	3	0	0	3
5	U18ESCS101	ES	Problem Solving and Python Programming	3	3	0	0	3
6	U18ESME101	ES	Engineering Graphics & Design	5	1	0	4	3
PRACTICAL								
7	*U18BSPH2L2	BS	Wave Optics and Semi Conductor Physics Lab	3	0	0	3	1.5
8	*U18BSCH2L4	BS	Chemistry Lab	3	0	0	3	1.5
9	U18ESCS1L1	ES	Problem Solving and Python Programming Lab	3	0	0	3	1.5
ACTIVITY BASED COURSES								
10	U18MCAB101	MC	Physical health – Sports & Games	2	0	0	2	0
11	U18MCAB102	MC	Gardening & Tree Plantation	2	0	0	2	0
			Total	34	15	2	17	23.5

***Laboratory Classes will be conducted on alternative weeks for Physics and Chemistry. The Lab Practical Examinations will be held only in the second semester (including the first semester experiments).**

SEMESTER III								
Sl. No	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18BSMA301	BS	Transforms and Partial Differential equation	4	3	1	0	4
2	U18PCEC301	PC	Signals and Systems	4	3	1	0	4
3	U18PCEC302	PC	Digital System design	3	3	0	0	3
4	U18PCEC303	PC	Electronic Devices	3	3	0	0	3
5.	U18PCEC304	PC	Network Theory	3	3	0	0	3
6	U18HSEC301	HS	Professional Ethics	3	3	0	0	3
PRACTICAL								
7	U18PCEC3L1	PC	Electronic devices Lab	2	0	0	2	1
8	U18PCEC3L2	PC	Digital System design lab	2	0	0	2	1
ACTIVITY BASED COURSES								
9	U18MCAB305	MC	Culture- Learning an art form	2	0	0	2	0
10	U18MCAB306	MC	Culture – Intangible Cultural, heritage (festivals, Food ways, Local games)	2	0	0	2	0
			Total	28	18	2	8	22

SEMESTER IV								
Sl. No	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18BSMA404	BS	Probability and Stochastic Process	4	3	1	0	4
2	U18PCEC401	PC	Analog and Digital Communication	3	3	0	0	3
3	U18PCEC402	PC	Analog Circuits	3	3	0	0	3
4	U18PCEC403	PC	Microcontrollers	3	3	0	0	3
5.	U18PCEC404	PC	Electromagnetic Waves	3	3	0	0	3
6	U18ESCS401	ES	Object Oriented Programming and Data Structures	3	3	0	0	3
7	U18MCTH502	MC	Universal Human Values	2	2	0	0	0
8	U18HSBA401	HS	Organizational Behavior	3	3	0	0	3
PRACTICAL								
9	U18PCEC4L1	PC	Analog and Digital communication Lab	2	0	0	2	1
10	U18PCEC4L2	PC	Microcontrollers Lab	2	0	0	2	1
11	U18PCEC4L3	PC	Analog Circuits Lab	2	0	0	2	1
ACTIVITY BASED COURSES								
11	U18MCAB407	MC	Literature & Media – Literature, Cinema & Media	2	0	0	2	0
12	U18MCAB408	MC	Literature & Media – Group Reading of Classics	2	0	0	2	0
			Total	34	23	1	10	25

SEMESTER V								
Sl. No	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18PCEC501	PC	Digital Signal Processing	4	3	1	0	4
2	U18PCEC502	PC	Transmission lines and waveguides	4	3	1	0	4
3	U18PCEC503	PC	Antennas and Propagation	4	3	1	0	4
4	U18PCEC504	PC	Microwave theory and techniques	4	3	1	0	4
5.		PE	Professional Elective-I	3	3	0	0	3
6	U18MCTH401	MC	Constitution of India	2	2	0		0
PRACTICAL								
8	U18PCEC5L1	PC	Digital Signal Processing	2	0	0	2	1
9	U18PCEC5L2	PC	Microwave Engineering Lab	2	0	0	2	1
ACTIVITY BASED COURSES								
10	U18MCAB509	MC	Social Services – Social Awareness	2	0	0	2	0
11	U18MCAB510	MC	Social Services – NSS	2	0	0	2	0
			Total	29	17	4	8	21

SEMESTER VI								
S.NO	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18PCEC601	PC	Control System	4	3	1	0	4
2	U18PCEC602	PC	Computer Network	3	3	0	0	3
3	U18PCEC603	PC	Biomedical Instrumentation	3	3	0	0	3
4		PE	Professional Elective-II	3	3	0	0	3
5.		OE	Open Elective-I	3	3	0	0	3
PRACTICAL								
7	U18PCEC6L1	PC	Computer Networks Lab	2	0	0	2	1
8	U18PCEC6L2	PC	Electronic Measurement Lab	2	0	0	2	1
9	U18EEEC6L3	EE	Electronic Design Project	4	0	0	4	2
ACTIVITY BASED COURSES								
10	U18MCAB611	MC	Self-Development – Spiritual, Mindfulness & Meditation	2	0	0	2	0
11	U18MCAB612	MC	Self-Development - religion and Inter-faith	2	0	0	2	0
			Total	28	15	1	2	20

SEMESTER VII								
Sl. No.	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1	U18PCEC701	PC	Embedded Systems	3	3	0	0	3
2		PE	Professional Elective-III	3	3	0	0	3
3		PE	Professional Elective-IV	3	3	0	0	3
4		PE	Professional Elective- V	3	3	0	0	3
5		PE	Professional Elective-VI	3	3	0	0	3
6	U18MCTH603	MC	Essence of Indian Knowledge Tradition	2	2	0	0	0
PRACTICAL								
7	U18EEEC7P1	EE	Project Stage-I	6	0	0	6	3
ACTIVITY BASED COURSES								
8	U18MCAB713	MC	Behavioral and interpersonal skills	2	0	0	2	0
9	U18MCAB714	MC	Nature – Nature club	2	0	0	2	0
			Total	27	17	0	10	18

SEMESTER VIII								
S. No	**Code No.**	**Category**	**Course Title**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY								
1		OE	Open Elective- II	3	3	0	0	3
2		OE	Open Elective- III	3	3	0	0	3
3		OE	Open Elective-IV(MOOC)	2	2	0	0	2
PRACTICAL								
4	U18EEEC8P2	EE	Project Stage-II	18	0	0	18	9
ACTIVITY BASED COURSES								
5	U18MCAB815	MC	Innovation – Project based – Sc., Tech, Social, Design & Innovation	2	0	0	2	0
			Total	28	8	0	20	17

Total No of Credits in the Programme: 169

Total No of Contacts in the Programme: 245

LIST OF PROFESSIONAL ELECTIVES

Professional Elective –I

S. NO	Course Code	Specialization	Course Title		L	T	P	C
1	U18PEEC011	Communication Engineering	Information Theory and Coding		3	0	0	3
2	U18PEEC012	Signal processing	Speech and Audio Processing		3	0	0	3
3	U18PEEC013	Networking	Cellular Mobile Communication		3	0	0	3
4	U18PEEC014	VLSI design	FPGA and System on Chip Design		3	0	0	3
5	U18PEEC015	Embedded system	Design of Semiconductor Memories		3	0	0	3
6	U18PEEC016	Signal processing	Mixed Signal Design		3	0	0	3

Professional Elective –II

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC021	Communication Engineering	Error Correcting Codes	3	0	0	3
2	U18PEEC022	Networking	Wireless Communication Networks	3	0	0	3
3	U18PEEC023	Networking	Wireless Sensor Networks	3	0	0	3
4	U18PEEC024	Embedded system	ASIC Design	3	0	0	3
5	U18PEEC025	VLSI design	Testing and Verification of Electronic Circuits	3	0	0	3
6	U18PEEC026	Signal processing	Statistical Signal Processing	3	0	0	3

Professional Elective –III

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC031	Communication Engineering	Cognitive radio	3	0	0	3
2	U18PEEC032	Communication Engineering	Ultra-wideband Communication	3	0	0	3
3	U18PEEC033	Networking	Broadband Network	3	0	0	3
4	U18PEEC034	Networking	Network Services	3	0	0	3
5	U18PEEC035	Embedded Systems	Internet of Things and Machine learning	3	0	0	3
6	U18PEEC036	VLSI design	System Modeling and Design	3	0	0	3
7	U18PEEC037	Signal Processing	Adaptive Signal Processing	3	0	0	3

Professional Elective -IV

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC041	Communication Engineering	Cryptography and Network Security	3	0	0	3
2	U18PEEC042	Networking	Routing Protocols	3	0	0	3
3	U18PEEC043	Embedded Systems	Robotics and Automation	3	0	0	3
4	U18PEEC044	VLSI Design	Nano Electronics	3	0	0	3
5	U18PEEC045	Signal Processing	Wavelets	3	0	0	3
6	U18PEEC046	Signal Processing	Pattern Recognition and Neural Networks	3	0	0	3

Professional Elective -V

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC051	Communication Engineering	Satellite Communication	3	0	0	3
2	U18PEEC052	Networking	High Performance Communication and Networks	3	0	0	3
3	U18PEEC053	Embedded System	Real Time Systems	3	0	0	3
4	U18PEEC054	VLSI design	Digital Hardware Design	3	0	0	3
5	U18PEEC055	Signal Processing	Medical Image Processing	3	0	0	3
6	U18PEEC056	Signal processing	Digital Image & Video Processing	3	0	0	3

Professional Elective -VI

S. NO	Course Code	Specialization	Course Title	L	T	P	C
1	U18PEEC061	Communication Engineering	RF Communication Circuits	3	0	0	3
2	U18PEEC062	Communication Engineering	Telecom Networks	3	0	0	3
3	U18PEEC063	Networking	Wireless Adhoc Networks	3	0	0	3
4	U18PEEC064	Embedded system	Embedded C and LINUX	3	0	0	3
5	U18PEEC065	VLSI design	High Speed Electronics	3	0	0	3
6	U18PEEC066	Signal processing	Multimedia Compression and Communication	3	0	0	3

LIST OF OPEN ELECTIVES COMMON TO ALL B.Tech PROGRAMMES ALL THE COURSES WITH L=3, T=0, P=0 & C=3

18. U18oeBA001 Sociology
19. U18OEBA002-Lean Six Sigma
20. U18OEBA003-Cyber Law and Ethics
21. U18OEBA004-Economic Policies in India
22. U18OEBA005-Management Information System
23. Total Engineering Quality Management
24. U18OEBA007-Industrial Psychology
25. U18OEBA008-Entrepreneurship Development and IPR
26. U18OEBA009-Intellectual Property Rights
27. U18OEBA010-Engineering Economics and Cost Analysis
28. U18OEEN001- Soft Skills and Interpersonal Communication
29. U18OEEN002-Indian Writing in English
30. U18OEEN003-Creative Writing
31. U18OEEN004- Proficiency in English and Accent Training
32. U18OEMA001-Cryptography
33. U18OEMA002-Finite Automata Theory / Formal Languages
34. U18OEMA003-Linear Programming

18.U18OECE001 - Metro Systems and Engineering

19. U18OECE002-Pollution Regulations

20 U18OECE003-Road Safety

79. U18OECE004- Infrastructure Development

80. U18OECE005-
    Project Safety
    Management
81. U18OECE006-
    Environment, Health
    and Safety in Industries
82. U18OEME001-
    Design for
    Manufacturing
    and Assembly
83. U18OEME002Industrial Safety
84. U18OEME003-
    Refrigeration and
    Cryogenics
85. U18OEME004-
    Product Design and
    Development
86. U18OEAU001-
    Electric and Hybrid
    Vehicles
87. U18OEAU00
    2-Intelligent
    Transportatio
    n System
88. U18OEAU003-
    Vibration and Noise
    Control
89. U18OEAU004-
    Automotive Sensors
    and Applications
90. U18OEMT001-
    MEMS and Nano
    Technology
91. U18OEMT002-
    Non-Destructive
    Testing
92. U18OEMT003-Bio Mechatronics
93. U18OEMT004-Artificial
    Intelligence for Robotics
94. U18OEAE001-Industrial
    Aerodynamics
95. U18OEAE002- Elements of
    Aeronautics and Astronautics
96. U18OEAE003- Unmanned Aerial
    Vehicle

97. U18OEAE004- Introduction to Avionics
98. U18OEAE005-Rocket Propulsion
99. U18OEEE001-Green Technologies
100. U18OEEE002-Electrical Safety and Quality Assurance
101. U18OEEE003-Energy Conservation Techniques
102. U18OEEE004-PLC and SCADA for Industrial
103. U18OEEC-001-Communication Systems
104. U18OEEC-002-VLSI circuits
105. U18OEEC-003-Image Processing Techniques
106. U18OEEC-004-Communication Networks
107. U18OEEC-005-An Introduction to DSP
108. U18OEEC-006-Basics of IoT
109. U18OEBM001-Medical Radiation Safety Engineering
110. U18OEBM002-Medical Waste Management
111. U18OEBM003-Quality Control in Healthcare
112. U18OEBM004-Wearable Technology
113. U18OEEI001-Analytical Methods and Instrumentation
114. U18OEEI002-Introduction to process Data Analytics
115. U18OEEI003-Reliability and Safety in Process industries
116. U18OEEI004-Multi sensor data fusion
117. U18OEBT001- Bioprocess Economics & Plant Design
118. U18OEBT002-Brewing technology
119. U18OEBT003-Biomining
120. U18OEBT004-Industrial Safety Engineering
121. U18OEAC001-Geo-informatics for Precision Farming
122. U18OEAC002-Livestock and poultry management
123. U18OEAC003-Extension methodologies and transfer of Agricultural Technologies
124. U18OEAC004-Soil and Water Conservation Engineering
125. U18OEIT001-Block Chain Technology
126. U18OEIT002-Semantic Web
127. U18OEIT003-Entrepreneurship Development
128. U18OEIT004-Ethical Hacking Techniques
129. U18OECS004-Mobile Application Development
130. U18OECS005-System Modelling and Simulation
131. U18OECS006-Web Programming
132. U18OECS007-Virtual Reality
133. U18OECS008- E Commerce
134. U18OEGE001-Metagenomics and Epigenomics
135. U18OEGE002-Molecular Genetics and Genomics
136. U18OEGE003-Principles of Molecular cell biology

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LIST OF COURSES CATEGORYWISE

HUMANITIES AND SOCIAL STUDIES INCLUDING MANAGEMENT COURSES (HS)

S. No	Code No.	Course Title	Contact Periods	L	T	P	C
1	U18HSEN101	Communicative English	4	2	0	2	3
2	U18HSEN201	Technical English	3	2	1	0	3
3	U18HSEC301	Professional Ethics	3	3	0	0	3
4	U18HSBA401	Organizational Behavior	3	3	0	0	3
Total Credit							12

MATHS & BASIC SCIENCES (BS)

S. No	Code No	Course Title	Contact Periods	L	T	P	C
1	U18BSMA101	Engineering Mathematics – I	4	3	1	0	4
2	U18BSPH101	Waves and Optics	3	3	0	0	3
3	U18BSCH101	Engineering Chemistry	3	3	0	0	3
4	U18BSBT101	Biology for Engineers	2	2	0	0	2
5	*U18BSPH2L2	Wave Optics and Semi Conductor Physics Lab	3	0	0	3	0
6	*U18BSCH2L4	Chemistry Lab	3	0	0	3	0
7	U18BSMA201	Engineering Mathematics II	4	3	1	0	4
8	U18BSPH202	Semi Conductor Physics	3	3	0	0	3
9	U18BSCH201	Environmental Sciences	3	3	0	0	3
10	*U18BSPH2L2	Wave Optics and Semi Conductor Physics Lab	3	0	0	3	1.5
11	*U18BSCH2L4	Chemistry Lab	3	0	0	3	1.5
12	U18BSMA301	Transforms and Partial Differential equation	4	3	1	0	4
13	U18BSMA405	Probability and Stochastic Process	3	3	0	0	3
Total Credits							32

ENGINEERING SCIENCES (ES)

S. No	Code No.	Course Title	Contact Periods	L	T	P	C
1	U18ESEE101	Basic Electrical and Electronics Engineering	3	0	0	3	3
2	U18ESME1L2	Workshop/Manufacturing Practices Laboratory	5	1	0	4	3
3	U18ESEE1L3	Basic Electrical and Electronics Engineering Practices Laboratory	3	0	0	3	1.5
4	U18ESCS101	Problem Solving and Python Programming	3	3	0	0	3

5	U18ESME101	Engineering Graphics & Design	5	1	0	4	3
6	U18ESCS1L1	Problem Solving and Python Programming Lab	3	0	0	3	1.5
7	U18ESCS401	Object Oriented Programming and Data Structures	3	3	0	0	3
Total Credits							18

PROFESSIONAL CORE (PC)

S. No	Code No.	Course Title	Contact Periods	L	T	P	C
1	U18PCEC301	Signals and Systems	4	3	1	0	4
2	U18PCEC302	Digital System design	3	3	0	0	3
3	U18PCEC303	Electronic Devices	3	3	0	0	3
4	U18PCEC304	Network Theory	3	3	0	0	3
5	U18PCEC401	Analog and Digital Communication	4	3	1	0	3
6	U18PCEC402	Analog Circuits	3	3	0	0	3
7	U18PCEC403	Microcontrollers	3	3	0	0	3
8	U18PCEC404	Electromagnetic Waves	3	3	0	0	3
9	U18PCEC501	Digital Signal Processing	4	3	1	0	4
10	U18PCEC502	Transmission lines and waveguides	4	3	1	0	4
11	U18PCEC503	Antennas and Propagation	4	3	1	0	4
12	U18PCEC504	Microwave theory and techniques	4	3	1	0	4
13	U18PCEC601	Control System	4	3	1	0	4
14	U18PCEC602	Computer Network	3	3	0	0	3
15	U18ESEC603	Biomedical Instrumentation	3	3	0	0	3
16	U18PCEC701	Embedded System	3	0	0	3	3
1	U18PCEC3L1	Electronic devices Lab	2	0	0	2	1
2	U18PCEC3L2	Digital System design lab	2	0	0	2	1
3	U18PCEC4L1	Analog and Digital communication Lab	2	0	0	2	1
4	U18PCEC4L2	Microcontrollers Lab	2	0	0	2	1
5	U18PCEC4L3	Analog Circuits Lab	2	0	0	2	1
6	U18PCEC5L1	Digital Signal Processing Lab	2	0	0	2	1
7	U18PCEC5L2	Microwave Engineering Lab	2	0	0	2	1
8	U18PCEC6L1	Computer Networks Lab	3	0	0	2	1
9	U18PCEC6L2	Electronic Measurement Lab	2	0	0	2	1
Total Credits							63

EMPLOYABILITY ENHANCEMENT (EE) COURSES

1	U18EEEC6L3	Electronic Design Project	4	0	0	4	2
2	U18EEEC7P1	Project Stage-I	6	0	0	6	3
3	U18EEEC8P2	Project Stage-II	18	0	0	18	9
Total Credits							14

MANDATORY COURSES (MC)

S.No	Code No.	Course Title	Contact Periods	L	T	P	C
1	U18MCTH502	Universal Human Values	2	2	0	0	0
2	U18MCTH401	Constitution of India	2	2	0	0	0
3	U18MCTH603	Essence of Indian Knowledge Tradition	2	2	0	0	0
1	U18MCAB203	Yoga	2	0	0	2	0
2	U18MCAB204	Physical health – NCC	2	0	0	2	0
3	U18MCAB101	Physical health – Sports & Games	2	0	0	2	0
4	U18MCAB102	Gardening & Tree Plantation	2	0	0	2	0
5	U18MCAB305	Culture- Learning an art form	2	0	0	2	0
6	U18MCAB306	Culture – Intangible Cultural, heritage (festivals, Food ways, Local games)	2	0	0	2	0
7	U18MCAB407	Literature & Media – Literature, Cinema & Media	2	0	0	2	0
8	U18MCAB408	Literature & Media – Group Reading of Classics	2	0	0	2	0
9	U18MCAB509	Social Services – Social Awareness	2	0	0	2	0
10	U18MCAB510	Social Services – NSS	2	0	0	2	0
11	U18MCAB611	Self-Development – Spiritual, Mindfulness & Meditation	2	0	0	2	0
12	U18MCAB612	Self-Development - religion and Inter-faith	2	0	0	2	0
13	U18MCAB613	Behavioral and interpersonal skills	2	0	0	2	0
14	U18MCAB614	Nature – Nature club	2	0	0	2	0
15	U18MCAB815	Innovation – Project based – Sc., Tech, Social, Design & Innovation	2	0	0	2	0
Total Contact Periods 36							

Summary of Credit Distribution

S. No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences including Management courses (HS)	3	3	3	3	-	-	-	-	12	7.10
2	Maths & Basic Sciences (BS)	12	13	4	4	-	-	-	-	33	19.53
3	Engineering Sciences (ES)	7.5	7.5	-	3	-	-	-	-	18	10.65
4	Professional Core (PC)	-	-	15	15	18	12	3	-	63	37.29
5	Professional Electives (PE)	-	-	-	-	3	3	12	-	18	10.65
6	Employment Enhancement Courses (EE)	-	-	-	-	-	2	3	9	14	8.28
7	Open Electives (OE)	-	-	-	-	-	3	-	6	9	5.33
8	Massive Open Online Course (MOOC)								2	2	1.18
9	Mandatory courses (MC)									0	
	Total Credit	22.5	23.5	22	25	21	20	18	17	169	100%
	Total Contact Hour	37	34	28	34	29	28	27	28	245Hrs	-

U18HSEN101	COMMUNICATIVE ENGLISH	L	T	P	C
	Total Contact Periods – 60	2	0	2	3
	Prerequisite – School English				
	Department:- Department of English				

COURSE OBJECTIVES:-

To gain fundamental knowledge of language and the uses in daily life.

UNIT I SPEAKING 6 hours

Speaking- Pronunciation, Intonation, Stress and Rhythm -Common Everyday Situations: Conversations and Dialogues -Communication at Workplace -Interviews -Formal Presentations -introducing one self – exchanging personal information- narrating events, -incidents , speaking about one's friend/pet -Wh- Questions- asking and answering-yes or no questions- parts of speech. Vocabulary development– prefixes- suffixes- articles, prepositions.

UNIT II READING 6 hours

Reading – comprehension (multiple choice questions, short questions) - short narratives and descriptions from newspapers including dialogues and conversations also used as short reading texts-- and longer passages - understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences vocabulary and structures- Vocabulary Building - The concept of Word Formation

UNIT III LISTENING 6 hours

Listening – listening to longer texts and filling in the table- product description- asking about routine actions and expressing opinions. –Listening to telephonic conversations -degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs- Identifying Common Errors in Writing - Subject-verb agreement - Noun-pronoun agreement

UNIT IV WRITING 6 hours

Writing- letter writing, formal and personal letters- after listening to dialogues or conversations and completing exercises based on them. Understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences -Tenses- simple present-simple past-present continuous and past continuous- Vocabulary development- synonyms-antonyms-phrasal verbs- Articles - Prepositions.

UNIT V LANGUAGE DEVELOPMENT 6 hours

Writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing- listening to talks, conversations to complete the remaining, participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense.– paragraph writing- topic sentence- main ideas short narrative descriptions . Synonyms, antonyms, and standard abbreviations- Basic Writing Skills- Sentence Structures- Use of phrases and clauses in sentences - Importance of proper punctuation - Creating coherence- Organizing principles of paragraphs in documents- Techniques for writing precisely.

SOFTSKILL LABORATORY 30

LIST OF EXPERIMENTS / EXCERCISES

1. Group discussion
2. Making effective presentations

3. Watching interviews &conversations

4. Reading different genres of texts
5. International English Language Testing System (IELTS)
6. Test of English as a Foreign Language (TOEFL)
7. Mock interviews
8. Time management &stress management
9. Role play
10. Listening to lectures, discussions from TV/ Radio.
11. Articulation of sounds- intonation.
12. Creative and critical thinking.

TEXT BOOKS:

1. English A Course book for Under Graduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
3. Dutt P. Kiranmai and RajeevanGeeta. Basic Communication Skills, Foundation Books: 2013
4. Means,L. Thomas and Elaine Langlois. English & Communication for Colleges. Cengage Learning ,USA: 2007
5. Practical English Usage. Michael Swan. OUP. 2005.
6. Remedial English Grammar. F.T. Wood. Macmillan.2007
7. On Writing Well. William Zinsser. Harper Resource Book. 2001

COURSE OUTCOMES (COs)	
CO1	The student will be able to comprehend the text with clarity
CO2	The capacity to read and listen will improve
CO3	Writing technical report will be learnt properly
CO4	Speaking skills will be acquired
CO5	Overall communication skills will make them employable

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO2	PSO3
2	CO1	3										3		2	2	2
	CO2		2							2						
	CO3			3							3					
	CO4				3		2									
	CO5					3		3	1							
	CO6															
3	Category	Humanities and Social Science (HS)														
4	Approval	47th Meeting of Academic Council														

U18BSMA101	ENGINEERING MATHEMATICS – I	L	T	P	C
	Total Contact Periods – 60	3	1	0	4
	Prerequisite – School Level Mathematics				
	Department:- Department of Mathematics				

COURSE OBJECTIVES:-

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate integration analysis and linear algebra.
It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

UNIT I DIFFERENTIAL CALCULUS - One Variable (9+3)

Representation of functions – limit of a function – continuity – Derivatives – Differentiation rule – Maxima and minima of functions of one variable – Rolle's Theorem – Mean Value Theorem – Taylor's and Maclaurin's Theorem with remainders.

UNIT II INTEGRAL CALCULUS - One Variable (9+3)

Definite integrals – Substitution rule – Techniques of integration – Integration by parts – Trigonometric integrals – Trigonometric substitutions – Integrations of rational functions by partial fractions – Integrations of irrational functions- Integration of improper functions - Beta, Gamma functions and their properties.

UNIT III DIFFERENTIAL CALCULUS - Several Variables (9+3)

Partial derivatives –Euler's theorem on Homogeneous functions - directional derivatives – total derivative – Jacobian – Maxima and minima of two variables.

UNIT IV MULTIPLE INTEGRALS - Several Variables (9+3)

Double integrals in Cartesian co-ordinates – Change of order of integrations – Area as a double integral – Triple integrals in Cartesian co-ordinates –Volume as triple integrals – Double integrals in polar co-ordinates – simple problems.

UNIT V MATRICES (9+3)

Characteristic Equations – Eigenvalue and Eigenvectors of the real matrix– Properties–- Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of Quadratic form.

TEXT BOOK:

1. Grewal B. S, Higher Engineering Mathematics, Khanna Publisher, Delhi – 2014.
2. Kreyszig. E, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, Singapore, 2012.

REFERENCES:

1. Veerarajan T, Engineering Mathematics, II edition, Tata McGraw Hill Publishers, 2008.
2. Kandasamy P &co., Engineering Mathematics, 9th edition, S. Chand & co Pub., 2010.
3. N.P.Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. Narayanan S., Manicavachagam Pillai T.K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I (2nd edition), S.Viswanathan Printers and Publishers,
5. George B. Thomas ,Jr ,Maurice D.Weir, Joel Hass., Thomas' Calculus ,Twelfth Edition Addison-Wesley, Pearson.

COURSE OUTCOMES (COs)	
CO1	To apply both the limit definition and rules of differentiation to differentiate functions. Also they will have a basic understanding of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
CO2	To apply definite integrals of algebraic and trigonometric functions using formulas and substitution. Also they will have a basic understanding of Beta and Gama functions.
CO3	To apply differential and integral calculus to notions of curvature. Also apply differentiation to find maxima and minima of functions.
CO4	To apply multiple integrals to compute area and volume over curves, surface and domain in two dimensional and three dimensional spaces.
CO5	Identify Eigenvalue problems from practical areas using transformations; Diagonalising the matrix would render the Eigen values.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
2	CO1	3				2		1			1			2	2	2
	CO2	3		3	1	2			2							
	CO3	3				2				1						
	CO4	3	2			2				1						
	CO5	3		3		2				2	1					
	CO6															
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18BSPH101	WAVES AND OPTICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Higher Secondary School Physics				
	Department:-Department of Physics				

COURSE OBJECTIVES:-
To gain fundamental knowledge of language and the uses in daily life.

UNIT 1 NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES IN ONE DIMENSION 9

Introduction - Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, standing waves, longitudinal waves and the wave equation for them, acoustics waves and speed of sound. Waves with dispersion, superposition of waves, wave groups and group velocity.

UNIT 2 ULTRASONIC WAVES 9

Production of ultrasonic by magnetostriction and piezoelectric methods - acoustic grating – Detection - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Industrial and Medical applications – Sonogram.

UNIT 3 THE PROPAGATION OF LIGHT AND GEOMETRIC OPTICS 9

Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations,

reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them

UNIT 4 WAVE OPTICS **9**

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer. Fraunhofer diffraction from a single slit and a circular aperture, Diffraction gratings and their resolving power

UNIT 5 LASERS **9**

Einstein's theory of matter radiation interaction and A & B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers(Neodymium), Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, applications of lasers in science, engineering and medicine.

TEXT BOOK:

1. M.N. Avadhanulu and P.G. Kshirsagar, "A Textbook of Engineering Physics" S.Chand Publishers, 2016 (for Units 1,3,4 & 5)
2. G.Senthil Kumar, "Engineering Physics", VRB publishers, Chennai, 2015 (for Unit 2)

REFERENCES:

1. Brij Lal and Subramanian, "Waves and Oscillation", Vikas Publishsing House, 2011
2. R.Murugesan,"Optics and Spectroscopy", S.Chand Publishers, 2015
3. BrijLal and Subramanian,"Optics", S.Chand Publishers 2006
4. Ian G. Main, "Vibration and waves in physics", Cambridge University Press, 1978
5. H.J. Pain, "The physics of vibrations and waves", 6th edition, Wiley 2006
6. Ajoy Ghatak, "Optics", Tata McGraw-Hill publishing company, New Delhi, 2009
7. O. Svelto, "Principles of Lasers", Springer, 2010
8. Online reference Wikipedia.org

COURSE OUTCOMES (COs)	
CO1	Understand the basic concept of waves and lights
CO2	Understand the importance of Ultrasonic waves and Non-Destructive Testing
CO3	Understand the propagation of light and geometrical optics
CO4	Understand the optical phenomenon like interference, diffraction and superposition of waves
CO5	Understand the concept of laser and its applications

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
2	CO1	3	3	2	3	2			2	3	3			2	2	2
	CO2	1	3	2	2	3			2		1	3				
	CO3	3	1			1			2	2		2				
	CO4	3	1			1			2	2		2				
	CO5	3	2	2	2				2		3	1				
	CO6															
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18BSPH101	ENGINEERING CHEMISTRY	L	T	P	C
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – School Level Chemistry				
	Department:-Department of Chemistry				

COURSE OBJECTIVES:-

To gain fundamental knowledge of Engineering Chemistry and its applications

UNIT I WATER TECHNOLOGY 9

Introduction - Characteristics: Hardness of Water – Types - Temporary and Permanent Hardness - Estimation by EDTA method. Alkalinity – Types of Alkalinity - Phenolphthalein and Methyl Orange Alkalinity - Determination – Domestic Water Treatment – Disinfection methods (Chlorination, Ozonation, and UV Treatment). Boiler feed water – Requirements – Disadvantages of using hard water in boilers (Caustic embrittlement, Boiler corrosion, Priming and foaming) – Prevention of scale formation – softening of hard water - Internal treatment (Calgon treatment method) – External treatment – Demineralization process – Desalination and Reverse osmosis.

UNIT II PHASE RULE AND ALLOYS 9

Introduction: Statement of Phase Rule and Explanation of terms involved – One component system – Water system – Construction of phase diagram by thermal analysis - Condensed phase rule - Two Component System : Simple eutectic systems (lead-silver system) – eutectic temperature – eutectic composition – Pattinson's Process of desilverisation of Lead.

Alloys: Importance, ferrous alloys – nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing –hardening – tempering - normalizing – carburizing - nitriding. Non- ferrous alloys: Brass and Bronze.

UNIT III NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction: Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation – breeder reactor. Solar energy conversion – solar cells – wind energy. Fuel cells – hydrogen – oxygen fuel cell. Batteries: Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries: Lead–acid storage battery –working –uses. Nickel–cadmium battery -working –uses. Solid – state battery: Lithium battery.

UNIT IV FUELS 9

Introduction: Calorific value – types of Calorific value - gross calorific value – net calorific value. Analysis of Coal – Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke –manufacture by Otto-Hoffmann method. Petroleum processing and fractions– cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number. Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG. Flue gas analysis – importance - Orsat apparatus.

UNIT V NANOCHEMISTRY 9

Introduction: Nanochemistry: Definition - Classification based on dimensions - Size dependent properties. Types of nanomaterials: Nanoparticles: Synthesis by Bottom-up and top-down approaches - Nanoporous materials: Synthesis by sol-gel method. Nanowires: Synthesis by VLS mechanism. Carbon Nanotubes (CNTs): Single walled and Multi walled nanotubes - Mechanical and electrical properties of CNTs - Applications of CNTs - Synthesis of CNTs by

Electric arc discharge method and Laser ablation method. Nanochemistry in biology and medicines – nanocatalysis. Nanocomposites – sensors and electronic devices.

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).
4. S. Vairam, P. Kalyani and Suba Ramesh, ―Engineering Chemistry‖, Wiley India PVT, LTD, New Delhi, 2013.
5. G. B. Sergeev, Nano chemistry, Elsevier Science, New York, 2006.

REFERENCES:

1. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

COURSE OUTCOMES (COs)	
CO1	To impart knowledge to the Students about the principles, water characterization, conversant with boiler feed water requirements and water treatment techniques.
CO2	To make them understand the industrial importance of Phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys
CO3	To make the students to be well versed with the principles of Conventional and non-conventional energy sources and energy storage devices.
CO4	To make the students to have a deep knowledge of the Chemistry of Fuels and calorific value, manufacture of solid, liquid and gaseous fuels.
CO5	To make them understand the Nanochemistry, Types of nanomaterials: Nanoparticles, Nanochemistry in biology and medicines.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3			2		3		3		1			2	2	2
	CO2		1	3		2		3		2		1				
	CO3		2		3		1				2					
	CO4	3		2	1			2			3					
	CO5		3		1		2				3					
	CO6															
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18ESEE101	**BASIC ELECTRICAL & ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – School Level Physics				
	Department:-Department of Electrical & Electronics Engineering				

COURSE OBJECTIVES:-

To gain fundamental knowledge of Electrical and Electronics Engineering and its applications

MODULE 1 : DC CIRCUITS **12**

Electrical circuit elements, voltage and current sources, Fundamental Relationship of VI for RLC circuit, Ohms Law, Source Transformation ,Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Basics of Superposition, Thevenin and Norton Theorems, Maximum Power Transfer Theorem.

MODULE 2: AC CIRCUITS **9**

Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Time-domain analysis of first-order RL and RC circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections.

MODULE 3: ELECTRICAL MACHINES & TRANSFORMERS **9**

Principles of operation and characteristics of; DC machines, Synchronous machines, three phase and single phase induction motors. Transformers (single and three phase) regulation and efficiency, all day efficiency and auto-transformer .

MODULE 4: SEMICONDUCTOR DEVICES AND APPLICATIONS **9**

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier and its applications, Introduction to OP-AMP.

MODULE 5: DIGITAL ELECTRONICS **6**

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – Fundamentals of A/D and D/A Conversion.

TEXT BOOK:

1. John Bird, Electrical Circuit Theory & Technology, Taylor & Francis Ltd, 6th, edition. 2017.
2. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, Second Edition, PHI Learning, 2007.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 10th Edition, 2011.
5. V. D. Toro, "Electrical Engineering Fundamentals", Pearson, 2nd Edition, 2015.
6. Millman and Halkias, "Integrated Electronics", McGraw Higher Ed, 2nd Edition, 2011.
7. Vincent Del Toro, `Electrical Engineering Fundamental, Prentice Hall, 2nd Edition, 2015.
8. K.A.Krishnamurthy and M.R.Raghuveer, `Electrical and Electronics Engineering for Scientists', New Age International Pvt Ltd Publishers, 2011.

REFERENCES:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, Third Reprint,2016.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", Mcgraw Higher Ed, 1st Edition, 2011.
3. Jacob Millman and Christos C-Halkias,"Electronic Devices and Circuits", Mcgraw Higher Ed, 4th Edition, 2015.

COURSE OUTCOMES (COs)

CO1	To gain knowledge regarding the various laws and principles associated with DC Circuits.

CO2	To gain knowledge regarding fundamentals of AC circuits.
CO3	To gain knowledge regarding electrical machines and transformers.
CO4	To gain knowledge regarding various types of semiconductor devices and small signal amplifiers.
CO5	To gain knowledge on principles of digital electronics systems.
CO6	

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	1			2				3		1		3	3	3
	CO2	3	1			2				3		1				
	CO3	3	2			2				3		1				
	CO4	3	1			2				3		1				
	CO5	3	1			2				3		1				
	CO6															
3	Category															
4	Approval	47th Meeting of Academic Council														

U18BSBT101	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Higher Secondary level biology, basic concepts in cell signaling				
	Department:-Dept of Industrial Biotechnology				

COURSE OBJECTIVES: -

To provide a basic understanding of the biological systems and its applications in the industrial sector

UNIT I INTRODUCTION TO LIFE 6

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell- Introduction to biomolecules - general classification and important functions of carbohydrates-lipids-proteins-nucleic acids – vitamins

UNIT II BIODIVERSITY 6

Plant System: basic concepts of plant growth-nutrition-photosynthesis-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions. Microbial System -types of microbes-economic importance and control of microbes.

UNIT III GENETICS AND IMMUNE SYSTEM 6

Evolution: theories of evolution- evidence of laws of inheritance-variation and speciation-nucleic acids as a genetic material-central dogma - immunity- antigens - antibody-immune response.

UNIT IV HUMAN DISEASES 6

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines -cloning- bioremediation-biofertilizer-biocontrol- biosensors-biopolymers-bioenergy-biomaterials-biochips

TEXT BOOK:

1. A Text book of Biotechnology, R. C. Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCES:

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

COURSE OUTCOMES (COs)	
CO1	To understand the basic concepts of the cell and its structure
CO2	To understand about biodiversity and its conservation
CO3	To know the fundamentals of genetics and the immune system
CO4	To create an awareness about human diseases
CO5	To give a basic knowledge of the applications of transgenics
CO6	To know the applications of bio systems in environment, medical and agricultural sectors

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3					2	2			3	2		2	2	2
	CO2	3			2		3		2	2						
	CO3	2		2			2									
	CO4							3			2	2				
	CO5	3	3					3	2	2						
	CO6	3						3				3				
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18BSPH2L2	**Wave Optics and Semi Conductor Physics Laboratory**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1.5
	Prerequisite – Wave Optics and Semi Conductor Physics				
	Department:-Department of Physics				

COURSE OBJECTIVES:

To impart knowledge of practical Physics to the students

Physics Lab experiments for Semester I & II

List of Experiments for Waves and Optics – Common for all branches

1) Ultrasonic Interferometer
2) Air-wedge Experiment
3) Particle size determination
4) Determination of acceptance angle
5) Determination of Laser Wavelength
6) Spectrometer – Determination of wavelength using grating

List of Experiments for Semiconductor Physics – Circuit branches

1) Determination of Band Gap
2) Zener diode characteristics
3) p-n junction diode Characteristics
3) Transistor Characteristics
5) V-I characteristics using LDR circuit
6) Carey Foster's Bridge

COURSE OUTCOMES (COs)	
CO1	Understand the fundamental concept of optics
CO2	Understand the concept of production of ultrasonic waves
CO3	Understand the functions of semiconductor
CO4	
CO5	
CO6	

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PSO 2	PSO 3
2	CO1	3		3	3				3	1	2			3	3	3
	CO2	3	3	1					3	1	2					
	CO3	1	3	3					3	1	2					
	CO4															
	CO5															
	CO6															
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18BSCH2L4	**CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1.5
	Prerequisite – Engineering Chemistry				
	Department:- Department of Chemistry				

COURSE OBJECTIVES:

To enhance the practical knowledge on Chemistry through Volumetric and circuit experiments

LIST OF EXPERIMENTS

1. Determination of Total Hardness, Temporary Hardness and Permanent hardness of Water by EDTA method

2. Estimation of Alkalinity - Titrimetry
3. Estimation of Dissolved Oxygen
4. Estimation of Chlorides in Water by Argentometric Method (MOHR'S Method)
5. Estimation of Copper by EDTA method
6. Estimation of Iron in Water by Spectrophotometry
7. Conductometric Titration of Strong Acid with Strong Base
8 Determination of Molecular weight of a polymer by Viscosity Average Method
9. pH measurements for Acid - alkali Titrations
10 Determination of rate of corrosion by weight loss method.
11. Conductometric Precipitation titration
12. Determination of Water Crystallization

REFERENCES:

1. R. Jeyalakshmi, "Practical Chemistry", Devi Publications 2014.
2. S.S. Dara, A text book on experiments and calculation Engg.

COURSE OUTCOMES (COs)	
CO1	Students will able to analyze - hardness, Alkalinity, Dissolved oxygen,Chlorides in Water by Argentometric Method, Determination of Water of Crystallization and as well as estimation of Copper by EDTA method using volumetric analysis.
CO2	Students will understand basic principle of spectrophotometric method
CO3	Students will learn Conductometric Titration of Strong Acid with Strong Base and Conductometric Precipitation titration.
CO4	Student will be able to analyze Determination of Molecular weight of a polymer by Viscosity Average Method
CO5	Student will understand about pH measurements for Acid - alkali Titrations and rate of corrosion by weight loss method
CO6	

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PS O3
2	CO1	3		2	2		3		3		1			3	3	3
	CO2	1	3			2		3		2		1				
	CO3		2		2						2					
	CO4	3		2				2				3				
	CO5		3		1		2				3					
	CO6															
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18ESME1L2	**WORKSHOP/MANUFACTURING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Periods – 75	1	0	4	3
	Prerequisite – NIL				
	Department:-Department of Mechanical Engineering				

COURSE OBJECTIVES:

To educate the students on common manufacturing processes employed in Industries.

Lectures & videos: **(15 hours)**

Detailed contents

- Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lecture)**
- CNC machining, Additive manufacturing **(2 lecture)**
- Fitting operations & power tools **(2 lecture)**
- Carpentry **(2 lecture)**
- Plastic moulding, glass cutting **(2 lecture)**
- Metal casting **(2 lecture)**
- Welding (arc welding & gas welding), brazing **(2 lecture)**

WORKSHOP PRACTICE:

1. Machine shop **(6 hours)**
   a) Facing
   b) Turning
   c) Drilling Practice

2. Fitting shop **(6 hours)**
   a) Fitting Exercises–Preparation of square fitting
   b) Vee–fitting models.

3. Carpentry **(9 hours)**
   a) Preparation of Lap joints.
   b) Mortise and Tenon joints.
   c) Cross Half joints.
   d) Dove Tail joints.

4. Welding shop **(Arc welding 6 hrs + gas welding 3 hrs) (9 hours)**
Preparation of butt joints, lap joints and Tee joints

5. Sheet Metal working **(9 hours)**
   a) Forming &Bending:
   b) Model making–Trays, funnels, etc.
   c) Different type of joints

6. Demonstration **(6 Hours)**
Smithy operations, upsetting, swaging, setting down and bending. Example–Exercise–Production of hexagonal headed bolt.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

SUGGESTED TEXT/REFERENCES:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers Private Limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology",4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

COURSE OUTCOMES (COs)	
CO1	Students will gain knowledge of the different manufacturing processes.

CO2	Students will be able to fabricate components with their own hands.
CO3	Students will gain practical knowledge of the dimensional accuracies and dimensional tolerances.
CO4	Students will be able to produce small devices of their interest.
CO5	
CO6	

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1											3		2	2	2
	CO2			3	2							3				
	CO3		2													
	CO4	3			1							3				
	CO5															
	CO6															
3	Category	Engineering Science (ES)														
4	Approval	47th Meeting of Academic Council														

U18ESEE1L3	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1.5
	Prerequisite – School Level Physics & Basic Electrical and Electronics Engineering				
	Department:-Department of Electrical & Electronics Engineering				

COURSE OBJECTIVES:-

To enhance the practical knowledge on basics of electrical and electronics components and circuits.

LIST OF EXPERIMENTS FOR BASIC ELECTRICAL ENGINEERING LAB

1. Verification of Ohms and Kirchoff's Voltage and Current Laws
2. Measurement of the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
3. Fluorescent lamp wiring
4. Staircase wiring
5. Measurement of energy using single phase energy meter
6. Observation of the no-load current waveform on an oscilloscope and Measurement of Primary and secondary voltages and currents of a Transformer
7. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
8. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

LIST OF EXPERIMENTS FOR BASIC ELECTRONICS ENGINEERING LAB

1. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
2. Characteristics – Half wave and Full wave Rectifiers
3. Characteristics – Common Base transistor configuration
4. Verification of truth tables of OR, AND, NOT, NAND, NOR gates and Flip-flops - JK and RS
5. Applications of Operational Amplifier

REFERENCES:

1. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Education India,2011

COURSE OUTCOMES (COs)	
CO1	To handle basic electrical equipment and verify current and voltage law
CO2	To understand the steady-state and transient time-response of R-L, R-C, and R-L-C circuits .
CO3	To understand domestic wiring procedures practically.
CO4	To analyze ac signal parameters using cathode ray oscilloscope and function generator
CO5	To understand all the fundamental concepts semiconductor Diode and Transistor
CO6	To understand all the fundamental concepts of logic Gates and Flip-Flaps

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3			3				3		2		3	3	3
	CO2	3	3			3				3		2				
	CO3	3	3			3				3		2				
	CO4	3	3			3				3		2				
	CO5	3	3			3				3		2				
	CO6	3	3			3				3		2				
3	Category															
4	Approval	47th Meeting of Academic Council														

U18HSEN201	**TECHNICAL ENGLISH**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	2	1	0	3
	Prerequisite – I semester English				
	Department:-Department of English				

COURSE OBJECTIVES:-

To gain fundamental knowledge of English language and its usage in day to day life.

UNIT I LISTENING 9

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking –Asking for and giving directions- extended definitions –listening to daily issue- -Vocabulary Development- technical vocabulary - Language Development –subject verb agreement – compound words.

UNIT II READING 9

Reading – reading longer technical texts- identifying the various transitions in a text- interpreting charts, graphs after reading the, practice in speed reading- vocabulary

Development-vocabulary used in formal letters/emails and reports -Language Development personal passive voice, numerical adjectives.

UNIT III TECHNICAL WRITING 9

Writing after listening to classroom lectures- talk should be on engineering /technology– introduction to technical presentations- longer texts both general and technical, Describing a process, use of sequence words- Vocabulary Development- sequence words- Misspelled words.

UNIT IV FORMAL WRITING 9

Writing- email etiquette- job application – cover letter –Resume preparation (via email and hard copy)- analytical essays and issue based essays–Vocabulary Development- finding suitable synonyms-paraphrasing-. Language Development- clauses- dependant, independent, if conditionals.

UNIT V LANGUAGE DEVELOPMENT 9

Speaking –participating in a group discussion – role play, Writing– Writing reports- minutes of a meeting- accident and survey-Vocabulary Development- transitive, intransitive verbs, Language Development- reported speech**.**

TEXT BOOK:

1. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

REFERENCES:

1. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges Cengage Learning, USA: 2007

COURSE OUTCOMES (COs)	
CO1	The student will acquire basic proficiency in English
CO2	Reading and listening ability will improve.
CO3	Comprehension techniques will develop.
CO4	writing and speaking skills will be acquired
CO5	Overall communication skills will make them employable.
CO6	

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2										3		3	3	3
	CO2		3							2						
	CO3			3							3					
	CO4				2		3									
	CO5					2		2	1							
	CO6															
3	Category	Humanities and Social Science (HS)														
4	Approval	47th Meeting of Academic Council														

U18BSMA201	**ENGINEERING MATHEMATICS II**	**L**	**T**	**P**	**C**
	Total Contact Periods – 60	**3**	**1**	**0**	**4**
	Prerequisite – School Level Mathematics				
	Department:-Department of Mathematics				

COURSE OBJECTIVES:-

The objective of this course is to equip the students of Engineering and Technology with techniques in ordinary equations, vector calculus, complex variables.
Laplace transform with advanced level of mathematics and applications that would be essential to formulate problems in engineering environment.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS (9+3)

Higher order linear differential equations with constant coefficients – linear differential equations with variable coefficients– Euler's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients- Method of variation of parameters

UNIT II VECTOR CALCULUS (9+3)

Scalar and vector point function - Gradient, Divergence and curl – Directional derivatives – Angle between two surfaces - Irrotational and Solenoidal vector fields – Line Integral - Green's theorem – Gauss divergence theorem and Stokes' theorem – Simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS (9+3)

Functions of complex variable - Analytic functions – Necessary and sufficient conditions (without proof), Cauchy Riemann Equations in Cartesian and polar form – Harmonic functions – properties of analytic functions – Construction of analytic functions using Milne Thomson method –Conformal mapping : and Bilinear Transformation.

UNIT IV COMPLEX INTEGRATION (9+3)

Cauchy integral theorem – Cauchy's integral formula – problems – Taylor's and Laurent's Series – classification of Singularities – Poles and Residues – method of finding residues - Cauchy's residue theorem and its applications to evaluate real integrals – contour integration.

UNIT V LAPLACE TRANSFORMS (9+3)

Transforms of elementary functions – Basic properties – Shifting theorem- Transforms of derivatives and integrals – Initial and final value theorem – Laplace transform of Periodic Functions – Inverse Laplace transform – Convolution theorem – Periodic Functions – Applications of Laplace transform for solving linear ordinary differential equations up to second order with constant coefficient.

TEXT BOOK:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Willie & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

REFERENCES:

1. Venkataraman. M. K, Engineering Mathematics, National Publishing Company, 2000.
2. Bali .N.P and Manish Goyal, A Text book of Engineering Mathematics, Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
3. Veerarajan T, Engineering Mathematics, II edition, Tata McGraw Hill Publishers, 2008.

COURSE OUTCOMES (COs)	
CO1	The mathematical tools for solution of differential equation that model physical process.
CO2	To evaluate the line, surface and volume integrals using Green's, Stoke's and Gauss Theorems and their verification.
CO3	To understand the analytic functions, conformal mapping and complex integration and their applications.
CO4	To evaluate real and complex integrals using the Cauchy's integral formula and Residue theorem.
CO5	To apply the concept of Laplace Transformation in analysis and solve differential equations.
CO6	

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2		1		3				2		3		2	2	2
	CO2	3	2			3			2		1					
	CO3	3		1				2		3						
	CO4								3	2	2	1				
	CO5	3		1	1			2				3				
	CO6															
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18BSPH202	SEMICONDUCTOR PHYSICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Higher Secondary School Physics				
	Department:-Department of Physics				

COURSE OBJECTIVES:-

To develop physics and engineering strategies of semiconductor materials and to discuss their functionalities in modern electronic and optoelectronic devices

UNIT 1 INTRODUCTION AND ELECTRONIC STATES OF SEMICONDUCTORS 9

Introduction to solid state materials - crystal structure - Reciprocal lattice - Brillouin zone and rules for band (k - space) representation. Dynamics of electrons in periodic potential: Kronig - penny and nearly free electron models - Real methods for band structure calculations; Band gaps in semiconductors - Holes and effective mass concept - Properties of conduction and valance bands

UNIT 2 CARRIERS AND DOPING 9

Fermi distribution and energy - Density of states - Valance and conduction band density of states - intrinsic carrier concentration – intrinsic Fermi level. Extrinsic semiconductors: n and p type doping - Densities of carriers in extrinsic semiconductors and their temperature dependence - extrinsic semiconductor Fermi energy level - Degenerate and non - degenerate semiconductors - Band gap engineering

UNIT 3 ELECTRICAL TRANSSORT 9

Scattering Mechanism: electron - electron and electron – phonon scattering. Macroscopic transport: Carrier transport by Diffusion - Carrier transport by Drift: Low field, High field and very high field.

UNIT 4 OPTICAL TRANSSORT 9

Electron - hole pair generation and recombination: band to band (direct and indirect band gap transitions) and intra band (impurity related) transitions, free - carrier & phonon transitions. Excitons: Origin, electronic levels and properties. Carrier transport - continuity equations. Optical constants: Kramers - Kronig relations.

UNIT 5 SEMICONDUCTOR AS DEVICES AND RECENT ADVANCES 9

Processing of Semiconductor devices (Brief), p - n Semiconductor as device and Semiconductor junctions - Homo and hetero Junctions. Active and passive optoelectronic devices: performance and response enhancement (photo processes)**.**

TEXT BOOK:

1. M.N. Avadhanulu and P.G. Kshirsagar, "A Textbook of Engineering Physics" S.Chand Publishers, 2014 **(for units 1 and 2)**
2. G.Senthil Kumar, "Engineering Physics", VRB publishers, Chennai, 2015 (for Unit 5)

REFERENCES:

1. Kevin F Brennan, "The Physics of Semiconductors", Cambridge Univ.Press 1999.
2. Peter Y Yu and Manuel Cardona, "Fundamentals of Semiconductors",Spriger, 1996.
3. Charles Kittel, "Introduction to Solid State Physics", 6th edition, Willey, 1991.
4. D.A. Neamen, "Semiconductor Physics and Devices", 3 rdEd.,Tata McGraw-Hill,2002.
5. Jasprit Singh, "Semiconductor Optoelectronics (Physics and Technology)", McGraw-Hill, 1995.
6. Online reference: Wikipedia, NPTEL

Course Outcome (COs)	
CO1	Understand the difference between metals, semiconductors and insulators
CO2	Understand the importance of doping to charge carrier density
CO3	Understand the electrical transport in semiconductors
CO4	Understand the difference between direct and indirect semiconductors
CO5	Understand the concept of semiconductor optoelectronic devices.
CO6	

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	1	1					2	1	2	2		2	2	2
	CO2	3	1	1	3				2	1	2	2				
	CO3	3			2				3	2						
	CO4	3	1	1					2	1	2	2				
	CO5	1	2	3	2	2	2		2	1	1	2				
	CO6															
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18BSCH20	**ENVIRONMENTAL SCIENCE**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Higher Secondary School Physical Science				
	Department:-Department of Chemistry				

COURSE OBJECTIVES:-

- To study the interrelationship between living organism and environment.
- To study of the nature and concepts of ecosystem.
- To learn about the integrated themes and biodiversity of an environment.
- To study of pollution control and waste management.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.

UNIT I -NATURAL RESOURCES **9**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people –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, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Equitable use of resources for sustainable lifestyles.

UNIT II -ECOSYSTEMS **9**

Introduction: concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)- Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and Possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III -BIODIVERSITY AND ITS CONSERVATION **9**

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega diversity nation, Hot-spots of biodiversity - Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

UNIT IV-ENVIRONMENTAL POLLUTION **9**

Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - pollution case studies - Disaster Management: floods earthquake, cyclone and landslides.

UNIT V- SOCIAL ISSUES AND HUMAN POPULATION **9**

Social issues: Environmental Protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Wildlife protection Act, Forest Conservation Act, Public awareness – Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder-Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes. Human population: population growth, variation among nations, Population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXT BOOK:

1. Gilbert M. Masters, Introduction to Environmental Engineering and Science‘, 2nd edition, Pearson Education 2004.
2. Benny Joseph, Environmental Science and Engineering‘, Tata McGraw-Hill, New Delhi, 2006.
3. R.K. Trivedi, Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards‘, Vol. I and II, Enviro Media.
4. Rajagopalan, R, Environmental Studies-From Crisis to Cure’, Oxford University Press 2005.
5. K.V.B. Raju and R.T. Ravichandran, “Basics of Civil Engineering”.

REFERENCES:

1. Cunningham, W.P. Cooper, T.H. Gorhani, Environmental Encyclopedia‘, Jaico Publ., House, Mumbai, 2001.
2. Dharmendra S. Sengar, Environmental law‘, Prentice hall of India PVT LTD, New Delhi, 2007.

Course Outcome (COs)	
CO1	Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving
CO2	Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
CO3	Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems
CO4	Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales
CO5	Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes
CO6	

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3			2		3		3		1		3	2	2	2
	CO2	1	3	3		2		3		2		1	1			
	CO3		2				1			3	2					
	CO4	3		2	1			2				2	3			
	CO5		3		1		2				3					
	CO6															
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18ESCS101	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Higher Secondary School Maths				
	Department:-Department of Computer Science & Engineering				

COURSE OBJECTIVES

To gain fundamental knowledge of algorithmic problem solving and python programming

MODULE 1 : ALGORITHMIC PROBLEM SOLVING **9**

Introduction to components of a computer system - disks, memory, processor, operating system, compilers – Problems, Solutions, Idea of Algorithm –Representation of Algorithm. Building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Problem Illustrations

MODULE 2: DATA, EXPRESSIONS, STATEMENTS **9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two Points.

MODULE 3: CONTROL FLOW, FUNCTIONS **9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

MODULE 4: LISTS, TUPLES, DICTIONARIES **9**

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

MODULE 5: FILES, PACKAGES **9**

Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, packages: NumPy, SciPy, Matplotlib, Scikit-learn, Scilab Interface.

TEXT BOOK:

1. Allen B. Downey, 'Think Python: How to Think Like a Computer Scientist', 2nd edition, Updated for Python3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. John V Guttag, ―Introduction to Computation and Programming Using Python‘‘,

Revised and expanded Edition, MIT Press , 2013

2. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5. Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013

Course Outcome (COs)	
CO1	Develop algorithmic solutions to simple computational problems
CO2	Demonstrate programs using simple Python statements and expressions.
CO3	To gain knowledge regarding control flow and functions associated with python
CO4	Use Python data structures – lists, tuples & dictionaries for representing compound data
CO5	To gain knowledge on files, exception, modules and packages in Python for solving problems

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	2	3	2	1		2	1	2		3	3	3
	CO2	3	3	2	2		2		1			2				
	CO3	2	2	1	3	2		1		1		2				
	CO4	2	2	1	2	3	2	1	2	1		2				
	CO5	2	3	1	2	2			2	2	1					
	CO6															
3	Category	Engineering Science (ES)														
4	Approval	47th Meeting of Academic Council														

U18ESME101	**ENGINEERING GRAPHICS & DESIGN (THEORY & LAB.)**	**L**	**T**	**P**	**C**
	Total Contact Periods – 75	1	0	4	3
	Prerequisite – +12 Level Maths and Physical Science				
	Department:-Department of Mechanical Engineering				

COURSE OBJECTIVES

To Prepare students to design a system, component, or process to meet desired needs, using the techniques, skills, and modern engineering tools necessary for engineering practice

SYLLABUS

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing;

Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM).

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

MODULE 1: INTRODUCTION TO ENGINEERING DRAWING (9+2)

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales; Draw simple annotation, dimensioning and scale. Construction of Conic sections; Cycloid, Epicycloid, Hypo cycloid and Involute of circle.

MODULE 2: ORTHOGRAPHIC PROJECTIONS (10+2)

Principles of Orthographic Projections; Conventions; Projections of points and Orthographic projection of lines in first quadrant - Parallel to both the planes – Perpendicular to one plane – Parallel to one plane and inclined to other plane – Inclined to both the planes; Projections of planes inclined to either HP or VP.

MODULE3:PROJECTIONS OF REGULAR SOLIDS&ISOMETRIC PROJECTIONS

(10+3)

Projection of solids in first quadrant – Prism, Pyramid, Cone and Cylinder inclined to one plane; Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions - Isometric Views of Simple Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa;

MODULE4: SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACE (10+3)

Sectional view of Prism, Cylinder, Pyramid, Cone (simple position in first quadrant) with cutting planes perpendicular to one plane and parallel or inclined to another plane– True shape of sections; Development of lateral surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone.

MODULE 5: BUILDING DRAWING (9+2)

Introduction to building drawing; Types of Projection adopted in Building Drawing; Scales for various types of Drawings, Symbols, Conventions and Abbreviations. Drawing of residential single and two storied buildings with detail of Line plan, Foundation Plan, Ground floor Plan, First floor plan, Elevation and Sections.

MODULE 6: OVERVIEW OF COMPUTER GRAPHICS (12+3)

Introduction to CAD; Basic commands; Coordinate systems; Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Setup a drawing with proper scale –

Dimensioning commands, Editing Dimensions and Dimension text; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles; Create basic drawing of objects such as polygon and general multi-line figures; Creating orthographic views of simple solids like prism, pyramid, cylinder, cone. Drawing sectional views of prism, pyramid, cylinder and cone; Preparation of fabrication

drawing (Development of surfaces); Drawing front view, top view and side view of objects from the given pictorial view; Creation of 3-D models of simple objects.

TEXT BOOK:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. (Corresponding set of) CAD Software Theory and User Manuals

Course Outcome (COs)	
CO1	Students will gain Exposure to engineering communication.
CO2	Students will learn standards of engineering graphics.
CO3	Students will get Exposure to basics of building construction
CO4	Students will get Exposure to computer-aided geometric design
CO5	Student will gain basic knowledge and Exposure to the visual aspects of Engineering Design.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3			2			3						2	2	2
	CO2	3	3	1		3	2									
	CO3			3												
	CO4											3				
	CO5	3						1								
	CO6															
3	Category	Engineering Science (ES)														
4	Approval	47th Meeting of Academic Council														

U18ESCS1L1	**PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1.5
	Prerequisite – **Problem Solving And Python Programmingg**				
	Department:-Department of Computer Science & Engineering				

COURSE OBJECTIVES:
To enhance the practical knowledge on writing programs using Python

LIST OF EXPERIMENTS FOR PROBLEM SOLVING AND PYTHON PROGRAMMING LAB

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. Exponentiation (Power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search

6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Find the most frequent words in a text read from a file
11. Simulate elliptical orbits in Pygame
12. Simulate bouncing ball using Pygame
13. Simulate matrix operations with Scilab
14. Simulate fitting curve with NumPy and Matplotlib

REFERENCES:

1 Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012
2. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux and Scilab

Course Outcome (COs)	
CO1	Write, test, and debug simple Python programs.
CO2	Implement Python programs with conditionals and loops
CO3	Develop Python programs step-wise by defining functions and calling them
CO4	Use Python lists, tuples, dictionaries for representing compound data
CO5	Read and write data from/to files in Python and to simulate using the packages Scilab, NumPy and Matplotlib

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	2	3	3	2	2	2	2		2		3	3	3
	CO2	3	3	1	3	3	2	1	2	2	2	2				
	CO3	3	3	2	2	2	2		2	2	2	2				
	CO4	3	2	3	3	3	2	2	2	2	1					
	CO5	3	3	2	3	2	2		2	2	1	2				
	CO6															
3	Category	Engineering Science (ES)														
4	Approval	47th Meeting of Academic Council														

U18BSMA301	**TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**	**L**	**T**	**P**	**C**
	Total Contact periods : 60	**3**	**1**	**0**	**4**
	Prerequisite – Engineering Mathematics I & II				
	Department:-Department of Mathematics				

COURSE OBJECTIVES:

- Grasp the Fourier series expansion for given periodic function in specific intervals and their different forms.

- Learn techniques of solving the standard types of first order and second order partial differential equations.
- Learn solving wave and heat equation using Fourier series.
  Understand the problems using Fourier transform and their properties. Understand the problems using Z - transform and their properties.

UNIT I FOURIER SERIES (9+3)

Dirichlet's conditions – General Fourier Series – Half range Sine and Cosine series – Parseval's Identity – Harmonic Analysis.

UNIT II PARTIAL DIFFERENTIAL EQUATIONS (9+3)

Formation – Solutions of standard types of first order equations – Lagrange's linear equations – Linear partial differential equation of second and higher order with constant coefficients.

UNIT III BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS (9+3)

Classifications second order linear partial differential equations – Solution of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation – Fourier Series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORMS (9+3)

Fourier integral theorem (without proof) – Fourier transform pairs – Fourier sine and cosine transform – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z – TRANSFORMS AND DIFFERENCE EQUATIONS (9+3)

Z – Transform – Elementary properties – Inverse Z – Transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – Transform.

TEXT BOOK:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Willie & Sons, 2006.

REFERENCES:

1. R. Haberman, Elementary Applied partial differential equations with Fourier Series and Boundary Value Problems, 4th Ed., Prentice Hall, 1998.
2. Manish Goya and .N.P Bali l, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
3. Venkataraman. M. K. "Engineering Mathematics Volume III" , 13th Edition National Publishing Company, Chennai, 1998.
4. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass., Thomas' Calculus, 12th Edition, Addison-Wesley, Pearson.
5. S. J. Farlow, Partial Differential Equations for Scientist and Engineers, Dover Publications 1993.
6. Shanmugam,T.N.:http:.www.annauniv.edu/shan/trans.h

Course Outcome (COs)	
CO1	Expand given function using the knowledge of Fourier Series and frequently needed practical harmonic analysis that an engineer may have to make from discrete data.
CO2	Solve PDE and higher order with constant coefficients and physically interpret the results.

CO3	Boundary Value Problems and Differential Equations will be knowledgeable about and will be able to analyze solutions to two-point boundary value problems, boundary value problems for partial differential equations.
CO4	Solve many problems in automobile, medicine, electronic engineering by applying Fourier transform with the possible special cases with attention to their applications.
CO5	Apply the basics of Z – Transform in its applicability to discretely varying functions, gained the skill of formulate certain problems in terms of difference equations and solve them using the Z – Transform techniques.
CO6	

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3		2	2						1		2	2	2
	CO2	3		1		3		2	2				1			
	CO3	3			3	2			2		1					
	CO4	3			2					1						
	CO5	3					2						1			
	CO6															
3	Category	Basic Science (BS)														
4	Approval	47th Meeting of Academic Council														

U18PCEC301	**SIGNALS AND SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours –60	3	1	0	4
	Prerequisite – Engineering Mathematics-II				
	Department:-Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:

This course trains students for an intermediate level of fluency with signals and systems in both continuous time and discrete time, in preparation for more advanced subjects in digital signal processing (including audio, image and video processing), communication theory, and system theory, control and robotics.

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9+3

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 singals, CT systems and DT systems, Classification of systems - Linear Time invariant Systems.

UNIT II ANALYSIS OF C.T. SINGALS 9+3

Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and Laplace Transform in Signal Analysis.

UNIT III LTI-CT SYSTEMS 9+3

Differential equation, Block diagram representation, Impulse response, Convolution integral, Frequency response, Fourier Methods and Laplace transforms in analysis, State equations and Matrix.

UNIT IV ANALYSIS OF D.T. SIGNALS 9+3

Spectrum of D.T. signals, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Properties of Z-transform in signal analysis.

UNIT V LTI-DT SYSTEMS 9+3

Difference equations, Block diagram representation, Impulse response, Convolution SUM, Frequency response, FFT and Z-transform analysis, State variable equation and Matrix.

TEXT BOOK:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2007.

REFERENCES:

1. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 20076.
4. www.nptel.ac.in

Course Outcome (COs)	
CO1	To Understand different types of signals-continuous and discrete, odd and even, periodic and aperiodic etc. Be able to classify systems based on their properties
CO2	To familiarize the concepts of transform based continuous time signals
CO3	Analyze continuous time systems by using appropriate mathematical tools
CO4	Analyze sampling process and sampling of discrete time signals.
CO5	Analyze discrete time signals by using appropriate mathematical tools
CO6	Determine Fourier transforms for discrete-time system, and understand how to interpret and plot Fourier transform magnitude and phase functions

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	3	3			3	3		3		3	3	3
	CO2	3	3	3	3	3			3	3	2	3				
	CO3	3	3	3	3	2			3	3	2					
	CO4	3			3	2			2				2			
	CO5	3	3	3	3	3			3	3		3				
	CO6	3	3	3	3	3			3	3	2	3				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC302	**DIGITAL SYSTEM DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Basic Electronics Engineering				
	Department:-Department of Electronics And Communication Engineering.				

COURSE OBJECTIVES:

To manipulate across various number system and to compute binary arithmetic operations.
To understand the design of combinational and sequential circuits using gates.
To know the concept of memories and programmable logic devices
To learn the design of asynchronous and synchronous sequential circuits

UNIT I BASIC CONCEPTS, BOOLEAN ALGEBRA AND LOGIC GATES 9

Number systems - Binary, Octal, Decimal, Hexadecimal, conversion from one to another, complement arithmetic, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables. Quine-McCluskey method of minimization

UNIT II COMBINATIONAL CIRCUITS 9

Problem formulation and design of combinational circuits, Half Adder, Full adder, Half Subtractor, Full Subtractor, Carry Look Ahead adder, BCD adder, Fast adder, Serial adder/subtractor, Binary Multiplier, Binary Divider, Encoder ,Decoder, Mux / Demux, Code-converters, Parity Generators, Comparators.

UNIT III SEQUENTIAL CIRCUIT 9

Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

UNIT IV LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES 9

TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

UNIT V VLSI DESIGN FLOW 9

Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

TEXT BOOK:

1. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. William I. Fletcher, " An Engineering Approach to Digital Design ", Prentice-Hall of India, 1980.

REFERENCES:

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning,2006.
3. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
4. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
5. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
6. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition,2006.

7 http://www.electrical4u.com/digital-electronics

Course Outcome (COs)	
CO1	Recall the different number systems and demonstrate the simplification of Boolean expressions using Boolean algebra & K-Map method.
CO2	Analyze the Combinational building blocks.
CO3	Analyze the sequential building blocks.
CO4	To Learn about Logic families.
CO5	To gain knowledge about semiconductor memories

CO6	To learn about VLSI design flow and the importance of VHDL															
Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low																
1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3		3	1	2			2				3	3	3
	CO2	2	3	2	3		2				2	3				
	CO3	3	3								2	3				
	CO4	3														
	CO5	2	3	2	3		2			2						
	CO6	3	3	2	3					2	3	3				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC303	**ELECTRONIC DEVICES**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics Engineering				
	Department:-Department of Electronics & Communication Engineering				

COURSE OBJECTIVES:

To acquaint the students with the construction, theory and operation of the basic semiconductor devices such as PN junction diode, Bipolar and Field effect Transistors.
To know the applications of the basic semiconductor devices

UNIT I SEMICONDUCTOR DEVICES 9

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes, Zener Diode and its characteristics ,Voltage Regulation using Zener Diode

UNIT II RECTIFIERS AND FILTERS 9

The P-N junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Harmonic components in a Rectifier Circuit, Inductor Filters, Capacitor Filters, L- Section Filters, π- Section Filters, Comparison of Filters

UNIT III TRANSISTOR BIASING AND STABILIZATION 9

Operating Point, The DC and AC Load lines, Need for Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector - Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Bias Compensation using Diodes and Transistors, Thermal Runaway, Thermal Stability

UNIT IV BIPOLAR JUNCTION TRANSISTOR AND UJT 9

BJT Construction, Operation, Common Base, Common Emitter and Common Collector Configurations, BJT as an Amplifier ,BJT Hybrid Model, Determination of h-parameters from Transistor Characteristics, Comparison of CB, CE, and CC Amplifier Configurations, UJT and Characteristics.

UNIT V FIELD EFFECT TRANSISTOR AND FET AMPLIFIERS 9

Field Effect Transistor: The Junction Field Effect Transistor (Construction, principle of operation, symbol) – Pinch-off Voltage - Volt-Ampere characteristics, The JFET Small Signal

Model, **MOSFET** (Construction, principle of operation, symbol), MOSFET Characteristics in Enhancement and Depletion modes.

TEXT BOOK:

1. Millman's Electronic Devices and Circuits – J. Millman, C.Halkias, and Satyabrata Jit, 2 Ed., 1998, TMH.
2. Electronic Devices and Circuits – David A. Bell, 5 Ed, Oxford.

REFERENCES:

1. Integrated Electronics – J. Millman and Christos C. Halkias, 1991 Ed., 2008, TMH.
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, 9 Ed., 2006, PEI/PHI.
3. Electronic Devices and Circuits – B. P. Singh, Rekha Singh, Pearson, 2 Ed, 2013.
4. Electronic Devices and Circuits - K. Lal Kishore, 2 Ed., 2005, BSP.
5. Electronic Devices and Circuits – Anil K. Maini, Varsha Agarwal, 1 Ed., 2009, Wiley India
6. www.electronics-notes.com/

Course Outcome (COs)	
CO1	To understand and analyze the different types of diodes, operation and its characteristics
CO2	To analyze the rectifier circuits and various filters
CO3	To study and understand the BJT and FET.
CO4	To study and understand the various biasing methods of BJT.
CO5	To understand various stabilization techniques of BJT.
CO6	To understand operation and characteristics of FET amplifiers

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	2	1	2			2	1		2		3	3	3
	CO2	3	2	2	1	2			2	2		2				
	CO3	2	3	2	2	3			3	2		1				
	CO4	2		1		2			2	2		2				
	CO5	2	1	1	1	2			3	2		2				
	CO6	3	2	2	1	2			3	1		1				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC304	**NETWORK THEORY**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	3	0	0	3
	Prerequisite – Engineering Mathematics-II & Basic Electrical and Electronics Engineering				
	Department:-Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:

- To analyze concepts of symmetrical and asymmetrical networks.
- To realize the basic Networks and Design the various filters.
- To design Attenuators and Equalizers which are employed in the communications system

- To study the response of the RLC circuits and construct the network.
- To realize the RL and RC networks by synthesis

UNIT I BASIC CIRCUITS ANALYSIS AND NETWORK THEOREMS 9

Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactance's, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Thallogen's theorem as applied to AC circuits.

UNIT II FOURIER TRANSFORMATIONS 9

Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

UNIT III LAPLACE TRANSFORM TECHNIQUES 9

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT IV TRANSIENT ANALYSIS 9

Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of admittance function, their properties, sinusoidal response from pole-zero locations,

UNIT V FILTER DESIGN TECHNIQUES 9

convolution theorem and Two four port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters

TEXT BOOK:

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000

REFERENCES:

1. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994
2 A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education
3. www.nptel.ac.in

Course Outcome (COs)	
CO1	Develop the capacity to analyze electrical circuits, apply the circuit theorems in real time.
CO2	Obtain the various network parameters for the given two port networks.
CO3	Design asymmetric, symmetric, attenuator and equalizer networks.
CO4	Determine the parameters for the design of various filters
CO5	Estimate Step and Impulse response of RL and RC networks.
CO6	Synthesize RL and RC networks.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PS O3

2	CO1	3	3	3	3	3			3	3		3	3	3	3	3
	CO2	3	3	3	3	3			3	3	2	3	3			
	CO3	3	3	3	3	2			3	3	2		3			
	CO4	3			3	2			2				3			
	CO5	3	3	3	3	3			3	3		3	3			
	CO6	3	3	3	3	3			3	3	2	3	3			
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18HSEC301	**PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – NIL				
	Department:-Dept of Management Studies				

COURSE OBJECTIVES:

To teach the philosophy of Life, personal value, social value, mind cultural value and personal health

To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues

UNIT I PROFESSIONAL ETHICS 9

Ethics in workplace- Formulation of Ethics- Managerial Ethics- Managing Ethical Behavior- codes of Ethics – Encouraging Ethical Behavior- Social Responsibility-Spirituality.

UNIT II SOCIAL VALUES 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftiness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III LIFE BODY RELATION & CULTURE 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV SOCIAL RESPONSIBILITIES FOR SAFETY FOR ENGINEERS'S 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V RIGHTS AND GLOBAL ISSUES FOR ENGINEERS'S 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership.

TEXT BOOK:

1. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006.
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005

REFERENCES:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications.
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004.
3. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications.
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004.
5. www.waceinc.org/philly2011/conference.../KARSTE~1.PDF

Course Outcome (COs)	
CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of responsibilities and rights as Professional and facing Global Challenges

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1				1		3		2	2			3	2	2	2
	CO2				2		3		3	3			3			
	CO3						3		3	3			3			
	CO4						3		2	2			3			
	CO5						3		2	2			3			
	CO6						3		2	2			3			
3	Category	Humanities ans Social Science (HS)														
4	Approval	48th Meeting of Academic Council														

U18PCEC3L1	**ELECTRONIC DEVICES LAB**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	0	0	2	1
	Prerequisite – Basic Electrical and Electronics Engineering Practices Lab				
	Department:-Department of Electronics & Communication Engineering				

COURSE OBJECTIVES:

To enhance the practical knowledge on Electronic Devices through Experiments.

LIST OF EXPERIMENTS FOR ELECTRONIC DEVICES LAB

1. Study of CRO
2. V-I characteristics of PN junction diode

3. V-I characteristics of Zener diode and Zener regulator Characteristics
4. Half-wave rectifier with and without filter
5. Full-wave rectifier with and without filter
6. BJT input/output characteristics (CE configuration)
7. UJT input/output characteristics
8. Comparison of performance of self bias and fixed bias circuits
9. Transfer characteristics of JFET
10. Transfer characteristics of MOSFET
11. Simulation experiments using Pspice or Multisim.

Experiments beyond the syllabus should be conducted

Course Outcome (COs)	
CO1	To analyze the characteristics of PN junction and Zener Diode
CO2	To analyze Rectifier with and without filter
CO3	To analyze the characteristics of BJT and UJT
CO4	To compare the performance of self bias and fixed bias circuits
CO5	To analyze the characteristics of JFET and MOSFET
CO6	To provide the capability to use simulation tools for performing various analysis of semiconductor devices

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	2	2	1	1			2	2		1		3	3	3
	CO2	2	1	1	2	3			2	1		2				
	CO3	2	2	1	2	3			2	2		1				
	CO4	2	1	1		3			3	2		2				
	CO5	3	1	1	2	3			3	2		2				
	CO6	2	2	3	2	1			2	1		2				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC3L2	**DIGITAL SYSTEM DESIGN LAB**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	0	0	2	1
	Prerequisite –Basic Electronics Engineering Lab				
	Department:-Department of Electronics & Communication Engineering				

COURSE OBJECTIVES:

To know the concepts of Combinational circuits.
To understand the concepts of flip-flops, registers and counters

List of Experiments

1. Study of logic gates.
2. Design and implementation of adders and subtractors using logic gates.
3. Design and implementation of encoder and decoder using logic gates.
4. Design and implementation of multiplexer and demultiplexer using logic gates.
5. Design and implementation of 2-bit magnitude comparator using logic gates,
6. Design and implementation of 16-bit odd/even parity checker.
7. Design and implementation of Flipflops using logic gates.

8. Design and implementation of code converters using logic gates.
9. Design and implementation of counters.
10. Design and Implementation of shift registers.

Experiments beyond the syllabus should be conducted.

Course Outcome (COs)	
CO1	Learn the basics of gates.
CO2	Construct basic combinational circuits and verify their functionalities
CO3	Apply the design procedures to design basic sequential circuits
CO4	Learn about counters
CO5	Learn about Shift registers
CO6	To understand the basic digital circuits and to verify their operation

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3		3							2		3	3	3
	CO2	3	3	3	3	3			2	2	3	3				
	CO3	3	3	3	3	3			2	2	3	3				
	CO4	2	3	3	3					2	3	3				
	CO5	2	3		2							3				
	CO6	3	3	3	2	3			2	3	3	2				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18MCAB305 LEARNING AN ART FORM

Cultivation of arts is an integral part of the development of human beings since the arts are what make us most human, most complete as people. They offer us the experience of wholeness because they touch us at the deepest levels of mind and personality. They come into being not when we move beyond necessity but when we move to a deeper necessity, to the deeper human need to create order, beauty and meaning out of chaos. They are the expressions of deepest human urges, imperatives and aspirations.
While enriching the process of learning through enhanced perceptual and cognitive skills, learning of arts promotes self-esteem, motivation, aesthetic awareness, cultural exposure, creativity, improved emotional expression, as well as social harmony and appreciation of diversity. They promote an understanding and sharing of culture, and equip the learners with social skills that enhance the awareness and respect of others. Each institution will offer a range of introductory courses in different art forms: music, dance, theatre, painting, and other art forms. Care should be taken to give adequate representation to local and regional art forms in which our culture abounds. For example, Banaras has local traditions in vocal music like Chaiti, Hori, Kajri and Birha.

An institution in Banaras area can offer courses on these art forms apart from regular classical and semi-classical vocal music forms. Similar local art tradition can be utilized in different cities and regions. This will, in turn, also ensure wider community involvement/interaction with the institution. Students will be given an option to choose a particular art form, and learn

and practice it under an artist -instructor. At the end of the course, a student should be able to demonstrate basic proficiency in that particular art form. Contact hours per week should be 3-4 hours.

Towards the end of the course, the institution can organize a function/program in which all the students publicly demonstrate their skills.

U18MCAB306 INTANGIBLE CULTURAL HERITAGE (FESTIVALS, FOOD WAYS, LOCAL GAMES)

As part of our rich intangible cultural heritage, foodways, fares and festivals, local games and sports are important sources for discovering the social and cultural values of our people and understanding the inner dynamics of our society, as these are sites where we witness the most significant and intimate representations of our society's self-perception—how our society perceives itself. These traditions have shaped and strengthened our social and cultural identities, and also the notion of community at the local, regional, and national levels. They have played a significant role in the making of our social life, and through them we have constructed for ourselves, individually and collectively, a sense of shared lived past and group identity. They facilitate the transmission of a culture's most deeply held values, from one generation to another and their continuity or discontinuity helps us to understand the changing social structure and culture of a society. For example, each community has its own foodways, and their overall health, well-being and cultural continuity are directly related to their ability to eat traditional foods and continue their traditional food practices. These traditional foods and food practices are deeply intertwined with their cultures and value systems, and play an important role in religious ceremonies and spirituality. Similar is the case with fares and festivals, and local games and sports. These traditions are bound up with rituals, customs, beliefs, and often also with trade, craft and professions. They are not mere superstitious rituals often condemned and denounced as being regressive, stagnant and backward, but repositories of our indigenous knowledge and wisdom which have evolved over centuries, and they still continue to serve social and cultural functions. This knowledge has been the basis for agriculture, food preparation, health care, education, conservation and the wide range of other activities that sustain societies in many parts of the world.

Most of these traditions are either on the verge of extinction or undergoing drastic changes due to globalization, acculturation, migration, questions of identity related to social mobility to confirm to a higher social order or simply because the context in which these traditions originated or were conceived no longer exist and their effectiveness or need seems no longer relevant. For example, while the agro-ecological and food systems offer some signs of resilience and adaptation, a range of factors are increasingly threatening these systems and peoples' well-being. The knowledge and skills of elders concerning traditional food preparation, and the use of traditional herbs and plants for healing purposes have not been passed on to the next generation and is at risk of being lost and disappearing altogether from reservation life and culture.

The course aims at exposing students to these traditions, and making them aware of the veritable treasure house of indigenous knowledge which can be utilized as resource for realizing a vision of sustainable future.

Each locality/region our Indian sub-continent abounds in a rich variety of food-ways, fares and festivals, games and sports. Students should be asked to identify one of these traditions and study them in detail. For example, the following guidelines can be adopted in the study of food-ways:

- To study and document the indigenous knowledge and wisdom of everyday food habits and food items consumed;
- To study and document the prevalent social practices and beliefs regarding traditional foods;
- To study and document the feasts on religious and social occasions of different communities;
- To identify and document the food items consumed by different communities and determine their nutritional values;
- To conduct chemical analysis of food ingredients;
- To identify and document the kitchen generated health ingredients used by different communities;
- To find out the uses of leftover food stuff of different communities;
- To develop hygienic food chart for people ailing and suffering from different metabolic disorders;
- To develop suitable communication strategies to effectively disseminate traditional knowledge regarding food habits.

Similarly, in the case of fares and festivals, and games and sports one could study how these traditions create a sense of community bonding and lead to the rules of commensality and social interaction and behavior. Suitable guidelines along the lines of foodways can be developed and adopted for such a study.

At the end of the course, students will be required to submit a detailed project report. Options should be given to the students to make short documentaries and films on these traditions.

U18BSMA404	**PROBABILITY AND STOCHASTIC PROCESSES**	**L**	**T**	**P**	**C**
	Total Contact Periods - 60	**3**	**1**	**0**	**4**
	Prerequisite – Basic knowledge of probability				
	Department:- Department of Mathematics				

COURSE OBJECTIVES

- The objective of this course is to introduce the students to the idea of random variables, distribution and random process, and an important mathematical tool in signal processing.
- An ability to design and analyze an Electronic circuits in Engineering as well as to formulate coding to interpret data.
- An ability to use the techniques, skills, and modern tools in science and engineering environment

UNIT I PROBABILITY THEORY (9+3) Hrs

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and Sampling models.

UNIT II RANDOM VARIABLES (9+3) Hrs

Discrete random variables, probability mass function, probability distribution function, and standard distributions; Continuous random variables, probability density function, probability distribution function, and standard distributions.

UNIT III TWO DIMENSIONAL RANDOM VARIABLES (9+3) Hrs

Joint distributions, Marginal and conditional distributions-covariance- correlation and regression: properties and problems- rank correlation; Transformation of a random variable.

UNIT IV APPLICATION OF TWO DIMENSIONAL RANDOM VARIABLES (9+3)Hrs

Random sequences and modes of convergence (everywhere, almost everywhere probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

UNIT V RANDOM PROCESS AND SPECTRAL DENSITY (9+3)Hrs

Random process, Stationary processes. Mean and covariance functions, Markov, Ergodicity, Power spectral density, Transmission of random process through LTI.

TEXT BOOK:

1. S.C.Gupta & V.K.Kapoor, “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons, New Delhi, 2003.
2. Peebles Jr., "Probability, Random Variables and Random Signal Principles", McGraw Hill Publishers, (1987).

REFERENCES:

1. A. Papoulis and S. Unni Krishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill 4.
2. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International.
4. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press

Course Outcome (COs)	
CO1	Apply concepts of Probability to solve problems in Electronic Engineering.
CO2	Make students understand Discrete and Continuous Random variables, Random Processes and their applications in Electronic Transmissions
CO3	Find the trend information from discrete data set through numerical differentiation and summary information through random process
CO4	Understand propagation of random signals in LTI systems
CO5	Find functional relationship between random inputs and outputs with the use of Random Process Techniques

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3				2		1			1	2		2	2	2
	CO2	3		3	1	2	1		2				2			
	CO3	3				2				1		2				
	CO4	3	2			2				1			1			
	CO5	3		3		2				2	1	2				
	CO6															
3	Category	Humanities and Social Scienc(HS)														

4	Approval	47Th Meeting of Academic Council

U18PCEC401	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Digital Electronics				
	Department:-Dept. of Electronics and Communication Engineering				

COURSE OBJECTIVES

The student should be made to:

- Understand analog and digital communication techniques.
- Learn data and pulse communication techniques.
- Be familiarized with source and Error control coding.
- Gain knowledge on multi-user radio communication.

UNIT I ANALOG COMMUNICATION 9

Noise: Source of Noise - External Noise- Internal Noise - Noise Calculation. Introduction to Communication Systems: Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of various Analog Communication System (AM –FM – PM).

UNIT II DIGITAL COMMUNICATION 9

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Minimum Shift Keying (MSK) –Phase Shift Keying (PSK) – BPSK – QPSK – 8 PSK – 16 PSK - Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK– FSK – PSK – QAM).

UNIT III DATA AND PULSE COMMUNICATION 9

Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Error Detection and Correction Techniques - Data communication Hardware - serial and parallel interfaces. Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System.

UNIT IV SOURCE AND ERROR CONTROL CODING 9

Entropy, Source encoding theorem, Shannon Fano coding, Huffman coding, mutual information, channel capacity, channel coding theorem, Error Control Coding, linear block codes, cyclic codes, convolution codes, viterbi decoding algorithm.

UNIT V MULTI-USER RADIO COMMUNICATION 9

Advanced Mobile Phone System (AMPS) - Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Hand - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.

TEXT BOOK:

1. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th Edition, Pearson Education, 2009.

REFERENCES:

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley & Sons, 2004
2. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2007

3. H.Taub, D L Schilling and G Saha, “Principles of Communication”, 3rd Edition, Pearson Education, 2007.
4. B. P.Lathi, “Modern Analog and Digital Communication Systems”, 3rd Edition, Oxford University Press, 2007.
5. Blake, “Electronic Communication Systems”, Thomson Delmar Publications, 2002.rd
6. Martin S.Roden, “Analog and Digital Communication System”, 3 Edition, Prentice Hall of India,2002.
7. B.Sklar, “Digital Communication Fundamentals and Applications” 2 Edition Pearson Education 2007.
8. www.nptel.ac.in

Course Outcome (COs)	
CO1	Apply analog and digital communication techniques.
CO2	Use data and pulse communication techniques.
CO3	Analyze Source and Error control coding.
CO4	Gain knowledge on multi-user radio communication.
CO5	To understand the various applications of coding
CO6	Discuss the various types of systems

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
2	CO1	3	3	3	2	1			1	2	1	1		3	3	3
	CO2	1	3	2	1	1			2	2	2	2	2			
	CO3	3	3	1	2	2			1	2	2	1				
	CO4	1	2	2	1	2			2	1	1	1				
	CO5	1	2	3	3	3			2	2	2	3	2			
	CO6	3	3	2	3	1			3	2	1	2	1			
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC402	**ANALOG CIRCUITS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic electrical and electronics, Electronic Devices				
	Department:-Dept. of Electronics and Communication Engineering				

COURSE OBJECTIVES

Learn about biasing of BJTs and various transistor models
To teach the fundamentals of amplifiers, types of amplifiers, gain margin
Study Oscillators and characteristics.
Study OP AMP and its applications
To introduce the fundamentals of DAC and ADC

UNIT I INTRODUCTION 9

Diode Circuits, Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small

signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

UNIT II HIGH FREQUENCY TRANSISTOR MODELS AND POWER AMPLIFIERS 9

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

UNIT III OSCILLATORS 9

Review of the basic concept, Barkhuizen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitts, Clapp etc.), non-sinusoidal oscillators. Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load.

UNIT IV OPEARTIONAL AMPLIFIER AND ITS APPLICATIONS 9

OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation. Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR.

OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

UNIT V DIGITAL TO ANALOG CONVERTERS (DAC) AND ANALOG TO DIGITAL CONVERTERS 9

Digital -to-analog converters Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

TEXT BOOKS

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.

REFERENCE BOOKS

1. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
2. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11Publishing, Edition IV
3. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition
4. www.nptel.ac.in

Course Outcome (COs)	
CO1	Understand the characteristics of diodes and transistors.
CO2	Design and analyze various rectifier and amplifier circuits

CO3	Design sinusoidal and non-sinusoidal oscillators.

CO4	Understand the functioning of OP-AMP and design OP-AMP based circuits
CO5	Design ADC and DAC.
CO6	Understand the applications of OP – AMP and special function IC's

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	3	3			3	3	3	3		3	3	3
	CO2	3	2	3	3	2			2		3	2				
	CO3	3	3	2	2	2			2	2		2				
	CO4	3	3	3	3	3			2	3	3	3				
	CO5	2	2	3	3											
	CO6	3	3	3	2	3			3	3	3	3				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC403	MICROCONTROLLERS	L	T	P	C
	Total Contact Hours – 60	3	0	0	3
	Prerequisite – Digital System Design				
	Department:-Dept. of Electronics and Communication Engineering				

COURSE OBJECTIVES

The student should be made to:

The objective of this course is to become familiar with the architecture and the instruction set of an Intel microcontroller

Assembly language programming will be studied as well as the design of various types of digital and analog interfaces

Understand the architecture of 8051

UNIT 1 MICROPROCESSORS AND MICROCONTROLLER INTRODUCTION 9

Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software. The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, Stacks.

UNIT II ADDRESSING MODES INSTRUCTION SET 9

Addressing Modes: Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing, Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction.

UNIT III 8051 PROGRAMMING 9

Assembler directives, Assembly language programs and Time delay calculations.

UNIT IV 8051 INTERFACING AND APPLICATIONS 9

Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming.

UNIT V 8051 INTERRUPTS AND TIMERS/COUNTERS 9

Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C .

TEXT BOOK:

1. The 8051 Microcontroller and Embedded Systems : Using Assembly and C" by Muhammad Ali Mazidi
2. "Microprocessors and Microcontrollers : Architecture, Programming and Interfacing Using 8085, 8086 and 8051" by Soumitra Kumar Mandal.

REFERENCES:

1. "Microprocessors And Microcontrollers" by A Nagoor Kani
2. "Microprocessors And Microcontrollers : Architecture, Programming and System Design 8085, 8086, 8051, 8096" by KRISHNA KANT
3. www.nptel.ac.in

Course Outcome (COs)	
CO1	Independently design and implement an embedded system based on an eight-bit microcontroller, taking into account energy conservation and possible software errors,
CO2	Program a microcontroller using C, including hardware configuration and interrupt service routines,
CO3	Manage parallel processes with different priority and real time constraints without the aid of an operating system,
CO4	Select data types and algorithms suitable for the architecture and instruction set of a given microcontroller
CO5	Give a detailed description of limitations of the chosen system design
CO6	Debug a microcontroller application using different tools.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3	3	2	2			1			2		3	3	3
	CO2	3	2	2	2	3			2			2				
	CO3	3	1	1	2	2						2				
	CO4	2	1	2	1	2				1		2				
	CO5	2	2	1	2	1			1	2		2				
	CO6	3	3	2	2	2			2	1		3				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC404	**ELECTROMAGNETIC WAVES**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Transforms and Partial Differential equation				
	Department:- Department of Electronics & Communication Engineering				

COURSE OBJECTIVES

- To impart knowledge on the basics of static electric and magnetic field and the associated laws.
- To give insight into the propagation of EM waves and also to introduce the methods in computational electro magnetics.
- To make students have depth understanding of antennas, electronic devices,

UNIT I STATIC ELECTRIC FIELD 9

Vector Algebra, Coordinate Systems, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Coulombs law, Electric field intensity, Point, Line, Surface and Volume charge distributions, Electric flux density, Gauss law and its applications, Gauss divergence theorem, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT II CONDUCTORS AND DI ELECTRICS 9

Conductors and dielectrics in Static Electric Field, Current and current density, Continuity equation, Polarization, Boundary conditions, Method of images, Resistance of a conductor, Capacitance, Parallel plate, Coaxial and Spherical capacitors, Boundary conditions for perfect dielectric materials, Poisson's equation, Laplace's equation, Solution of Laplace equation, Application of Poisson's and Laplace's equations.

UNIT III STATIC MAGNETIC FIELDS 9

Biot-Savart Law, Magnetic field Intensity, Estimation of Magnetic field Intensity for straight and circular conductors, Ampere's Circuital Law, Point form of Ampere's Circuital Law, Stokes theorem, Magnetic flux and magnetic flux density, The Scalar and Vector Magnetic potentials, Derivation of Steady magnetic field Laws.

UNIT IV MAGNETIC FORCES AND MATERIALS 9

Force on a moving charge, Force on a differential current element, Force between current elements, Force and torque on a closed circuit, The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions involving magnetic fields, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance, Basic expressions for self and mutual inductances, Inductance evaluation for solenoid, toroid, coaxial cables and transmission lines, Energy stored in Magnetic fields.

UNIT V TIME VARYING FIELDS AND MAXWELL'S EQUATIONS 9

Fundamental relations for Electrostatic and Magnetostatics fields, Faraday's law for Electromagnetic induction, Transformers, Motional Electromotive forces, Differential form of Maxwell's equations, Integral form of Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and their solutions, Poynting's theorem, Time harmonic fields, Electromagnetic Spectrum.

TEXT BOOK:

1. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems

REFERENCES:

1. Karl F. Warnick: "Numerical Methods for Engineering: An Introduction Using MATLAB and Computational Electromagnetics Examples," SciTech Publishing, 2010
2. Matthew N.O. Sadiku: "Numerical Techniques in Electromagnetics with MATLAB," Third Edition, CRC Press

3. A. F. Peterson, S. L. Ray, and R. Mittra, "Computational Methods for Electromagnetics" (IEEE Press, New York, 1998).
4. www.Wiley.com

Course Outcome (COs)	
CO1	Analyze field potentials due to static changes and static electric fields
CO2	Explain how materials affect electric fields
CO3	To analyze about static magnetic field.
CO4	Explain how materials affect magnetic fields
CO5	Analyze the relation between the fields under time varying situations
CO6	Discuss the principles of propagation of uniform plane waves

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	3	3			3	3		3		3	3	3
	CO2	3	3	3	3	3			3	3	3	3				
	CO3	3	3	2	2	3					3					
	CO4	3	2	3	2											
	CO5	3	3	3	3				3	3	2	3				
	CO6	3	2	2		3			2	2						
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18ESCS401	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Fundamentals of Computing and Programming				
	Department:- Dept of Information Technology				

COURSE OBJECTIVES

- To provide a brief, hands-on overview of object-oriented analysis in software process
- To discuss Case studies-based project specifications to develop object-oriented models and identify implementation strategies.
- To demonstrate and apply basic object-oriented techniques to create and modify object-oriented analysis and design models.
- To understand and apply testing techniques for object-oriented software.

UNIT I DATA ABSTRACTION & OVERLOADING 9

Overview of C++–Structures–Class Scope and Accessing Class Members –Reference Variables–Initialization–Constructors–Destructors–MemberFunctionsandClasses– Friend Function – Dynamic Memory Allocation – Static Class Members –Overloading: Function overloading and Operator Overloading.

UNIT II INHERITANCE&POLYMORPHISM 9

Base Classes and Derived Classes–Protected Members–Overriding –Public, Protected and Private Inheritance –Constructors and Destructors in derived Classes–Implicit Derived– Class

Object to Base–Class Object Conversion–Virtual functions–This Pointer–Abstract Base Classes and Concrete Classes– Virtual Destructors– Dynamic Binding.

UNIT III LINEAR DATA STRUCTURES 9

Abstract Data Types (ADTs)–List ADT–array-based implementation– linked list implementation– singly linked lists–Polynomial Manipulation-Stack ADT – Queue ADT

UNIT IV NON-LINEAR DATA STRUCTURES 9

Trees–Binary Trees –Binary tree representation and traversals–The Search Tree ADT– Graph and its representations–Graph Traversals–Breadth-first search–Depth-first search– Bi-connectivity**.**

UNIT V SORTING AND SEARCHING 9

Sorting algorithms: Insertion Sort-Quick sort –Mergesor-Searching: Linear search –Binary S

TEXT BOOK:

1. Deitel and Deitel, - C++, How to Program, Fifth Edition, Pearson Education, 2005.
2. Bhushan Trivedi, - Programming with ANSIC++ ,A Step-By-Step approach Oxford University Press, 2010.

REFERENCES:

1. Goodrich, Michael T., Roberto Tamassia, David Mount, ―Data Structures and Algorithms in C++‖, 7th Edition, Wiley. 2004
2. Thomas H. Cormen, CharlesE. Leiserson, RonaldL. Rivest and Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
3. Bjarne Stroustrup, - The C++ProgrammingLanguage‖,3rd Edition, Pearson Education,2007
4. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, ―Fundamentals of Data Structures In C++‖, Galgotia Publications, 2007.
5. http://users.cis.fiu.edu/~weiss/
6. www.youtube.com/watch?

Course Outcome (COs)	
CO1	Develop solutions to a given problems using class object concepts.
CO2	Illustrate overloading, inheritance and polymorphism concepts with example
CO3	Explain the basic data structures and its operations
CO4	Make use of basic data structures to solve problems
CO5	To develop programs using C++ which forms the basic for advanced programming
CO6	Outline various searching and sorting algorithms

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1		3				2							3	3	3
	CO2	2			3	2				2						
	CO3		2									1				
	CO4	1														
	CO5			1	2						2					
	CO6															
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18MCTH502	UNIVERSAL HUMAN VALUES	L	T	P	C
	Total Contact Periods – 30	2	0	0	0
	Prerequisite –nil				
	Department:-AICTE				

Course Objective

The objective of the course is four-fold:

1. Sensitization of student towards self, family (relationship), society and nature.
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcome

At the end of the course, students are expected to become more aware of their surroundings, society, social problems and their sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they believe in (humane values. humane relationships and humane society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be mad

U18HSBA401	ORGANIZATIONAL BEHAVIOR	L	T	P	C
	Total No. of contact hours: 45	3	0	0	3
	Pre-requisite: NIL				
	Department:-Dept of Management Studies				

COURSE OBJECTIVES

Understanding the basic approaches in organization
Knowledge on theories of Personality
Clear sight on the Decision Making in Groups
Analyze the behavior of individuals and groups in organizations in terms of the key factors that influence organizational behavior. Assess the potential effects of organizational - level factors (such as structure, culture and change) on organizational behavior.

UNIT I **9**

Organizational Behavior – Definition, need for studying Organizational Behavior, Disciplines involved in the study of Organizational Behavior, -Contributing disciplines and area - Application of Organizational Behavior in Business.

UNIT II **9**

Individual behavior – personality, perception, learning, attitudes inter-personal behavior – Group and inter-group behavior.

UNIT III **9**

Group Dynamics – Formal and Informal Group, Group Norms, Group Cohesiveness, Group Behavior and Group Decision – Motivation – Need and Importance – Theories of Motivation

UNIT IV **9**

leadership-nature, stles and approaches, development of leadership including laboratory

training. Power and Authority – Definition of Power – Types of Power.

UNIT V **9**

Management of change-conflict Management- Management of culture, Cross Cultural Management.

REFERENCES:

1. Uma Sekaran, Organizational Behavior: Text and Cases TMH Publications
2. Ashwathappa K, Organizational Behavior: Text, cases and games, Himalaya Publishers
3. Chandhan JS, Organizational Behavior, Vikas Publishers
4. Stephen Robbins, Organizational Behavior, Pearson Education
5. RS Diwedi, Human Relations and Organizational Behavior, Mac Millan

Course Outcome (COs)	
CO1	Familiarity with the knowledge of Frame work of Organizational Behavior
CO2	Knowledge of the Interpersonal perception
CO3	Awareness of the Merits and Demerits of Group decision making.
CO4	Understanding of the Sources of power
CO5	Fmiliarity with the knowledge of types of Conflicts

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3					3					3		1	1	1
	CO2		3		2					3						
	CO3	2							2		3					
	CO4			2	3							3				
	CO5							2								
	CO6															
3	Category	Humanities and Social Science including Management Courses (HS)														
4	Approval	48th Meeting of Academic Council														

U18PCEC4L1	**ANALOG AND DIGITAL COMMUNICATION LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	0	0	2	1
	Prerequisite – Digital Electronics				
	Department:-Dept. of Electronics and Communication Engineering				

COURSE OBJECTIVES

- Understand analog and digital communication techniques.
- Learn data and pulse communication techniques.
- Be familiarized with source and Error control coding.
- Gain knowledge on multi-user radio communication.

List of Experiments:

1. Generation of noise and observations of its effect on a sinusoidal signal
2. Generation of AM signals
3. Demodulation of AM signals
4. Frequency modulation
5. Introduction to phase locked loop
6. FM Demodulators
7. Digital Modulation: FSK
8. Pre-emphasis & De-emphasis
9. Pulse code modulation
10. MATLAB basic for communication system design

11. Introduction to amplitude modulation (SIMULINK implementation)
12. Introduction to amplitude modulation (MATLAB implementation)

Course Outcome (COs)	
CO1	Apply analog and digital communication techniques.
CO2	Use data and pulse communication techniques.
CO3	Analyze Source and Error control coding.
CO4	Gain knowledge on multi-user radio communication.
CO5	To understand the various applications of coding
CO6	Discuss the various types of systems

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	2	3	2	2			2	2		1	1	3	3	3
	CO2	3	2		2	2			2	1		1				
	CO3	2	2	3	2	2			1	2		1				
	CO4	3	2	2	2	1			2	1		2	3			
	CO5	3	2	2	1	2			2	1		1				
	CO6	2	2	3	2	1			1	2		2				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC4L2	**MICROCONTROLLER LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	**0**	**0**	**2**	**1**
	Prerequisite – Digital System Design				
	Department:-Dept. of Electronics And Communication Engineering				

COURSE OBJECTIVES

The student should be made to:

- To introduce the basics of microcontroller and its applications.
- To provide in depth knowledge of 8051 ,PIC Microcontroller and Embedded-C programming
- To expertise working with Keil compiler and embedded C programming.
- To impart the I/O interfacing concepts for developing real time embedded systems.
- To encourage the students in building real time applications.

EMBEDDED C PROGRAMMING

LED Blinking using 8051 Microcontroller
Displaying Numbers on 7-Segment Display using 8051 Microcontroller
Timer/Counter Calculations and Program using 8051 Microcontroller
Serial Communication Calculations and Program using 8051 Microcontroller
Keypad Programming using 8051 Microcontroller
LCD Programming with 8051 Microcontroller
LED Blinking using PIC Microcontroller
Displaying Numbers on 7-Segment Display using PIC Microcontroller
Timer/Counter Calculations and Program using PIC Microcontroller
Serial Communication Calculations and Program using PIC Microcontroller

Keypad Programming using PIC Microcontroller
LCD Programming with PIC Microcontroller

MINI PROJECTS (any one)
Interfacing GPS with 8051 Microcontroller
Bidirectional Visitor Counter using 8051 Microcontroller
Water Level Controller using 8051 Microcontroller
Stepper Motor Control using 8051 Microcontroller
Password Based Door Locking System using 8051
Noncontact Digital Tachometer using 8051
Digital humidity sensor using PIC microcontroller

Course Outcome (COs)	
CO1	Familiarize with the embedded C programming using 8051.
CO2	Familiarize with 8051
CO3	Familiarize with the Keil µVision-3/4 and IAR Embedded Workbench tools.
CO4	Design circuits for various applications using microcontrollers.
CO5	Apply the concepts on real- time applications
CO6	To study about interfacing techniques

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2	PS O3
2	CO1	3	2	2	2	2			1		1	2		3	3	3
	CO2	3	2	2	2	2						2				
	CO3	3	2	2	2	3				1		2				
	CO4	2	3	3	2	2			1	1		2				
	CO5	2	3	3	1	2				1		2				
	CO6	2	3	3	1	2				1		2				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC4L3	**ANALOG CIRCUIT LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**0**	**0**	**2**	**1**
	Prerequisite –Basic Electronics Lab				
	Department:-Dept of Electronics and communication engineering				

COURSE OBJECTIVES
The student should be made to:
Study the characteristic of CE, CB and CC Amplifier
Learn the frequency response of CS Amplifiers
Study the Transfer characteristic of differential amplifier
Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
Perform SPICE simulation of Electronic Circuits

List of Experiments

1. Half Wave and Full Wave Rectifiers, Filters, Power supplies
2. Frequency Response of CE, CB, CC and CS amplifiers
3. Darlington Amplifier
4. Differential Amplifiers- Transfer characteristic, CMRR Measurement
5. Cascode / Cascade amplifier
6. Class A and Class B Power Amplifiers
7. Determination of bandwidth of single stage and multistage amplifiers
8. Astable and Monostable multivibrators using transistors.
9. Single Tuned Amplifier
10. Double Tuned amplifiers.
11. Pspice Simulation of Common Emitter and Common Source amplifiers
12. Pspice Simulation of Clippers and Clampers

Course Outcome (COs)	
CO1	Differentiate cascade and cascade amplifier
CO2	Analyze the limitation in bandwidth of single stage and multi stage amplifier
CO3	Simulate amplifiers using Spice
CO4	Measure CMRR in differential amplifier
CO5	Analyze the characteristics of single tuned and double tuned amplifiers
CO6	Understand the characteristics of Multivibrators

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	2	2	2	2			1		1	2		3	3	3
	CO2	3	2	2	2	2						2				
	CO3	3	2	2	2	3				1		2				
	CO4	2	3	3	2	2			1	1		2				
	CO5	2	3	3	1	2				1		2				
	CO6	2	3	3	1	2				1		2				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18MCAB407 LITERATURE, CINEMA AND MEDIA (WORKSHOP, READING MULTIPLE NEWS SOURCES, ANALYZE ADS)

The objective is to inculcate the habit of active (or interactive) consumption of the best content available in literature, films and media, rather than passive consumption.

Description.

Literature is perhaps as old as history or Aug be older and it is difficult to think of a fully educated person without any exposure to the best of the world literature (not just the literature of their own country or in their own language). Cinema is more recent and mass media is even more recent, but all these have a vital role in today's society. The problem is that the content available easily to most people (partly due to extensive promotion) caters to the lowest common denominator. Engineering students should be encouraged to read the best of the world literature and watch the best of the world cinema (regardless of their viewpoints). They should also be

made aware that news is best collected from different sources, which don't necessarily agree, so that they can understand the true meaning of democracy and also learn to form educated opinions about various topics based on the information from diverse sources. They should learn that being opinionated without being properly informed (say, by relying only on one source of news on TV based on TRPs) is not the right way to be a good citizen. They should get the experience of their opinion being contradicted by the most reliable evidence, so that they realize that there is no shame in changing a wrong opinion in the light of overwhelming evidence. For that, they will also have to learn how to find out the degree of reliability of different sources. One way to achieve this is to conduct workshops where students, aided by invited experts, read news from different sources, watch the best cinema and read or watch different media sources. They can then discuss these with their peers and with the invited experts and learn to talk peacefully with people of different viewpoints, as well as learn to form their own opinions. They should then be encouraged to write about their takeaways from these discussions or their opinions and their reasons for forming those opinions. Such activities can counter the current culture of being 'trolls' on the social media, for example. Instead, we should have citizens who give due respect to their fellow citizens and learn to analyze, discuss and reach conclusions in an agreeable manner, without unnecessary feelings of bitterness and enmity.

Another related exercise could be to read or watch advertisements and then analyze them in terms of the biases they promote (such as the desirability of fair skin) or the deception they indulge in to psychologically compel consumers to buy things they don't really need. Some advertisements even promote the habit of treating fellow human beings with contempt for being different from them (even in terms of possessing the products they are promoting). A well-educated citizen should be less susceptible to such practices in advertisements. Advertisements are just one example. Something similar could be done with all kinds of propaganda material

U18MCAB408 LITERATURE & MEDIA GROUP READING (SAAMUHIKVAACHAN) OF CLASSICS

This will make group to read one or two books during a semester.
Process: An hour Aug be fixed for a small group for a classic. Group sits, and each person reads aloud (if possible, with proper modulation) taking turns. This if done properly for an hour one Aug complete 30-40 pages in an hour. A normal classic can be finished in 15 to 20 days. If serious books on philosophy etc. are taken up a discussion can be held after every idea is complete.

U18PCEC501	**DIGITAL SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
	Total Contact Periods – 60	**3**	**1**	**0**	**4**
	Prerequisite – Signals & Systems				
	Department:-Department of Electronics & Communication Engineering				

COURSE OBJECTIVES

To study about discrete time systems and to learn about FFT algorithms.

- -To study the design techniques for FIR and IIR digital filters.
- -To study the finite word length effects in signal processing.
- -To study the properties of random signal, Multirate digital signal processing and about QMF filters.

UNIT I DISCRETE – TIME SIGNALS AND SYSTEMS 9+3

Sampling of Analogue signals – aliasing – standard discrete time signals – classification – discrete time systems – Linear time invariant stable casual discrete time systems – classification methods – linear and circular convolution – Overlap add and Save Methods-Difference

equation representation – DFS, DTFT, DFT – FFT computations using DIT and DIF algorithms.

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS 9+3

Review of design of analogue Butterworth and Chebyshev Filters, Frequency transformation in analogue domain – Design of IIR digital filters using impulse invariance technique – Design of digital filters using bilinear transform – pre-warping – Frequency transformation in digital domain – Realization using direct, cascade and parallel forms.

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS 9+3

Symmetric and Antisymmetric FIR filters – Linear phase FIR filters – Design using Frequency sampling technique – Window design using Hamming, Hanning and Blackman Windows – Concept of optimum equiripple approximation – Realisation of FIR filters – Transversal, Linear phase and Polyphase realization structures.

UNIT IV FINITE WORD LENGTH EFFECTS 9+3

Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representations – Comparison – Overflow error – truncation error – coefficient quantization error – limit cycle oscillations- signal scaling – analytical model of sample and hold operations.

UNIT V SPECIAL TOPICS IN DSP 9+3

Discrete Random Signals- Mean, Variance, Co-variance and PSD – Periodiogram Computation – Principle of Multi rate DSP – decimation and Interpolation by integer factors – Time and frequency domain descriptions – Single, Multi stage, polyphase structures – QMF filters –Sub band Coding-Digital Signal Processor based applications

TEXT BOOK:

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing–Principles,
2. Algorithms & Applications", Fourth Edition, Pearson Education/Prentice Hall,2007.

REFERENCES:

1. Sanjit K.Mitra, "Digital Signal Processing–A Computer Based Approach", Tata McGraw Hill,
2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson,2004.
3. www. ocw.mit.edu.

Course Outcome (COs)	
CO1	To apply DFT for the analysis of digital signals & systems.
CO2	To design FIR filters.
CO3	To design IIR filters.
CO4	To characterize finite Word length effect on filters.
CO5	To have a deep understanding on basics of digital signal processing which can be applied to communication systems.
CO6	To design the Multirate Filters.

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	3	3			3	3		3		3	3	3
	CO2	3	3	3	3	3			3	3	3	3				

	CO3	3	3	3	3	3			3	3	3	3				
	CO4	3	2		2											
	CO5	3	3	2	3				2	2	2					
	CO6	3	2	2	3	3			3	2						
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC502	TRANSMISSION LINES AND WAVEGUIDES	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Semiconductor Physics				
	Department:-Dept. of Electronics and Communication Engineering				

COURSE OBJECTIVES

To introduce the various types of transmission lines and to discuss the losses associated.
To give thorough understanding about impedance transformation and matching.
To impart knowledge on filter theories and waveguide theories

UNIT I TIME VARRYING FIELDS AND MAXWELL'S EQUTIONS 12

Motional Electromotive Force, General Expression for motional EMF, Faraday's Law of Induction, Displacement current, Maxwell's equation in the point or differential form, Maxwell's equations in Integral form, Maxwell's equations from Gauss's Law, Maxwell's equations and Boundary conditions, Poynting's theorem, Time harmonic (sinusoidal) fields, Maxwell's equations in phasor form.

UNIT II TRANSMISSION LINES 12

Need for Transmission Lines, Types of Transmission lines, Characterization in terms of primary and secondary constants, Characteristic impedance, General wave equation, Loss less propagation, Propagation constant, Wave reflection at discontinuities, Voltage standing wave ratio, Transmission line of finite length, The Smith Chart, Smith Chart calculations for lossy lines, Impedance matching by Quarter wave transformer, Single and double stub matching.

UNIT III THE UNIFORM PLANE WAVE 12

Wave propagation in free space, Wave propagation in dielectrics, Forward and Backward Travelling Wave, Poynting Theorem and Wave Power, Energy of the Radiated wave, Propagation in good conductors and good dielectrics, Skin effect, Wave polarization, Linearly, Elliptically and Circularly polarized waves

UNIT IV TRANSMISSION AND REFLECTION OF PLANE WAVES AT BOUNDARIES 12

Normal incidence of Uniform Plane waves: Conductor-Conductor interface, Dielectric-Dielectric interface, Dielectric-perfect Conductor interface, Dielectric-Conductor interface. Oblique incidence on a plane boundary for perpendicular polarization, Dielectric-Dielectric interface, Dielectric-Conductor interface.

UNIT V WAVE GUIDES AND CAVITY RESONATORS 12

General Wave behaviors along uniform Guiding structures, Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, TM and TE waves between parallel plates, TM and TE waves in Rectangular wave guides, Bessel's differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular and circular cavity Resonators.

TEXT BOOK:

1. John D Ryder, "Networks Lines and Fields", Prentice Hall of India, New Delhi, 2005

REFERENCES:

1. William H Hayt and Jr JohnA Buck, "Engineering Electro Magnetic" Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008
2. David KCheng, "Field and Wave Electromagnetics", Pearson Education Inc,Delhi,2004
3. John D Krausand Daniel A Fleisch,"Electromagnetics with Applications", McGraw Hill BookCo,2005
4. GSN Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, 2005
5. Bhag Singh Guru and HR Hiziroglu, "Electromagnetic Field Theory Fundamentals", Vikas Publishing House, New Delhi,2001.
6. N.Narayana Rao, " Elements of Engineering Electromagnetics" 6th Edition Prentice Hall, 2004
7. mit.edu/.../Microwave_Engineering_David_M_Pozar_4ed_Wiley_2011

Course Outcome (COs)	
CO1	Discuss the fundamental concepts of wave propagation in Transmission Lines and Wave Guides.
CO2	Analyze the line parameters and various losses in transmission lines.
CO3	Apply smith chart for line parameter and impedance calculations
CO4	Evaluate the characteristics of parallel plane and rectangular wave guides.
CO5	Evaluate the characteristics of Circular waveguides.
CO6	Evaluate the characteristics of resonators.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3				2							3	3	3
	CO2				3	2				2						
	CO3		2					1				1				
	CO4	1								1						
	CO5	3	3	1	2			2			2					
	CO6						3									
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC503	**ANTENNAS AND PROPAGATION**	**L**	**T**	**P**	**C**
	Total Contact Periods – 60	**3**	**1**	**0**	**4**
	Prerequisite – Transforms and Partial Differential equation				
	Department:- Department of Electronics & Communication Engineering				

COURSE OBJECTIVES

Students will be introduced to antennas, their principle of operation
Antenna analysis and their applications.
Introduce the student to wave propagation over ground, through troposphere and ionosphere; diversity principles

UNIT I BASIC ANTENNA CONCEPTS 9+3

Radiation Patterns Beam solid angle, radiation intensity, Directivity, effective aperture, Antenna field zones, Polarization, impedance, cross field, Poynting vector. Friis Transmission

formula, Duality of Antennas, Antenna and Transmission line, Radiation from a dipole antenna, Antenna temperature System temperature**.**

UNIT II POINT SOURCES 9+3

Definition, Power patterns, Array of two-point sources – Pattern multiplication, Broad side array, End fire array, n-isotropic array, Evaluation of null directions and maxima, Amplitude distributions. Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array.

UNIT III SMALL ANTENNAS 9+3

Halfwave dipole antenna radiated fields of short dipole, small loop and helical Antenna, monofilar- multifilar helix. Radiation resistance, Directivity and Design Feature. Half wave dipole: radiated fields and other feature. Numerical tool for antenna analysis.

UNIT IV SPECIAL ANTENNAS: 9+3

Yagi uda Antenna, Tunstile antenna, Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, rhombic antenna, Horn antenna, Reflector antennas and their feed systems, Micro strip antenna, Impedance and antenna measurements.

UNIT V WAVE PROPOGATION 9+3

Ground wave propagation, Troposphere wave, wave- tilt of the surface wave, Ionosphere propagation – effective permittivity and Conductivity of ionized gas, Reflection – Refraction of waves from ionosphere, regular – irregular variation of Ionosphere, earth magnetic field, Faraday rotation, wave propagation in the Ionosphere. Duct propagation, Critical frequency and Space propagation,

TEXT BOOK:

1. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antenna and Wave Propagation", Tata McGraw Hill, 4th Edition, 2010.
2. R.L.Yadava, "Antennas and Wave Propagation", PHI, 2011

REFERENCES:

1. Constantine A.Balanis, "Antenna Theory: Analysis and Design", Third Edition, John Wiley and Sons, 2012.
2. G.S.N. Raju, "Antennas and wave propagation", 1st Edition Pearson Education, 2012.
3. Robert S. Elliott, "Antenna Theory and Design", John Wiley and Sons, Revised Edition, 2007.
4. www.studynama.com/.../229-Antenna-wave-propagation-(AWP)-pdf-eb.

Course Outcome (COs)	
CO1	Define various antenna parameters
CO2	Analyze radiation patterns of antennas
CO3	Evaluate antennas for given specifications
CO4	Illustrate techniques for antenna parameter measurements
CO5	To understand the various applications of antennas.
CO6	Discuss radio wave propagation and Propagation effects in microwave systems, satellite, space, and radar links

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3

2	CO1	3	1	3	1	2			2	1		2	2	3	3	3
	CO2	3	2	2	1	2			2	2		2				
	CO3	2	2	3	2	2			2	1		2				
	CO4	2	2	2	1	2			3	1		2	3			
	CO5	2	1	2	1	2			2	1		2				
	CO6	3		1	2	2			2	1		1				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC504	MICROWAVE THEORY AND TECHNIQUES	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite –Electromagnetic Waves				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES

Learn the concepts related to microwave transmission

Understand the principle and working of microwave devices

UNIT I INTRODUCTION TO MICROWAVES AND MATHEMATICAL MODEL OF MICROWAVE TRANSMISSION 9+3

History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.-Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

UNIT II ANALYSIS OF RF AND MICROWAVE TRANSMISSION LINES 9+3

Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line. Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

UNIT III PASSIVE AND ACTIVE MICROWAVE DEVICES 9+3

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

UNIT IV MICROWAVE DESIGN PRINCIPLES 9+3

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

UNIT V MICROWAVE MEASUREMENTS AND SYSTEMS 9+3

Power, Frequency and impedance measurement at microwave frequency, Network Analyzer

and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal,. Measurement of Microwave antenna parameters.

Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aids to Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RF MEMS for microwave components, Microwave Imaging.

TEXT BOOK:

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

REFERENCES:

1. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house
2. www.nptel.ac.in

Course Outcome (COs)	
CO1	To understand the concepts involved in microwave transmission and its applications
CO2	To analyse the microwave transmission lines
CO3	To learn the various active microwave devices.
CO4	To learn the various passive microwave devices.
CO5	To understand the various microwave design principles and the antenna parameters
CO6	To have a better understanding about microwave systems and its measurements

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3	3	2	2			2	2		2		3	3	3
	CO2	2	3	2	2	2			2	2	2	2	2			
	CO3	3	3	3	2	2				2		2				
	CO4	3	3	3	2	2						2				
	CO5	3	3	3	2	2			2	3	3	3	2			
	CO6	3	3	3	2	2			2	3	3	3				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18MCTH401	**CONSTITUTION OF INDIA**	**L**	**T**	**P**	**C**
	Total Contact Hours – 24	2	0	0	0
	Prerequisite – NIL				
	Department:-AICTE				

COURSE OBJECTIVES:-

- Understand the premises informing the twin themes of liberty and freedom from a civil right perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in
- the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution

UNIT I **4**

History of Making of the Indian Constitution**:** History Drafting Committee, (Composition & Working)

UNIT II **4**

Philosophy of the Indian Constitution: Preamble, Salient Features

UNIT III **4**

Contours of Constitutional Rights &Duties: Fundamental Rights**,** Right to Equality**,** Right to Freedom**,** Right against Exploitation**,** Right to Freedom of Religion**,** Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV **4**

Organs of Governance: Parliament, Composition**,** Qualifications and Disqualifications**,** Powers and Functions**,** Executive**,** President**,** Governor**,** Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

UNIT V **4**

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Augor and role of Elected Representative CEO of Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT VI **4**

Election Commission**:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning.

Institute and Bodies for the welfare of SC/ST/OBC and women.

SUGGESTED READING

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcome (COs)	
CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution
CO4	Discuss the passage of the Hindu Code Bill of 1956.
CO5	Understand the concept of Administration
CO6	Understand the concept of Election commission
Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low	

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3					3					3		1	1	1
	CO2		3		2					3						
	CO3	2							2		3					
	CO4			2	3							3				
	CO5							2								
	CO6	3					3					3				
3	Category	Mandatory Courses (MC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC5L1	**DIGITAL SIGNAL PROCESSING LAB**	**L**	**T**	**P**	**C**
	Total Contact Periods – 30	**0**	**0**	**2**	**1**
	Prerequisite – Signals & Systems				
	Department:-Department of Electronics & Communication Engineering				

COURSE OBJECTIVES

- To implement Linear and Circular Convolution.
- To implement FIR and IIR filters.
- To study the architecture of DSP processor

LIST OF EXPERIMENTS FOR DIGITAL SIGNAL PROCESSING LABORATORY

1. Waveform generation
2. Sampling and its effect on aliasing
3. Linear and circular convolution
4. DFT computation
5. Fast Fourier transforms
6. FIR Filters Implementation
7. IIR Filters Implementation
8. Quantization Noise.
9. Multirate Signal Processing

10 DSP processor implementation.

Course Outcome (COs)	
CO1	Experiment concepts of DSP and its applications using MATLAB Software
CO2	To understand about the basic signal generation.
CO3	To learn Fourier Transform Concepts.
CO4	To design FIR filters.
CO5	To design IIR filters.
CO6	Demonstrate their abilities towards DSP processor-based implementation of DSP systems.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	3	3			3	3	3	3		3	3	3
	CO2	3	3	2	2	3										
	CO3	3	3	3	3	3			3	3	3	3				
	CO4	3	3	3	3	3			3	3	3	3				
	CO5	3	3	3	3	3			3	3	3	3				

	CO6	3	2	3	3					2	2						
3	Category	Professional Core (PC)															
4	Approval	48th Meeting of Academic Council															

U18PCEC5L	MICROWAVE ENGINEERING LAB	L	T	P	C
	Total Contact Hours – 30	0	0	2	1
	Prerequisite –Transmission Lines and Networks				
	Department:-Dept. of Electronics and Communication Engineering				

COURSE OBJECTIVES

Know about the behavior of microwave components.
Understand the radiation pattern of horn antenna.

LIST OF EXPERIMENTS

1. Study of microwave components
2. Characteristics of reflex klystron oscillator
3. Characteristics of gunn diode oscillator
4. Radiation pattern of horn antenna
5. Measurement of Antenna gain
6. Frequency and wavelength measurement
7. Impedance measurement by slotted line method
8. VSWR and Reflection Co-efficient measurement
9. Characteristics of E Plane/ H Plane Tee.
10. Characteristics of Magic Tee.
11. Characteristics of Directional coupler.

Experiments beyond the syllabus should be conducted.

Course Outcome (COs)	
CO1	Demonstrate the characteristics of Microwave sources
CO2	Demonstrate the characteristics of directional Couplers
CO3	To test the characteristics of microwave components
CO4	To analyze the radiation pattern of antenna.
CO5	To measure antenna gain
CO6	Practice microwave measurement procedures

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3		3	3		2		1					3	3	3
	CO2	2	1	3	3					3	2					
	CO3	2			3							1				
	CO4	2			3	2		2								
	CO5		2		3	2				1	2					
	CO6	3		3	3		2		1							
3	Category	Professional Core (PC)														
4	Approval															

U18MCAB509- SOCIAL AWARENESS (ARTISANS-RELATES TO ENGG., VISIT TO HOSPITALS, ORPHANAGES, POLICESTATION, COURTS, TRAUMA CENTERS, CONSUMER FORUMS)

Human beings live in relationship with their family members and with others in the society. As a society, mankind strives to achieve ordered and organized life through which an environment of cooperation and coexistence is expected. A healthy society creating an environment of fearlessness is a key for the mankind to achieve higher goals because it is society which makes us most human, most complete as people.

Although as a society, our expectation is fearlessness, but due to lack of understanding of our role in a society, we fail to fulfill the expectation. The social awareness activity shall promote an understanding and sharing of issues of societal problem through exposure to variety of artisans and different kind of organizations. It is expected that this exposure will enable the learners to appreciate social issues, problems and challenges.

Each institution will offer a range of introductory activity-based courses focusing on local artisans related to engineering so that students are sensitized to appreciate their problems and can take up some of the problems to solve while they do their regular studies. This course shall also include visits to visit to hospitals, orphanages, police station, courts, trauma centers, consumer forums so that they get exposed to different facets of societal problems. Care should be taken to give adequate representation to local and regional organizations and artisans. For example, Banaras has local traditions in Banarasi Saari, Toy making, etc. and has almost all types of organizations. An institution in Banaras area can offer courses on these artisans. This will, in turn, also ensure wider community involvement/interaction with the institution. At the end of the course/semester, a student should be able to identify a social issue, prepare project report and give presentation on the selected issues. Contact hours per week should be 3 -4 hours. Towards the end of the course, the institution can organize an exhibition in which all the students publicly demonstrate findings of their reports and their future plan of actions.

U18MCAB510 SOCIAL SERVICE

(teach in neighborhood, adopt an underprivileged school, village stay / visit (NSS), cleanliness drive, and skill transfer)

U18PCEC601	**CONTROL SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – Transforms and Partial Differential equation				
	Department:-Department of Electronics & Communication Engineering				

COURSE OBJECTIVES:

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and study the effect of state feedback

UNIT I CONTROL SYSTEM MODELING 9

Introduction to control problem- Industrial Control examples. Transfer function. System with dead-time. System response. Translational and rotational mechanical systems, simple Electro - mechanical systems. Block diagram representation of systems. Block Diagram reduction methods. Closed loop transfer function, determination of Signal flow graphs. Mason's gain formula. Examples.

UNIT II TIME RESPONSE ANALYSIS 9

Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain. proportional, integral and derivative systems. Feed forward and multi-loop control configurations,..

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency-response analysis- Polar plots, Bode plot, Nyquist plots, M and N Circle, Performance specifications in frequency-domain. Frequency domain methods of design, Compensators-Lead, Lag and Lead-Lag compensation.

UNIT IV STABILITY ANALYSIS 9

Feedback control systems- stability concept, relative stability, Routh stability criterion, Nyquist stability criterion, Root locus method of design.

UNIT V STATE VARIABLE ANALYSIS 9

State variable Analysis- Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability.

TEXT BOOK:

1. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi
2. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.

REFERENCES:

1. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
2. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.

Course Outcome (COs)	
CO1	Students will be able to determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
CO2	Students will be able to determine the time and frequency-domain responses of first and second-order systems to step and sinusoidal (and to some extent, ramp) inputs
CO3	Students are able to determine the (absolute) stability of a closed-loop control system
CO4	Students are able to apply root-locus technique to analyze and design control systems.
CO5	Students are able to express and solve system equations in state-variable form (state variable models).
CO6	Students will be able to design the compensation technique that can be used to stabilize control

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	2	3	3	3			3	3	3	3	3	3	3	3
	CO2	3	1	2	3	3			3	3	2	2	3			

	CO3	3	1	3	3	3			3	2	2	2	3			
	CO4	3	2	3	3	2			2	2	3	2	3			
	CO5	3	2	3	2	2			2	2	2	3	3			
	CO6	3	3	3	3	2			2	3	2	2	3			
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC602	**COMPUTER NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – Analog and digital communication				
	Department:-Department of Electronics & Communication Engineering				

COURSE OBJECTIVES

- To make the students to understand the different layers of ISO /OSI model and TCP/IP Network IEEE standards.
- To understand IP addressing methods and QOS parameters.
- To know the functions and congestion control mechanism of TCP.
- To know about application layer and network security

UNIT I INTRODUCTION 9

Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic Mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

UNIT II SWITCHING NETWORKS 9

Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical multiplexing.

UNIT III TRANSPORT LAYER 9

Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call.

UNIT IV NETWORK LAYER 9

Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines congestion Control, Congestion Avoidance Mechanisms and Quality of Service. Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing

UNIT V DATALINK LAYER 9

ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

TEXT BOOK:

1. Behrus A. Forouzane.tal, “Data Communication and Networking”, Tata McGraw-Hill

REFERENCES:

1. William Stallings, "Data and Computer Communication", Fifth Edition, Prentice Hall of India,1997.
2. Andrew S.Tanenbaum, "Computer networks", Third Edition, prentice Hall of India, 1996.
3. www.studytonight.com/computer-network.

Course Outcome (COs)	
CO1	Explain the networks, topologies and layers of OSI model, compare with TCP/IP model.
CO2	Classify error control and flow control techniques and types of LAN technologies.
CO3	Analyze different routing algorithms and methods to improve QOS.
CO4	Explain the role of protocols in networking.
CO5	Summarize the transport layer protocols and congestion controls methods.
CO6	Describe various application layer services and cryptographic techniques.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3			2	2				3	1	1	3	3	3
	CO2	2	1							2						
	CO3	2	3	2	2			3			2					
	CO4	2	3	2	2	3		2		2		3	3			
	CO5								1	3						
	CO6	3					2									
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC603	**BIOMEDICAL INSTRUMENTATION**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Nil				
	Department:- Department of Electronics & Communication Engineering				

COURSE OBJECTIVES: The objective of the course is to make the student acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance.

UNIT I BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9

PH, PO2, PCO2, PHCO3, Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood cell counters.

UNIT II ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

The origin of Bio-potentials; biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, EOG, lead systems and recording methods, typical waveforms and signal characteristics

UNIT III ASSIST DEVICES AND BIO-TELEMETRY 9

Cardiac pacemakers, DC Defibrillator, Telemetry principles, frequency selection, Biotelemetry, radio-pill and tele-stimulation.

UNIT IV RADIOLOGICAL EQUIPMENTS 9

Ionizing radiation, Diagnostic x-ray equipment's, use of Radio Isotope in diagnosis, Radiation Therapy.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Thermograph, endoscopy unit, Laser in medicine, Diathermy units, Electrical safety in medical equipment.

TEXT BOOK:

1. Khandpur, R.S., ―Handbook of Biomedical Instrumentation‖, TATA McGraw-Hill, New Delhi, 1997.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 .

REFERENCES:

1. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
2. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation',John Wiley & Sons, 1975.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
4. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India) Ltd, Orient Longman ltd, 2000.
5. https://lecturenotes.in/subject/27/biomedical-instrumentation-bi

Course Outcome (COs)	
CO1	To introduce the student to the various sensing and measurement devices of electrical origin
CO2	To Know about the origin of Bio-potentials; bio potential electrodes, biological amplifiers
CO3	To know about the ECG, EEG, EMG, PCG, EOG
CO4	To know about cardiac pacemakers, DC Defibrillator, Bio-telemetry
CO5	To know about Diagnostic x-ray equipments, Radiation Therapy,
CO6	To know about Endoscopy unit, Laser in medicine, Electrical safety in medical equipment

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	1	1	3	2			2	1		2		3	3	3
	CO2	3	2	2	3	2			2	2		2				
	CO3	3	2	3	2	2			2	1		2				
	CO4	2	1	1	2	2			2	1		1				
	CO5	3	2	2	2	1			2	1		2				
	CO6	3	1	1	2	3			2	2		3				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC6L1	COMPUTER NETWORKS LAB	L	T	P	C
	Total Contact Periods – 30	0	0	2	1
	Prerequisite – **Computer Networks**				
	Department:- Department of Electronics & Communication Engineering				

COURSE OBJECTIVES

To understand the working principle of various communication protocols.
To analyze the various routing algorithms.
To know the concept of data transfer between nodes.

List of Experiments

1. Creation and transmission of data between two nodes with duplex link
2. Data transmission between multiple sender and one receiver via router
3. TCP Scenario with droptail queue mechanism
4. Simulate a complex topology with a link failure
5. Creation and transmission of data between two nodes via wireless link
6. Simulation of Different network topology
7. Implementation and study of stop and wait protocol
8. Implementation and study of Goback-N and selective repeat protocols
9. Implementation of distance vector routing algorithm
10. Implementation of Link state routing algorithm
11. Implementation of Data encryption and decryption

Course Outcome (COs)	
CO1	Understand fundamental underlying principles of computer networking
CO2	Understand details and functionality of layered network architecture.
CO3	Apply mathematical foundations to solve computational problems in computer networking
CO4	Analyze performance of various communication protocols.
CO5	Compare routing algorithms
CO6	Practice packet /file transmission between nodes.

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation)
3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	3	3			3	3	3	2	2	3	3	3
	CO2	3	3	3	3	3			3	3	3	2				
	CO3	3	3	3	3	2			2	3		2				
	CO4	3	3	3	3	3			3	3	3	3	3			
	CO5	3	3	3	3	2			3	3	3	2				
	CO6	3	3	3	3	3			3	3	3	2				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18PCEC6L2	ELECTRONICS MEASUREMENT LAB	L	T	P	C
	Total Contact Periods – 45	0	0	2	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Department:- Department of Electronics & Communication Engineering				

COURSE OBJECTIVES

To introduce students to the use of various electrical/electronic instruments, their construction, applications, principles of operation, standards and units of measurements
To provide students with opportunities to develop basic skills in the design of electronic equipment's.
To experimentally verify the principle and characteristics of various transducers.
To introduce students a knowledge to use modern tools necessary for electrical projects.
To provide a student a knowledge to design and create novel products and solutions for real life problems.
To impart the students with an adequate knowledge and work experience of the different types of

List of Experiments

1. Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
2. Designing AC bridge Circuit for capacitance measurement
3. Designing signal Conditioning circuit for Pressure Measurement
4. Designing signal Conditioning circuit for Temperature Measurement
5. Designing signal Conditioning circuit for Torque Measurement
6. Designing signal Conditioning circuit for Strain Measurement
7. Experimental study for the characteristics of ADC and DAC
8. Error compensation study using Numerical analysis using MATLAB (regression)

Course Outcome (COs)	
CO1	Students will be able to design and validate DC and AC bridges
CO2	Students will be able to analyze the dynamic response and the calibration of few instruments
CO3	Students are able to learn about various measurement devices, their characteristics, their operation and their limitations
CO4	Students are able to understand statistical data analysis
CO5	Students are able to understand computerized data acquisition.
CO6	Students will be able to learn about the various types of electrical transducers

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	2	2			2	2	3	2		3	3	3
	CO2	2	3	2	2	1			1	1	2	2				
	CO3	2	3	2	3	2			2	3	2	2				
	CO4	2	3	2	2	2			3	3	1	3				
	CO5	2	3	2	3	3			3	2	2	2				
	CO6	2	3	2	3	3			3	3	1	2				
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18MCAB611 SPIRITUAL, MINDFULNESS AND MEDITATION

The human mind especially among the youth needs to transcend its preoccupation with negative experiences such as fear, anxiety, anger and obsession and to become more comfortable with the experience of compassion, acceptance and forgiveness. The student's

attitude of acceptance towards negativity, aggression and turbulent emotions should be diffused with the practice of mindfulness. Rather than suppressing emotions or by indulging in them, the student be taught to handle such vibes with acceptance and generosity and with the observation of the self.

A mindful state has to be achieved when negative thoughts and experiences are becoming more personalized and do not serve as dictators of subsequent feelings and activities (e.g. suicide attempts, violence etc.). Both concentrative and insight meditation techniques Aug be practiced for 10-day sessions during every two months. Behavioral techniques of self monitoring should also be practiced to observe the stream of consciousness from the perspective of a vigilant but detached observer.
The students should be trained to practice different models of mindfulness and meditation so as to elicit a state of deep physical and behavioral relaxation. They Aug work on selectively influencing or changing the symmetry in hemispheric brain activity. Positive addiction, meta -cognitive practices etc. are exercised to make the students experience the universal human capacity through spiritual experiences.

The students Aug learn to turn-off or bypass the cognitive processing of usual daily pre-occupations and concerns, allowing access to mindful, spiritual and meditative state of self realization.

Activities

Reading (10 books/ narrations)
Exercises (Mindfulness based Stress Reduction (MBSR) and 10 more) Sessions: multiple 10-day sessions Aug be organized over a semester.

U18MCAB612 RELIGION AND INTER-FAITH

The objective is to gain knowledge about the beliefs and philosophies of different religions on issues like environment, gender equality, unity, financial equality etc.

The scholars of different religious and philosophical sects should be invited to talk about the issues mentioned above. Efforts should be made to ensure that such talks and discourses should stay clear-off making a critical study on these areas.

Following activities must be included.

Reading of books on religious texts of different faiths by famous authors. (Reading methods Aug be as suggested under 'book reading'.)
Organizing lecture on interfaith issues covering philosophies and chronology and contemporary situations world over at a given time.

U18PCEC701	**EMBEDDED SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Microcontroller				
	Department:-Dept of Electronics & Instrumentation Engineering				
COURSE OBJECTIVES To introduce the Building Blocks of Embedded System To Educate in Various Embedded Development Strategies					

To Introduce Bus Communication in processors, Input/output interfacing.
To impart knowledge in various processor scheduling algorithms.
To introduce Basics of Real time operating system and example tutorials to discuss on one real time operating system tool

UNIT I EMBEDDED DESIGN WITH MICROCONTROLLERS 9

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Microprocessor Vs Micro Controller – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits – RTOS Micro Controller - issues in selection of processors.

UNIT II PARTITIONING DECISION 9

Hardware / Software duality – Hardware-Software portioning- coding for Hardware- software development – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization –memory enhancement – Firmware-speed and code density -System startup.

UNIT III FUNCTIONALITIES FOR SYSTEM DESIGN 9

Timers, Watch dog timers – RAM, Flash Memory basic toolset – Integration of Hardware & Firmware- in System Programming, in Application Programming, IDE-Target Configuration-Host based debugging – Remote debugging – ROM emulators – Logic analyzer.

UNIT IV REAL TIME OPERATING SYSTEMS 9

Definitions of process, tasks and threads - Clear cut distinction between functions - ISRs and tasks by their characteristics - Operating System Services- Goals - Structures- Kernel - Process Management - Memory Management - Device Management - File System Organisation and Implementation - I/O Subsystems - Interrupt Routines Handling in RTOS, REAL TIME OPERATING SYSTEMS : RTOS Task scheduling models - Handling of task scheduling and latency and deadlines as performance metrics - Co-operative Round Robin Scheduling - Cyclic Scheduling with Time Slicing (Rate Monotonics Co-operative Scheduling) - Preemptive Scheduling Model strategy by a Scheduler - Critical Section Service by a Preemptive Scheduler - Fixed (Static) Real time scheduling of tasks - Inter Process Communication and Synchronisation - Shared data problem - Use of Semaphore(s) - Priority Inversion Problem and Deadlock Situations - Inter Process Communications using Signals - Semaphore Flag or mutex as Resource key - Message Queues - Mailboxes - Pipes - Virtual (Logical) Sockets - Remote Procedure Calls (RPCs).

UNIT V EMBEDDED DESIGN LIFE CYCLE & TESTING 9

Objective, Need, different Phases & Modeling of the EDLC, choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Software &Hardware Design, PCB Design, Manufacturing & PCB Assembly-Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

TEXT BOOK:

1. James K.Peckol, “Embedded system Design”, John Wiley & Sons, 2010
2. Lyla B.Das, “Embedded Systems an integrated Approach”, Pearson, 2013

REFERENCES:

1. Rajkamal, ”Embedded Systems”, TMH, 2009.
2. Arnold S. Berger –“Embedded System Design”, CMP books, USA 2002
3. http://www.crectirupati.com/sites/default/files/lecture_notes/final%20ES.pdf

Course Outcome (COs)	
CO1	Acquire a basic knowledge about fundamentals of microcontrollers
CO2	Acquire a basic knowledge about programming and system control to perform a specific task.
CO3	Acquire knowledge about devices and buses used in embedded networking
CO4	Develop programming skills in embedded systems for various applications.
CO5	Acquire knowledge about basic concepts of REAL Time Operating Systems
CO6	Build complex embedded system with the use of RTOS.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	2	3	3	2			2	3	3	3	1	3	3	3
	CO2	3	2	3	3	3			2	3	3	3	1			
	CO3	3	2	3	3	3			2	3	3	3	1			
	CO4	3	2	3	3	3			2	3	3	3	1			
	CO5	3	2	3	3	3			2	3	3	3	1			
	CO6	3	2	3	3	3			2	3	3	3	1			
3	Category	Professional Core (PC)														
4	Approval	48th Meeting of Academic Council														

U18MCTH603	**Essence of Indian Knowledge Tradition**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	2	0	0	0
	Prerequisite – NIL				
	Course Designed by – Department of Electronics & Communication Engineering				

OBJECTIVE

- It will also focus on Indian philosophical, linguistic and artistic traditions, along with yoga and Indian perspective of modern scientific worldview.

The course aims at imparting basic principles of thought process, reasoning and inferencing

U18MCAB713 BEHAVIORAL AND INTERPERSONAL SKILLS (NON-VERBAL SKILLS / BEHAVIOURS, NON-AGGRESSION)

Each individual has behavior patterns that are shaped by the context of his or her past. Most often, adapting the behaviour to the changing context of the reality a person lives in becomes difficult which Aug lead to the reduction in personal effectiveness and natural self-expression. The main focus of this course is to equip the students with useful approaches to help in the deeper understanding of self and help individuals empower themselves to be the source of their own growth and development. The course will help students to learn effective communication skills, Group and team building skills and will help them learn the goal setting process and thus become more effective in achieving their goals.

The broader objective of this course is to make the students aware about the different facets of self and to help them learn skills to strengthen their inner capacities. So that they are able to understand themselves, think and act effectively, to be able to communicate in an effective manner and to learn to lead and to form an effective team. The specific objectives, however, are as following.

- To help the students to understand their real self by recognizing different aspects of their self-concept that will lead to an increased self-confidence.
- To train the students for communicating effectively in both formal as well as in informal settings.
- To help the students to understand the importance of non-verbal aspects of effective communication.
- To help the students to understand Emotion and emotional intelligence, Managing ones' own emotional reservoirs, effective dealing with emotions at work
- To facilitate the students in understanding the formation and function of group and team and to help them to learn the skills of a successful leader.
- To help the students in understanding and practicing the goal setting process by recognizing the importance of each step involved in goal setting. The activities involved are designed to facilitate their career goal decision making.

The activities to achieve the above objectives can be suggested as follows.

- Motivational lectures
- Group Discussions/activities
- Case Study
- Games/Stimulation Exercises
- Role-Playing
- Mindfulness training.

U18MCAB714- NATURE

Nature club (bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity

Impart knowledge and inculcate the habit of taking interest and understanding biodiversity in and around the college campus. The students should be encouraged to take interest in bird watching, recognizing local plants, herbs and local animals. The students should be encouraged to appreciate the difference in the local biodiversity in their hometown, in the place of their study and other places they visit for vacation/breaks etc.
Following activities must be included.

Identify a tree fruit flower peculiar to a place or having origin from the place.

Making high resolution big photographs of small creatures (bees, spiders, ants. mosquitos etc.) especially part of body so that people can recognize (games on recognizing animals/plants).

Videography/ photography/ information collections on specialties/unique features of different types of common creatures.

Search and explore patents and rights related to animals, trees etc. Studying miracles of mechanisms of different body systems.

U18MCAB815 INNOVATION PROJECT BASED – SC., TECH, SOCIAL, DESIGN & INNOVATION

Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to direct it to exploration and sustained pursuit by the student which Aug result in development

of a working system, a prototype, or a device or material, etc. They are not required or even expected to produce research or an innovation.

Students Aug be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non -conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute.

Two types of activities Aug be undertaken under this

Exposure to social problems (which are amenable to technological solutions)
Design & Innovation (to address above problems)

After this student, be encouraged to undertake technology projects of social relevance.

PROFESSIONAL ELECTIVES

U18PEEC011	**INFORMATION THEORY AND CODING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Probability and Stochastic Processes, Analog and Digital Communication				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

The student should be made to:

- Understand error–control coding.
- Understand encoding and decoding of digital data streams.
- Be familiar with the methods for the generation of these codes and their decoding techniques.
- Be aware of compression and decompression techniques.
- Learn the concepts of multimedia

UNIT I INFORMATION ENTROPY FUNDAMENTALS 9

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

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III ERROR CONTROL CODING 9

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

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

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

TEXT BOOK:

1. Simon Haykin, "Communication Systems", 4th Edition, John Wiley and Sons, 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.
3. https://lecturenotes.in/subject/540/information-theory-coding-itc

COURSE OUTCOMES (COs)	
CO1	Design an application with error–control
CO2	Use compression and decompression techniques
CO3	Apply the concepts of multimedia communication
CO4	Discuss about various error control coding
CO5	To study about audio coding techniques
CO6	To study about video coding techniques

Mapping of Course Outcomes with Program outcomes
(POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3	3	1	2			2	1	1	2		3	3	3
	CO2	3	3	2	2	2			2	1		3				
	CO3	3	2	3	2	2			2	2	2	3				
	CO4	2	2	2	3	2			3		1	2				
	CO5	3	2	2	3	2			2		1	2				
	CO6	3	2	2	2	2			2	1	1	2				
3	Category	Professional Elective (PE)														
4	Approval	49th Meeting of the Academic Council,														

U18PEEC012	**SPEECH & AUDIO PROCESSING**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – Digital Signal Processing				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To introduce speech production and related parameters of speech.
To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.
To understand different speech modeling procedures such as Markov and their implementation issues

UNIT I BASIC CONCEPTS 9

Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods. Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of speech production; Review of Digital

UNIT II SPEECH ANALYSIS 9

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III SPEECH MODELING 9

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

UNIT IV SPEECH RECOGNITION 9

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT V SPEECH SYNTHESIS 9

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

TEXT BOOK:

1. Lawrence Rabiner and Biing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, “Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Pearson Education, 2002.
3. Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press, 1997.

REFERENCES:

1. Steven W. Smith, “The Scientist and Engineer‟s Guide to Digital Signal Processing”, California Technical Publishing, 1997.
2. Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, Pearson Education, 2004.
3. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, John Wiley and Sons, 1999.
4. Ben Gold and Nelson Morgan, “Speech and Audio Signal Processing, Processing and Perception of Speech and Music”, Wiley- India Edition, 2006.
5. https://nptel.ac.in/courses/117105145/

COURSE OUTCOMES (COs)	
CO1	Model speech production system and describe the fundamentals of speech.
CO2	Extract and compare different speech parameters.
CO3	Choose an appropriate statistical speech model for a given application.
CO4	Design a speech recognition system.
CO5	Use different speech synthesis techniques.
CO6	To study about speech analysis and modeling

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low															
1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	2	3	2	2			2	2	2			3	3	3
	CO2	3			2							2	2			
	CO3	3		3		2							2			
	CO4	3	2		2				2				2			
	CO5	3	2	3		2				3	2	2				
	CO6	3	3	3	2	2			2	3	2					
3	Category	Professional Elective (PE)														
4	Approval	49th Meeting of the Academic Council,														

U18PEEC013	**CELLULAR MOBILE COMMUNICATION**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Analog and Digital Communication				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To understand the basic cellular system concepts.

To have an insight into the various propagation models and the speech coders used in mobile communication.

To understand the multiple access techniques and interference education techniques in mobile communication

UNIT I INTRODUCTION TO WIRELESS MOBILE COMMUNICATION 9

History and evolution of mobile radio systems, Types of mobile wireless services/systems – Cellular, WLL, Paging, Satellite systems, Standard, Future trends in personal wireless systems.

UNIT II CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS 9

Cellular concept and frequency reuse, Multiple Access Schemes, Channel assignment and handoff, Interface and system capacity, Trucking and Erlang capacity calculations.

UNIT III MOBILE RADIO PROPAGATION 9

Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading and based and impulse models, Parameters of mobile multipath channels, Antenna systems in mobile radio.

UNIT IV MODULATION AND SIGNAL PROCESSING 9

Analog and digital modulation techniques, Performance of various modulation techniques – Spectral efficiency, Error rate, Power Amplification, Equalization/Rake receiver concepts, Diversity and Space-time processing, Speech coding and channel coding.

UNIT V SYSTEM EXAMPLES AND DESIGN ISSUES 9

Multiple Access Techniques – FDMA, TDMA and CDMA Systems, Operational Systems, Wireless networking, design issues in personal wireless systems.

TEXT BOOK:

1. K. Feher, Wireless Digital Communication, Prentice Hall of India, New Delhi, 1995.

REFERENCES:

1. T.S. Rappaport, Wireless Communication; Principles and Practice, Prentice Hall, NJ, 1996.
2. W.C.Y. Lee, Mobile Communication Engineering; Theory and Application, Second Edition, McGraw-Hill International, 1998.

3. https://en.wikipedia.org/wiki/Cellular_network

COURSE OUTCOMES (COs)	
CO1	Discuss cellular radio concepts
CO2	Identify various propagation effects
CO3	To have knowledge of the mobile system specifications.
CO4	Classify multiple access techniques in mobile communication.
CO5	Outline cellular mobile communication standards.
CO6	Analyze various methodologies to improve the cellular capacity

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3			1	2			2			2		2	2	2
	CO2	2			1	2			1	2		2				
	CO3	2		2	2	1			1			2	3			
	CO4	3				2			2	2		1				
	CO5	2			1	2			1	1		2				
	CO6	2			2				2	1		2				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC014	FPGA AND SYSTEM ON CHIP	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Digital System Design				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To make the students to learn the role of FPGA's and ASIC are perceived to be enormous in embedded systems.

To make the student learn, FPGA fundamentals, design and implementation of circuits in them.

To make the student learn System-on-chip fundamentals, their applications and On-chip networking methods**.**

To give the student an understanding of basics of System on Chip and Platform based design

UNIT I INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN 9

Types of ASICs – Design Flow – CMOS transistors, CMOS design rules – Combinational Logic Cell – Sequential logic cell – Data path logic cell – Transistors as Resistors – Transistor Parasitic Capacitance – Logical effort –Library cell design –Library architecture.

UNIT II PROGRAMMABLE LOGIC CELLS AND I/O CELLS 9

Anti fuse – static RAM – EPROM and EEPROM technology – PREP bench marks – Actel ACT – Xilinx LCA –Altera FLEX – Altera MAX DC & AC inputs and outputs – Clock and power inputs – Xilinx I/O block

UNIT III ASIC DESIGN SOFTWARE, FLOOR PLANNING, PLACEMENT AND ROUTING 9

Actel ACT – Xilinx LCA – Xilinx EPLD – Altera MAX 5000 and 7000 – Altera MAX 9000 Altera FLEX – System partition – FPGA partitioning – partitioning methods – floor planning – placement – physical design flow –global routing – detailed routing – special routing – circuit extraction – DRC.

UNIT IV SOC FUNDAMENTALS, SOFTWARE AND ENERGY MANAGEMENT 9

Essential issues of SoC design – A SoC for Digital still camera – multimedia IP development: Image and video codecs. SoC embedded software – energy management techniques for SoC design.

UNIT V SYSTEM DESIGN AND METHODOLOGY, SOFTWARE AND APPLICATION INTERFACES 9

Design methodology for NOC based systems – Mapping concurrent application onto architectural platforms.MP-SoC from software to hardware – NoC APIs – multilevel software validation for NoC – Software for network on chip.

TEXT BOOK:

1. M.J.S. SMITH, "Application Specific Integrated Circuits", Addison Wesley Longman Inc., 1997.
2. Wolf Wayne, "FPGA Based System Design", Pearson Education India, 2004.
3. Youn-Long, Steve Lin, "Essential Issues of SoC Design: Designing Complex Systems-On-Chip", Springer,2006.

REFERENCES:

1. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.
2. Design manuals of Altera, Xilinx and Actel. (From the web).
3. Axel Jantsch, HannuTenhunen, "Network on chips", Kluwer Academic Publishers, 2003.
4. J..M.Rabaey,A.Chandrakasan, B.Nikolic,"Digital Integrated Circuit Design Perspective (2/e)", PHI 2003.
5. D. A.Hodges, "Analysis and Design of Digital Integrated Circuits (3/e)", MGH 2004.
6. https://www.mepits.com/tutorial/421/vlsi/system-on-chip

COURSE OUTCOMES (COs)	
CO1	Demonstrate VLSI tool-flow and appreciate FPGA architecture
CO2	understand the issues involved in ASIC design, including technology choice, design management, tool-flow, verification, debug and test, as well as the impact of technology scaling on ASIC design
CO3	To study the programmable logic cells and i/o cells and understand the algorithms used for ASIC construction
CO4	understand the basics of System on Chip, On chip communication architectures like AMBA,AXI and utilizing Platform based design
CO5	To study the design principles of FPGA and PLA.
CO6	To learn various floor planning methods for system design.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1		2			3	2		3	2		3		3	3	3

	CO2		3		2			3	2		1					
	CO3		2	1				2	1	3		1	3			
	CO4	3			1	3			2		3	2				
	CO5			3			2		2		3					
	CO6	3				2			3	2		3	2			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC015	DESIGN OF SEMICONDUCTOR MEMORIES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Semiconductor Physics				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To study the architectures for SRAM and DRAM
To know about various non-volatile memories.
To study the fault modeling and testing of memories for fault detection.
To learn the radiation hardening process and issues for memory.
To know about Ferroelectric Random Access Memories (FRAMs).

UNIT I RANDOM ACESS MEMORY TECHNOLOGY 9

Static Random Access Memories(SRAM) SRAM Cell Structure-MOS SRAM Architecture-MOS SRAM Cell and Peripherals Circuit Operation – Bipolar SRAM Technologies –Silicon On Insulator (Sol) Technology – Advanced SRAM Architecture and Technologies – Application Specific SRAMs Dynamic Random Access Memoirs(DRAMs) DRAM Technology Development – CMOS DRAMs-DRAMs Cell Theory and Advanced Cell Structures-BICMOS DRAMs – Soft Error Failure in DRAMs – Advanced DRAM Designs and Architecture – Application Specific DRAMs.

UNIT II NON-VOLATILE MEMORIES 9

Mask Read Only Memories (ROMs)-High Density ROMs-Programmable Read Only Memories(PROMs)-Bipolar PROMs CMOS PROMs-Erasable (UV) – Programmable Read Only Memories(EPROMs) - Floating – Gate EPROM Cell-One Time Programmable (OTP) EPROMs -Electrically Erasable PROMs(EEPROMs) – EEPROM Technology and Architecture – Non Volatile SRAM – Flash Memories (EPROM or EEPROM)

UNIT III MEMORY FAULTS MODELLING, TESTING AND MEMORY DESIGN FOR TESTABILITY AND FAULT TOLERANCE 9

RAM Fault, Electrical Testing, Pseudo Random Testing-Megabit DRAM Testing-Nonvolatile Memory Modeling and Testing-IDDQ Fault modeling and Testing-Application Specific Memory Testing

UNIT IV SEMICONDUCTOR MEMORY RELIABILITY AND RANDOM EFFECTS 9

General Reliability Issues-RAM Failure Modes and Mechanism - Nonvolatile Memory Reliability – Reliability Modeling and Failure Rate Prediction – Design for Reliability – Reliability Test Structures – Reliability Screening and Qualification. Radiation Effects-Single Event Phenomenon (SEP) – Radiation Hardened Memory Characteristics – Radiation Hardness Assurance and Testing – Radiation Dosimettry - Water Level Radiation Testing and Test Structures.

UNIT V ADVANCED MEMORY TECHNOLOGIES AND HIGH-DENSITY MEMORY PACKAGING TECHNOLOGICS 9

Ferroelectric Random-Access Memories (FRAMs) – Gallium Arsenide (GaAs) FRAM – Analog Memories Magneto Resistive Ferroelectric Random-Access Memories (MRAMS) – Experimental Memory Devices Memory Hybrids and MCMs (2D – Memory Stacks and MCMs 3D) – Memory MCM Testing and Reliability Issues – Memory Cards – High Density Memory Packing Feature Directions.

TEXT BOOK:S

1. Ashok K. Sharma, "Semiconductor Memories Technology, Testing, and Reliability", Prentice Hall of India Limited. New Delhi 1997.
2. Ashok K Sharna, Advanced Semiconductor Memories – Architecture, Design and Applications, Wiley 2002.

REFERENCES:

1. Anjan Ghosh, High Speed Semiconductor Devices, NPTEL Courseware, 2009.
2. Luecke Mize Care, "Semiconductor Memory design & application", Mc-Graw Hill.
3. Belty Prince, " Semiconductor Memory Design Handbook".
4. Memory Technology design and testing 1999 IEEE International Workshop on: IEEE Computer Society Sponsor (S).
5. http://bwrcs.eecs.berkeley.edu/Classes/IcBook/SLIDES/slides10.pdf

COURSE OUTCOMES (COs)	
CO1	Design Memory Structures.
CO2	Decide the type of memory for a specific application.
CO3	Describe the smartness in the circuits used for memories.
CO4	Design the architectures of Static and Random Access, Nonvolatile memories
CO5	Evaluate the fault modeling and testing procedures for memory circuit
CO6	Identification of new developments in semiconductor memory design.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3		3			2		3	2		3	3	3
	CO2	2		3	2	3				3	1					
	CO3		3	1		3		2	1		2	1				
	CO4	1		2	1	3	2		2		3	2				
	CO5	2														
	CO6	2		3	2	3			3	2		3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC016	**MIXED SIGNAL DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – Analog Circuits & Signals and Systems				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To know the fundamentals of Signals, Filters and Sampling process
To understand the design techniques of analog and digital filters Structures
To know the fundamentals of analog and digital conversion techniques in logical design

UNIT I SIGNALS, FILTERS AND SAMPLING 9

Sinusoidal Signals, Comb Filters, Representing Signals, Impulse Sampling, Decimation, The Sample-and-Hold, Interpolation, K-Path Sampling, The Track-and-Hold Implementing the S/H, The S/H with Gain, The Discrete Analog Integrator.

UNIT II ANALOG FILTERS 9

Integrator Building Blocks- Lowpass Filters, Active-RC Integrators, MOSFET-C Integrators, gm-C (Transconductor-C) Integrators, Discrete-Time Integrator, Filtering Topologies- The Bilinear Transfer Function, The Biquadratic Transfer Function.

UNIT III DIGITAL FILTERS 9

SPICE Models for DACs and ADCs- The Ideal DAC, The Ideal ADC, Number Representation, Sinc-Shaped Digital Filters- The Counter, Lowpass Sinc Filters, Bandpass and Highpass Sinc Filters, Interpolation using Sinc Filters, Decimation using Sinc Filters, Filtering Topologies- FIR Filters, Stability and Overflow, The Bilinear Transfer Function, The Biquadratic Transfer Function

UNIT IV DATA CONVERTER FUNDAMENTALS 9

Analog Versus Discrete Time Signals, Converting Analog Signals to Digital Signals, Sample-and-Hold (S/H) Characteristics, Digital-to-Analog Converter (DAC) Specifications, Analog-to-Digital Converter (ADC) Specifications, Mixed-Signal Layout Issues.

UNIT V DATA CONVERTER ARCHITECTURES 9

DAC Architectures- Digital Input Code, Resistor String, R-2R Ladder Networks, Current Steering, Charge-Scaling DACs, ADC Architectures- Flash, The Two-Step Flash ADC, The Pipeline ADC, Integrating ADCs, The Successive Approximation ADC, The Oversampling ADC.

TEXTBOOK:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

REFERENCES:

1. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
2. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
3. https://www.youtube.com/playlist?list=PLLDC70psjvq5vtrb0EdII4xIKA15ec-Ij

COURSE OUTCOMES (COs)	
CO1	Understand the practical situations where mixed signal analysis is required.
CO2	Analyze and handle the inter-conversions between signals. Design systems involving mixed signals
CO3	To understand the various conversion architectures for analog and digital signal processing.
CO4	To be able to design analog and digital filters Structures.
CO5	To be able to carry out the filters design in data conversions.

CO6	To be able to design conversion architectures for DSP algorithms.														
Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low															
1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	2	2	2				2	2			3	3	3
	CO2	3	2	3	2					2		2				
	CO3	3	3	2	2					2						
	CO4	3	3	3	3	3				3	3	3				
	CO5	3	2	3	3	3				3	3					
	CO6	3	3	3	2					2	2	3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council,														

U18PEEC021	ERROR CORRECTING CODES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Digital System Design				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

Theory and application of error detecting and correcting codes.
Encoding, decoding and error correcting techniques.
System control with emphasis on hardware implementation

UNIT 1 INTRODUCTION TO CODING 9

Basic Definitions, Block Codes and Maximum Likelihood Decoding, Decoding Tables, Hamming Weight and Distance, Error Correction Vs Detection

UNIT II LINEAR BLOCK CODES 9

Definitions, Generator Matrix, Parity-Check Matrix, Error-Correcting Capability of a Linear Code, The Standard Array

UNIT III BINARY CYCLIC CODES 9

Description of Cyclic Codes, encoding with (n-k)-Stage Shift Register, Syndrome Calculations and Error Detection, A General Decoder for Cyclic Codes, Shortened Cyclic Codes

UNIT IV ERROR TRAPPING DECODING FOR CYCLIC CODE 9

Error Trapping Decoding, Hamming Codes, Double-Error-Detecting and Single-Error Correcting Hamming Codes, A Modified Error-Trapping Decoding, Oley Code

UNIT V BCH CODES 9

Description of Codes, Decoding of the BCH Codes, Implementation of Error Correction, Non binary BCH Codes and Reed-Solomon Codes, Single-Burst-Error-Correcting Codes, Burst-and-Random-Error-Correcting Codes, Error Detecting and Correcting Systems Design and Hardware Implementation

TEXT BOOK:

1. Nagi El Naga, “Error Detecting and Correcting Systems Design,” Lecture Notes, ECE Department, California State University, Northridge.

REFERENCES:

1. Shu Lin, "An Introduction to Error-Correcting Codes", Prentice-Hall
2. Wakerly, John, "Error Detecting Codes, Self-Checking Circuits and Applications."
3. Peterson, W. W. and E.J. Weldon, Jr., "Error-Correcting Codes", the M.I.T. Press, Cambridge, MA 1970
4. Lin, Shu/D. J. Costello, Jr., "Error Control Coding: Fundamentals and Applications", Prentice-Hall, 1983

5.http://www.cs.cmu.edu/~odonnell/toolkit13/lecture10.pdf

COURSE OUTCOMES (COs)	
CO1	Understand Block Codes and Maximum Likelihood Decoding.
CO2	Understand Decoding Tables, Hamming Weight and Distance and Error Correction Vs Detection.
CO3	Understand Generator Matrix, Parity-Check Matrix and Error-Correcting Capability of a Linear Code.
CO4	Design an error detecting and correcting system for semiconductor memory system to meet given system specification.
CO5	Understand Binary Cyclic Codes, encoding with (n-k)-Stage Shift Register and Syndrome Calculations and Error Detection
CO6	Design an error detecting and correcting system for magnetic storage device to meet given system specification.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
2	CO1	2	1	1	2	2			2	1		1		3	3	3
	CO2	2	1		2	2			2	2		1				
	CO3	3	1		2	2			2	1						
	CO4	2	2	1	2	2			2	2	1	2				
	CO5	2			2	2			3	2		3				
	CO6	3	3	2	2	2			1	2	1	2				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC022	**WIRELESS COMMUNICATION NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Computer Network and Analog & Digital Communication				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To provide the students with the fundamental treatment about many practical and theoretical concepts that forms basic of wireless communications.

To equip the students with various kinds of wireless networks and its operations.

To prepare students to understand the concept of frequency reuse and be able to apply it in the design of mobile cellular system.

UNIT I THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS 9

Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies-Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity — Co channel Interference and system capacity, Channel planning for Wireless Systems,

Adjacent Channel interference ,Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems.

UNIT II MOBILE RADIO PROPAGATION 9

Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Outdoor Propagation Models,lndoor Propagation Models, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

UNIT III MOBILE RADIO PROPAGATION 9

Small Scale Fading and Multipath: Small Scale Multipath Propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel-Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels.

UNIT IV EQUALIZATION AND DIVERSITY 9

Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-linear Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer.

UNIT V WIRELESS NETWORKS 9

Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

TEXT BOOK:

1. Wireless Communications, Principles, Practice — Theodore, S.Rappaport, 2nd Ed., 2002, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication — Gottapu Sasibhushana Rao, Pearson Education, 2012.

REFERENCES:

1. Principles of Wireless Networks — Kaveh Pah Laven and P. Krishna Murthy, 2002, PE
2. Wireless Digital Communications — Kamilo Feher, 1999, PHI.
3. Wireless Communication and Networking — William Stallings, 2003, PHI.
4. Wireless Communication — Upen Dalal, Oxford Univ. Press
5. Wireless Communications and Networking — Vijay K. Gary, Elsevier.
6. https://www.academia.edu/6383890/Wireless_Communications_and_Networking_by_William_Stallings_2nd_Edition

U18PEEC023	**WIRELESS SENSOR NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – Computer Networks				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To Obtain a broad understanding about the network architecture of wireless sensor network.
To Understand all basic characteristics of wireless sensor networks and sensor nodes.

COURSE OUTCOMES (COs)	
CO1	Understand the principles of wireless communications.
CO2	Understand fundamentals of wireless networking
CO3	Understand cellular system design concepts.
CO4	Analyze various multiple access schemes used in wireless communication.
CO5	Understand wireless wide area networks and their performance analysis.
CO6	Demonstrate wireless local area networks and their specifications.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3			2	2			1	3		3		3	3	3
	CO2	2	1		2	2			2	1						
	CO3	3	2	2	1	2			2			2				
	CO4	3	1		1	2			1			2	2			
	CO5	2	1		2	2			3	2		2				
	CO6	2	2		1	2			2	1		1				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

To learn the principles of data transmission, clustering algorithm and routing protocols.
To Understand different constraint of wireless sensor network, e.g., coverage, power management, security and data collisions.
To Design and development of new network architecture and MAC protocols

UNIT I BASIC WIRELESS SENSOR TECHNOLOGY AND APPLICATIONS 6

Introduction, Sensor Node Technology, Sensor Taxonomy, Examples of Category 1 WSN Applications, Examples of Category 2 WSN Applications, WN Trends.

UNIT II MEDIUM ACCESS CONTROL PROTOCOLS FOR WIRELESS SENSOR NETWORKS 9

Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSN, Sensor-MAC Case Study, IEEE 802.15.4 LR-WPANs Standard Case Study

UNIT III ROUTING PROTOCOLS FOR WIRELESS SENSOR NETWORK 12

Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in Wireless Sensor Network, Routing Strategies in Wireless Sensor Networks, Traditional Transport Control Protocols, Examples of Existing Transport Control Protocols

UNIT IV MIDDLEWARE FOR WIRELESS SENSOR NETWORKS 6

Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware

UNIT V OPERATING SYSTEM & NETWORK MANAGEMENT FOR WIRELESS SENSOR NETWORKS 12

Introduction, Network Management Requirements, Traditional Network Management Models Network Management Design Issues, Example of Management Architecture: MANNA, Other Issues Related to Network Management, Operating System Design Issues, TinyOS, Mate, Magnet OS, MANTIS.

TEXT BOOK:

1. WIRELESS SENSOR NETWORKS Technology, Protocols, and Applications, Kazem Sohraby Daniel Minoli Taieb Znati, Copyright 2007 by John Wiley & Sons, Inc.

REFERENCES:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009
6. http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w02

COURSE OUTCOMES (COs)	
CO1	Design wireless sensor networks for a given application
CO2	Understand emerging research areas in the field of sensor networks
CO3	Understand MAC protocols used for different communication standards used in WSN
CO4	Explore new protocols for WSN
CO5	Understand Middleware of wireless sensor networks
CO6	Understand the operating system and network management of WSN

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3	3	2	2			2	3	3	3		3	3	3
	CO2	2	3	3	2	2			2	3	3	3				
	CO3	2	3	3	2	2			2	3	3	3				
	CO4	2	3	3	2	2			2	3	3	3	2			
	CO5	2	3	3	2	2			2	3	3	3				
	CO6	2	3	3	2	2			2	3	3	3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC024	**ASIC DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Digital System design				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To acquire knowledge about different types of ASICs design.
To study about various types of Programmable ASICs architectures and interconnects

UNIT I INTRODUCTION TO ASICS, CMOS LOGIC, ASIC LIBRARY DESIGN 9

Types of ASICs - Design flow – CMOS transistors- CMOS Design rules –Combinational logic Cell Sequential logic cell - Transistor as Resistors - Transistor parasitic capacitance – Logical effort - Library cell design – Library architecture.

UNIT II PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS 9

Anti fuse - Static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Xilinx I/O blocks.

UNIT III PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN 9

Entry: Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX –Design systems - Logic Synthesis - Half gate ASIC -Low level design language - PLA tools EDIF- CFI design representation.

UNIT IV SYSTEM ON-CHIP DESIGN 9

Voice over IP SOC - Intellectual Property – SOC Design challenges- Methodology and design-FPGA to ASIC conversion – Design for integration-SOC verification-Set top box SOC.

UNIT V PHYSICAL AND LOW POWER DESING 9

Over view of physical design flow- tips and guideline for physical design- modern physical design techniques- power dissipation-low power design techniques and methodologies-low power design tools- tips and guideline for low power design.

TEXT BOOK:

1. M.J.S. Smith, "Application Specific Integrated Circuits", Pearson Education, 2008

REFERENCES:

1. Wayne Wolf, "FPGA-Based System Design", Prentice Hall PTR, 2009.
2. Farzad Nekoogar and Faranak Nekoogar, "From ASICs to SOCs: A Practical Approach", Prentice Hall PTR, 2003.
3. www.vhdl.org/rassp/vhdl/guidelines/DesignReq.pdf

COURSE OUTCOMES (COs)	
CO1	Recognize need for programmable devices.
CO2	Describe architecture of programmable devices.
CO3	Explain programmable methodologies.
CO4	Recall IC fabrication techniques vis-à-vis CMOS switch.
CO5	Relate design and implementation flow for PLDs.
CO6	Low power design techniques and methodologies.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3		2		2	2	2	3	2		1	1	3	3	3
	CO2	2	1	3				3		1	3					
	CO3	2	3	2				2	2	2		3	3			
	CO4	2	3	3		2				2		2	2			
	CO5		1			2	2	2		1		2	2			
	CO6				2	2	3	2								
3	Category	Professional Elective (PE)														
4	Approval	49th Meeting of the Academic Council,														

U18PEEC025	**TESTING AND VERIFICATION OF ELECTRONIC CIRCUITS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic electrical and electronics, Electronic circuits				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVE:-

Gain knowledge on the basics of testing and the testing equipment's
Emphasize the needs of fault modeling and simulation

UNIT I INTRODUCTION 9

Introduction to Testing: Testing philosophy, Role of testing, Digital and analog circuit testing, Technology trends affecting testing, Test Equipment's, Economics and Quality: Test economics, Defining cost, Benefit-cost analysis, The rule of ten, Yield.
Verification: Importance of verification, Verification plan, Verification flow, Levels of verification, Verification methods and languages. Functional Verification: Introduction to test bench, Test bench architecture, Types of test benches.

UNIT II FAULT SIMULATION AND TESTABILITY MEASURES 9

Simulation for Design Verification, Simulation for Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-Value Simulation, Algorithms for Fault Simulation, SCOAP Controllability and Observability.

UNIT III TESTING AND TESTABILITY OF COMBINATIONAL CIRCUITS 9

Test Generation Techniques: One dimensional path sensitization, Boolean Difference, D-Algorithm, PODEM, FAN, Delay Fault Detection. Detection of multiple faults, The Reed-Muller Expansion Technique, Three level OR-AND-OR Design, Automatic Synthesis of Testable Logic, Testable PLA Design

UNIT IV TESTING AND TESTABILITY OF SEQUENTIAL CIRCUITS 9

Testing of sequential circuits as iterative combinational circuits, State Table Verification, Test Generation based on Circuit Structure, Ad Hoc Design Rules, Scan Path Technique, Partial Scan and Boundary Scan

UNIT V DELAY TEST AND IDDQ TEST 9

Delay Test Problem, Path-Delay Test, Faults Detected by IDDQ Tests, IDDQ Testing Methods, Limitations of IDDQ Testing, IDDQ Built-In Current Testing, IDDQ Design for Testability

TEXT BOOK:

2. Michael L. Bushnell and Vishwani D. Agarwal, "Essentials of Electronic Testing for Digital, Memory & Mixed-Signal VLSI Circuits", Springer, 2006.
2. P. K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
3. Dimitris Gizopouilos, "Advances in Electronic Testing", Springer 2006. Course nature

REFERENCES:

1. M. L. Bushnell and V. D. Agrawal, Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits, Kluwer.
2. Janick Bergeron, Writing Testbenches, Functional Verification of HDL Models, Springer.
3. Abramovici, M. A. Breuer and A. D. Friedman, Digital Systems Testing and Testable Design, Wiley/IEEE Press.
4. Laung-Terng Wang et al., VLSI Test Principals and Architecture:, Morgan Kaufman.
5. https://pdfs.semanticscholar.org/997c/0204674bff79f5542ac7e78ddbe448bed15b.pdf

COURSE OUTCOMES (COs)	
CO1	Understand the need of testing also able to identify the different characteristics of verification, validation, testing and diagnosis in context of electronic circuits.

CO2	Effectively use the different verification tools and methods
CO3	Effectively use the automatic test equipment and automatic test pattern generator
CO4	Add DFT and BIST techniques in given electronic design
CO5	Analyze the various fault models
CO6	Analyze IDDQ testing Methods

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2		3	2		1			3		1	1	3	3	3
	CO2		2			3		1		2	1					
	CO3				1	2		1	3		2					
	CO4		3		1		3		1	2		3				
	CO5	3		1	2			2		1			2			
	CO6			2		3			1			3	2			
3	Category	Professional Elective (PE)														
4	Approval	49th Meeting of the Academic Council,														

U18PEEC026	**STATISTICAL SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – Digital signal processing				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To Introduce the basics of random signal processing and Concept wise Introduction to Estimation and prediction theory

UNIT I INTRODUCTION TO RANDOM SIGNAL PROCESSING 9

Discrete Random Processes- Ensemble Averages, Stationary processes, Bias and Estimation, Auto covariance, Autocorrelation, Parseval's theorem, Wiener-Khintchine relation, White noise, Power Spectral Density, Spectral factorization, Filtering Random Processes, Special types of Random Processes – ARMA, AR, MA – Yule-Walker equations.

UNIT II SPECTRAL ESTIMATION 9

Estimation of spectra from finite duration signals, Nonparametric methods - Periodogram, Modified periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric method, AR (p) spectral estimation and detection of Harmonic signals, MUSIC algorithm.

UNIT III LINEAR ESTIMATION AND PREDICTION 9

Linear Prediction of Signals-Forward and Backward Predictions, Solution to Prony's normal equation, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters. Linear Minimum Mean-Square Error (LMMSE)

UNIT IV ADAPTIVE FILTERS 9

FIR adaptive filters – adaptive filter based on steepest descent method- Widrow-Hopf LMS algorithm, Normalized LMS algorithm, Adaptive channel equalization, Adaptive echo cancellation, Adaptive noise cancellation, RLS adaptive algorithm.

UNIT V APPLICATION OVERVIEW-SPEECH PROCESSING 9

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Short-term Fourier transform (STFT): overview of Fourier representation, non-stationary signals, development of STFT, transform and filter-bank views of STFT; Short time Homomorphic Filtering of Speech; Linear Prediction (LP) analysis: Basis and development, Levinson-Durbin's method, normalized error, LPC spectrum.

TEXT BOOK:

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc, Singapore, 2002.
2. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition". Pearson Education, 2003.

REFERENCES:

1. Dimitris G. Manolakis and Vinay K .Ingle ,"Applied Digital Signal Processing", Cambridge University Press, 2011.
2. L.R. Rabiner and R.W. Schafer, "Introduction to Digital Speech Processing" (Foundations and Trends in Signal Processing), Now Publishers Inc., USA, 2007.
3. https://nptel.ac.in/content/storage2/courses/117105077/pdf-m-2/m2l9.pdf

COURSE OUTCOMES (COs)	
CO1	Students will analyze the random signal processing
CO2	Students will learn to understand the spectral Estimation
CO3	Students will develop knowledge in Estimation and Prediction theory.
CO4	To know about adaptive filtering and its Applications.
CO5	Understand the fundamentals of Speech
CO6	Understand about speech processing.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	2	3	3			2	3	2	2	2	3	3	3
	CO2	3	2		3					3	3	3				
	CO3	3	2	2	2	2			2	2			2			
	CO4	3	3	2	3	3			2	3		3				
	CO5	3				2			2				1			
	CO6	3	2		2	3				2	2	2	1			
3	Category	Professional Elective (PE)														
4	Approval	49th Meeting of the Academic Council,														

U18PEEC031	**COGNITIVE RADIO**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Analog and Digital Communication				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

Learn the design of the wireless networks based on the cognitive radios
Understand the concepts of wireless networks and next generation networks.

UNIT I INTRODUCTION TO SOFTWARE DEFINED RADIO 9

Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.

UNIT II SDR ARCHITECTURE 9

Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top-level component interfaces, interface topologies among plug and play modules,.

UNIT III INTRODUCTION TO COGNITIVE RADIOS 9

Marking radio self-aware, cognitive techniques–position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

UNIT IV COGNITIVE RADIO ARCHITECTURE 9

Cognitive Radio- functions, components and design rules, Cognition cycle-orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.

UNIT V NEXT GENERATION WIRELESS NETWORKS 9

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing , upper layer is sues,cross –layer design.

TEXT BOOK:

1. Joseph Mitola III, ”Software Radio Architecture: Object– Oriented Approaches to Wireless System Engineering”, JohnWiley&SonsLtd.2000.
2. Thomas W.Rondeau, Charles W .Bostain, “Artificial Intelligence in Wireless Communication”, ARTECH HOUSE.2009.
3. Bruce A. Fette, “Cognitive Radio Technology”, Elsevier,2009.
4. Ian F. Akyildiz, Won –Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, “Next generation/Dynamic spectrum access/cognitive radio wireless networks: A survey “Elsevier Computer Networks, Aug, 2006.

REFERENCES:

1. Simon Haykin, “Cognitive Radio: Brain–Empowered Wireless Communications”, IEEE Journal on selected areas in communications, Feb 2005.
2. Hasari Celebi, Huseyin Arslan, “Enabling Location and Environment Awareness in Cognitive Radios”, Elsevier Computer Communications, Jan 2008.
3. Markus Dillinger, Kambiz Madani , Nancy Alonistioti, “Software Defined Radio”,JohnWiley,2003.
4. Huseyin Arslan,“ Cognitive Radio, SDR and Adaptive System”, Springer, 2007.
5. Alexander M. Wyglinski, Maziar nekovee ,Y. Thomas Hu, “Cognitive Radio Communication and Networks”, Elsevier, 2010
6. www.nptel.ac.in

COURSE OUTCOMES (COs)	
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 network based on the cognitive radios.
CO4	Gives an understanding of cognitive radio architecture
CO5	Explain the concepts behind the wireless networks and next generation networks
CO6	To have a better understanding of cognitive techniques

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low															
1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	1			1			2	1		2		3	3	3
	CO2	2	2	1	1	2			1			2				
	CO3	3	1	2	2	1			2			2	3			
	CO4	3	2	2	1	2			2	1		1				
	CO5	3		1	2	2			2	1		1	3			
	CO6	2			2	1			1	2		2				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC032	**ULTRA WIDEBAND COMMUNICATION**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Analog and Digital Communication				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

This course focuses on the basic signal processing techniques that concerns present and future dynamic UWB communication systems.

This course encompasses all areas of design and implementation of UWB systems.

At the end of the semester, the student should be able to develop a comprehensive overview of UWB system design that spans propagation, transmit and receive antenna implementations, standards and advanced topics, modulation and multiple access, network issues, and applications

UNIT I UWB SIGNALS AND SYSTEMS WITH UWB WAVEFORMS 9

Introduction – Power spectral density – Pulse shape – Pulse trains – Spectral masks – Multipath – Penetration characteristics – Spatial and spectral capacities – Speed of data transmission – Gaussian waveforms – Designing waveforms for specific spectral masks – Practical constraints and effects of imperfections.

UNIT II SIGNAL PROCESSING TECHNIQUES FOR UWB SYSTEMS AND UWB CHANNEL MODELING 9

Effects of a lossy medium on a UWB transmitted signal – Time domain analysis – Frequency domain techniques – A simplified UWB multipath channel model – Path loss model – Two-ray UWB propagation model – Frequency domain autoregressive model

UNIT III UWB COMMUNICATIONS AND ADVANCED UWB PULSE GENERATION UWB 9

Modulation methods – Pulse trains – UWB transmitter/receiver – Multiple access techniques in UWB – Capacity of UWB systems – Comparison of UWB with other wideband communication systems – Interference and coexistence of UWB with other systems – Hermite pulses – Orthogonal prolate spheroidal wave functions – Wavelet packets in UWB PSM – Applications of UWB communication systems.

UNIT IV UWB COMMUNICATION STANDARDS AND ADVANCED TOPICS IN UWB COMMUNICATION SYSTEMS UWB 9

Standardization in wireless personal area networks – DS-UWB proposal – MB-OFDM UWB proposal – IEEE proposals for UWB channel models – UWB ad-hoc and sensor networks – MIMO and Space-time coding for UWB systems – Self interference in high data-rate UWB communications – Coexistence of DS-UWB with WIMAX

TEXT BOOK:

1. M. Ghavami, L. B. Michael and R. Kohno, "Ultra Wideband signals and systems in Communication Engineering", 2nd Edition, John Wiley & Sons, NY, USA, 2007.

REFERENCES:

1. Jeffrey H. Reed, "An Introduction to Ultra Wideband Communication systems", Prentice Hall Inc., NJ, USA, 2005.
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/117102062/lec1.pdf

COURSE OUTCOMES (COs)	
CO1	To understand the operational characteristics of UWB
CO2	To study the working principle UWB technologies
CO3	To understand the working concept of all the Blocks Standards of UWB..
CO4	The ability to identify, formulate the radio channel,
CO5	To demonstrate the Wireless OFDM and RFID
CO6	To study the UWB signal characteristics , mask features, fundamentals and standards

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3			2	2			1	1		1		3	3	3
	CO2	2		2	1	1			3	1						
	CO3	2			1	2				2		2				
	CO4	2	3	2	2	1			2	1		1	3			
	CO5	3	2	2	3	1			2			2	3			
	CO6	2			2	1			1	3		2				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC033	**BROADBAND NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Computer Networks				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To understand the basics of networks and to study packet switched networks and circuit switched networks and to study ATM ad optical networks

UNIT I BASIC OF NETWORKS 9

Telephone, computer, cable Television and Wireless network, Networking principles, Digitalization , service integration, network services, and layered Architecture, traffic characterization and QOS, networks services, network elements and network mechanisms

UNIT II PACKET SWITCHED NETWORK 9

CSI and IP models: Ethernet (IEEE 802.3), tokentring(IEEE 802.5) FDDI, QDB, frame relay, SMDS, internet working with SMDS

UNIT III INTERNET AND TCP/IP NETWORKS 9

Interview , internet protocol , TCP and VDP, performance of TCP/IP networks circuit switched networks, SONET , DWDM, Fibre to home ,DSL, Intelligent networks, CATV.

UNIT IV BROAD BAND NETWORK TECHNOLOGY 9

Broadband services, ATM and IP , IPV6, High speed switching, resource reservation, Buffer management, traffic shaping, caching, scheduling and policing, throughput, delay and jitter performance.

UNIT V APPLICATIONS 9

MIME, Peer-to-peer computing, shared application, video conferencing, centralized and distributed conference control, distributed virtual reality, light weight session philosophy.

TEXT BOOK:

1. Jean Warland and PravinVaraiya, High Performance Communication Networks, 2nd Edition, Harcourt and Morgan Kauffman , London, 2000
2. Leon Gracia, Widjaja , Communication networks, Tata McGraw Hill, New Delhi. 2000
3. Jon Crowcroft, Mark Handley, Ian Wakeman. Internetworking Multimedia, Harcourt Asia Pvt.Ltd. Singapore, 1998.
4. B.O. Szuprowicz, Multimedia Networking, McGraw Hill, NewYork. 1995

REFERENCES:

1. SumitKasera, Pankaj sethi, ATM Networks, Tata McGraw Hill, New Delhi 2000
2. Behrouz. a. Forouzan ,Data communication and Networking , Tata McGraw Hill, New Delhi,2000.
3. Tay Vaughan, Multimedia making it to work, 4ed,Tata McGrawHill, NewDelhi,2000.
4. https://onlinelibrary.wiley.com/doi/book/10.1002/9780470434949

COURSE OUTCOMES (COs)	
CO1	To develop skills in networking.
CO2	To gain knowledge in TCP/IP and ISDN concepts.
CO3	To study Internet And Tcp/Ip Networks
CO4	To study packet switched networks and circuit switched networks.
CO5	To study ATM ad optical networks
CO6	To learn about real time applications in broad band networks

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3											2	3	3	3
	CO2		2			2				2			2			
	CO3				3			2								
	CO4	2		1			3		1			1				
	CO5									1	2					
	CO6															
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC034	NETWORK SERVICES	L	T	P	C
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Computer Network				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

The course gives an introduction to network processors including architecture and how such devices can be used in a system. Additionally, the course looks at how to program Intel IXP network processors and how to use these in a distributed multimedia system

UNIT I INTRODUCTION 9

Traditional protocol processing Systems – Network processing Hardware – Basic Packet Processing Algorithms and data Structures - Packet processing functions – Protocol Software –Hardware Architectures for Protocol processing – Classification and Forwarding– Switching Fabrics.

UNIT II NETWORK PROCESSOR TECHNOLOGY 9

Network Processors: Motivation and purpose - Complexity of Network Processor Design – Network Processor Architectures architectural variety, architectural characteristics Peripheral Chips supporting Network Processors: Storage processors, Classification Processors, Search Engines, Switch Fabrics, Traffic Managers.

UNIT III COMMERCIAL NETWORK PROCESSORS 9

Multi-Chip Pipeline, Augmented RISC processor, Embedded Processor plus Coprocessors Pipelilne of Flomogeneous processors. Configurable Instruction set processors – Pipeline of Electrogeneous processors – Extensive and Diverse processors – Flexible RISC plus Coprocessors – Scalability issues – Design Tradeuffs and consequences.

UNIT IV NETWORK PROCESSOR: ARCHITECTURE ANDPROGRAMMING 9

Architecture: Intel Network Processor: Multiheaded Architecture Overview – Features-Embedded EISC processor - Packet Processor Hardware – Memory interfaces – System and Control Interface Components – Bus Interface. Programming Software Development Kit-IXP Instruction set –register formats – Micro Engine Programming – Intra thread and Inter-thread communication –thread synchronization – developing sample applications – control plane – ARM programming.

UNIT V IOS TECHNOLOGIES 9

CISCO COS – Connectivity and scalability – high availability – IP routing – IP services – IPV6 –Mobile IP – MPLS – IP Multicast 0 Manageability – QoS – Security – Switching – Layer VPN2.

TEXT BOOK:

1. Douglas E.Comer “Networks Systems Design using Network Processors” Prentice Hall Jan 2003.
2. Panas C. Lekkas, “Network Processors: Architectures, Protocols and Paradigms Telecom Engineering)”, McGraw Hill, Professional, 2003.
3. Patrick Crowley, M aEranklin, H. Hadminglu, PZ Onfryk, “Network Processor Design, Issues and Practices Vol-1” Morgan Kaufman, 2002.

REFERENCES:

1. Patrick Crowley, M a Frankliln, H. Hadimioglyum PZ Onufryk, Network Processor Design,. Issues and Prentices vol.II, Morgan Kaufman, 2003.

2. Erik, J.Johnson and Aaron R.Kunze, "IXP2400/2806 Programming: The Microengine Coding Grade" Intel Press.
3. https://en.wikipedia.org/wiki/Network_service

COURSE OUTCOMES (COs)	
CO1	Understand network processing hardware.
CO2	Understand network processors and classification of processors.
CO3	Understand Embedded processors and coprocessors and pipelining.
CO4	Explore network processor architecture and programming.
CO5	Understand IP routing and IP services.
CO6	Understand the Quality of service and security.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3	3	2	2			2	3	3	3		3	3	3
	CO2	2	3	3	2	2			2	3	3	3				
	CO3	2	3	3	2	2			2	3	3	3				
	CO4	2	3	3	2	2			2	3	3	3	3			
	CO5	2	3	3	2	2			2	3	3	3				
	CO6	2	3	3	2	2			2	3	3	3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC035	**IOT AND MACHINE LEARNING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Embedded System				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To Understand the Architectural Overview of IoT
To Understand the IoT Reference Architecture and real World Design Constraints.
To Understand about cloud systems and sensors in IoT
To Understand the various learning algorithms and the applications of IoT

UNIT I OVERVIEW 9

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.

UNIT II IOT SMART SENSORS 9

Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas, etc., Important Characteristics of Sensors Importance and Adoption of Smart Sensors Architecture of Smart Sensors Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel

UNIT III IOT CLOUD SYSTEMS 9

The Cloud -Hype cycle-metaphorical interpretation-cloud architecture standards and interoperability- Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public, private clouds community cloud, role of virtualization in enabling the cloud.

UNIT IV LEARNING ALGORITHMS IN IOT 9

Regression Algorithms-Linear Regression- Polynomial Regression-Recurrent Neural Networks-Long Short term Memory Networks-Logistic Regression-Support Vector machines-Anomaly Detection-Python Programming

UNIT V CASE STUDIES 9

Design and Implementation of IoT for Environmental Condition Monitoring Case study: Development of WSN Based Smart Bed for Health Care Application Case study: Study of Smart City and its Design Case study: Study of Smart Airport and its Design Relevance of IoT to Developing World and Research Scope for the Internet of things

TEXT BOOK:

1. Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach",2014, ISBN:978 0996025515.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
3. Reese, G. (2009). Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. Sebastopol, CA: O'Reilly Media, Inc. (2009).

REFERENCES:

1. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN: 978-1-118-43062-0 2. Daniel Kellmereit, "The Silent Intelligence: The Internet of Things". 2013, ISBN 0989973700.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
3. https://www.coursera.org/learn/machine-learning
4. https://www.leverege.com/blogpost/machine-learning-applications-in-iot

COURSE OUTCOMES (COs)	
CO1	Able to understand the design principles of IoT
CO2	To learn about the architecture of IoT
CO3	Able to realize the concepts of IoT smart sensors
CO4	Able to understand the importance of cloud systems
CO5	To develop knowledge about the learning algorithms in IoT
CO6	To learn about the applications of IoT

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2			2	3			2	2				3	3	3
	CO2	2	2	3	2	3			2	2			3			
	CO3	2	3	3	3	3			3	3	3	3	3			
	CO4	2	3	3	3	3			3	3	3	3	3			

	CO5	3	3	3	3	3			3	3	3	3	3			
	CO6	2	3	3	3	3			3	3	3	3	3			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC036	SYSTEM MODELING & DESIGN	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Analog & Digital Communication and Computer Networks				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To enable the student to understand the various aspects of simulation methodology and performance, appreciate the significance of selecting sampling frequency and modeling different types of signals and processing them

UNIT I SIMULATION METHODOLOGY 9

Introduction, Aspects of methodology, Performance Estimation, Simulation sampling frequency, Low pass equivalent simulation models for band pass signals, Multicarrier signals, Non-linear and time varying systems, Post processing – Basic graphical techniques and estimations.

UNIT II RANDOM SIGNAL GENERATION & PROCESSING 9

Uniform random number generation, Mapping uniform random variables to an arbitrary pdf, Correlated and Uncorrelated Gaussian random number generation, PN sequence generation, Random signal processing, Testing of random number generators.

UNIT III MONTE CARLO SIMULATION 9

Fundamental concepts, Application to communication systems, Monte Carlo integration, Semianalytic techniques, Case study: Performance estimation of a wireless system.

UNIT IV ADVANCED MODELS & SIMULATION TECHNIQUES 9

Modeling and simulation of non-linearities : Types, Memoryless non-linearities, Non-linearities with memory, Modeling and simulation of Time varying systems : Random process models, Tapped delay line model, Modelling and simulation of waveform channels, Discrete memoryless channel models, Markov model for discrete channels with memory.

UNIT V EFFICIENT SIMULATION TECHNIQUES 9

Tail extrapolation, pdf estimators, Importance Sampling methods, Case study: Simulation of a Cellular Radio System.

TEXT BOOK:

1. William.H.Tranter, K. Sam Shanmugam, Theodore. S. Rappaport, Kurt L. Kosbar, Principles of Communication Systems Simulation, Pearson Education (Singapore) Pvt. Ltd, 2004.
2. M.C. Jeruchim, P.Balaban and K. Sam Shanmugam, Simulation of Communication Systems: Modeling, Methodology and Techniques, Plenum Press, New York, 2001.

REFERENCES:

1. Averill.M.Law and W. David Kelton, Simulation Modeling and Analysis, McGraw Hill Inc., 2000.

2. Geoffrey Gorden, System Simulation, Prentice Hall of India, 2nd Edition, 1992.
3. Jerry Banks and John S. Carson, Discrete Event System Simulation, Prentice Hall of India, 1984.
4. https://cs.ccsu.edu/~stan/classes/CS410/Notes16/05-SystemModeling.html

COURSE OUTCOMES (COs)	
CO1	The student would be able to mathematically model a physical phenomena
CO2	To simulate the phenomena to depict the characteristics that Aug be observed in a real experiment
CO3	The student would be able to apply his knowledge of the different simulation techniques for designing a communication system or channel
CO4	To show the performance so as to match a realistic scenario.
CO5	To expose the student to the different simulation techniques, their pros and cons
CO6	To enable him to understand and interpret results using case studies

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	2	3	2	2			1	2	2	2		3	3	3
	CO2	2	3	3	2	2			2	1		2	3			
	CO3	3	2	3	2	1			2	1	3	2	3			
	CO4	2	3	2	2	1			2	2		1	3			
	CO5	3	2	3	1	3			2	1	3	2	3			
	CO6	3	2	2	2	3			2	1	1	2	3			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC037	**ADAPTIVE SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – Digital signal processing				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

Introduction to the various techniques used to predict the outcomes of a random Process.
Ability to appreciate the various filters, their inherent assumptions and the statistics they require.
Top-level understanding of the convergence issues, computational complexities and optimality of different filters.
Ability to develop adaptive systems for various applications.

UNIT I ADAPTIVE SYSTEMS 9

Definitions and characteristics - applications – properties-examples - adaptive linear combiner input signal and weight vectors - performance function-gradient and minimum mean square error - introduction to filtering-smoothing and prediction - linear optimum filtering-orthogonality - Wiener – Hop equation-performance surface.

UNIT II STABILITY AND RATE OF CONVERGENCE 9

Learning curve-gradient search - Newton's method - method of steepest descent - comparison - Gradient estimation - performance penalty - variance - excess MSE and time constants – mis-adjustments.

UNIT III LMS ALGORITHM CONVERGENCE OF WEIGHT VECTOR 9

LMS/Newton algorithm - properties - sequential regression algorithm - adaptive recursive filters - random-search algorithms - lattice structure - adaptive filters with orthogonal signals.

UNIT IV INVERSE ADAPTIVE MODELING 9

Equalization, and de-convolution adaptive equalization of telephone channels-adapting poles and zeros for IIR digital filter synthesis.

UNIT V APPLICATIONS 9

Adaptive Modeling and System Identification, Multipath communication channel, geophysical exploration, FIR digital filter synthesis.

TEXT BOOK:

1. John R. Treichler, C. Richard Johnson, Michael G. Larimore, "Theory and Design of Adaptive Filters", Prentice-Hall of India, 2002
2. S. Thomas Alexander, "Adaptive Signal Processing - Theory and Application", Springer-Verlag

.

REFERENCES:

1. Bernard Widrow and Samuel D. Stearns, "Adaptive Signal Processing", Person Education, 2005.
2. Simon Haykin, "Adaptive Filter Theory", Pearson Education, 2003.
3. D. G. Manolokis, V. K. Ingle and S. M. Kogar, "Statistical and Adaptive Signal Processing", Mc Graw Hill International Edition,2000.
4. https://nptel.ac.in/courses/117105075/

COURSE OUTCOMES (COs)	
CO1	To learn about adaptive systems
CO2	To analyse about stability and rate of convergence
CO3	To analyze about LMS algorithm.
CO4	To Analyze and implement recursive filters.
CO5	To analyze about inverse adaptive modeling
CO6	To apply adaptive signal processing to various applications.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3		2	3	2			3					3	3	3
	CO2	3	2	2	2					3	3		3			
	CO3	3			2	2						2	3			
	CO4	3	3			2					2		3			
	CO5	3	2	2					3				3			
	CO6	3			3	2			2	3	2	3	3			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC041	CRYTOGRAPHY AND NETWORK SECURITY	L	T	P	C
	Total Contact Hours-45	3	0	0	3
	Prerequisite: Computer Networks				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

The student should be made to:
Understand OSI security architecture and classical encryption techniques.
Acquire fundamental knowledge on the concepts of finite fields and number theory.
Understand various block cipher and stream cipher models.
Describe the principles of public key cryptosystems, hash functions and digital signature.

UNIT I INTRODUCTION & NUMBER THEORY 10

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid‟s algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat‟s and Euler‟s theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

UNIT II BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY 10

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. **Public key cryptography:** Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT III HASH FUNCTIONS AND DIGITAL SIGNATURES 8

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

UNIT IV SECURITY PRACTICE & SYSTEM SECURITY 8

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

UNIT V E-MAIL, IP & WEB SECURITY 9

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-Repudiation-Pretty Good Privacy-S/MIME. **IP Security:** Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). **Web Security:** SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

TEXT BOOK:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013. (UNIT I,II,III,IV).

2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.(UNIT V).

REFERENCES:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
3. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
5. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication in Public World", PHI 2002.
6. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
7. Douglas R Simson "Cryptography – Theory and practice", First Edition, CRC Press, 1995.
8. http://nptel.ac.in/.

COURSE OUTCOMES (COs)	
CO1	Able to Compare various Cryptographic Technique.
CO2	Design Secure applications
CO3	Understand Inject secure coding in the developed applications
CO4	Explore Security of Hash function and MAC.
CO5	Understand Firewall related terminology and Types of Firewall.
CO6	Understand the concepts of web security and IP security.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3	3	2	2			2	3	3	3		3	3	3
	CO2	2	3	3	2	2			2	3	3	3	3			
	CO3	2	3	3	2	2			2	3	3	3	3			
	CO4	2	3	3	2	2			2	3	3	3	3			
	CO5	2	3	3	2	2			2	3	3	3				
	CO6	2	3	3	2	2			2	3	3	3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC042	**ROUTING PROTOCOLS**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	3	0	0	3
	Prerequisite: Computer Networks				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

Obtain a broad understanding about the routing protocol; it specifies how routers communicate with each other, distributing information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. Each router has a prior knowledge only of networks attached to it directly. A routing protocol shares this information first among immediate neighbors, and then throughout the network

UNIT I INTRODUCTION TO ROUTING AND PACKET FORWARDING 9

Inside the Router, CLI Configuration and Addressing, Building the Routing Table, Path Determination and Switching Functions.

UNIT II ROUTING TABLE 9

The Routing Table Structure, Routing Table Lookup Process, Routing Behavior

UNIT III STATIC ROUTING PROTOCOLS 9

Routers and the Network, Router Configuration Review, Exploring Directly Connected Networks, Static Routes with "Next-Hop" Addresses, Static Routes with Exit Interfaces, Managing and Troubleshooting Static Routes

UNIT IV DYNAMIC ROUTING PROTOCOLS 9

Introduction to Dynamic Routing Protocols , Classifying Dynamic Routing Protocols, Distance Vector Routing Protocols, Link-State Routing Protocols.

UNIT V ROUTING INFORMATION PROTOCOL 9

Basic RIPv1 Configuration, Basic RIPv2 Configuration, Verification and Troubleshooting, Automatic Summarization.

TEXT BOOK

1. Routing Protocols and Concepts CCNA Exploration Companion Guide, Rick Graziani, Allan Johnson, Copyright© 2008 Cisco Systems, Inc. Published by: Cisco Press 800 East 96th Street Indianapolis, IN 46240 USA.

REFERENCES:

1. IP Routing Protocols, by Uyless Black, Publisher: Prentice Hall *Release Date: February 2000*, ISBN: 0130142484
2. C S. Ram Murthy, B. S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall of India, 2nd ed. 2005.
3. R. Hekmat, Ad hoc Networks: Fundamental Properties and Network Topologies, Springer, 1st ed. 2006.
4. http://osnet.cs.nchu.edu.tw/powpoint/Computer%20Network93_1/Chapter%2013.pdf

COURSE OUTCOMES (COs)	
CO1	Understand the basics of Routing and Packet Forwarding
CO2	Understand about the details and structure of Routing Table
CO3	Understand about the Static Routing Protocols and its types
CO4	Understand about the Dynamic Routing Protocols and its types
CO5	Understand about the Routing Information Protocol version 1
CO6	Understand about the Routing Information Protocol version 2

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3	3	2	2	1		2	3	3	3	1	3	3	3
	CO2	2	3	3	2	2	1		2	3	3	3	1			
	CO3	2	3	3	2	2	1		2	3	3	3	1			
	CO4	2	3	3	2	2	1		2	3	3	3	1			
	CO5	2	3	3	2	2	1		2	3	3	3	1			
	CO6	2	3	3	2	2	1		2	3	3	3	1			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC043	ROBOTICS AND AUTOMATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Microcontroller				
	Department:- Dept. of Electronics and Communication Engineering.				

To study the various parts of robots and fields of robotics
To study the various kinematics and inverse kinematics of robots
To study the Euler, Lagrangian formulation of Robot dynamics
To study the trajectory planning for robot.
To study the control of robots for some specific applications

UNIT I BASIC CONCEPTS 9

Definition and origin of robotics – various generations of robots - Asimov's laws of robotics - robot anatomy – robot configuration, robot motions and degrees of freedom –control system of a robot - types of robot control – performance measures – stability, resolution, accuracy, repeatability and compliance of robot

UNIT II SENSORS AND MACHINE VISION 9

Requirements of a sensor, Principles and Applications of the tactile sensors – touch sensors, force and torque sensors – non tactile sensors – light/ fiber optic sensor, laser sensor, acoustic, magnetic sensor – machine vision: model, sensing and digitizing, image processing and analysis, applications of machine vision in robotics.

UNIT III DRIVES, MANIPULATORS AND GRIPPERS 9

Hydraulic, pneumatic and electric drive systems – gears – Construction of manipulators – manipulator dynamics and force control – grippers – mechanical, vacuum and magnetic grippers design considerations.

UNIT IV KINEMATICS AND PROGRAMMING 9

Robot kinematics and Solution of inverse kinematics problem - Robot programming methods – lead through programming method: program as path in space, commands, program for pick and place operation – textual programming method: language structure, elements and functions languages

UNIT V CASE STUDIES 9

Multiple robots and machine interface – robot cell layout/ work cell, work cell design consideration, work cell controller – Robots in manufacturing applications, robots in nonmanufacturing applications - selection of robot.

TEXT BOOK::

1. M.P.Groover, Mitchell Weiss, R.N Nagel, N.G Odrey, "Industrial Robotics – Technology, Programming and Applications",McGraw-Hill, 2008
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.

REFERENCES:

1. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
2. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.
4. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.
5. http://engineering.nyu.edu/mechatronics/smart/pdf/Intro2Robotics.pdf

COURSE OUTCOMES (COs)	
CO1	To study the various parts of robots and fields of robotics
CO2	To study the various kinematics and inverse kinematics of robots
CO3	To study the Euler, Lagrangian formulation of Robot dynamics
CO4	To study the trajectory planning for robot.
CO5	To study the control of robots for some specific applications
CO6	To study the various parts of robots and fields of robotics

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3		1	3		2	1				1	2	3	3	3
	CO2		3		1	3			2		2	1	2			
	CO3				3	2		1	2			3	2			
	CO4		3		1		3		1	2		3	2			
	CO5	2			3			2		1			2			
	CO6			2		1			3		2		2			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC044	NANO ELECTRONICS	L	T	P	C
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Semiconductor Physics				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE 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

UNIT I INTRODUCTION TO NANOTECHNOLOGY 9

Background to nanotechnology: Types of nanotechnology and nanomachines – periodic table – atomic structure – molecules and phases – energy – molecular and atomic size – surface and dimensional space – top down and bottom up; Molecular Nanotechnology: Electron microscope – scanning electron microscope – atomic force microscope – scanning tunnelling microscope – nano manipulator – nano tweezers – atom manipulation– nanodots – self assembly – dip pen nanolithography. Nano materials: preparation –plasma arcing – chemical vapor deposition – sol-gels – electro deposition – ball milling –applications of nanomaterials.

UNIT II FUNDAMENTALS OF NANOELECTRONICS 9

Fundamentals of logic devices:- Requirements – dynamic properties – threshold gates; physical limits to computations; concepts of logic devices:- classifications – two terminal devices – field effect devices – coulomb blockade devices – spintronics – quantum cellular automata – quantum computing – DNA computer; performance of information processing systems;- basic binary operations, measure of performance processing capability of biological neurons – performance estimation for the human brain. Ultimate computation: - power dissipation limit – dissipation in reversible computation – the ultimate computer.

UNIT III SILICON MOSFETs & QUANTUM TRANSPORT DEVICES 9

Silicon MOSFETS - Novel materials and alternate concepts: - fundamentals of MOSFET Devices- scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions & contacts – advanced MOSFET concepts. Quantum transport devices based on resonant tunneling: - Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applications: - Single electron devices – applications of single electron devices to logic circuits.

UNIT IV CARBON NANOTUBES 9

Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs –Nanotube for memory applications – prospects of an all carbon nanotube nanoelectronics.

UNIT V MOLECULAR ELECTRONICS 9

Electrodes & contacts – functions – molecular electronic devices – first test systems – simulation and circuit design – fabrication; Future applications: MEMS – robots – random access memory – mass storage devices.

TEXTBOOKS:

1. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard
2. Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman &Hall / CRC, 2002
3. T. Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007
4. Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003
5. Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, “Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications”, Cambridge University Press 2011.
6. Supriyo Datta,“Lessons from Nanoelectronics: A New Perspective on Transport”, World Scientific2012

REFERENCES:

1. Mircea Dragoman, Daniela Dragoman, “Nanoelectronics: principles and devices”, CRC Press 2006.
2. Karl Goser, Peter Glösekötter, Jan Dienstuhl,“Nanoelectronics and Nano systems: From Transistors to Molecular and Quantum Devices“, Springer 2004
3. W. R. Fahrner, Nanotechnology and Nan electronics: Materials, Devices, Measurement Techniques (Springer Verlag Berlin Heidelberg 2005)
4. Mark A. Reed, Takhee Lee,“ Molecular nanoelectronics”, American Scientific Publishers 2003
5. Jaap Hoekstra, “Introduction to Nano electronic Single-Electron Circuit Design”, Pan Stanford Publishing 2010
6. W. Ranier, “Nano Electronics and Information Technology”, John Wiley & Sons 2012.
7. https://nptel.ac.in/courses/117108047/

COURSE OUTCOMES (COs)	
CO1	Students will understand about nano technology and nano machines.
CO2	Students will have in-depth technical knowledge about logic devices,their properties and their performance

CO3	Students will learn about silicon MOSFET and advanced MOSFET Concepts
CO4	Students will develop deep knowledge about quantum transport devices
CO5	Students will learn about carbon nano tubes.
CO6	Students will learn about the concepts related to molecular electronics.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	3	3			3	3	3	3		3	3	3
	CO2	3	2	3	2	2										
	CO3	3	2	3	3	3			3	2	3	2				
	CO4	3									2					
	CO5	3								2						
	CO6	3		3	3	3			3	3	3	3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC045	**WAVELETS**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – Digital signal processing				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To study the basics of signal representation and Fourier theory.
To understand Multi Resolution Analysis and Wavelet concepts
To study the wavelet transform in both continuous and discrete domain
To understand the design of wavelets using Lifting scheme
To understand the applications of Wavelet transform

UNIT I FUNDAMENTALS 9

Vector Spaces – Properties– Dot Product – Basis – Dimension, Orthogonality and Orthonormality – Relationship Between Vectors and Signals – Signal Spaces – Concept of Convergence – Hilbert Spaces for Energy Signals- Fourier Theory: Fourier series expansion, Fourier transform, Short time Fourier transform, Time-frequency analysis.

UNIT II MULTI RESOLUTION ANALYSIS 9

Definition of Multi Resolution Analysis (MRA) –Haar Basis – Construction of General Orthonormal MRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT – Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.

UNIT III CONTINUOUS WAVELET TRANSFORMS 9

Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency – Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (Daubechies , Coiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal)– Tiling of Time – Scale Plane for CWT.

UNIT IV DISCRETE WAVELET TRANSFORM 9

Filter Bank and Sub Band Coding Principles – Wavelet Filters – Inverse DWT Computation by Filter Banks – Basic Properties of Filter Coefficients – Choice of Wavelet Function Coefficients – Derivations of Daubechies Wavelets – Mallat's Algorithm for DWT –Multi Band Wavelet Transforms Lifting Scheme- Wavelet Transform Using Polyphase Matrix Factorization – Geometrical Foundations of Lifting Scheme – Lifting Scheme in Z –Domain.

UNIT V APPLICATIONS 9

Wavelet methods for signal processing- Image Compression Techniques: EZW–SPHIT Coding– Image Denoising Techniques: Noise Estimation – Shrinkage Rules – Shrinkage Functions –Edge Detection and Object Isolation, Image Fusion, and Object Detection.

TEXT BOOK:

1. Rao R M and A S Bopardikar, ―Wavelet Transforms Introduction to theory and Applications, Pearson Education, Asia, 2000.
2. L.Prasad & S.S.Iyengar, Wavelet Analysis with Applications to Image Processing, CRC Press, 1997.

REFERENCES:

1. J. C. Goswami and A. K. Chan, "Fundamentals of wavelets: Theory, Algorithms and Applications" Wiley Interscience Publication,John Wiley & Sons Inc., 1999.
2. M. Vetterli, J. Kovacevic, "Wavelets and subband coding" Prentice Hall Inc, 1995.
3. Stephen G. Mallat, "A wavelet tour of signal processing" 2 nd Edition Academic Press, 2000.
4. Soman K P and Ramachandran K I, ―Insight into Wavelets From Theory to practice, Prentice Hall, 2004.
5. https://www.springer.com/gp/book/9783319594323

COURSE OUTCOMES (COs)	
CO1	Understand time-frequency nature of the signals.
CO2	Apply the concept of wavelets to practical problems.
CO3	Mathematically analyze the systems or process the signals using appropriate wavelet functions.
CO4	Gain knowledge about MRA and representation using wavelet bases.
CO5	Acquire knowledge about various wavelet transforms and design wavelet transform
CO6	Apply wavelet transform for various signal & image processing applications.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	3									3	3	3
	CO2	3	3	2	2	2	2			2	3		3			
	CO3	3	3	2	2	2					3	3	3			
	CO4	3	3				3			2		3				
	CO5	3	3	3	3		3			3		3	3			
	CO6	3	3	3	3	3	3			3	3		3			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC046	PATTERN RECOGNITION AND NEURAL NETWORKS	L	T	P	C
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Digital Signal Processing				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

The course provides a comprehensive foundation to Artificial Neural Networks with applications to Pattern Recognition and Data Mining. Learning processes: supervised and unsupervised, deterministic and statistical.

UNIT I INTRODUCTION AND SIMPLE NEURAL NET WORK 9

Elementary neurophysiology and biological neural network-Artificial neural network – Architecture, biases and thresholds, Hebb net, Perceptron, Adaline and Madaline.

UNIT II BACK PROPOGATION AND ASSOCIATIVE MEMORY 9

Back propogation network, generalized delta rule, Bidirectional Associative memory, Hopefield network.

UNIT III NEURAL NETWORKS BASED ON COMPETITION 9

Korhonen Self organizing map, Learning Vector Quantization, counter propagation network.

UNIT IV UNSUPERVISED LEARNING AND CLUSTERING ANALYSIS 9

Patterns and features, training and learning in pattern recognition, discriminant functions, different types of pattern recognition. Unsupervised learning- hierarchical clustering, partitional clustering. Neural pattern recognition approach – perceptron model.

UNIT V SUPERVISED LEARNING USING PARAMETRIC AND NON-PARAMETRIC APPROACH 9

Bayesian classifier, non-parametric density estimation, histograms, kernels, window estimators, k-nearest neighbor classifier, estimation of error rates.

TEXT BOOK:

1. B. D. Ripley: “Pattern Recognition and Neural Networks”, Cambridge University Press, Cambridge, UK, 1996.
2. K. Fukunaga: “Introduction to Statistical Pattern Recognition”, Academic Press, San Diego, CA, 1990.
3. S. Haykin: Neural Networks: A Comprehensive Foundation, second Edition, 1999.
4. www.vidyarthiplus.com

REFERENCES:

1. C. M. Bishop: “Neural Networks for Pattern Recognition”, Oxford University Press, Oxford, UK, 1995.
2. H. A. Bourlard, N. Morgan: “Connectionist Speech Recognition”, Kluwer Academic Publishers, Boston, MA, 1994
3. R. O. Duda, P. E. Hart, D. G. Stork: “Pattern Classification” 2nd ed., J. Wiley & Sons, New York, NY, 2001
4. https://www.vidyarthiplus.com/vp/Thread-BM2401-Pattern-Recognition-and-Neural-Networks-Lecture-Notes-All-Units#.XagPHZIzbIU

COURSE OUTCOMES (COs)	
CO1	To understand the basics of Neural Network and Architecture

CO2	To gain knowledge about back propagation and associative memory
CO3	To provide knowledge of self self-organizing
CO4	To understand different types of pattern recognition
CO5	To understand and apply both supervised classification methods to detect and characterize patterns in real-world data
CO6	To provide knowledge of learning and adaptation in supervised modes of learning

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	1	2	2	1			2	1		2		3	3	3
	CO2	2		2	1				1	1		2				
	CO3	2		2	1	2			1	2		1				
	CO4	2	1	2	2	2			1	1		2				
	CO5	2		1	2	1			2	1		1				
	CO6	2		1	2	1			1	2		2				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC051	**SATELLITE COMMUNICATION**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Electromagnetic Waves & Analog& Digital Communication				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To enable the student to become familiar with satellites and satellite services.
Study of satellite orbits and launching.
Study of earth segment and space segment components
Study of satellite access by various users

UNIT I INTRODUCTION 9

Introduction, Types – Active and Passive Satellite, Frequency allocation, Satellite orbits, Kepler's laws, Definitions of terms for earth-orbiting Satellites, Apogee and Perigee heights, Orbit Perturbations, Geo stationary orbit, Antenna look angles, Limits of visibility, Earth Eclipse of Satellite, Sun transit outage, launching orbits.

UNIT II THE SPACE SEGMENT 9

Introduction, The Power supply, Attitude control, spinning satellite, stabilization, Momentum Wheel Stabilization, Station keeping, Thermal control, TT&C subsystem, Transponders, The Wide Band receiver, The Input Demultiplexer, The Power Amplifier, The Antenna subsystem.

UNIT III THE EARTH SEGMENT AND ANTENNAS 9

Transmit receive earth station subsystems, up-converters-High Power Amplifier-Receive chain-LNA&LNB.TVRO earth station, The isotropic radiator and antenna gain, Horn antenna, The Parabolic reflector, Double reflector antenna-Cassie grain antenna-Gregorian antenna.

UNIT IV THE SPACE LINK & SATELLITE ACCESS 9

EIRP, Transmission losses The Link budget equation, System noise, Effects of rain, up link and down link C/N ratio. Multiple access techniques-Concepts and types of TDMA, FDMA and CDMA-Comparison and contrast of TDMA, FDMA and CDMA.

UNIT V SATELLITE APPPLICATIONS **9**

Satellite Mobile services, DBS, VSAT, Remote sensing, GPS, INTELSAT, INMARSAT, SARSAT, Video Conferencing and Internet connectivity

TEXT BOOK:

1. Dennis Roddy, "Satellite Communication", 4th Edition,McGrawHill International,2006.

REFERENCES:

1. Wilbur L.Pritchard, Hendri G.Suyderhoud,Robert A.Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. N.Agarwal,"Design of Geosynchronous Space Craft", Prentice Hall,1986.
3. BruceR.Elbert,"TheSatelliteCommunicationApplications",HandBook,ArtechHouseBosta n London,1997.
4. TriT. Ha, "Digital Satellite Communication", IInd Edition,1990.
5. Emanuel F Thenakis, "Manual of Satellite Communications", McGraw Hill Book Co.,1984.
6. Robert G.Winch, "Telecommunication Transmission Systems",McGraw-Hill Book Co., 1983.
7. BrianAckroyd,"WorldSatelliteCommunicationandEarthStationDesign",BSP Professional Books,1990.
8. G.B.Bleazard,"Introducing Satellite communications", NCC Publication,1985
9. https://lecturenotes.in/notes/1654-notes-for-satellite-communication-system-scs-by-bhagyalaxmi-jena

COURSE OUTCOMES (COs)	
CO1	Define orbital mechanics and launch methodologies
CO2	Describe satellite subsystems
CO3	Design link power budget for satellites
CO4	Compare competitive satellite services
CO5	Explain satellite access techniques
CO6	DTH and compression standards

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	2	2	1	2			1		1	2	2	3	3	3
	CO2	3	2	3	1	2			2			2	2			
	CO3	2	2	3	2	1			2		1	1	2			
	CO4	2			1	2			3		1		2			
	CO5	2	1	2	2	1			2			3	2			
	CO6	2			2	1			2			2	2			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC052	**HIGH PERFORMANCE COMMUNICATION NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	3	0	0	3
	Prerequisite: Computer Networks				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To Provide the various high speed digital access and broadband technologies, Switching techniques used for communication, Congestion control Performance issues and quality of service required for better performance of high speed networks and focuses how networking

UNIT I BASIC OF NETWORKS 9

Telephone, computer, cable Television and Wireless network, Networking principles, Digitalization , service integration, network services, and layered Architecture, traffic characterization and QOS, networks services, network elements and network mechanisms.

UNIT II PACKET SWITCHED NETWORK 9

CSI and IP models: Ethernet (IEEE 802.3), tokentring(IEEE 802.5) FDDI, QDB, frame relay, SMDS, internet working with SMDS.

UNIT III INTERNET AND TCP/IP NETWORKS 9

Interview , internet protocol , TCP and VDP, performance of TCP/IP networks circuit switched networks, SONET , DWDM, Fiber to home ,DSL, Intelligent networks, CATV.

UNIT IV ATM AND WIRELESS NETWORKS 9

Main features- addressing, signaling and routing , ATM header structure- adaptation layer, management and control, BISDN, Interworking with ATM, Wireless channel, link level design, channel access, Network design and wireless networks.

UNIT V OPTICAL NETWORKS AND SWITCHING 9

Optical links- WDM systems, cross –connects, optical LAN'S, optical paths and networks, TDS and SDS, modular switch designs- packet switching, distributed, shared, input and output buffers.

TEXT BOOK:

1. Jean Warland and Pravin Varaiya, High Performance Communication Networks, 2nd Edition, Harcourt and Morgan Kauffman, London, 2000
2. Leon Gracia, Widjaja , Communication networks, Tata McGraw Hill, New Delhi. 2000.

REFERENCES:

1. Sumit Kasera, Pankaj sethi, ATM Networks, Tata McGraw Hill, New Delhi 2000
2. Behrouz. a. Forouzan ,Data communication and Networking , Tata McGraw Hill, New Delhi,2000
3. https://www.elsevier.com/books/high-performance-communication-networks/walrand/978-0-08-050803-0

COURSE OUTCOMES (COs)	
CO1	Understand about basics of network.
CO2	Gain knowledge in TCP/IP and ISDN concepts.
CO3	Understand about Internet and Tcp/Ip Networks
CO4	Understand about packet switched networks and circuit switched networks
CO5	Understand about ATM and optical networks
CO6	Understand different networking and switching design
Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low	

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3	3	2	2			2	3	3	3		3	3	3
	CO2	2	3	3	2	2			2	3	3	3				
	CO3	2	3	3	2	2			2	3	3	3				
	CO4	2	3	3	2	2			2	3	3	3				
	CO5	2	3	3	2	2			2	3	3	3				
	CO6	2	3	3	2	2			2	3	3	3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC053	**REAL TIME SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Embedded systems				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To expose the students to the fundamentals of Real Time systems
To teach the fundamentals of Scheduling and features of programming languages
To study the data management system for real time
To introduce the fundamentals of real time communication
To teach the different algorithms and techniques used for real time systems

UNIT I INTRODUCTION 9

Introduction – issues in real time computing – structure of a real time system – task glasses – performances measures for real time systems – estimating program run time – task assignment and scheduling – classical uniprocessor scheduling algorithms – uniprocessor scheduling of IRIS tasks – tasks assignment – mode changes – fault tolerant scheduling.

UNIT II PROGRAMMING LANGUAGES AND TOOLS 9

Language features – desired language characteristics – data typing – control structure – facilitating hierarchical decomposition – package – run – lime error handling – overloading and generics – multi tasking – low-level programming – task scheduling – lining specifications – programming environment – run-time support – code generation.

UNIT III REAL TIME DATA BASES 9

Real time data base- basic definition – real lime vs general – purpose database – main memory data bases – transaction priorities – transaction aborts – concurrent control issues –disk scheduling algorithms – two-phase approach to improve predictability – maintaining serialization consistency- databases for hard real time systems.

UNIT IV COMMUNICATION 9

Real time communication – communications media – network topologies – protocols – buffering data – synchronization – deadlock – mailboxes and semaphores – fault tolerance techniques – fault types – fault detection – fault error containment – redundancy – data diversity – reversal checks – integrated handling.

UNIT V EVALUATIION TECHNIQUES 9

Reliability evaluation techniques – reliability models for hardware redundancy – software error models – response time calculations – interrupt latency – time loading and its measurement –

reducing response times – latency – time loading and its measurement – reducing response times – analysis of memory requirements – reducing memory loading.

TEXT BOOK

1. C.M Krishna, kangG.shin, real- time systems, McGraw-hill international editions, 1997.

REFERENCES:

1. Straut Bennett, real time computer control – an introduction, PHI, 1998.
2. Peter D Lawrence, real time micro computer system design – an introduction, McGraw hill, 1998.
3. S.T allworth and R.N Zobel, introduction to real time software design macmillan, 2nd edition, 1987.
4. www.rts.org/rassp/vhdl/guidelines/**Design**Req.pdf

COURSE OUTCOMES (COs)	
CO1	Explain and apply the fundamental concepts and terminology of real-time systems.
CO2	Explain and address the fundamental problems of real-time systems
CO3	Analyze real-time systems designs
CO4	Design a real-time system (at least partially)
CO5	Identify and assess the relevant literature and research trends of real-time systems.
CO6	Analyze the programming languages of real time systems

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1			3	2					2		3	3	3	3	3
	CO2	3	2	2		3	3				3	1	3			
	CO3				3	1			3	1		2	3			
	CO4		3	1		2	1	3		2		3	3			
	CO5	2											3			
	CO6		3			2				2			3			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC054	**DIGITAL HARDWARE DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Periods – 45	**3**	**0**	**0**	**3**
	Prerequisite – Digital System Design				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To study the applications of logic gates.
To use K-maps for digital circuit design.
To study and understand basics of microprocessors
To understand fundamentals of multicore technology

UNIT I DIGITAL CIRCUIT DESIGN 9

Introduction to digital circuit design, Circuit design using logic gates: Binary to gray converter, Gray to Binary converter, Decimal to BCD encoder, Circuit designusing state table/K-map: Design of Full adder, full subtractor, BCD to seven segment decoder, Concept of excitation table, Design of 3 bit synchronous up counter , 3 bit random sequence generator .

UNIT II MEMORY 9

Memory Architecture, Memory Hierarchy, Introduction to USB storage device, Memory parameters (Access time, speed, capacity, cost), Vertical & horizontal Memory expansion (increasing the capacity, increasing word size), Associative Memory, Cache memory, cache mapping techniques, virtual memory, virtual memory mapping (paging and segmentation).

UNIT III COMPUTER ORGANIZATION 9

Concept of Address Bus, Data Bus, Control Bus. Register based CPU organization, stack organization, I/O organization: need of interface, block diagram of general I/O interface. Working concepts like polling, interrupt initiated data transfer. Concept of DMA , DMA transfer, DMA Controller Serial communication: Synchronous, asynchronous and their data transmission formats, RS–232, General block diagram of UART.

UNIT IV MICROPROCESSOR 9

Evolution of Microprocessor (8086 to Pentium 4), Features like address, data, bus size, speed, cache capacity, number of parallel instructions executed. Concept of RISC & CISC, Von-Neumann & Harvard Architecture, Concept of pipeline.

UNIT V ARCHITECTURE OF BASIC MICROPROCESSOR 9

Architecture of basic microprocessor: 8086 & Pentium (Basic Version), Introduction to multicore processors, its development and impact on Hardware, Software.

TEXT BOOK:

1. Fundamental of Digital electronics : R.P. Jain ,
2. Digital design : M. Morris Mano, Prentice-Hall of India
3. Computer System Architecture : Morris Mano, Prentice-Hall of India

REFERENCES:

1. The Pentium Microprocessor : James Antonakos
2. Microprocessors and Interfacing Programming and Hardware: Douglas V. Hall- TATA McGraw-Hill Edition
3. The Intel Microprocessors : Barry B. Brey- Pearson Education Asia.
4. https://www.academia.edu/34906578/Digital_Hardware_Design.pdf

COURSE OUTCOMES (COs)	
CO1	To lay a strong foundation to understand the concepts in Digital circuit design.
CO2	To learn about Memories
CO3	To gain knowledge about computer organization
CO4	To understand about serial communication
CO5	To understand the basics of microprocessor
CO6	To understand about multi core processor.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS
2	CO1	3	3	3	2	2			2	2		2		3	3	3
	CO2	3		3	2				2	3	2					
	CO3	2		2		2					2					
	CO4	2	3	2	2	2			2			2				
	CO5	2	3	3	3					2						
	CO6	2	3	3	3				2	2	2	2				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC055	MEDICAL IMAGE PROCESSING	L	T	P	C
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Digital Signal Processing				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

This course provides in depth knowledge about the various digital image processing techniques applied in processing of the medical images

UNIT I IMAGE FUNDAMENTALS 9

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms.

UNIT II IMAGE PREPROCESSING 9

Image enhancement – point operation, Histogram modeling, spatial operations, Transform operations, Image restoration – Image degradation model, Inverse and Weiner filtering. Image Compression – Spatial and Transform methods .

UNIT III MEDICAL IMAGE RECONSTRUCTION 9

Mathematical preliminaries and basic reconstruction methods, Image reconstruction in CT scanners, MRI, FMRI, Ultra sound imaging., 3D Ultra sound imaging Nuclear Medicine Imaging Modalities SPECT,PET, Molecular Imaging.

UNIT IV IMAGE ANALYSIS AND CLASSIFICATION 9

Image segmentation- pixel based, edge based, region based segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and image classification – Statistical, Rule based, Neural Network approaches.

UNIT V IMAGE REGISTRATION AND VISUALIZATION 9

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Medical image fusion, Image visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization.

TEXT BOOK:

1. Atam P.Dhawan, 'Medical Image Analysis', Wiley Interscience Publication, NJ, USA 2003.
2. R.C.Gonzalez and R.E.Woods, 'Digital Image Processing', Second Edition, Pearson Education, 2002.
3. Anil. K. Jain, 'Fundamentals of Digital Image Processing', Pearson education, Indian Reprint 2003.

REFERENCES:

1. Alfred Horowitz, 'MRI Physics for Radiologists – A Visual Approach', Second edition Springer Verlag Network, 1991.
2. Kavyan Najarian and Robert Splerstor," Biomedical signals and Image processing",CRC – Taylor and Francis,New York,2006
3. John L.Semmlow,"Biosignal and Biomedical Image Processing Matlab Based applications" Marcel Dekker Inc.,New York,2004
4. Jerry L.Prince and Jnathan M.Links," Medical Imaging Signals and Systems"- Pearson Education Inc. 2006 5.. Geoff Dougherty, "Digital Image Processing for Medical Apllications," Cambridge University Press,India 2009

5. http://ultra.sdk.free.fr/docs/DxO/Digital%20Image%20Processing%20for%20Medical%20Applications.pdf

COURSE OUTCOMES (COs)	
CO1	To study the image fundamentals and image transforms
CO2	To study the image enhancement techniques
CO3	To understand about reconstruction methods related to medical images
CO4	To study the image segmentation and image analysis
CO5	To study the image registration procedures
CO6	To learn about image visualization techniques

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	3	3			3	2	2	3		3	3	3
	CO2	3	3	3	3	3			3	2	2	3				
	CO3	2	3	3	2	3			2	2	2	3				
	CO4	2	3	3	2	3			3	2	2	3				
	CO5	2	3	3	3	3			2	2	2	3				
	CO6	2	3	3	3	3			2	2	2	3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC056	DIGITAL IMAGE & VIDEO PROCESSING	L	T	P	C
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Digital signal processing				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

This course will cover the fundamentals of image and video processing.
Students will gain knowledge to understand about algorithm design, mathematical tools, and practical implementations of various digital image & video applications

UNIT I FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS 9

Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms

UNIT II IMAGE PROCESSING TECHNIQUES 9

Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation.

UNIT III IMAGE COMPRESSION 9

Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding,

run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards.

UNIT IV BASIC STEPS OF VIDEO PROCESSING 9

Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations.

UNIT V 2-D MOTION ESTIMATION 9

Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

TEXT BOOK:

1. Gonzaleze and Woods ,"Digital Image Processing ", 3rd edition , Pearson
2. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication ",1st edition , PHI .
3. 1.M. Tekalp ,"Digital video Processing", Prentice Hall International

REFERENCES:

1. Relf, Christopher G.,"Image acquisition and processing with LabVIEW", CRC press
2. Aner ozdemi R, "Inverse Synthetic Aperture Radar Imaging with MATLAB Algorithms", John Wiley & Sons
3. Chris Solomon, Toby Breckon ,"Fundamentals of Digital Image Processing A Practical Approach with Examples in Matlab", John Wiley & Sons.
4. https://nptel.ac.in/courses/117105079/

COURSE OUTCOMES (COs)	
CO1	Learn the signal processing algorithms and techniques in image enhancement and image restoration.
CO2	Mathematically represent the various types of images and analyze them.
CO3	Process these images for the enhancement of certain properties or for optimized use of the resources.
CO4	Develop algorithms for image compression and coding.
CO5	Get broad exposure to and understanding of various applications of image processing in industry, medicine, and defense.
CO6	Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	3	3	2	2			2		3	3		3	3	3
	CO2	3			2				2			3	1			
	CO3	3	3	3	2								3			
	CO4	3	2	2	3	2			2	3	2	3	2			
	CO5	3		3		2				3	2	2	2			
	CO6	3	3	3	3	2			2	3						
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC061	RF COMMUNICATION CIRCUITS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Analog & Digital Communication				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To learn about the CMOS RF Front End (RFE) building block and in all of wireless and many high frequencies wire-line systems

To learn about the important building blocks within including the Low Noise Amplifiers, Phase Locked Loop Synthesizers, Mixers, Power Amplifiers, and impedance matching circuits.

UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES 9

Introduction to MOSFET Physics, Noise: Thermal, shot, flicker, popcorn noise, Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR, Phase noise - Specification distribution over a communication link, Homodyne Receiver, Heterodyne Receiver, Image reject, Low IF Receiver Architectures Direct up conversion Transmitter, Two step up conversion Transmitter.

UNIT II IMPEDANCE MATCHING AND AMPLIFIER 9

S-parameters with Smith chart, Passive IC components, Impedance matching networks, Common Gate, Common Source Amplifiers, OC Time constants in bandwidth estimation and enhancement, High frequency amplifier design, Power match and Noise match, Single ended and Differential LNAs, Terminated with Resistors and Source Degeneration LNAs.

UNIT III FEEDBACK SYSTEMS AND POWER AMPLIFIERS 9

Stability of feedback systems: Gain and phase margin, Root-locus techniques, Time and Frequency domain considerations , Compensation, General model – Class A, AB, B, C, D, and F amplifiers, Power amplifier Linearisation Techniques, Efficiency boosting techniques, ACPR metric, Design considerations

UNIT IV MIXERS AND OSCILLATORS 9

Mixer characteristics, Non-linear based mixers, Quadratic mixers, Multiplier based mixers, Single balanced and double balanced mixers, subsampling mixers, Oscillators describing Functions, Colpitts oscillators Resonators, Tuned Oscillators, Negative resistance oscillators, Phase noise.

UNIT V PLL AND FREQUENCY SYNTHESIZERS 9

Linearised Model, Noise properties, Phase detectors, Loop filters and Charge pumps, Integer-N frequency synthesizers, Direct Digital Frequency synthesizers.

TEXT BOOK:

1. T.Lee, “Design of CMOS RF Integrated Circuits”, Cambridge,2004.
2. B.Razavi, “RF Microelectronics”, Pearson Education, 1997.
3. Jan Crols, Michiel Steyaert, “CMOS Wireless Transceiver Design”, Kluwer Academic. Publishers, 1997.

REFERENCES:

1. B.Razavi, “Design of Analog CMOS Integrated Circuits”, McGraw Hill, 2001
2. http://www.ee.iitm.ac.in/~ani/ee6240/
3. https://onlinelibrary.wiley.com/doi/10.1002/9781119259411.ch4

COURSE OUTCOMES (COs)	
CO1	The student after completing this course must be able to translate the top level Wireless architectures
CO2	Communications system specifications into block level specifications of the RFE.
CO3	The student should also able to learn about the feedback concepts
CO4	The students will gain knowledge about the amplifiers
CO5	The present course will introduce the principles of operation and design principles of mixers and oscillators
CO6	The course will also provide and highlight the importance of phased locked system and about frequency synthesizers.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1						2						1	3	3	3
	CO2	2			3				1	2						
	CO3		2								1					
	CO4			2		1		2								
	CO5	3					3					1				
	CO6				1											
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC062	TELECOM NETWORKS	L	T	P	C
	Total Contact Periods – 45	3	0	0	3
	Prerequisite – Computer Network				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

Understand the concept of a network.

Identify several major developments and trends in the industries, technologies, and business applications of telecommunications and Internet technologies

UNIT I INTRODUCTION TO SWITCHING AND TELECOM NETWORKS 9

Introduction to crossbar & electronics exchange, Types of networks, Network design issues, Design tools, switching technologies (circuit switching and packet switching)

UNIT II BROADBAND TELECOM NETWORKS 9

ISDN, Basic structure, ISDN Interfacing & functions, transmission structure Protocol architecture, Narrow band & Broadband ISDN

UNIT III FRAME RELAY & ATM 9

Frame Relay introduction, Protocol, architecture frame, mode call control, LAPF core Protocol, frame Relay congestion control. ATM, ATM Protocols, Public ATM networks, ATM cells their details and transmission, AAL, Traffic congestion and control.

UNIT IV BROADBAND ACCESS AND ROUTING TECHNOLOGIES 9

DSL, ADSL, Cable modems, WLL, Optical wireless, Leased lines. Routing Algorithms for shortest path centralized routing, Distributed, Static and dynamic routing.

UNIT V TELECOM NETWORK MANAGEMENT 9

Telecom network operation and maintenance, Traffic management, Management of Transport Networks, Configuration management, Fault management, Security, Network planning support, Network management using SNMP: Object management, management Information base, traps.

TEXT BOOK:

1. Aaron Kirshenbaum "Telecommunication Networks Design Algorithms", MGH.
2. Mischa Schwartz, "Telecommunication Networks protocols modelling and analysis" Pearson Education
3. Data and computer communication – William Stallings- PHI.
4. ISDN &Broadband ISDA with Frame Relay & ATM, - William Stallings Pearson Education Asia 4th edition B.E._ETC09.doc - 15 -15
5. Telecommunication Switching, Traffic & networks-J.E.Flood, Pearson Education Asia 1st edition.

REFERENCES:

1. Introduction to Telecommunications: Voice, data& internet- Pearson Education
2. OSS For telecom Networks by Kundan Mishra – Springer.
3. Telecommunication network and management – R.C. Jaiswal
4. Telecom technology by Tyagrajan vishwanathan –PHI
5. ATM Networks by Rainer handel Manfred N. Huber 3rd Edition 2001
6. Computer Networks by Andrew s. tanenbaum.
7. www.telecommunications-tutorials.com

COURSE OUTCOMES (COs)	
CO1	To understand various types of networks and switching technologies
CO2	To gain knowledge about broadband telecom networks
CO3	To understand architecture and protocols of Frame Relay and ATM
CO4	To learn about DSL,ADSL and cable modems
CO5	To gain knowledge about various routing technologies
CO6	To understand Telecom Network Management

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3	2	3	3	2			2	1	2	2		3	3	3
	CO2	2	1	2	2	2			2	1	1	1				
	CO3	2	1	2	1	2			1	2	2	2				
	CO4	2	1	2	2	2			1	1	2	1				
	CO5	3	1	2	2	1			2	1	1	2				
	CO6	3	1	2	2	3			2	1	1	2				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC063	**WIRELESS ADHOC NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	3	0	0	3
	Prerequisite: Computer Networks				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To provide more advanced in-depth networking concepts to graduate students. Upon completion of this course, students will be able to apply the knowledge in their networking

UNIT I AD HOC NETWORKS 6

Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT II MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS 12

Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT III ROUTING PROTOCOLS FOR AD HOC WIRELESS NETWORKS 8

Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand routing protocol.

UNIT IV TRANSPORT LAYER PROTOCOLS FOR AD HOC WIRELESS NETWORK 7

Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks.

UNIT V SECURITY & QUALITY OF SERVICE IN ADHOC WIRELES NETWORKS 12

Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions.

TEXT BOOK:

1. C S. Ram Murthy, B. S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall of India, 2nd ed. 2005.
2. R. Hekmat, Ad hoc Networks: Fundamental Properties and Network Topologies, Springer, 1st ed. 2006.

REFERENCES:

1. B. Tavli and W. Heinzelman, Mobile Ad Hoc Networks: Energy Efficient Real Time Data Communications, Springer, 1st ed. 2006.
2. Carlos De MoraisCordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, 2006.
3. G. Anastasi, E. Ancillotti, R. Bernasconi, and E. S.Biagioni, Multi Hop Ad Hoc Networks from Theory to Reality, Nova Science Publishers, 2008
4. https://nptel.ac.in/courses/106105160/

COURSE OUTCOMES (COs)	
CO1	Understand about basics of network.
CO2	Gain knowledge in TCP/IP and ISDN concepts.
CO3	Understand about Internet and Tcp/Ip Networks
CO4	Understand about packet switched networks and circuit switched networks
CO5	Understand about ATM and optical networks
CO6	Understand different networking and switching design

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low																
1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	3	3	2	2			2	3	3	3	1	3	3	3
	CO2	2	3	3	2	2			2	3	3	3	3			
	CO3	2	3	3	2	2			2	3	3	3				
	CO4	2	3	3	2	2			2	3	3	3				
	CO5	2	3	3	2	2			2	3	3	3				
	CO6	2	3	3	2	2			2	3	3	3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC064	**EMBEDDED C AND LINUX**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Embedded System				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To expose the students to the fundamentals of embedded Programming.
To Introduce the GNU C Programming Tool Chain in Linux.
To study basic concepts of embedded C, Embedded OS & Python Programming
To introduce time driven architecture, Serial Interface with a case study.
To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts acquired over the 5 Units of the subject for improved employability skills.
To learn to implement embedded linux applications

UNIT I EMBEDDED PROGRAMMING 9

C and Assembly - Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization – In-line Assembly.

UNIT II C PROGRAMMING TOOL CHAIN IN LINUX 9

C preprocessor - Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities

UNIT III EMBEDDED C 9

Adding Structure to 'C' Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

UNIT IV EMBEDDED OS 9

Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS- Memory requirements - embedding serial communication &scheduling data transmission - Case study: Intruder alarm system.

UNIT V PYTHON PROGRAMMING 9

Basics of PYTHON Programming Syntax and Style – Python Objects– Dictionaries – comparison with C programming on Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

TEXT BOOK:

1. Karim Yaghmour, Jon Masters, Gillad Ben Yossef, Philippe Gerum, "Building embedded linux systems", O'Reilly, 2008.
2. Christopher Hallinan, "Embedded Linux Primer: A practical real world approach", Prentice Hall, 2007.

REFERENCES:

1. Steve Oualline, 'Practical C Programming 3rd Edition', O'Reilly Media, Inc, 2006.
2. Michael J Pont, "Embedded C", Pearson Education, 2007.
3. Christian Hill, Learning Scientific Programming with Python, CAMBRIDGE UNIVERSITYPRESS ,2016.
4. https://www.sciencedirect.com/topics/engineering/high-speed-circuit

COURSE OUTCOMES (COs)	
CO1	Ability to use GNU C to develop embedded software.
CO2	Knowledge and understanding of fundamental embedded systems design paradigms, architectures, possibilities and challenges, both with respect to software and hardware
CO3	To explain programming concepts and embedded programming in C and assembly language
CO4	Understanding and knowledge of python programming, Errors and Exceptions
CO5	Identification of new developments in embedded linux programming
CO6	Analyze the programming languages of real time systems

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1		2	3		3			2		3	2	3	3	3	3
	CO2	3			2	3				3	1					
	CO3		2	1		3		2	1		2	1	1			
	CO4	1		2	1	3	2		2		3	2	1			
	CO5	2														
	CO6	2		3		3			3	2		3	2			
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC065	**HIGH SPEED ELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Electronic Devices				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

To learn about the issues involved in high speed electronics
To learn about the materials involved in high speed devices
To understand the working of various high-speed devices

UNIT I INTRODUCTION 9

Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high-speed buses; Noise Analysis: radiated emissions and minimizing system noise; Noise Sources, Noise Figure, Gain compression, Harmonic distortion, Intermodulation, Cross-modulation, Dynamic range

UNIT II MATERIALS FOR HIGH SPEED DEVICES AND CIRCUITS 9

Merits of III –V binary and ternary compound semiconductors (GaAs, InP, InGaAs, AlGaAs ETC.), silicon-germanium alloys and silicon carbide for high speed devices, as compared to silicon-based devices. Brief outline of the crystal structure, dopants and electrical properties such as carrier mobility, velocity versus electric field characteristics of these materials. Material and device process technique with these III-V and IV – IV semiconductors.

UNIT III AMPLIFIER DESIGN 9

Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages Mixers –Up conversion Down conversion, Conversion gain and spurious response. Oscillators Principles. PLL Transceiver architectures

UNIT IV HIGH SPEED CIRCUITS 9

GaAs Digital Integrated Circuits for high speed operation- Direct Coupled Field Effect Transistor Logic (DCFL), Schottky Diode FET Logic (SDFL), Buffered FET Logic(BFL). GaAs FET Amplifiers. Monolithic Microwave Integrated Circuits (MMICs) High Frequency resonant – tunneling devices. Resonant-tunneling hot electron transistors and circuits.

UNIT V PRINTED CIRCUIT BOARD 9

Anatomy, CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.

TEXT BOOK:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press

REFERENCES:

1. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2004, ISBN 0521835399.
2. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.
3. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.

COURSE OUTCOMES (COs)	
CO1	To learn about high frequency power delivery and to analyze the noise involved
CO2	To learn in detail about the various materials involved in High speed devices and circuits
CO3	To understand about the design principles involved in amplifier design
CO4	To understand the working of different high speed devices
CO5	Understand the fabrication procedure for Printed circuit board
CO6	To learn about the various design challenges involved in PCB design

Mapping of Course Outcomes with Program outcomes (POs) (1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low																
1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	2	2	2	2	2			2	2	2	2		3	3	3
	CO2	2			2	2			2	2	2					
	CO3	2	3	3	2	2			2	2	2	2				
	CO4	2	3	3	2	2			2	2		2				
	CO5	2	2	2	3	2			3	3	2	3				
	CO6	2	3	3	3	2			3	3	3	3				
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														

U18PEEC066	**MULTIMEDIA COMPRESSION & COMMUNICATION**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Computer Networks, Analog and Digital Communication				
	Department:- Dept. of Electronics and Communication Engineering.				

COURSE OBJECTIVES:-

The comprehensive objective of this course is to make students familiar with the different types of compression techniques used for textual, audio, image and video compression

UNIT I MULTIMEDIA COMPONENTS 9

Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.

UNIT II AUDIO AND VIDEO COMPRESSION 9

Audio compression–DPCM-Adaptive PCM –adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding Video compression –principles-H.261-H.263-MPEG 1, 2, and 4.

UNIT III TEXT AND IMAGE COMPRESSION 9

Compression principles-source encoders and destination encoders-lossless and lossy compression- entropy encoding –source encoding -text compression –static Huffman coding dynamic coding – arithmetic coding –Lempel ziv-welsh Compression-image compression

UNIT IV VOIP TECHNOLOGY 9

Basics of IP transport, VoIP challenges, H.323/ SIP –Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service- CODEC Methods- VOIP applicability.

UNIT V MULTIMEDIA NETWORKING 9

Multimedia networking -Applications-streamed stored and audio-making the best Effort service- protocols for real time interactive Applications-distributing multimedia-beyond best effort service- secluding and policing Mechanisms-integrated services-differentiated Services-RSVP.

TEXT BOOK:

1.Fred Halshall "Multimedia communication - Applications, Networks, Protocols and Standards", Pearson Education, 2007.

REFERENCES:

1. Tay Vaughan, "Multimedia: Making it work", 7 th Edition, TMH 2008 98
2. Kurose and W.Ross "Computer Networking "a Top Down Approach", Pearson Education 2005
3. Marcus Goncalves "Voice over IP Networks", Mc Graw hill 1999.
4. KR. Rao,Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education 2007.
5. R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education Ranjan Parekh, "Principles of Multimedia", TMH 2007.
6. https://www.vidyarthiplus.com/vp/Thread-EC6018-Multimedia-Compression-and- Communication-Question-Bank-2017-VEC-Edition#.Xagli5IzbIU

COURSE OUTCOMES (COs)	
CO1	To Apply the compression concepts in multimedia communication.
CO2	To have a complete understanding of error–control coding
CO3	To understand encoding and decoding of digital data streams.
CO4	To introduce methods for the generation of these codes and their decoding techniques
CO5	To have a detailed knowledge of compression and decompression techniques.
CO6	To introduce the concepts of multimedia communication

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
2	CO1	3					2		3	2	3			3	3	3
	CO2	2	1	2				3		1						
	CO3	2	3	2	1		2	1				3				
	CO4	2	3		2	3		2	2		2					
	CO5		1				2			1						
	CO6				2	3	3			2						
3	Category	Professional Elective (PE)														
4	Approval	49th Meetings of Academic Council														