B. Tech. Syllabus

(Electronics & Communication Engineering)

Electronics & Communication Engineering,

North-Eastern Hill University,

Shillong - 793 022

Meghalaya

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1 Syllabus Scheme

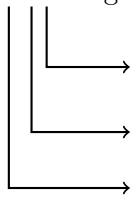
1.1 Coding Used in the Syllabus

MA	-	Mathematics
PH	-	Physics
CH	-	Chemistry
HU	-	Humanities
ES	-	Environmental Science
EC	-	Electronics and Communication Engineering
EE	-	Electrical Engineering
ME	-	Mechanical Engineering
CE	-	Civil Engineering
CS	-	Computer Science and Engineering
EL	-	Elective (Core) paper
EO	-	Elective (Open) paper

1.1.1 Paper Coding for *Core Papers:*

Three Digit Numeric Number is used as Paper Code (e.g. EC - 603 Digital Signal Processing):

EC - XXX Digital Signal Processing



Paper Number (In case of Practical, this number stands for its corresponding theory subject number

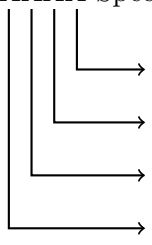
0 for Theory and 1 for Practical/Drawing/Design

Semester Number

1.1.2 Paper Coding for *Elective Papers*:

Four Digit Numeric Numbers Used in Course Code (e.g. EL – 7041 Speech Processing)

EL - XXXX Speech Processing



Elective/Open Paper Number

Paper Serial Number in the Semester

0 for Theory and 1 for Practical/Drawing/Design

Semester Number

1.2 Semester: I

Branch: *Electronics & Communication Engineering* **Year:** I **Semester:** I

Sl. No.	Paper Code	Paper Name	Periods (Contact Hours)			Evaluation Scheme (Distribution of Marks)					Credits
Theory			**L**	**T**	**P**	**TA**	**CT**	**ST**	**ESE**	**TOT**	
2	MA - 101	Engineering Mathematics - I	3	1	0	20	20	40	60	100	4
3	PH - 101	Engineering Physics - I	3	1	0	20	20	40	60	100	4
4	ES - 103	Environmental Science	3	0	0	15	15	30	45	75	3
1	HU - 104	Professional Communication Skills	3	0	0	15	15	30	45	75	3
5	EE - 105	Basic Electrical Engineering	3	1	0	20	20	40	60	100	4
Practical/Design/Laboratory/Seminar											
6	HU - 114	Digital English Language Lab.	-	-	4	20	-	20	30	50	2
7	CE - 116	Engineering Graphics	-	-	4	20	-	20	30	50	2
		Total	**15**	**3**	**8**	130	90	**220**	**330**	**550**	22

L - Lecture **T -** Tutorial **P -** Practical **TA -** Assesment by Teacher
CT - Class Test **ST -** Sub-Total **ESE -** End Semester Evaluation **TOT -** Total

Contact Hours: *26* **Total Marks:** *550* **Total Credits:** *22*

1.3 Semester: II

Branch: *Electronics & Communication Engineering* **Year:** I **Semester:** II

Sl. No.	Paper Code	Paper Name	Periods (Contact Hours)			Evaluation Scheme (Distribution of Marks)					Credits
Theory			**L**	**T**	**P**	**TA**	**CT**	**ST**	**ESE**	**TOT**	
1	MA - 201	Engineering Mathematics - II	3	1	0	20	20	40	60	100	4
2	PH - 202	Engineering Physics - II	3	1	0	20	20	40	60	100	4
3	CH - 203	Engineering Chemistry	3	1	0	20	20	40	60	100	4
4	EC - 204	Basic Electronics	3	1	0	20	20	40	60	100	4
Practical/Design/Laboratory/Seminar											
5	PH - 212	Engineering Physics Lab.	-	-	4	20	-	20	30	50	2
6	CH - 213	Engineering Chemistry Lab.	-	-	4	20	-	20	30	50	2
7	EC - 214	Basic Electronics & Electrical Lab.	-	-	4	20	-	20	30	50	2
		Total	**12**	**4**	**12**	140	80	**220**	**330**	**550**	22

L - Lecture **T -** Tutorial **P -** Practical **TA -** Assesment by Teacher
CT - Class Test **ST -** Sub-Total **ESE -** End Semester Evaluation **TOT -** Total

Contact Hours: *28* **Total Marks:** *550* **Total Credits:** *22*

1.4 Semester: III

Branch: *Electronics & Communication Engineering* **Year:** 2 **Semester:** III

Sl. No.	Paper Code	Paper Name	Periods (Contact Hours)			Evaluation Scheme (Distribution of Marks)					Credits
Theory			**L**	**T**	**P**	**TA**	**CT**	**ST**	**ESE**	**TOT**	
1	EC - 301	Computer Programming	3	1	0	20	20	40	60	100	4
2	EC - 302	Electronic Devices and Circuits	3	1	0	20	20	40	60	100	4
3	EC - 303	Signals and Systems	3	1	0	20	20	40	60	100	4
4	EE - 304	Electrical Network Theory	3	1	0	20	20	40	60	100	4
Practical/Design/Laboratory/Seminar											
5	EC - 311	Computer Programming Lab.	-	-	4	20	-	20	30	50	2
6	EC - 312	Electronic Devices Lab.	-	-	4	20	-	20	30	50	2
7	EC - 316	Circuit Simulation Lab.	-	-	4	20	-	20	30	50	2
		Total	**12**	**4**	**12**	140	80	**220**	**330**	**550**	22

L - Lecture **T -** Tutorial **P -** Practical **TA -** Assesment by Teacher
CT - Class Test **ST -** Sub-Total **ESE -** End Semester Evaluation **TOT -** Total

Contact Hours: *28* **Total Marks:** *550* **Total Credits:** *22*

1.5 Semester: IV

Branch: *Electronics & Communication Engineering* **Year:** 2 **Semester:** IV

Sl. No.	Paper Code	Paper Name	Periods (Contact Hours)			Evaluation Scheme (Distribution of Marks)					Credits
Theory			**L**	**T**	**P**	**TA**	**CT**	**ST**	**ESE**	**TOT**	
1	EC - 401	Instrumentation and Measurements	3	1	0	20	20	40	60	100	4
2	EC - 402	Digital Electronics	3	1	0	20	20	40	60	100	4
3	EC - 403	Electromagnetic Theory	3	1	0	20	20	40	60	100	4
4	EE - 404	Analog Communication	3	1	0	20	20	40	60	100	4
Practical/Design/Laboratory/Seminar											
5	EC - 411	Instrumentation and Measurements Lab.	-	-	4	20	-	20	30	50	2
6	EC - 412	Digital Electronics Lab.	-	-	4	20	-	20	30	50	2
7	EC - 414	Analog Communication Lab.	-	-	4	20	-	20	30	50	2
		Total	**12**	**4**	**12**	140	80	**220**	**330**	**550**	22

L - Lecture **T -** Tutorial **P -** Practical **TA -** Assesment by Teacher
CT - Class Test **ST -** Sub-Total **ESE -** End Semester Evaluation **TOT -** Total

Contact Hours: *28* **Total Marks:** *550* **Total Credits:** *22*

1.6 Semester: V

Branch: *Electronics & Communication Engineering* **Year:** 3 **Semester:** V

Sl. No.	Paper Code	Paper Name	Periods (Contact Hours)			Evaluation Scheme (Distribution of Marks)					Credits
Theory			**L**	**T**	**P**	**TA**	**CT**	**ST**	**ESE**	**TOT**	
1	MA - 501	Statistical and Random Process	3	1	0	20	20	40	60	100	4
2	EC - 502	Microprocessores	3	1	0	20	20	40	60	100	4
3	EC - 503	Digital Communication	3	1	0	20	20	40	60	100	4
4	EC - 504	Linear IC Systems	3	1	0	20	20	40	60	100	4
Practical/Design/Laboratory/Seminar											
5	EC - 512	Microprocessor Lab.	-	-	4	20	-	20	30	50	2
6	EC - 513	Digital Communication Lab.	-	-	4	20	-	20	30	50	2
7	EC - 514	Linear IC Systems Lab.	-	-	4	20	-	20	30	50	2
		Total	**12**	**4**	**12**	140	80	**220**	**330**	**550**	22

L - Lecture **T -** Tutorial **P -** Practical **TA -** Assesment by Teacher
CT - Class Test **ST -** Sub-Total **ESE -** End Semester Evaluation **TOT -** Total

Contact Hours: *28* **Total Marks:** *550* **Total Credits:** *22*

1.7 Semester: VI

Branch: *Electronics & Communication Engineering* **Year:** 3 **Semester:** VI

Sl. No.	Paper Code	Paper Name	Periods (Contact Hours)			Evaluation Scheme (Distribution of Marks)					Credits
Theory			**L**	**T**	**P**	**TA**	**CT**	**ST**	**ESE**	**TOT**	
1	EC - 601	Digital Signal Processing	3	1	0	20	20	40	60	100	4
2	EC - 602	Microcontrolleres and Its Applications	3	1	0	20	20	40	60	100	4
3	EC - 603	Microwave Engineering	3	1	0	20	20	40	60	100	4
4	EO - 604X	Elective - I (Open)§	3	1	0	20	20	40	60	100	4
Practical/Design/Laboratory/Seminar											
5	EC - 611	Digital Signal Processing Lab.	-	-	4	20	-	20	30	50	2
6	EC - 612	Microcontrollers and its Applications	-	-	4	20	-	20	30	50	2
7	EC - 613	Microwave Engineering Lab.	-	-	4	20	-	20	30	50	2
		Total	**12**	**4**	**12**	140	80	**220**	**330**	**550**	22

§ List electives at (Section 1.10, pp. ix)

L - Lecture **T -** Tutorial **P -** Practical **TA -** Assesment by Teacher
CT - Class Test **ST -** Sub-Total **ESE -** End Semester Evaluation **TOT -** Total

Contact Hours: *28* **Total Marks:** *550* **Total Credits:** *22*

1.8 Semester: VII

Branch: *Electronics & Communication Engineering* **Year:** 4 **Semester:** VII

Sl. No.	Paper Code	Paper Name	Periods (Contact Hours)			Evaluation Scheme (Distribution of Marks)					Credits
Theory			**L**	**T**	**P**	**TA**	**CT**	**ST**	**ESE**	**TOT**	
1	HU - 701X	Elective - II	3	1	0	20	20	40	60	100	4
2	EC - 702	Fundamentals of Mobile Communication	3	1	0	20	20	40	60	100	4
3	EC - 703	Control System	3	1	0	20	20	40	60	100	4
4	EC - 704	VLSI Systems	3	1	0	20	20	40	60	100	4
5	EC - 705X	Elective - III (Open)[¶]	3	1	0	20	20	40	60	100	4
Practical/Design/Laboratory/Seminar											
6	EC - 714	VLSI Systems Lab.	-	-	4	20	-	20	30	50	2
		Total	**15**	**4**	**4**	120	100	**220**	**330**	**550**	22

[¶] List electives at (Section 1.10, pp. ix)

L - Lecture **T -** Tutorial **P -** Practical **TA -** Assesment by Teacher
CT - Class Test **ST -** Sub-Total **ESE -** End Semester Evaluation **TOT -** Total

Contact Hours: *24* **Total Marks:** *550* **Total Credits:** *22*

1.9 Semester: VIII

Branch: *Electronics & Communication Engineering* **Year:** 4 **Semester:** VIII

Sl. No.	Paper Code	Paper Name	Periods (Contact Hours)			Evaluation Scheme (Distribution of Marks)					Credits
Theory			**L**	**T**	**P**	**TA**	**CT**	**ST**	**ESE**	**TOT**	
Practical/Design/Laboratory/Seminar											
1	EC - 816	PCB Laboratory and Electronics Workshop.	-	-	4	20	30	50	-	-	2
2	EC - 817	Project	-	-	32	90	90	180	270	450	18
2	GP - 818	General Viva	-	-	-	-	50	50	-	50	2
		Total	**-**	**-**	**36**	**110**	**140**	**250**	**300**	**550**	22

Projects evaluation will be as follows: TA = Assessment from the Guide(s,) in case of a student has done a part of their project outside the Department the external and internal supervisor would share the marks equally, CT = Project Presentation and viva, and ESE = Seminar in presence of External expert, Marking scheme will be as follows: 50% weightage of marks will be given by external examiner, 20% by respective supervisor and rest 30% by three faculty members nominated by the Head of the Department for each project group.

L - Lecture **T -** Tutorial **P -** Practical **TA -** Assesment by Teacher
CT - Class Test **ST -** Sub-Total **ESE -** End Semester Evaluation **TOT -** Total

Contact Hours: *40* **Total Marks:** *550* **Total Credits:** *22*

1.10 List of Electives:

EO - 604X Elective - I (*Open*)

EO - 6041 Optical Communication

EO - 6042 Digital Control Systems

EO - 6043 Antenna and Radar Engineering

EO - 6044 Computer Communication

EO - 6045 Nano Electronics

EO - 6046 Digital System Design using VHDL

HU - 701X Elective - II

HU - 7011 Engineering Economics

HU - 7012 IPR and Professional Ethics

HU - 7013 Business Survey and Research

EO - 705X Elective - III (*Open*)

EO - 7051 Fundamentals of Biotechnology

EO - 7052 Advanced Digital Signal Processing

EO - 7053 Digital Image Processing

EO - 7054 Fundamentals of Speech Processing

EO - 7055 Advanced Communication Theory

EO - 7056 Optical Networks

EO - 7057 Smart Systems

EO - 7058 Social Robotics

* Enrollment of minimum 25 students are required to float a elective course.

2. B. Tech. Syllabus

2.1 First Semester Papers

2.1.1 MA - 101 Engineering Mathematics - I

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	$MA-101$
Paper Name	:	*Engineering Mathematics - I*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Differential Calculus of Single Variable: Functions, continuity and differentiability (with emphasis on hyperbolic and inverse hyperbolic functions), Properties of continuous functions on closed intervals, Intermediate value theorem and its applications, Successive differentiation ;Taylor's and Maclaurin's series; L'Hospital rule (statements only with applications)

Unit II:
Complex analysis: Analytic functions, Cauchy-Riemann equations, Cauchy's integral theorem, Cauchy's integral formula, Taylor series and Laurent series. Residues and its applications to evaluating real integrals (statements only with applications).

Unit III:
Laplace and Fourier Transforms: Laplace transforms, Inverse transform.,Shifting on the s and t axes, convolutions, partial fractions, Fourier transforms, Solutions of ordinary differential equations by Laplace and Fourier transforms.

Unit IV:
Linear Algebra: Vector space over the field of real and complex numbers, subspaces, bases and dimension; Matrices and Linear Transformation; Elementary row and column operations; echelon form; normal form; system of linear equations; eigen values and eigen vectors; Cayley-Hamilton theorem; diagonalization.

Text Books:

1. E. Kreyszig, Advance Engineering Mathematics, 8th Ed, J. Willey & Co, 1999.
2. Spiegel, Fourier Analysis with application & Laplace Transforms, Tata McGraw-Hill.
3. S. Pal and S. C. Bhunia, Engineering Mathematics , Oxford University Press, 2015.
4. B.S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publication.

Reference Books:

1. Babu Ram, Engineering Mathematics, Pearson.
2. Sastry, Engineering Mathematics, PHI.
3. M. C. Potter, J. L Goldberg and E.F. Aboufadel, Advance Engineering Mathematics, (Third Edition), Oxford University Press

2.1.2 PH - 102 Engineering Physics - I

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*PH − 102*
Paper Name	:	*Engineering Physics-I*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Classical mechanics and General properties of matter Co-ordinate system: Cartesian, plane polar and Spherical polar coordinate system, Relationship between the coordinate system, velocity and acceleration in plane polar and spherical polar coordinate systems. Dimension analysis. Theory of Errors. Moment of inertia: Theorems of parallel and perpendicular axes. Compound pendulum and its theory. Elasticity: Interrelation of elastic constants. Torsion of a cylinder.

Unit II:
Optics Interference: Concept of Interference, types of interference, Young's double slit experiment, Newton's ring experiment: Theory and application, Diffraction: Fraunhofer diffraction at a single slit, diffraction grating. Fresnel diffraction, zone plate. Polarization: Types of polarization. Nicol prism as polarizer and analyzer, half wave plate and quarter wave plate and applications.

Unit III:
Atomic, molecular and nuclear Physics Rutherford model , Bohr model and Sommerfeld model of hydrogen atom. Vector atom model; Spectra of hydrogen atom. Concept of a molecule, molecular spectra, Raman effect. Nuclear binding energy. Nuclear reaction and Q-value, Nuclear fission, chain reaction, concept of a nuclear reactor, nuclear fusion and stellar energy.

Unit IV:
Electromagnetism Electric field intensity and electric potential and the relation between them, Gauss law, Lorentz force, Biot-Savart law, Ampere's law, Faraday law, Maxwell's equation, Electromagnetic (e. m.) wave equation, solution of e. m. wave, transverse nature of e. m. wave

Text Books:

1. P K Chakrabarthy, Mechanics and General Properties of Matter, Books & Allied Ltd., 2001
2. B B Laud, Electromagnetics, 2/e, New age international, 1997
3. A Beiser, Concepts of Modern physics, Tata McGraw Hill, New Delhi, 1997
4. H K Malik and A K Singh, Engineering Physics, Tata McGraw Hill, New Delhi, 2010.

Reference Books:

1. F W Sears, M W Zemansky and H D Young, University Physics, Narosa Publishing House, 1982
2. G R Fowles and G L Cassiday, Analytical Mechanics, 7/e, Ceingage Learning, Indian Edition, 2005.
3. P V Naik, Principles of Physics, Prentice Hall of India Pvt. Ltd., 2000.
4. S G Lipson, H Lipson and D S Tannhauser, Optical Physics, Cambridge University Press, 1995

2.1.3 ES - 103 Elements of Environmental Science

L	-	T	-	P	Cr
3	-	-	-	0	3

Paper Code	:	*ES – 103*
Paper Name	:	*Elements of Environmental Science*
Contact Hours per Week	:	*3(Three) Hours.*
Marks Distribution	:	*Sessional Works = 30, End Semester Examination = 45.*
Questions to be Set	:	*Six. [Q1. compulsory for 15 Marks (Consisting all the three units), rest 10 marks]*
Questions to be Answered	:	*Q1. and any 3(Three).*
Duration of End Semester Examination	:	*2-30(Two and Half) Hours.*

Unit I:
Environment, ecosystems and biodiversity: Concept of environment: components of environment and their interactions; abiotic and biotic factors; Ecosystems: characteristic feature and structure and function of forest, grassland, desert and aquatic ecosystem (Ponds, streams, lakes, rivers, oceans, estuaries); Ecological pyramid; energy flow and nutrient cycling; Biodiversity: value of biodiversity; loss and conservation of biodiversity

Unit II:
Environmental problems and issues: Environmental problems and issues: green house effect, ozone depletion, acid rain; Renewable and non renewable resources; natural resources, associated problem and its conservation: forest, water, mineral, food, energy and land resources; environmental impact assessment; environment protection act.

Unit III:
Environmental pollution and management: Environmental pollution: sources and types of air, water, soil, radioactive and noise pollution; Industrial pollutants and their impact on environment and human health; Toxicants and toxicity; toxic chemicals: heavy metals and pesticides; Safety and prevention of industrial pollution; bio-transformation and bioremediation; Aerobic and anaerobic treatment of waste water; waste management and cleaner production.

Text Books:

1. W. P. Cunningham, and W.B. Saigo, Environmental Science, McGraw Hill, New York, 1999.
2. E. P. Odum, and G. W. Barrett, Fundamentals of Ecology, Thomson Asia Pvt. Ltd., Singapore, 2005.
3. E. Bacci, Contaminants in the Environment, CRC Press, 1994.
4. T. Ingold, The Perceptions of Environment, Routledge (Taylor and Francis Group), UK, 2000.

Reference Books:

1. N. J. Sell, Industrial Pollution Control: Issues and Techniques, Wiley Pub., 1992.
2. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2/e, PHI, 1997.
3. Venugopal Rao, Textbook of Environmental Engineering, PHI, 2003.
4. S. S. Dara, A Text Book of Environmental Chemistry and Pollution Control, 7/e (revised), S. Chand and Co. Ltd., 2006.
5. C. Park, The Environment: Principles and Applications, Routledge (Taylor & Francis Group), UK, 2001.

2.1.4 HU - 104 Professional Communication Skills

L	-	T	-	P	Cr
3	-	0	-	0	3

Paper Code	:	*HU – 104*
Paper Name	:	*Professional Communication Skills*
Contact Hours per Week	:	*3(Three) Hours.*
Marks Distribution	:	*Sessional Works = 30, End Semester Examination = 45.*
Questions to be Set	:	*Six. [Q1. compulsory for 15 Marks (Consisting all the three units), rest 10 marks]*
Questions to be Answered	:	*Q1. and any 3(Three).*
Duration of End Semester Examination	:	*2-30(Two and Half) Hours.*

Unit I:
Understanding Communication and Soft Skills:

a. Communication and its basic concepts: process of communication, communication barriers, types of communication, forms of communication, principles of communication, e-communication (netiquette)
b. Listening skills: Importance of listening, , types of listening, Active and passive listening
c. Non-verbal communication: importance of non-verbal communication and body language, types of body language
d. Soft skills: importance of soft skills, types of soft skills, presentation skills and practice, personality development

Unit II:
Speaking Techniques and Vocabulary Building:

a. Sounds of the English language, speech mechanism, phonetic vowels and consonants symbols (IPA), stress and intonation, pronunciation and accent according to word stress and sentence stress
b. Vocabulary building through word formation: prefixes, suffixes, compounding, conversion and other forms of word formation like acronyms, clipping, back-formation, one word for many, idioms and phrases
c. Practice pronunciation through reading of authentic materials like magazines, newspapers etc., vocabulary games for practice on building words
d. Reading skills: importance of reading, sub- skills of reading, reading comprehension and classroom practical exercises.

Unit III:
Writing for Business purposes and preparing for Interviews:

a. Writing skills: paragraph writing, essay writing, summary writing, drafting letters and e-mails, curriculum vitae, report writing.
b. Group discussion: importance of GDs, Process of conducting GDs, mock GDs.
c. Job Interview skills and mock interviews.
d. Practice writing using authentic material.

Text Books:

1. Parikh, J. P., Surve A., Swarnabharati, Bahrainwala A., Business Communication, Orient Blackswan Pvt, 2011.
2. Das, B. K., Samantray K., et al., An introduction to Professional English and Soft Skills, CUP India, New Delhi, 2009.

Reference Books:

1. Mitra B. K., Personality Development and Soft Skills, OUP, India, 2011.
2. Roach P., English Phonetics and Phonology, CUP India, 2011.
3. Muralikrishna C. and Mishra S., Communication Skills for Engineers, Pearson, India, 2011
4. Patnaik P., Group Discussion and Interview Skills, CUP, New Delhi, 2011.
5. Gangal J. K., A practical Course for Developing Writing Skills in English, PHI Learning Pvt. Ltd., New Delhi, 2011.

2.1.5 EE - 105 Basic Electrical Engineering

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EE – 105*
Paper Name	:	*Basic Electrical Engineering*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Engineering Circuit Analysis: Circuit elements, Ohm's law, Kirchoff's law, Nodal Analysis, Mesh Analysis, Source transformations. Linearity and Superposition, Thevenin and Norton Theorems, Maximum power transfer theorem, Star-Delta and Delta-Star Conversion.

Unit II:
Simple RL and RC Circuits, Unit Step Forcing Function, source free RLC Circuits, Sinusoidal Forcing Function, Complex Forcing Function, Phasor Concept, Impedance and Admittance, Phasor diagrams, Response as a Function of Instantaneous Power, Average Power, RMS values of Current and Voltage, Apparent Power and Power Factor, Complex Power, Introduction to Three Phase Circuits.

Unit III:
DC Machines: Principle of DC Generator, Methods of excitation, Characteristics and Applications, Principle of DC Motor, Types, Speed – Torque Characteristic, Speed Control. Transformers: Working principle of Transformers, Equivalent Circuit, Transformer tests.

Unit IV:
Three Phase Induction Motor: Construction, Production of rotating field, Slip, Torque and Slip. Single Phase Induction Motor: Double field revolving theory, Shaded Pole single phase induction motor. Stepper Motors.

Text Books:

1. W.H. Hayt, J.E. Kemmerly and S.M. Durbin, Engineering Circuit Analysis, 8/e, TMH, 2012.
2. V. Del Toro, Electrical Engineering Fundamentals, PHI, 1994.
3. D.P. Kothari, I. J. Nagrath, Theory and Problems of Basic Electrical Engineering, PHI, 2004.
4. B.L. Thereja and A.K. Thereja, Electrical Technology, Vol-II, S. Chand, Reprint 2006.

Reference Books:

1. Van Valkenburg, Network Analysis, 3/e, PHI, 2005.
2. J.A. Edminister, Electric circuits, 2/e, Eleventh reprint, TMH, 1997.
3. D. Roy Choudhury, Networks and Systems, New Age Publishers, 1998.

2.1.6 HU - 114 Digital English Language Lab.

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*HU – 114*
Paper Name	:	*Digital English Language Lab*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

Laboratory Practices:

1. Articulation and practice of vowel sounds
2. Articulation and practice of consonant sounds
3. Practice word stress using three or more syllable words
4. Intonation practice
5. Practice situational dialogues
6. Practice presentations skills
7. Telephone skills
8. Debating
9. Job Interviews
10. Group Discussion (GD)
11. Public Speaking
12. Comprehension Practice
13. Public Speaking
14. Drafting Emails
15. Drafting Business Letters
16. Drafting CVs
17. Reporting

Text Books:

1. Software: Orell Digital Language Lab (ODLL) software
2. Jones, Daniel, Cambridge English Pronouncing Dictionary with CD, New Delhi, 2011
3. Cambridge Learners Dictionary with Cd, CUP, New Delhi, 2009

2.1.7 CE- 116 Engineering Graphics

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	$CE-116$
Paper Name	:	*Engineering Graphics*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of Drawing Plates/Sheets::

1. Introduction of Drawing (Sheet layout and Sketching, Lines, Lettering and Dimensioning).
2. Geometrical Constructions (Bisecting a lines, Perpendicular lines, divide a lines, Construction of Polygons).
3. Conics and Engineering Curves (Ellipse, Parabola, Hyperbola).
4. Conics and Engineering Curves (Cycloid, Epicycloid, Hypocycloid, Trochoid, Involute).
5. Projection of Points.
6. Projection of Lines.
7. Projection of Planes.
8. Projection of Solid (Cube, Prism, Pyramids).
9. Projection of Solid (Cylinder, Cone and Sphere).
10. Isometric projection of solids (Prisms, Pyramids, Cylinders, Cone and Sphere).
11. Development of Surfaces (Truncated Cylinder, Square Prism, Pyramid, Truncated Cone).
12. Introduction to CAD Tools (Scale, Units, Draw, Modifying, Dimension, Sheet Layout, Plotting).

Text Books:

1. T. E. French, C.J. Vierck and R. J. Foster, Engineering Drawing and Graphics Technology, TMH, 1987.
2. N. D. Bhatt and V.M. Panchal, Elementary Engineering Drawing, Charotar Publishing House, 1996.

Reference Books:

1. 1. K.Venugopal, Engineering Drawing and Graphics, New Age, 2005.
2. Dhananjay A. Johle, Engineering Drawings, McGraw Hill Education Pvt. Ltd., 2008.

2.2 Second Semester Papers

2.2.1 MA - 201 Engineering Mathematics - II

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	$MA-201$
Paper Name	:	*Engineering Mathematics - II*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Calculus of several variables: Partial derivatives. Chain rule, Standard Jacobians for change of variables. Gradient and directional derivatives.Tangent and normal planes. Exact differentials. Euler's theorem on homogeneous functions. Repeated and multiple integrals, maxima and minima for several variables, method of Lagrange multipliers.

Unit II:
Vector Calculus: Vector valued function of one or more variables (up to 3), derivatives of such a function of one variable. Gradient of a scalar valued function. Geometrical properties of gradient. Divergence and Curl of vector valued functions. Line, surface, and volume integrals. Green's theorem, Gauss's divergence theorem and Stoke's theorem in Cartesian coordinates (statements only with applications).

Unit III:
Numerical Methods: Bisection method, Newton-Rapson's and Secant methods for roots of nonlinear equations. Polynomial interpolation, divided differences.Numerical differentiaon and Numerical integration, trapezoidal and Simpson's rules..

Unit IV:
Ordinary Differential Equations (ODE): Ordinary linear differential equations of nth order, solutions of homogeneous equations, Wronskian, Operator method (simple problems only with emphasis on second order homogeneous equations). Variation of Parameters for second order linear ODE with variable coefficients. Nonlinear equations and Clairaut's equations.

Text Books:

1. E. Kreyszig, "Advance Engineering Mathematics", 8/e, J. Willey & Co, 1999.
2. S. Pal and S. C. Bhunia, "Engineering Mathematics", Oxford University Press, 2015.
3. B.S. Grewal, "Higher Engineering Mathematics", 42/e, Khanna Publication.

Reference Books:

1. Babu Ram, "Engineering Mathematics", Pearson.
2. Sastry, "Engineering Mathematics", PHI.
3. M. C. Potter, J. L Goldberg and E.F. Aboufadel, "Advance Engineering Mathematics", 3/e, Oxford University Press

2.2.2 PH - 202 Engineering Physics - II

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*PH – 202*
Paper Name	:	*Engineering Physics-II*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Laser and Fibre Optics: Fundamentals of LASER: Energy level in atoms, Spontaneous and stimulated emission, He-Ne laser, Applications of laser in drilling, welding, etc. Introduction to optical fibre: Propagation of light in optical fibres, Numerical aperture, single and multimode fibres, Attenuation, Dispersion, Applications.

Unit II:
Wave mechanics: De Broglie Hypothesis. Wave-Particle Duality. Davisson-Germer Experiment. Group and Phase Velocities and Relation between them. Heisenberg uncertainty principle: Illustrations and applications, Wave function and its significance, Schrödinger wave equation, Particle in 1-D potential box.

Unit III:
Semiconductor Physics: Concept of Band theory of solids (qualitative description). Difference between metal, semi-conductor, and insulator. Direct and indirect band gap semiconductor, Intrinsic semiconductor, concept of holes - effective mass - carrier concentration and electrical conductivity. Intrinsic semiconductor at 0K and at room temperature, Fermi energy, Extrinsic semiconductor, conductivity, Hall effect.

Unit IV:
Nano Science: Introduction to nanophysics. Properties of material from bulk to nano size., Synthesis of nanomaterials by physical methods and chemical methods. Applications of nano-materials in energy, health, space and environment etc.

Text Books:

1. Thomas A. Moore, Six Ideas that Shaped Physics:Particle Behave like Waves, 3/e, McGraw Hill, 2003.
2. Gerd Keiser, Optical Fibre Communications, 3/e, McGraw Hill, 2000
3. A K Bandopadhyay, Nano materials, 2/e, New Age International Pvt Ltd Publishers, 2007
4. Ben G. Streetman, Sanjay Banerjee, Solid State Electronic Devices, 6/e, Pearson Prentice Hall, 2006.

Reference Books:

1. F W Sears, M W Zemansky and H D Young, University Physics, 2/e, Narosa Publishing House, 1982
2. H K Malik and A K Singh, Engineering Physics, Tata McGraw Hill, New Delhi, 2010.
3. David J Griffiths, Introduction to Quantum mechanics, 2/e, Pearson, 2004.
4. S O Pillai, Solid State Physics, 7/e, New age international, 2014

2.2.3 CH - 203 Engineering Chemistry

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*CH − 203*
Paper Name	:	*Engineering Chemistry*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Chemical Thermodynamics: Second law of thermodynamics, entropy and its physical significance, entropy change of ideal gases, free energy, Maxwell's relations, Gibbs-Helmholtz equation, thermodynamic equilibrium, Van't Hoff equation, Clausius-clapeyron equation, Nernst heat theorem, third law of thermodynamics.

Unit II:
Organic Chemistry: Structures, functions and classification of biologically important molecules (Amino acids, peptides, proteins, Nucleic acids, Carbohydrates); Preparative methods of amino acids and Peptides; Peptides sequencing; 3D structure of proteins; Reactions of monosaccharides. Polymers: Types of Polymerization; Classification and structures of polymers; commercial uses of some important polymers (e.g. Nylons, polyester, polyurethane, rubber, Teflon, polycarbonate, Bakelite, epoxy resin, silicones, etc.)

Unit III:
Electrochemistry: Electromechanical cells, EMF and application of its measurement, commercially important cells, corrosion (its electrochemistry and remedial measures); Chemical Kinetics: reactions of different orders- general discussion, rate law with example of zero, first and second order reactions, problem based on zero, first and second order reactions, pseudo-uniorder reaction, activation energy and role of catalyst in reaction- collision theory and activation energy.

Unit IV:
Water and its hazard in industry: Soft and Hard water and estimation of hardness of water, hazards of hard water in industry and treatment of industrial water (external and internal methods); Fundamentals of Spectroscopy: Microwave, Infra-red and UV-VIS spectroscopic techniques.

Text Books:

1. Prakash, Tuii, Basu and Madan, Advanced Inorganic Chemistry, Vol. I and II (Diamond Ed) S. Chand, Reprinted, 2006.
2. Morrison and Boyd, Organic Chemistry, 6/e, Prentice Hall of India, reprinted, 2006.
3. Jain and Jain, Engineering Chemistry, Dhanpat Rai Publishing Co., 2008.
4. Levine, Physical Chemistry, 5/e (7th reprint), TataMcGraw Hil, 2006.

Reference Books:

1. Shriver, Atkins and Langford; Inorganic chemistry, 5/e, ELBS, 2009.
2. S. H. Pine, Organic Chemistry, 5/e,Tata McGraw Hill 2007.
3. Banwell and McCash, Fundamental of Molecular Spectroscopy, 4/e, Tata McGraw Hill, 1962.
4. I. L. Finar, A Textbook of Organic Chemistry, 6/e, Vol and II, ELBS, 2006.

2.2.4 EC - 204 Basic Electronics

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 204*
Paper Name	:	*Basic Electronics.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Properties of Semiconductors: Energy bands in solids, E-K Diagram; intrinsic & extrinsic semiconductors; carriers transport phenomena: drift & diffusion current, mobility & resistivity. Generation & recombination of carriers; Hall effect. PN-Junction Diode: General idea; characteristics; Transition capacitance and diffusion capacitance.

Unit II:
Applications PN-Junction Diodes: Half wave, full wave center-tapped and bridge rectifiers; Clipping & clamping circuits. Characteristics and Applications of Special Purpose Diodes: Zener, Photo, Varactor, Schottky, Tunnel diode & Light emitting diode, Photovoltaics.

Unit III:
Transistors: Constructions, symbols, principle of operations, configurations and characteristics of BJT and FET(JFET & MOSFET). Application of BJT as amplifier. Unijunction Transistor(UJT). Transistor Biasing: Q point; Graphical analysis (DC & AC load line); Various bias circuits.

Unit IV:
Special Diodes: Tunnel Diods, Varactor diode, Schottky diode, CCD, Impatt diode, Gunn diode etc. their characteristics and applications.

Text Books:

1. D. Chattopadhay and P. C. Rakshit, Electronics Fundamentals and Applications, 12/e, New Age International(P) Lid., 2014.
2. J. Millman and C. Halkias, Integrated Electronics, 42nd Reprint, TMH, 2006.
3. R. Boylestead and L. Nashelsky, Electronic Devices and Circuits Theory, 9/e, PHI, 2006.
4. M. S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronics Engineering, Oxford, 2012.
5. B. Streeman and S. Banerjee, Solid State Electronics Devices, 6/e , PHI, 2006

Reference Books:

1. A. P. Malvino, Electronic Principles, 6/e, TMH, 1998.
2. R. P. Jain, Modern Digital Electronics, 3/e, TMH, 2003.
3. R. J. Tocci, Digital Systems, 6/e, PHI, 2001.

2.2.5 PH - 212 Engineering Physics Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*PH − 212*
Paper Name	:	*Engineering Physics Lab*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

Laboratory Practices:

1. To determine the acceleration due to gravity by bar pendulum/Kater's pendulum.
2. To determine the Young's modulus of a wire by any method
3. To determine rigidity modulus of a wire by statical method/dynamical method.
4. To find the wavelength of monochromatic light by using Newton's ring method.
5. To determine the wavelength of sodium light by Michelson's interferometer.
6. To determine the specific rotation of sugar solution by Polarimeter.
7. To determine the magnetic moment of a bar magnet (M) and the earth's horizontal intensity at a place by deflection and vibration magnetometers
8. To determine the wavelength of laser light using diffraction grating
9. To determine the resistance per unit length of a meter bridge wire by Carey- Foster method.
10. To determine the time constant of the RC circuit.
11. To obtain the hysteresis curves (B-H) for a ferromagnetic material (thin rod or wire) on a CRO using solenoid and to determine the related magnetic constants.
12. To study the Hall Effect and determine the Hall Coefficient of a given material.
13. To determine the Planck's constant by a Photocell.
14. To determine the value of e/m of an electron by any method.
15. To determine the refractive index of a prism by using spectrometer.
16. To determine the velocity of ultrasonic waves in liquids.
17. To calibrate the given ammeter and voltmeter by potentiometer.
18. To determine energy band gap of a given semiconductor material.

Text Books:

1. Samir Kumar Ghosh, A Text book of Practical Physics, New Central Book Agency, Kolkata, 2006.
2. Gupta and Kumar, Practical Physics, Progati Prakashan, Meerut, U.P., 2005.
3. Harnam Singh, B.Sc. Practical Physics, S Chand & Company, 2004.
4. C. L. Arora, Advance B.Sc. Practical Physics, S. Chand, 2004.

2.2.6 CH - 213 Engineering Chemistry Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*CH – 213*
Paper Name	:	*Engineering Chemistry Lab.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

Laboratory Practices:

1. Volumetric estimation of Mg2+ and Ca2+ ions by EDTA titration (Hardness of water).
2. Volumetric estimation of Fe2+ ions by permanganatometry.
3. Determination of composition of the given liquid mixture by viscosity measurement.
4. Determination of partition-coefficient of iodine between carbon tetrachloride and water.
5. Determination of integral heats of dilution of the sulphuric acid solutions, and to determine the strength of the given unknown acid solution.
6. Standardisation of a strong acid by conductometric titration with a strong base.
7. Determination of rate constant of the acid-catalysed hydrolysis of methyl acetate.
8. Experimental verification of Hasselbach-Henderson equation by pH measurement for a buffer mixture.
9. Verification of Beer-Lambert's law with potassium permanganate and the estimation of potassium present in the given solution.
10. Systematic qualitative analysis of organic compounds containing one functional group:
    a. Detection of element out of N, S, Cl, Br, I
    b. Detection of a functional group out of -COOH, -NO2, -OH (alcoholic or phenolic), ¿CO carbonyl, -NH2 group.
11. Standardisation of sodium hydroxide against the known solution of HCl spectrotometrically.

Text Books:

1. Pandey, Bajpai and Giri, Practical Chemistry, 8/e (reprinted), S. Chand & Co. Ltd., 2006.
2. Gurtu and Kapoor, Advanced Experimental Chemistry, Vol. I – III, 4/e (reprinted), S.Chand & Co. Ltd., 1989.

Reference Books:

1. Vogel's Textbook of Quantitative Chemical Analysis, 5/e, ELBS, 1991.
2. Vogel's Textbook of Practical Organic Chemistry, 5/e, ELBS, 1996.

2.2.7 EC - 214 Basic Electronics & Electrical Lab.

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 214*
Paper Name	:	*Basic Electronics & Electrical Laboratory.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of Programs: Part A:

1. To Study the IV Characteristics of Silicon and/or Germanium Diodes.
2. To Study the IV Characteristics of Zener Diode.
3. To design and Analysis of a Half wave Rectifier using Diode.
4. To design and Analysis of a center-tap Full wave Rectifier using Diodes.
5. To design and Analysis of a Bridge Rectifier Circuit.
6. To design and Analysis of a Clipping Circuit with one voltage source (different possible configurations).
7. To design and Analysis of a Clipping Circuits with two voltage source (different possible configurations).
8. To design and Analysis of Clamper Circuits.
9. To analysis of the characteristics of BJT (CE and CB mode).
10. To design and Analysis of fixed bias circuit using NPN transistor (DC).
11. To design and Analysis of voltage divider bias circuit using NPN transistor (DC)
12. To study of the characteristics of JFET.
13. To study of the characteristics of MOSFET.
14. To verify of truth tables of basic logic gates.

Part B:

1. To verify Thévenin's theorem.
2. To verify Norton's theorem.
3. To verify Maximum Power Transfer theorem.
4. To verify that the phasor sum of currents at any junction in an A.C. circuit is zero.
5. To measure Power and power factor of the load by three ammeters method.
6. To measure Power and power factor of the load by three voltmeters method.
7. To perform Open circuit and Short Circuit Tests on a single phase transformer.
8. To determine the Open Circuit Characteristic of D.C. Generator
9. To measure and control the Speed of D.C. motors using Tachometer.
10. To calibrate an ammeter as voltmeter.

Text Books:

1. R. Boylestead and L. Nashelsky, Electronic Devices and Circuits Theory, 9/e, PHI, 2006.
2. D. Chattopadhay and P. C. Rakshit, Electronics Fundamentals and Applications, 12/e, New Age International(P) Ltd., 2014.
3. M. S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronics Engineering, Oxford, 201

2.3 Third Semester Papers

2.3.1 EC - 301 Computer Programming

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 301*
Paper Name	:	*Computer Programming.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Fundamentals of Digital Computer: Functional components of a digital computer, Von Newman architecture, Algorithm and flowcharts, Data representation, Programming languages, Function of system software; Overview of C.

Unit II:
Fundamentals of C: Constants, Variables and Data Types, Operators and Expressions, Input & Output Operations, Branching & looping operations; Functions: Definition, Accessing method; Parameter Passing. Array, Structures, Union & Pointers: Definition, Accessing method; Parameter Passing, Return Values; Strings & string handling functions.

Unit III:
File Management: Introduction; Opening & Closing a File; Input/Output Operations; Error Handling during I/O Operations. Data Structures : Basic Concepts; Types of data structures.

Unit IV:
Object-Oriented Programming(OOP) : Concept of OOP; Variables, Decision loops, methods, Parameter Passing, Return Values, Scope of variables; Class and objects; Arrays; Members; Access operators; Functions; Templates; Exception handling.

Text Books:

1. V. Rajraman, Fundamental of Computer, 4/e, PHI, 2006.
2. E. Balaguruswami, Programming in ANSI C, 2/e, TMH, 2004.
3. R. Thareja, Computer Fundamentals and Programming in C, 2/e, Oxford University Press, 2016.
4. E. Balaguruswamy, Object oriented programming with C++, 6/e, TMH, 2001.
5. H. Schildt, The Complete Reference to Java, J2SE 7/e, TMH, 2006.

Reference Books:

1. Y. Kanetkar, Let us C, BPB Publication, 2004.
2. C. Horstmann, Big Java: Late Objects, Wiley, 2012.
3. Y. Langsum, M. J. Augenstein, A. M. Tenenbaum, Data Structures using C and C++, 2/e, PHI.
4. B. Stroustrup, The C++ Programming Language, Addison Wesley.
5. R. Thareja, Object Oriented Programming with C++, Oxford University Press, 2015.

2.3.2 EC - 302 Electronic Devices and Circuits

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 302*
Paper Name	:	*Electronic Devices, Circuits and Materials*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 60, End Semester Examination = 90.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Voltage regulators: Zener regulator; Series regulator; Shunt regulator; Voltage regulator ICs; Passive filters and their characteristics. Low-frequency Equivalent Circuit of BJT: Analysis of BJT amplifiers using h-parameters (all configurations); Miller's Theorem.

Unit II:
High-frequency Equivalent Circuit of BJT: High frequency effects in transistors; Hybrid-p model, CE short circuit current gain, Approximate CE high frequency model with resistive load; Noise in transistors. Equivalent circuit of FET: Analysis of FET amplifiers using low-frequency ac equivalent circuits for all configurations; FET high-frequency equivalent circuits.

Unit III:
Multistage Amplifiers: Classification of amplifiers; distortion in amplifiers; frequency response of amplifiers; RC-coupled amplifier; Darlington Connection. Large signal amplifier: Analysis of class A, B, AB, C amplifiers; class-B push pull amplifier; class-C tuned amplifier. Feedback amplifiers: Concept of feedback; Effects of negative feedback; Topological classification of feedback amplifiers.
Sinosoidal oscillators: Classification, basic concepts of oscillators; feedback oscillator concepts; R-C phase-shift, Wien-bridge, Hartley, Colpitts and Crystall oscillators. Multivibrators: Construction and working of astable, monostable and bistable multivibrators (using transistors); Schmitt trigger.

Unit IV:
Semiconductor Materials, Properties & Application of Silicon,Germanium, Selenium,Graphite, Silicon Carbide,Gallium Arsenide & Cadmium Sulphide, Magnetic Materials, Principal of Magnetism, BCC, FCC, Crystallography and amorphous, III-IV semiconductor materials

Text Books:

1. D. Chattopadhay and P. C. Rakshit, Electronics Fundamentals and Applications, 12/e, New Age International(P) Ltd., 2014.
2. J. Millman and C. Halkias, Integrated Electronics, 42^{nd} Reprint, TMH, 2006.
3. D. A. Bell, Electronic Devices and Circuits, 5^{th} impression, Oxford University Press,2008
4. R. Boylestead and L. Nashelsky, Electronic Devices and Circuits Theory, 9/e, PHI, 2006.

Reference Books:

1. A. S. Sedra and K. C. Smith, Microelectronic circuits, , 7/e, ISE, Oxford University Press, 2014.
2. L. K. Maheshwari and MMS Anand, Analog Electronics, PHI, 2005.
3. J. Milman and A. Grabel, Microelectronics, 2/e, McGraw Hill, 1988.

2.3.3 EC - 303 Signals and Systems

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 303*
Paper Name	:	*Signals and Systems.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Introduction to signals, Classification of signals, Basic operations on signals, Elementary signals and functions, Introduction to systems, Classification of system and properties, Linear time-invariant(LTI) systems, Convolution as Impulse response representation for LTI systems.

Unit II:
Signal space representations for continuous and discrete time signals, The Fourier series representation,The Fourier transform and properties, Frequency response of LTI systems, Fourier transform representations for periodic signals, Fourier transform representation for discrete-time signals, sampling and Reconstruction of continuous-time signals from samples.

Unit III:
Introduction to Laplace Transform, Region of convergence, Inverse Laplace transform, Initial and final value theorems, Analysis of continuous systems using Laplace Transform.

Unit IV:
Introduction to the Z-transform, properties of the Region of convergence, Z-Transform properties, Inversion of the Z-Transform, Block diagram representations of LTI systems.

Text Books:

1. A. V. Oppenheim, A. S. Willsky & A. Nawab, 'Signals and Systems', PHI./Pearson Education, New Delhi, 2002.
2. Simon Haykin & Barry Van Veen, 'Signals and Systems', John Wiley & Sons, New Delhi, 2005.

Reference Books:

1. Hsu, R. Ranjan, 'Signals and Systems', Schaums's outline, Tata McGraw Hill, New Delhi, 2006.
2. B. P. Lathi, 'Linear systems and Signals', Oxford University Press, 2005.

2.3.4 EE - 304 Electrical Network Theory

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EE − 304*
Paper Name	:	*Electrical Network Theory*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit - I:
Network topology: Graph of a network, Concept of tree and links; Matrices associated with graphs: Incidence, fundamental circuit/loop/tie-set and fundamentals of cut-set matrices. *Network solution methods*: Nodal, Mesh and Loop Analysis including application of graph theory while solving them.

Unit - II:
Network theorems: Superposition principle, Source transformations, Thévenin and Norton equivalent circuits, Maximum power transfer, Delta-Wye conversion.

Unit - III:
Sinusoidal circuit analysis: Sinusoidal voltage and current, element responses, series RL sinusoidal response, series RC sinusoidal response; Steady state sinusoidal analysis using phasors; Time domain analysis of simple linear circuits; Solution of network equations using Laplace transform; Frequency domain analysis of RLC circuits.

Unit - IV:
Linear 2-port networks: Network variables, short circuit and open circuit parameters, transmission and hybrid parameters, relationships between parameter sets, parallel connection of 2-port network, calculations of network functions for Ladder and general network, Poles and zeroes of network functions; State equations for networks; Tellegena's theorem.

Text Books:

1. Nilsson and Riedel, Electric Circuits, 10e, Pearson Education Inc., 2015
2. W.H. Hayt, J.E. Kemmerly, S.M. Durbin, *Engineering Circuit Analysis, 8/e*, McGraw Hill, 2012.
3. M.E. Van Valkenburg, *Network Analysis, 3/e*, PHI, 2005.

Reference Books:

1. M. Nahvi, J.A. Edminister, *Schuama's Outline Electric Circuits, 4/e*, TMH, SIE, 2007.
2. A. Sudhakar, S.S. Palli, *Circuits and Networks: Analysis and Synthesis, 2/e*, TMH, 2002.
3. D. Roy CHoudhury, *Networks and Systems*, New Age Publishers, 1998.

2.3.5 EC - 311 Computer Programming Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 311*
Paper Name	:	*Introduction to Computer Programming Laboratory.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of Programs:

1. To write C programs using operators and expressions.
2. To write C programs using if & switch-case constructs of C (one each).
3. To write C programs incorporating for, while & do-while loops (one each).
4. To write C programs using 1D & 2D arrays (one each).
5. To write C programs for string manipulation and using standard library functions.
6. To write C programs to demonstrate the call-by-value & call-by-address method (one each).
7. To write C programs using function & pointer (two each).
8. To write C programs involving opening, closing, reading/writing a file.
9. To write C programs involving copying the content of one file to another file using commands line arguments.
10. To write a program using array to implement Stacks & Queue (one each).
11. To write a program using Link List to implement Stacks & Queue (one each).
12. To Programs in C++ & Java, illustrating overloading and overriding methods (one each).
13. To write Programs in C++ & Java, illustrating the implementation of various forms of inheritance.
14. To write programs in C++ & Java to implement 'static class member function' using class Item which has a static member count (one each).
15. To write Java program to implement 'static class member function' using class Item which has a static member count.

Text Books:

1. Y. Kanetkar, Let us C, BPB Publication, 2004.
2. E. Balaguruswamy, Object oriented programming with C++, 6/e, TMH, 2001.
3. H. Schildt, The Complete Reference to Java, J2SE 7/e, TMH, 2006.
4. S. Lipschutz, Data Structures, 4/e, TMH, 2006.

2.3.6 EC - 312 Electronic Devices Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 312*
Paper Name	:	*Electronic Devices and Circuits Laboratory.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of Programs:

1. Design and Analysis of voltage regulator circuit using Zener diode.
2. Design and Analysis of shunt and series voltage regulator circuits using transistors.
3. Design and Analysis of voltage regulators using ICs 78xx and 79xx series.
4. Study the frequency response characteristics of passive filters using resistor, capacitor and inductor (LP, HP and BP).
5. Design and Analysis the Voltage series, Voltage shunt, Current series and Current shunt feedback amplifiers.
6. Design and Analysis of RC phase shift oscillator and Wien bridge oscillators (using BJTs/ FETs).
7. Design and Analysis of Hartley and Colpitts oscillators (using BJTs/ FETs).
8. Design and Analysis of a 2-stage RC-coupled transistor amplifier.
9. Design and Analysis of transformer-coupled Class-A and class-AB power amplifiers.
10. Design and Analysis of Class-B Push-Pull and Class-C amplifier power amplifiers.
11. Design and Analysis of Astable, Mono stable and Bistable Multivibrator circuits using BJT.

Text Books:

1. R. Boylestead and L. Nashelsky, Electronic Devices and Circuits Theory, 9/e, PHI, 2006.
2. D. Chattopadhay and P. C. Rakshit, Electronics Fundamentals and Applications, 12/e, New Age International(P) Ltd., 2014.
3. D. A. Bell, Electronic Devices and Circuits, 5th impression, Oxford University Press,2008.

2.3.7 EC - 316 Circuit Simulation Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 316*
Paper Name	:	*Circuit Simulation Laboratory*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

Laboratory Practices:

1. To simulate a linear dc circuit for determining all node voltages using SPICE
2. To perform nodal analysis for a given linear dc circuit using SPICE
3. To perform nodal analysis for a given linear dc circuit using MATLAB
4. To obtain Thévinin's equivalent circuit with the help of SPICE program
5. To obtain Thévinin's equivalent circuit with the help of MATLAB
6. To simulate a given d.c. network with sub circuit in SPICE
7. To verify maximum power transfer theorem for dc circuits in SPICE
8. To verify maximum power transfer theorem for dc circuits in MATLAB
9. To verify superposition theorem for linear dc circuits using SPICE
10. To verify superposition theorem for linear dc circuits using MATLAB
11. To simulate a half wave rectifier circuit using SPICE
12. To simulate a full wave rectifier circuit using SPICE
13. To verify the characteristics of a given clipper circuit using SPICE
14. To verify the characteristics of a given clamper circuit using SPICE
15. To study an Op-amp Regulator with Series-Pass Transistor using SPICE
16. To verify the characteristics of CE Amplifier using SPICE
17. To verify the characteristics of CB Amplifier using SPICE
18. To verify the characteristics of CC Amplifier using SPICE
19. To simulate basic gates using SPICE

Text Books:

1. Paul B Zbar and Alber P Malvino, Michael A Miller, *Basic Electronics: A Text Lab Manual*, 7/e, Tata McGraw Hill, 2009.
2. John Okyere Attia, *PSPICE and MATLAB for Electronics: An Integrated Approach*, 2/e, CRC Press, 2010.

Reference Books:

1. John Okyere Attia, *Electronics and Circuit Analysis using MATLAB*, 2/e, CRC Press, 2004.
2. David A Bell, *Laboratory Manual for Electronic Devices and Circuits*, 4/e, PHI, 2001.
3. Muhammed H Rashid, *SPICE for circuits and electronics using PSPICE*, 2/e, PHI, 1995.

2.4 Fourth Semester Papers

2.4.1 EC - 401 Instrumentation and Measurement

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 401*
Paper Name	:	*Instrumentation and Measurements*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Art of measurement: Accuracy and precision, types of Errors, Classification of standards of Measurements. Bridges and their applications: Maxwell Bridge, Maxwell Wien Bridge, Andersons Bridge, Schering Bridge, Desauty Bridge, Wien Bridge, Applications of AC bridges.

Unit II:
Electronic Measuring Instruments: Digital voltmeters, Cathode Ray Tube (CRT) Construction, Basic CRO circuits, CRO Probes, Techniques of Measurement of frequency and Phase Angle, Dual Trace and Dual Beam Oscilloscopes, Wave analyzer, Spectrum analyzer.

Unit III:
Display devices and recorders: Light emitting diode, Liquid crystal displays, Graphic Recorders: strip chart recorder, X-Y recorder, magnetic tape recorder.

Unit IV:
Transducers: Principles and classification of transducers, basic requirements of transducers,Principle of operation and applications of: LVDT, Strain gauge, capacitive and inductive transducers, Potentiometric transducer,piezoelectric transducer, temperature, pressure and optical transducers.

Text Books:

1. A.K.Sawhney, A course in Electrical measurement and measuring instruments, Dhanpat Rai, 2005.
2. Rangan Mani Sharma, Instrumentation Devices and Systems, 2/e, TMH, 1999.
3. Helfrick and Cooper, Modern Electronic Instrumentation and Measurement Techniques, PHI,1992.

Reference Books:

1. P.H.Mansfield, Electrical Transducers and Industrial Measurements, 1992.
2. G H.K.P. Neubert, Instrument Transducers, 2/e, Oxford University Press, 1975.
3. A. K. Ghosh, Introduction to Measurements and Instrumentation, 2/e, PHI, 2007.
4. H.S. Kalsi, Electronic Instrumentation, 7/e, TMH,1999.

2.4.2 EC - 402 Digital Electronics

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 402*
Paper Name	:	*Digital Electronic Circuits.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Six.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Signed numbers; Canonical representations-minterm, maxterm; Karnaugh map simplification up to six variables, Quine- McCluskey minimization, r's and r-1's complement arithmetic, binary coded decimal codes; Gray codes.

Unit II:
Combinational circuits: adders: half and full; ripple carry adder, carry-look-ahead adder; subtractors: half and full; comparators; parity circuits; decoders, encoders, multiplexers, demultiplexers and their applications; code converter.

Unit III:
Sequential logic devices and circuits: latches; flip-flops, SR, JK, D and T flip-flops; shift-registers; digital system design, ASM, FSM, synchronous and asynchronous module counter, Semiconductor Memory: Read Only Memory (ROM) - PROM, EPROM, EEPROM, Random Access Memory (RAM)-static, dynamic, and PLAs.

Unit IV:
Digital IC families (DTL, TTL, ECL, MOS, CMOS). Logic families: TTL inverter circuit description and operation; CMOS inverter circuit description and operation; other TTL and CMOS gates; electrical behavior of logic circuits: noise margins, fan-in, fan-out, propagation delay, power dissipation.

Text Books:

1. M. Mano, Digital Design, 3/e, PHI, 2006.
2. R. P. Jain, Modern Digital Electronics, 3/e, TMH, 2009.
3. Tocci and Widmer, Digital Systems: Principles and Applications, 8/e, PHI, 2006.
4. M. Mano, Digital Logic and Computer Design, PHI, 1996

Reference Books:

1. Sanjay Sharma, Digital Electronics and Logic Design, 4th Edn., S.K. Kataria & Sons, 2015.
2. G. K. Kharate, Digital Electronics, 1st Edn, Oxford University Press, 2014
3. A. Anand Kumar, Fundamental of Digital Circuits, 2/e, PHI, 2009.
4. Donald P. Leach, Digital Principles and Applications, 6/e, TMH, 2006.

2.4.3 EC - 403 Electromagnetic Theory

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 403*
Paper Name	:	*Electromagnetic Theory*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Six.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Static Electric Fields: Review of vector analysis, Coulomb's Force Law, Electric field intensity and potential charge distributions. Electric flux and flux density: Gauss law and its applications, boundary conditions, Gauss divergence theorem, Poisson's and Laplace's equations and their solutions.

Unit II:
Electric Current: Charge conservation and continuity equation, conductivity and Ohm's law Interior and Exterior fields of conductors and boundary conditions. Polarisibility of dielectrics: Dielectric Constant, Artificial dielectric, capacitance, spherical shell, parallel plate, coaxial and parallel wire lines, dielectric strength, and energy stored in a capacitor and in an electric field.

Unit III:
Steady magnetic fields: Postulates, magnetic forces, magnetic fields, straight wires and wire loops, solenoid and torroid; Ampere's law and its applications, magnetic field strength, and parallel wire/lines, energy stored in an inductor and in a magnetic field, Stoke's theorem, vector potential and its applications, boundary conditions for magnetic fields.

Unit IV:
Maxwell's Equations and E.M. Waves: Maxwell's equations in various forms, wave equations in free space and material media, plane, waves in dielectric and conducting media. Use of Maxwell's equation: Flow of energy and Poynting vector, energy density in a plane wave, energy, velocity, complex Poynting vector theorem. Reflection of E.M waves: Reflection of plane waves from perfect conductors and dielectrics, linear, elliptic and circular polarization, reflection coefficient and standing wave ratio, Brewster's angle, total reflection, surface waves.

Text Books:

1. Martin A. Plonus, Applied Electromagnetic, McGraw-Hill, 1978.
2. W.H.Hayt, Engineering Electromagnetics (Special Indian Edition), 7/e, TMH, 2006.
3. J.D. Kraus and D. A. Fleisch, Electromagnetics (International Edition), 5/e, TMH, 1999.
4. Jordan and Balman, Electromagnetic Waves and Radiating Systems, 2/e, PHI, 2006.

Reference Books:

1. Peterson, Scott L.Ray, Mitra, Computational Methods for Electromagnetics, Wiley, 1998.
2. Ramo, Whinnery and Duzer, Field's waves in Electromagnetic systems, 3/e, Wiley, 1994.
3. Matthew N.O. Sadiku, Elements of Electromagnetics, 4/e, Oxford University Press, 2006.
4. Joseph A. Edminister and Priye, Schaums' outline series Electromagnetics, 2/e, TMH, 2006.

2.4.4 EC - 404 Analog Communication

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 404*
Paper Name	:	*Analog Communication.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Linear Modulation: Basic blocks in a communication system, Generation and Detection of Amplitude Modulation (AM), Double Sideband Suppressed Carrier (DSB-SC), Single Sideband Suppressed Carrier (SSB-SC) and Vestigial Sideband (VSB) signals. Time domain and Frequency domain representation of different typpes of AM.

Unit II:
Angle modulation: Frequency Modulation (FM) & Phase modulation (PM); narrow and wide-band FM, Time Domain and Frequency Domain representation of FM and PM, Carson's rule, Generation of FM: Direct Method and Indirect method, Demodulation of FM..

Unit III:
Radio Receivers and Pulse Modulation: Tuned Radio Frequency Receiver (TRF), AM Supereterodyne receiver,Receiver characteristics: Sensitivity, Selectivity, Fidelity, Sampling Process, Generation and Detection of Pulse Amplitude Modulation (PAM), Pulse width Modulation (PWM), pulse position modulation (PPM) signals Angle modulation & Demodulation Techniques: Frequency Modulation (FM) & Phase modulation (PM); narrow and wide-band FM, Time Domain and Frequency Domain representation of FM and PM, Carson's rule, Generation of FM: Direct Method and Indirect method, Demodulation of FM.

Unit IV:
Noise: Types of Noise, Noise in cascaded stages in amplifier, Signal to Noise ratio (SNR), Noise Figure, Noise Temperature, Noise in DSB-SC, SSB, AM & FM receivers, Pre-emphasis and De-emphasis,

Text Books:

1. S. Haykin, An Introduction to Analog and Digital Communications: Willey India, 2006.
2. B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems: Oxford, 4/e, 2011.
3. Taub and Shilling, Principles of Communication Systems: Tata McGraw Hill, 4/e, 2013.
4. L. W. Couch, Digital and Analog Communication Systems: Pearson Education, 8/e, 2013.

Reference Books:

1. George Kennedy, Electronic Communication Systems: Tata McGraw Hill, 4/e, 2006.
2. A. Bruce Carlson, Communication Systems: Tata McGraw Hill, 5/e, 2009.
3. P. R. Rao, Communication Systems: McGraw Hill Education, 2013.
4. V. Chandra Sekhar, Analog Communication: Oxford University Press India, 2010.

2.4.5 EC - 411 Instrumentation and Measurement Laboratory

	L	-	T	-	P	Cr
	0	-	0	-	4	2

Paper Code	:	$ECS-411$
Paper Name	:	*Instrumentation and Measurement Lab.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of experiments:

1. Extension of range of Ammeter.
2. Extension of range of Voltmeter.
3. Study of loading effect of Ammeter and voltmeter.
4. Measurement of frequency using Lissajous Pattern (CRO).
5. Measurement of Phase-angle using Lissajous Pattern (CRO).
6. Study of Maxwell bridge Circuit.
7. Study of Wein bridge Circuit.
8. Study of Anderson bridge Circuit.
9. Study of Schering bridge Circuit.
10. Study of Desauty Bridge Circuit.
11. Study of transducers (photo register/photodiode/phototransistor).

Text Books:

1. A.K.Sawhney, A course in Electrical Measurement and Measuring Instruments,Dhanpat Rai, 2001.
2. A. K. Ghosh, Introduction to Measurements and Instrumentation, 2/e, PHI, 2007.

Reference Books:

1. P.H.Mansfield, Electrical Transducers and Industrial Measurements, 1992.
2. H.K.P. Neubert, Instrument Transducers, 2/e, Oxford University Press, 1975.

2.4.6 EC - 412 Digital Electronics Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 412*
Paper Name	:	*Digital Electronic Laboratory.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of experiments:

1. Conversion of Binary to Excess-3 Code and Excess-3 to Binary
2. Conversion of Binary to Gray Code and Gray to Binary
3. Design of a Half Adder and a Full Adder
4. Design of a Half Subtractor and a Full Subtractor
5. Design of Parity Checker and Parity Generator
6. Design of 4 X 1 Multiplexer and 1 X 4 Demultiplexer
7. Design of 3-bit comparator circuit;
8. Design of priority encoder;
9. Design of 8-bit Decoder circuits using IC.
10. Design of Shift-register (all types).
11. Design of asynchronous Mod-5 and Mod-6 counters.
12. Design of synchronous Mod-5 and Mod-6 counters.
13. Design of a PLA circuit.

Text Books:

1. M. Mano, Digital Design, 3/e, PHI, 2006.
2. R. P. Jain, Modern Digital Electronics, 3/e, TMH, 2009.
3. J. F. Wakerly, Digital Design Principles and Practices, 4/e, PHI, 2006.
4. M. Mano, Digital Logic and Computer Design, PHI, 1996

Reference Books:

1. Sanjay Sharma, Digital Electronics and Logic Design, 4th Edn., S.K. Kataria & Sons,2015.
2. G. K. Kharate, Digital Electronics, 1st Edn, Oxford University Press, 2014
3. A. Anand Kumar, Fundamental of Digital Circuits, 2/e, PHI, 2009.
4. Donald P. Leach, Digital Principles and Applications, 6/e, TMH, 2006.

2.4.7 EC - 414 Analog Communication Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 414*
Paper Name	:	*Analog Communication Laboratory.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of Experiment:

1. Study the generation and detection of Amplitude Modulation (AM).
2. Study the generation and detection of Double Sideband Suppressed Carrier (DSB-SC) Modulation.
3. Study the generation and detection of Single Sideband Suppressed Carrier (SSB-SC) Modulation.
4. Study of sensitivity, selectivity of a radio receiver.
5. Study the effect of noise in standard AM and FM waves.
6. Study the generation of Frequency Modulation (FM) and detection using Foster Seeley Discriminator.
7. Study the generation of Frequency Modulation (FM) and Demodulation of FM using PLL.
8. Study of phase modulation and demodulation.
9. Study the generation and detection of PAM signal.
10. Study the generation and detection of PWM signal.
11. Study the generation and detection of PPM signal.
12. Study of the Satellite receiver.

Text Books:

1. S. Haykin, An Introduction to Analog and Digital Communications: Willey India, 2006.
2. B. P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems: Oxford, Fourth Edition, 2011.
3. Taub and Shilling, Principles of Communication Systems: Tata McGraw Hill, Fourth Edition, 2013.
4. L. W. Couch, Digital and Analog Communication Systems: Pearson Education, Eighth Edition, 2013.

Reference Books:

1. George Kennedy, Electronic Communication Systems: Tata McGraw Hill,Fourth Edition, 2006.
2. A. Bruce Carlson, Communication Systems: Tata McGraw Hill, Fifth Edition, 2009.
3. P. R. Rao, Communication Systems: McGraw Hill Education, First Edition, 2013.
4. V. Chandra Sekhar, Analog Communication: Oxford University Press India, 2010.

2.5 Fifth Semester Papers

2.5.1 MA - 501 Statistics and Random Process

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	$MA-501$
Paper Name	:	*Statistical and Random Process.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Six.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Introduction to probability: Events, Set, set operations, classical and relative frequency based definitions of probability, axiomatic definition of probability, conditional probabilities, independence. total probability, Raye's rules and applications. Repeated trails. Random variables : Continuous and discrete random variables, cumulative distribution function (cdf), probability mass function(pmf), probability density functions(pdf) and properties.

Unit II:
Some special distributions: Binomial and Poisson discrete distributions, Uniform, exponential, Gaussian and Raleigh continuous distributions. Expected value of a random variable(s), mean, variances and moments of random variables. Function of single random variable. Moment generating and characteristic functions and their applications, Chebyshev inequality.

Unit III:
Two dimensional random variables: joint distribution and density functions, marginal probability distribution, conditional probability distribution, independence. Functions of two random variables, Multivariate random variables, covariance and correlations, independence. Multivariate Gaussians distributions, vector-space representation of random variables. Inner product, Schwarz inequality. sequence of random variables: almost sure and mean square convergence. convergence in probability and distribution, law of large numbers. central limit theorem.

Unit IV:
Random Proccess: Discrete and continuous time processes, probabilistic description of random process, mean, auto correlation and auto covariance functions. Stationarity: strict sense stationary (SSS), wide sense stationary (WSS) processes, auto correlation functions of a WSS process and its properties, Cross correlation functions. Power spectral densities and properties. Gaussian process, Poison process and Markov processes.

Text Books:

1. I. A. Papoulis and S.U. Pi llai, "Probability, Random variables and Stochastic process", 4 ed, Mc Craw Hill, 2002.
2. H, Stark and J.W. Wooids, Probability and Random Processes with applications to Signal Processing, Pearson Education, 2002

Reference Books:

1. L P. Z, Pebbles, Probability, random variables and random signals principles, 4ed, Mc Graw Hill, 2000.
2. T, Veerarajan, Probability, statistics and random processes, 2ed, Mc Graw Hill, 2003.

2.5.2 EC - 502 Microprocessor

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 502*
Paper Name	:	*Microprocessores*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
8085 Processor: Architecture,addressing modes, Interrupts, Programming using 8085 instruction set. Interfacing I/O, memory mapped I/O and I/O mapped I/O.

Unit II:
8086/8088 Processor: Architecture of 8086, addressing modes, Assembler directives and advanced programming.

Unit III:
8086 Interrupts and DOS interrupt 21H functions, 8255 PPI, Interfacing: A/D converters, Interfacing D/A converters, wave form generation, stepper motor.

Unit IV:
80286/80386/80486: real and protected mode, segmentation, paging, tlb, addressing modes.Pentium processor: Introduction, Memory management,Bus inteface: ISA, PCI, USB.Hyper-threading Technology.

Text Books:

1. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, 6/e, Penram Pvt. Ltd. Oct, 2013
2. Douglas V.Hall, Microprocessor and interfacing, 2/e, McGraw Hill International Ed., 2006.
3. Barry B.Brey, The Intel Microprocessors,8/e, Pearson Education Inc., 2009

Reference Books:

1. B. Ram, Fundamentals of microprocessors and microcomputers, 3/e, Dhanpat Rai Publication, 1989.
2. A. K. Ray, K.M.Bhurchandi, Advanced Microprocessors and peripherals, 2/e, Tata McGraw-Hill, 2007.
3. Daniel Tabak, Advanced Microprocessors, 2/e, McGraw-Hill, 1994.

2.5.3 EC - 503 Digital Communication

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 503*
Paper Name	:	*Digital Communication*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Introduction to probability and random processes, Sampling and quantization, PCM, Delta modulation, Adaptive delta modulation, Matched filter detector and optimum filter detector.

Unit II:
Representation of bandpass signals in signal space diagram, memoryless modulation (PAM, PSK, QAM, PPM), M-ary transmissions, properties of modulation schemes (error probability, spectral efficiency), classification of signal sets, modulation with memory (DPSK, CPM, MSK,GMSK).

Unit III:
Introductory information theory and channel models, Source coding techniques (arithmetic, Ziv-Lempel, ShannonFano-Elias, Huffman), Lossy source coding, Channel coding (parity, Huffman, cyclic codes)

Unit IV:
Communication through band-limited channels, ISI-free communication, equalization, decision feedback equalisation, adaptive equalisation, synchronization, Introduction to propagation of the signals (fading), Introduction to OFDM, CDMA, MIMO.

Text Books:

1. Simon Haykin, Digital Communication System, John Wiley & Sons, 2014.
2. J. G. Proakis and S. Salehi, Contemporary Communication Systems Engineering, 2/e, PHI, 2005.
3. S. Haykin, Communication Systems, 4/e, John Wiley and Sons, 2006.
4. B. Sklar, Digital Communication- Fundamentals and Applications, 2/e, Pearson, 2001.
5. B.P. Lathi, Modern Digital and Analog Communication Systems, 4/e, Oxford University Press, 2010.

Reference Books:

1. J. G. Proakis and S. Salehi, Contemporary Communication Systems Engineering, 2/e, PHI, 2005.
2. S. Haykin, An Introduction to Analog and Digital Communications, Willey Eastern, New York, 1989.
3. Taub H., Schilling D L. and Saha G., Principles of Communication Systems, 3/e, TMH Publishing Company Ltd, New Delhi, 2008.

2.5.4 EE - 504 Linear IC Systems

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 504*
Paper Name	:	*Linear IC Systems*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
OPAMP architecture: Two stage architecture, differential amplifier, input impedance, CMRR, SVRR, active loading, compensation bandwidth consideration, offset voltages and currents, slew rate.

Unit II:
Linear application of Opamp, positive and negative feedback, inverting and non-inverting amplifier, voltage follower, summing amplifier, Subtractor, phase shifter, voltage to current converter, current to voltage converter, Instrumentation amplifier. Integrator, Differentiator, Active filters: Low pass, high pass, band pass and band reject filters, Butter worth and Chebychev approximation.

Unit III:
ADC/DAC: Converter: ADC dual slope, counter, successive approximation and flash type. DAC weighted R-2R networks, introduction to ADC/DAC ICs. Non - linear application of Opamp: Comparators, Schmitt trigger, (inverting and non -inverting), astable multivibrator, monostable multivibrator (retriggerable and non-retriggerable), triangular wave generator, precision rectifier, peak detector, Log amplifier.

Unit IV:
Other ICs: 555 Timer architecture and applications (Schmitt trigger, monostable and astable multivibrator, linear time base generator), PLL architecture and applications, VCO architecture and applications, IC voltage regulators (fixed and variable).

Text Books:

1. J. Milman and A. Grable, Microelectronics, 2/e, McGraw Hill, 1988.
2. Ramakant Gayakwad, Op-Amps and Linear Integrated Circuits, 4/e, PHI, 2006.
3. M. Roden, G. Carpenter, W. Wieserman, Electronic Design (from concept to reality), 4/e, Schoff Publishers and Distributors, 2002.

Reference Books:

1. S. Franco, Design with Operational Amplifiers and Analog Integrated Circuits, TMH, 1988.
2. Bell, Operational Amplifiers and Linear ICs, 2/e, PHI, 2006.
3. Coughlin and Driscoll, Operational Amplifiers and Linear Integrated Circuits, 6/e, PHI, 2006.

2.5.5 EC - 512 Microprocessor Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 512*
Paper Name	:	*Microprocessor Laboratory.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of experiments:

1. Write an 8085 ALP to perform Binary /BCD addition between two bytes stored in consecutive / different location (Generated Carry)
2. Write an 8085 ALP to perform Binary / BCD subtraction between two bytes stored in consecutive / different locations with sign of the result taken into account.
3. Write an 8085 ALP to generate of Fibonacci Series
4. Write an 8085 ALP to reverse a string .The string is either a binary byte or a bunch of data bytes stored in consecutive locations.
5. Write an 8085 ALP to arrange the bytes (stored in consecutive locations) in sorted order either ascending or descending order.
6. Write an 8085 ALP to verify the incoming and outgoing data using LEDS and a PPI chip.
7. Write an 8085 ALP to generate a square wave of a certain frequency using PPI chip and a CRO display.
8. Write an 8086 ALP to find the largest number from an array of 16 bit numbers stored sequentially in memory location.
9. Write an 8086 ALP to convert a given word into its decimal equivalent.
10. Write an 8086 ALP to find out whether a given byte is present in the string or not.
11. Write a 8086 ALP program to open a new file kmb.dat in the current directory and drive if it is successfully opened. Write 200H Bytes of data into it from a data block named BLOCK. Display a message if the file is not opened successfully.
12. Write an ALP to interface a keyboard with 8086 microprocessor using PPI chips.
13. Write an ALP to interface a stepper motor with 8085 microprocessor using PPI chips

Text Books:

1. Douglas V.Hall, Microprocessor and interfacing, 2/e, McGraw Hill International Ed., 2006.
2. Bary B. Brey, The Intel Microprocessors: 8086/8088, 80286, 80386, 80486, 7/e, PHI, 2006.
3. Ramesh S. Gaonkar, Microprocessor architecture, programming and applications with 8085, 5/e, Penram International Publishing (India) Pvt. Ltd, 2002.

2.5.6 EC -513 Digital Communication Laboratory

Paper Code	:	*EC – 513*	L	-	T	-	P	Cr
Paper Name	:	*Digital Communication Lab*	0	-	0	-	4	2
Contact Hours per Week	:	*4(Four) Hours.*						
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*						
Questions to be Set	:	*Minimum Ten.*						
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*						
Duration of End Semester Examination	:	*3(Three) Hours.*						

List Experiments:

1. Study of Sampling and Quantization.
2. Generation and Detection of PCM.
3. Generation of eye diagrams of four-level PAM Signalling.
4. Generation and Detection of ASK.
5. Generation and Detection of PSK.
6. Generation and Detection of FSK.
7. Generation and Detection of QAM.
8. Study and generation of Source Coding.
9. Study and generation of Channel Coding.
10. Generation of OFDM Transmission of QAM signals.
11. Study of MIMO channel Capacity.

Text Books:

1. J. G. Proakis and S. Salehi, Contemporary Communication Systems Engineering, 2/e, PHI, 2005.
2. S. Haykin, An Introduction to Analog and Digital Communications, Willey Eastern, New York, 1989.
3. B.P. Lathi, Modern Digital and Analog Communication Systems, 4/e, Oxford University Press, 2010.
4. Taub H., Schilling D L. and Saha G., Principles of Communication Systems, 3/e, TMH Publishing Company Ltd, New Delhi, 2008.

2.5.7 EC - 514 Linear IC Systems Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 514*
Paper Name	:	*Linear IC System Lab.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of Experiments:

1. Design a differential amplifier using transistor.
2. Design of analog adder and subtractor using opamp.
3. Design of analog integrator and differentiator using opamp.
4. Design of voltage to current and current to voltage converters using opamp.
5. Design of Comparators and monostable multivibrators using opamp.
6. Design of bistable and astable multivibrators using opamp.
7. Design of opamp R-C phase shift oscillator
8. Desing of opamp based Wien bridge oscillator.
9. Design of opamp based LPF and HPF active filters(first order only).
10. Design of opamp based BPF active filters (first order only)
11. Design of monostable and astable multivibrator using 555 timer.
12. Design of instrumentation amplifier using Opamp.
13. Series and Shunt voltage regulator using IC.

Text Books:

1. Ramakant Gayakwad, Op-Amps and Linear Integrated Circuits, 4/e, PHI, 2006.
2. Bell, Operational Amplifiers and Linear ICs, 2/e, PHI, 2006.

2.6 Sixth Semester Papers

2.6.1 EC - 601 Digital Signal Processing

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 601*
Paper Name	:	*Digital Signal processing.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Discrete Fourier Transform: Frequency domain sampling and reconstruction of discrete time signals: DFT, properties of the DFT, use of DFT in linear filtering, filtering of long data sequences, Efficient computation of the DFT: FFT Algorithms, Radix 2 DITFFT and DIFFFT, in-place computation.

Unit II:
Design of IIR filters: characteristics and design of commonly used filters ñ butter worth and Chebyshev filters, Spectral transformations, Direct design of IIR filters from analog filters by impulse invariance and bilinear transformation. Design of Digital FIR Filters: General considerations, Linear phase FIR Filters, Symmetric and anti-symmetric impulse response, Design using windows, frequency sampling design, optimum design.

Unit III:
Implementation of Discrete time Systems: Structures for FIR systems ñ Direct form, cascade form, frequency sampling structures. Structures for IIR systems: Direct forms, cascade and parallel form structures, Finite word length effects.

Unit IV:
Estimation of power spectra from Finite duration of observation of signals. Non-parametric methods of PSD estimation, Periodogram, Parametric methods of PSD estimation: Autoregressive (AR) model and filter, comparison of estimation methods.

Text Books:

1. Proakis J. G. and Manolakis D. G. Mimitris D., "Introduction to Digital Signal Processing", Prentice Hall, India, 2003.
2. Oppenheim A.V. and Schafer R.W. "Discrete Time Signal Processing", Pearson Education, 2003.
3. Sanjit Mitra K., "Digital Signal Processing: A computer based approach", TMH, 2001.

Reference Books:

1. Rabiner L.R and Gold D.J, "Theory and applications of digital signal processing", Prentice Hall, India, 1988.
2. Johnson J.R, "Introduction to Digital Signal Processing" Prentice Hall, India, 1994.

2.6.2 EC - 602 Microcontroller and Embedded Systems

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 602*
Paper Name	:	Microcontrollers and its Applications
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
The 8051 Microcontrollers, Microcontrollers and Embedded Processors, Overview of the 8051 Family, 8051 Block Diagram, Registers of the 8051, Assembler Directives, PSW Register, Signals and Pins of 8051. 8051 Assembly Language Programming, Instruction set.

Unit II:
8051 Addressing Modes, Single Bit Instructions, 8051 programming in C, Counter/Timer Programming in the 8051, 8051 Serial Communication, 8051 interrupts, Interrupt Enable Register, TCON Register.

Unit III:
Pic Microcontroller: Introduction, architecture, registers, instruction sets, ARM processor fundamentals, and architecture, ARM instruction set and programming.

Unit IV:
Introduction to embedded systems with examples, embedded system design, Memory, Embedded Processors, Architectures, Embedded Systems I/O, Interfacing: bus, LCD, ADC, DAC, Sensors and Memory.

Text Books:

1. Raj Kamal, Embedded System, TMH, 2003.
2. Muhammad Ali Mazidi , Janice Gillispie Mazidi and Rolin D. McKinlay, The 8051 Microconroller and Embedded Systems, Pearson Education, 2006
3. Kenneth Ayala, The 8051 Microcontroller Architecture, Programming and Applications, 3/e, Thomson, Penram International Publishing (India) Pvt. Ltd., 2007.

Reference Books:

1. Dreamtech Software Team, Programming For Embedded Systems Cracking The CodeTM, Wiley Publishing Inc., 2002.
2. FTP websites involved with embedded systems and software.

2.6.3 EC - 603 Microwave Engineering

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 603*
Paper Name	:	Microwave Engineering
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Microwave Transmission lines: Transmission line equations and Solutions, Reflection and Transmission Coefficient, Standing waves and SWR, Line impedance and Admittance, Impedance matching using Smith chart.

Unit II:
Microwave wave guides: Detailed study of Rectangular and Circular waveguides. Microwave components: Cavity resonators, Slow wave structures, Microwave hybrid circuits, S- parameters, Wave guide Tees, Directional Couplers, Circulators and Isolators, Hybrid couplers.

Unit III:
Microwave sources: Klystrons, Reflex klystrons, TWTs, Twystron Hybrid amplifier, BWO, Microwave switching tubes, Magnetrons, Forward wave cross-field amplifiers. Microwave solid state devices: Transistors, Tunnel Diodes, FETs, Gunn diodes, Avalanche transit time devices-Read Diode, IMPATT, TRAPATT, BARITT Diodes,

Unit IV:
Fundamentals of Antennas: Radiation mechanism, radiation patterns, lobes, power density and intensity, directive gain and directivity power gain, beam widths, radiation efficiency, input impedance, effective aperture, antenna temperature.Solution of vector potential wave equation, duality, reciprocity and reaction theorems.

Text Books:

1. D. M. Pozar, Microwave Engineering, 2/e, John Wiley, 1998.
2. S. M. Liao, Microwave Devices and Circuits, 3/e, PHI, 1995.
3. R. E. Collin, Foundations for Microwave Engineering, 2/e, McGraw Hill, 1992.
4. J.D. Kraus, Antennas, 2/e, McGraw Hill Book Co., 1988.

Reference Books:

1. K. C. Gupta, Microwaves, New Age International (P) Ltd., 1983.
2. G. D. Vendelin, A. M. Pavio and U. L. Rohde, Microwave Circuit Design, John Wiley, 1990
3. Guillermo Gonzalez, Microwave Transistor Amplifiers, Analysis and Design, 2/e, Prentice Hall, 2000.
4. Jordan and Balmain, Electromagnetic Wave and Radiating Systems, John Wiley, 2002.

2.6.4 EO - 604X Elective - I: *Core*

2.6.4.1 EO - 6041 Optical Fiber Communication

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 6041*
Paper Name	:	*Optical Fiber Communication.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Six.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Introduction of Optical Communications: The general system, advantages, different communication windows, and different generations, Transmission Characteristics of optical fibers: Ray Theory Transmission-Acceptance angle, NA, Skew rays Wave transmission, Phase and group velocity, Evanescent field, Goos Hanchen Shift cylindrical waveguides- Modes, step index fiber, graded index fiber.

Unit II:
Single and multimode fiber characteristics, Attenuation in Fibers: material absorption, Linear scattering losses, Non-linear scattering losses, fiber bend loss; Dispersion Characteristics: Intermodal and Group Velocity Dispersion.

Unit III:
Optical Sources: Laser-basic concept,lasing action conditions, optical emission from semiconductors, SLD efficiency; LED-requirements, LED power and efficiency,LED structures,LED characteristics, Laser for communication.

Unit IV:
Optical Detectors: requirements for detectors,optical detection principles, responsivity, quantum efficiency, p-n photodiode, p-i-n photodiode,speed of operation, noise,avalanche photodiodes, III-V alloy avalanche photodiodes Multiplexer factor.Power Budget and rise time budget for OFC communication design.

Text Books:

1. Le Nguyen Binh, Optical Fiber Communication Systems with MATLAB and Simulink Models, 2/e,CRC Press,2014
2. G. P. Agarwal, Optical Fiber Communication System, 4/e, John Wiley & Sons, New York, 2010
3. Le Nguyen Binh,Advanced Digital Optical Communications, 2/e. CRC Press, 2015
4. Gerd Keiser, Optical Fiber Communications, 3/e, McGraw Hill, 2000.

Reference Books:

1. Z. Ghassemlooy, W. Popoola, S. Rajbhandari,Optical Wireless Communications: System and Channel Modelling with MATLAB,1/e, CRC Press 2012.
2. G.P. Agarwal, Nonlinear fiber Optics, 2/e, Academic Press, 2000.
3. R. P. Khare, Fiber Optic and Optoelectronics, 1/e, Oxford University Press India,2004
4. Ghatak and Thyagrajan, Introduction to fiber Optics, 4/e, Cambride University Press,USA,2002

2.6.4.2 EO - 6042 Digital Control Systems

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 6042*
Paper Name	:	*Digital Control Systems.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 60, End Semester Examination = 90.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Signal Processing in Sampled Data Control System: Configuration of the basic digital control scheme, Sampling and frequency domain analysis, linear difference equations, data reconstruction process.

Unit II:
Modelling of Discrete Time System: z- transform, pulse transfer function, open loop and closed loop sampled data control system, stability on the z plane and Jury's stability test. state error analysis for stable systems.

Unit III:
Design of Digital Control Algorithm: Digital PID controller, Digital compensator design using root locus plots and frequency response plots.

Unit IV:
State Variable Analysis of Digital Control Systems: State descriptions of digital processors conversion of state variable models to transfer functions and vice versa, solution of state difference equations, state transition matrix, concept of controllability and absorbability- design of state observers.

Text Books:

1. M. Gopal, Digital Control & State Variable Methods: Tata McGraw Hill, Fourth Edition, 2012.
2. B. C. Kuo, Digital Control System: Oxford University Press, Second Edition, 2008.
3. A. Visioli, M. S. Fadali and V. Fadali, Digital Control Engineering: Elsevier Science, 2012.
4. Kannan M. Moudgalya, Digital Control: Wiley, 2009.

Reference Books:

1. K. Ogata, Discrete Time Control System, Pearson Education, Second Edition, 2007.
2. Gene F. Franklin, Abbas Emami-Naeini and J. David Powell, Feedback Control of Dynamic Systems: Pearson Education, Fifth Edition, 2008
3. V. I. George, C. P. Kurian, Digital Control Systems: Cengage, 2012.
4. A. K. Ghosh, Introduction to Linear and Digital Control: Prentice Hall India Learning Pvt Limited, 2007.

2.6.4.3 EO - 6043 Antenna and RADAR Engineering

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 6043*
Paper Name	:	*Antenna and RADAR Engineering*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Linear Wire and Loop Antennas: Small, finite length and half wave length dipoles, determination of radiation fields, radiation patterns, radiation resistance, directivity and input impedance of dipoles, mutual impedance between linear elements, linear elements near infinite lines conductors and ground effects. Propagation of EM wave, Ground wave, Line of sight, Tropospheric and Ionospheric propagation.

Unit II:
Study of different types of antennas: Circular loop with constant current, Square, triangular, rectangular, and rhombic and ferrite loop antennas; Cylindrical dipole, folded dipole, matching techniques, baluns and transformers. Antenna arrays: Two elements array, Nelement linear array, and planar and circular arrays. couplers.

Unit III:
Travelling wave and broad band antennas, Long wire V, rhombic and helical antennas, Yagi Uda array, Huygen's principle, circular apertures, microstrip antennas, Cabinet's principle, sectoral, pyramidal and conical horns, parabolic reflector antennas.

Unit IV:
Radar: Basic principles, Range equation, modification of Radar range equation considering receiver noise and radar frequencies, radar types- Pulsed radar system, PPI, CWD, MTI Displays.

Text Books:

1. J.D. Kraus, Antennas, 2/e, McGraw Hill Book Co., 1988.
2. C. A. Balanis, Antenna Theory, 3/e, John Wiley and Sons, 2005.
3. Skolnik M.I, Radar Systems, TMH, 2006
4. Jordan and Balmain: Electromagnetic Wave and Radiating Systems, John Wiley, 2002.

Reference Books:

1. F.E. Terman, Electronic and Radio Engineering, 4/e, McGraw Hill Book
2. Albert A. Smith, Radio Frequency Principles and its Applications - The generation, propagation and reception of signal and noise, McGraw Hill, 2006.
3. Thomas A. Milligan, Modern Antenna Design, Wiley-IEEE Press, 2/e, 2005.
4. Yi Huang and Kevin Boyles, Antennas: From Theory to Practice, Wiley-IEEE Press, 2008.

2.6.4.4 EO - 6044 Data Communication

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 6044*
Paper Name	:	*Computer Communication*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Protocols- review: OSI, TCP/IP, IBM, SNA, ATM. Bit oriented (BSC) & Character oriented Protocol (SDLC, LAPB, LAPD, LLC), HDLC- frame format, station, states, configuration, access control.

Unit II:
IEEE standards, fiber optic network. LAN Topology Ethernet (IEEE 802.3), Token Bus (IEEE 802.4), Token Ring (IEEE 802.5). WAN Topology DQDB (IEEE 802.6) & FDDI. Switching Technologies Circuit, Message, and Packet. X.25, X.21, RS-232 C frame format, channel, packet frames, facilities.

Unit III:
ISDN: Principles and objectives, ISDN channels, International Standards, NT1, NT2, TA, TE Devices. Introduction to leased lines, DSL, Digital Carriers.

Unit IV:
Bridging & Routing: Static & Dynamic. IP, IP addressing, ICMP, ARP.RARP. Congestion Control, TCP, UDP. HTTP, FTP, Telnet, SMTP. Introduction to data security: private key, public key, ISO standards.

Text Books:

1. Forouzan, Data Communication and Networking, TMH, 2005.
2. Tannenbaum, Computer Networks, PHI, 2005.
3. Stallings, Data and Computer Communications, PHI, 2005.

Reference Books:

1. Walrand, Comminication Networks, TMH, 2003.
2. Shanmugam and Rajeev, Computer Communication Networks, ISTE/EXCEL, 2004.
3. Prakash C. Gupta, Data Communications, PHI, 1992.
4. Tittel, Computer Networking, Schaum Outline Series, TMH, 1998.
5. Miller, Data and Network Communications, VIKAS, 1994.
6. Dr. Prasad, Data Communication and Network, Wiley Dreamtech, 1994.
7. Prasad, Computer network Theory, Scitech,1998.
8. Martin P. Clark, ATM Networks Principles and Uses, John Wiley, 1996.
9. Hunt, TCP/IP Network Administration, SPD/O'REILLY, 1998

2.6.4.5 EO - 6045 Nano Electronics

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3	-	1	-	0	4

Paper Code	:	*EO – 6045*
Paper Name	:	*Nanoelectronics*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Overview: Nano devices, Nano materials, Nano characterization. Definition of Technology node, Basic CMOS Process flow. MOS Scaling theory, Issues in scaling MOS transistors : Short channel effects, Description of a typical 65 nm CMOS technology. Requirements for Non classical MOS transistor.

Unit II:
MOS capacitor, Gate oxide thickness scaling trend, SiO2 v/s High-k gate dielectrics. Integration issues of high-k dielectrics. Transport in Nano MOSFET, velocity saturation, ballistic transport, velocity overshoot.

Unit III:
SOI - PDSOI and FDSOI. Ultrathin body SOI - double gate transistors, integration issues.Vertical transistors - FinFET and Surround gate FET. Metal source/drain junctions - Properties of schotky junctions on Silicon, Germanium and compound semiconductors.

Unit IV:
Characterization techniques for nanomaterials: XRD, AFM, SEM, TEM etc. Applications and interpretations of results. Emerging nano materials : Nanotubes, nanorods and other nano structures.

Text Books:

1. Fundamentals of Modern VLSI Devices, Y. Taur and T. Ning, Cambridge University Press,1/e, 2003.
2. Ultra thin Body MOSFETs and FinFETs, J. G. Fossum, V.P. Trivedi, Cambridge University Press, 1/e, 2012.
3. Silicon VLSI Technology, Plummer, Deal , Griffin , Pearson Education India,1/e, 2009.

Reference Books:

1. Yannis Tsividis, Operation and Modeling of the MOS Transistor, 2/e, OUP, 2003.
2. Brundle, C.Richard, Evans, Charles A. Jr., Wilson, Shaun, Encyclopedia of Materials Characterization, Butterworth-Heinemann (Elsevier), 1992.

L	-	T	-	P	Cr
3	-	1	-	0	4

2.6.4.6 EO - 6046 Digital System Design using VHDL

Paper Code	:	*EO – 6046*
Paper Name	:	*Digital System Design using VHDL.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Introduction: Introduction: VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter. Additional Topics in VHDL: Attributes, Transport and Inertial delays, Operator overloading, Multi-valued logic and signal resolution, IEEE-1164 standard logic, Generics, Generate statements, Synthesis of VHDL code, Synthesis examples, Files and Text IO.

Unit II:
Designing With Programmable Logic Devices: Read-only memories, Programmable logic arrays (PLAs), Programmable array logic (PLAs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner. Designing With Programmable Gate Arrays And Complex Programmable Logic Devices: Xlinx 3000 series FPGAs, Designing with FPGAs, Xlinx 4000 series FPGAs, using a one-hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series CPLDs.

Unit III:
Design Of Networks For Arithmetic Operations: Design of a serial adder with accumulator, State graphs for control networks, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider. Digital Design with SM Charts: State machine charts, Derivation of SM charts, Realization of SM charts. Implementation of the dice game, Alternative realization for SM charts using microprogramming, Linked state machines.

Unit IV:
VHDL Models For Memories And Buses: Static RAM, A simplified 486 bus model, Interfacing memory to a microprocessor bus. Floating-Point Arithmetic: Representation of floating-point numbers, Floating-point multiplication, Other floating-point operations.

Text Books:

1. Charles H. Roth. Jr:, Digital Systems Design using VHDL, Thomson Learning, Inc, 9th reprint, 2006.

Reference Books:

1. Stephen Brwon & ZvonkoVranesic, Fundamentals of Digital Logic Design with VHDL, Tata McGrw-Hill, New Delhi, 2nd Ed., 2007
2. Mark Zwolinski, Digital System Design with VHDL, 2 Ed, Pearson Education., 2004
3. Volnei A Pedroni . Circuit Design with VHDL. MIT Press, 2004

2.6.5 EC - 611 Digital Signal Processing Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 611*
Paper Name	:	*Digital Signal Processing Laboratory.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of Experiments:

1. Perform DFT and IDFT of a sequence.
2. Perform Circular convolution of two sequences.
3. Implement the overlap and save method of filtering of a long data sequence.
4. Implement the overlap and add method of filtering of a long data sequence.
5. Design a Butterworth Low Pass filter with the following specifications: Stop band edge frequency Fs=800kHz with stop band ripple of 30dB, Pass band edge frequency Fp=1kHz with pass band ripple of 0.5dB. Assume the sampling frequency 8 kHz. Use impulse invarient method.
6. Design a Type 1 Chebyshev IIR high pass filter with normalized pass band edge at 0.7 , normalized edge at 0.5 , pass band ripple of 1dB, and minimum stop band attenuation of 32dB. Take the sampling frequency to be 8kHz. Use Bilinear Transform.
7. Design an IIR Butterworth band pass filter with following specifications: Stop band edge frequencies Fs1=800Hz and Fs2=3kHz with stop band ripple of 40dB, Pass band edge frequencies Fp1=900Hz and Fp2=2.8kHz with pass band ripple of 1dB. Assume the sampling frequency 12kHz. Use Bilinear transform.
8. Design a Type 1 Chebyshev IIR highpass digital filter with following specifications: Passband edge Fp=700Hz with passband ripple of p=1dB, Stopband edge Fs=500Hz with minimum stopband attenuation s=32dB. Plot the gain responses of a) the prototype analog LPF and b) the transformed digital HPF filter. Take T=2sec. Use spectral transformation method.
9. Design a linear phase FIR highpass filter with the following specifications: stopband edge s=0.45, passband edge at p=0.6 , maximum passband attenuation of p=0.2dB, and minimum stopband attenuation of s=45dB. Use Rectanguar window for the design. Plot the gain response of the designed filter.
10. Design a linear phase FIR highpass filter with the following specifications: stopband edge s=0.45, passband edge at p=0.6, maximum passband attenuation of p=0.2dB, and minimum stopband attenuation of s=45dB. Use Hamming window for the design. Plot the gain response of the designed filter.
11. Write a program to estimate the Power spectral density (PSD) of an input consisted of two sinusoids using (i) non- overapping and (ii) overlapping sections.
12. Write a program to estimate the PSD of an input signal composed of two sinusoids burried in noise.

Text/Reference Books:

1. S. K. Mitra, "Digital Signal Processing", 3/e, TMH, 2006.
2. V. K. Ingle and J. G. Proakis, "Digital Signal Processing using MATLAB", International Thomson Publishing, 1997.
3. S. Salivahanan, A. Vallavaraj and C. Gnanapriya, "Digital Signal Processing", 5/e, TMH, 2002.

2.6.6 EC - 612 Microcontroller and Embedded Systems Laboratory

			L	-	T	-	P	Cr
Paper Code	:	*EC – 612*	0	-	0	-	4	2
Paper Name	:	*Microcontrollers and Embedded System Lab.*						
Contact Hours per Week	:	*4(Four) Hours.*						
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*						
Questions to be Set	:	*Minimum Ten.*						
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*						
Duration of End Semester Examination	:	*3(Three) Hours.*						

List of Experiments:

1. Write a program to add ten numbers using 8051.
2. Write a program to find no of 1's in a given 16 bit number using 8051.
3. Write a program to convert packed BCD to ASCII code using 8051.
4. Write a program on 8051 a) To clear the accumulator & add 5 to accumulator 20 times. b) Write a program to load accumulator with the value 65H & complement the accumulator 100 times.
5. Write an 8051 ALP to move block of data bytes present in internal memory with starting address 10H and ending address 20H to the destination memory with starting address 30H.
6. Write an 8051 ALP to move block of data bytes present in external memory with starting address 8000H to the destination memory with starting address 9000H and size of array is 10H.
7. Write an 8051 ALP to add 'n' bytes stored in external RAM
8. 15. Write an 8051 ALP to convert hexadecimal number to its equivalent decimal number.
9. Write an 8051 ALP to convert decimal number to its equivalent ASCII code.
10. Write a program using 8051 to convert ASCII code to its equivalent decimal number.
11. Write an 8051 ALP to get 8-bit data from P1 and send it to ports P0, P2 and P3(86)
12. Write an 8051 ALP to illustrate addition, subtraction, multiplication and division of two 8 bit numbers.
13. Write an 8051 ALP to illustrate a) addition and b) subtraction of two 8 bit numbers.
14. Write an 8051 ALP to illustrate a) multiplication and b) division of two 8 bit numbers.
15. Interfacing of ADC and DAC.
16. Interfacing of LED and LCD.
17. Interfacing EPROM and interrupt
18. Interfacing stepper motor and temperature sensor.

Text Books:

1. Dreamtech Software Team, Programming For Embedded Systems Cracking The CodeTM, Wiley Publishing Inc., 2002.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems, 2/e, Pearson Education, 2009.
3. Raj Kamal, Embedded system, TMH, 2003.

2.6.7 EC - 613 Microwave Engineering Laboratory

L	-	T	-	P	Cr
0	-	0	-	4	2

Paper Code	:	*EC – 613*
Paper Name	:	*Microwave Lab.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of Experiments:

1. Study the characteristics of a rectangular waveguide.
2. Determine the standing wave ratio and reflection coefficient.
3. Measurement of unknown impedance using Smith Chart.
4. Study the characteristics of a Gunn diode.
5. Study the characteristics of a directional coupler.
6. Study of power division in a Magic Tee.
7. Study the isolator and circulators.
8. Study the fixed and variable type attenuators.
9. Study the characteristics of a cavity resonator.
10. Study the characteristics of a microwave filter.
11. Study the characteristics of a Klystron amplifier.
12. Study the characteristics of a Reflex Klystron amplifier.
13. Study the characteristics of a Magnetron.
14. Study the characteristics of a TWT.
15. Study the characteristics of microwave a BJT.
16. Study the characteristics of microwave a FET.
17. Study the characteristics of a microwave avalanche diode oscillator.
18. To design a single stage microwave amplifier.
19. To design a single stage microwave oscillator.

Text Books:

1. S. M. Liao, Microwave devices and Circuits, 3/e, PHI, 1995.

2.7 Seventh Semester Papers

2.7.1 HU - 701X Elective - II:

2.7.1.1 HU - 7011 Business Management

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*HU – 7011*
Paper Name	:	*Business Management*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I
Entrepreneurship Theory -The Entrepreneurial Mindset, The Entrepreneurial Process Creativity and Innovation, Entrepreneurship Practice, Essentials of Business Ownership, New Venture Planning and Creation, Managing and Growing the Venture.

Unit II:
Concept of demand and supply, elasticity of demand, types of market structure, firm and industry, business cycle, input and out analysis, plant location decision, types of cost, Production process, types of production, plant layout, production planning and control, Inventory control techniques.

Unit III:
Management principles and functions, managerial skills, decision making process, types of organization structures, Maslow's hierarchy of needs, types of communication, leadership styles.

Unit IV:
Marketing concept, factors affecting consumer behavior, types of market segments, product life cycle, pricing methods, distribution channels, advertising and sales promotion, value engineering.

Text Books:

1. R.R. Barthwal, Industrial Economics: An Introductory Text Book, New Age, 2000.
2. Ahuja, H, L., Managerial Economics, S. Chand and Company Ltd., New Delhi, 2007.
3. Murugan , M and Sakthivel, Management Principles and Practices , New Age International Publishers, New Delhi, 2008.
4. Aswathapa, K, Human Resource and Personnel Management, TMH, New Delhi, 2005.
5. Kotler, Keller, Koshy, Jha, Marketing Management-A South Asian Perspective, Pearson Ltd., 2009.
6. Entrepreneurship-Class XII-C. B. S. E. Delhi
7. Entrepreneurial Development by C. B. Gupta and N. P. Srinivasan, Publisher Sultan Chand & Sons, 1992.

2.7.1.2 HU - 7012 IPR and Professional Ethics

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*HU – 7012*
Paper Name	:	*IPR and Professional Ethics*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
IPR I: Intellectual property, definition, types, rights and functions, patents, trademark, software design, industrial designs, semi-conductor and integrated circuits layout design, grant of patent in India, authority and procedure, patent forms, surrender and revocation of patents and compulsory licensing, acquisition of inventions by the Government.

Unit II:
IPR II: Contents of draft application for patents, Drafting patent specification and claims, WTO and drafting patent specification and claims, IPR infringement and piracy under Indian Laws.

Unit III:
Engineering as a profession, historical and social context, Ethics in Engineering, Codes of Engineering Ethics, history and purpose, consequentialism and utilitarianism, Deontological approaches, duties, rights and respect for a person, responsibility, virtue Ethics, honesty, moral autonomy, obligations of Engineering profession and moral propriety.Engineer's moral responsibility for safety and human right, risk assessment and communication, product liability, development ethics, engineers and employer relationship, whistle blowing and its moral justifications. Computer Ethics: Social impact of computers, privacy, cybercrime, ethical use of software

Unit IV:
Summary Provision of IPR act: Introduction, Patents , Patent Databases & Patent Information System , Preparation of Patent Documents, Process for Examination of Patent Application, Patent Infringement, Recent Developments in Patent System , Trademarks, Copyrights, Industrial Designs, Protection of Trade Secrets, Key Business Concerns in Commercializing Intellectual Property Rights.

Text Books:

1. Vinod V. Sople, Managing Intellectual Property: The Strategic Imperative, PHI, 2006.
2. Charles and Harri Michael S Pritchard and Michael J Robins, Engineering Ethics: Concepts and cases, Wordsworth/ Thompson Leaaring, Belmont Calif, 2000.
3. (Case study of selected legal battles/cases on IPR and related issues).
4. Dr. B. L. Wadehra, Law Relating to Intellectual Property, Universal Law Publishing, 2009.

Reference Books:

1. Huff and Finholt, Social Issues in Computing: Putting Computing in Place, McGraw Hill,1994.
2. Govindarajan, Natarajan and Senthil Kumar, Engineering Ethics, PHI, 2004.
3. Jones and Bartlett, Cyber Ethics: Morality and Law in Cyber Space, 4/e, Jones and Bartlett India Pvt. Ltd., 2011.
4. Schinzinger Roland Mike and Martin, Introduction to Engineering Ethics, Boston MA: TMH, 2000.
5. Robin Attfield, A theory of value and obligation, London, CroomHelm, 1987.
6. M. Govindarajan, S. Vatarajan and V. S. Senthilkumar, Engineering Ethics includes Human Values, PHI, 2009

2.7.1.3 HU - 7013 Business Survey and Research

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*HU – 7013*
Paper Name	:	*Business Survey and Research*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I: Introduction: Concept of Research: objectives, Motivation, Importance & types of research Social research: Nature, scope, importance & limitations. Role of research in functional areas of business: Accounting, finance, marketing, human resource management

Unit II:
Research Process: Scientific method: steps involved in a process of research, Process of formulating research problem, Defining problem, Hypothesis formation, Sources of data : primary and secondary, Qualities of workable hypothesis, Importance of Hypothesis, Research Design, Criteria of a good research design, Types of research design, Experimental method: Definition, characteristic, and steps involved, Difficulties in experimental method, advantages & limitations. Observation: meaning & characteristics, types, advantages & disadvantages

Unit III:
Sampling Meaning, Advantages, and disadvantages, Sampling Design, Different types of sampling design used for business research. Measurement in research: Possible sources of error in measurement
Tools used: Schedule & questionnaire: Meaning Types of schedules, Evaluation of schedule/questionnaire, construction of questionnaire, layout of questionnaire, essentials of a good questionnaire, Interview: meaning & role, objectives, types of interviews, the process of interviews advantages & disadvantages of interviews

Unit IV:
Data presentation: Tabular and graphical Analysis: Uni-variate, bi-variate analysis Report writing: Categories of report, Parts of Report, Presentation of a report, Essential qualities of research report

Text Books:

1. Cooper & Schindler: Business Research Methods, Tata McGraw Hills, New Delhi.
2. Gaur & Gaur: Statistical Methods for Practice and Research, Sage Publications.
3. Johnson & Clarke: Business and Management Research Methodology, Sage Publications.
4. Saunders: Research Methods for Business Students, Pearson India, New Delhi.

Reference Books:

1. Creswell, JW: Research Design, Sage Publications
2. Smith & Album: Fundamental of Marketing Research, Sage Publications
3. Smith, Thorpe & Lowe: Management Research, Sage Publications, 2007

2.7.2 EC - 702 Fundamental of Mobile Communication

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 702*
Paper Name	:	*Fundamental of Mobile Communication*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Cellular Architecture - Multiple Access techniques - FDMA, TDMA, CDMA and their Capacity calculations Cellular concept- Frequency reuse - channel assigning techniques- hand off-different types interference and system capacity- trunking and grade of service methods of coverage and capacity improvement.

Unit II:
Large scale fading Free Space and Two-Ray models -Link Budget design , Concept of Small scale fading- Parameters of mobile fading channels Time dispersion parameters- Coherence bandwidth Doppler spread & Coherence time, Flat fading and frequency selective fading, fast fading and slow fading.

Unit III:
Techniques to Mitigate the fading effect : Equalisation Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity Micro and Macrodiversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

Unit IV:
Introduction to 4G features and challenges of 4G, various applications of 4G, 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

Text Books:

1. Jochen Schiller, Mobile Communications, Second Edition, Pearson Education 2012.
2. W. C. Y. Lee, Mobile Communications Design Fundamentals, 2/e, Wiley, 2011.
3. T. S. Rappaport, Wireless Communications, 2/e, Pearson Education, 2010.
4. G. H. Stuber, Principles of Mobile Communications, 3/e, Kluwer, 2012.

2.7.3 EE - 703 Control Systems

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 703*
Paper Name	:	*Control System.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Introduction to Control Systems & Time response Analysis: Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph, Transient and steady-state analysis of LTI systems.

Unit II:
Stability Analysis, Control Actions and Error Constants, : Steady -state errors and error constants, Routh-Hurwitz stability criteria and Bode and root-locus plots; Control actions: Proportional, integral, derivative, and their combinations. Stability analysis.

Unit III:
Frequency Response Analysis & Compensators: Bode plot, Nyquist stability criterion, lead, lag and lag-lead compensator.

Unit IV:
State Variable Analysis: State variable model and solution of state equation for LTI systems, Elementary concept of controllability and observability.

Text Books:

1. Nagrath and Gopal, Modern Control Engineering: New Ages International, Fifth Edition, 2007.
2. K Ogata, Modern Control Engineering: Phi Learning Pvt. Ltd., Second Edition, 2009.
3. Richard C. Dorf and Robert H.Bishop, Modern Control System Engineering: Pearson Education, Twelfth Edition, 2014.
4. B. C. Kuo and Farid Galnaraghi, Automatic Control System: Wiley India Pvt Ltd, Nineth Edition, 2014.

Reference Books:

1. M. Gopal, Control Systems: Principles and Design: Tata McGraw-Hill, Third Edition, 2008.
2. S. K. Bhattacharya, Control Systems Engineering: Pearson India, 2013.
3. B. S. Manke, Linear Control Systems with MATLAB Applications: Khanna Publishers, Eleventh Edition, 2012.
4. R. Ananda Natarajan and P. Ramesh Babu, Control Systems Engineering: Scitech Publications (India) Pvt. Ltd, Second Edition, 2011.

2.7.4 EC - 704 VLSI Systems

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 704*
Paper Name	:	*VLSI Systems.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Unit steps for IC fabrication, Crystal growth and Wafer preparation, Oxidation, Diffusion, Ion Implantation, Lithography, Deposition, Metallisation, MOS Fabrication.

Unit II:
VLSI design flow, Moore's law, MOS transistor characteristics, types of MOS transistors, Basic MOS Device Physics, Small-Signal Model for the MOS, NMOS and CMOS inverter circuits, MOS inverter Static and Switching Characteristics, Scaling Theory, Design rules and Layouts, Pass Transistor Logic, Transmission Gate Logic,Combinational MOS logic Circuit Design.

Unit III:
Sequential MOS logic Circuits: SR latch, Clocked latches, CMOS D-latch, Flip-Flop Circuits using MOS, Dynamic Logic Circuits, Pseudo n-MOS, Semiconductor memories, Bi-CMOS logic circuits, Low power design approaches, Analog CMOS Subcircuits: MOS Diode/Active Resistor, Current Sinks and Sources, Current Mirrors, Current and Voltage References, CMOS Single Stage Amplifiers, Differential Amplifier.

Unit IV:
High level Synthesis, Scheduling, Allocation and Binding, Finite State Machine Synthesis, Physical Design Automation: Placement, Floor planning and Routing Binary Decision Diagram: Introduction and construction, Introduction to Verification.

Text Books:

1. B. Razavi, Design of Analog CMOS Integrated Circuits, McGraw-Hill, 2000.
2. Sung-Mo (Steve) Kang,Yusuf Leblebici ,CMOS Digital Integrated Circuits Analysis & Design, 4/e, 2014.
3. Phillip E. Allen and Douglas R. Holberg, CMOS Analog Circuit Design, 3/e, Oxford,2011.
4. G. De Micheli. Synthesis and optimization of digital circuits, 1st edition, 1994.
5. D. D. Gajski, N. D. Dutt, A.C.-H. Wu and S.Y.-L. Lin, High-Level Synthesis: Introduction to Chip and System Design, Springer, 1st edition, 1992.
6. S.M. Sze, VLSI Technology, 2/e, McGraw-Hill International Editions, 1988.

Reference Books:

1. Yannis Tsividis & Colin McAndrew, The MOS Transistor, 3/e, Oxford, 2013
2. Bushnell and Agrawal, Essentials of Electronic Testing for Digital, Memory & Mixed-Signal Circuits, Kluwer Academic Publishers, 2000.
3. M. Huth and M. Ryan, Logic in Computer Science modeling and reasoning about systems,Cambridge University Press, 2nd Edition, 2004.

2.7.5 EO - 705X Elective - II *Open*

2.7.5.1 EO - 7051 Fundamentals of Biotechnology

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 7051*
Paper Name	:	*Fundamentals of Biotechnology*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Structure of prokaryotic and eukaryotic cells: Bacterial chromosomes and plasmids; Cellular organelles: plasma membrane, cell wall, mitochondria, nucleus and other organelles and their organization, Golgi bodies and endoplasmic reticulum; Cell cycle and cell division (Mitosis and Meiosis)

Unit II:
Types of macromolecules in biological systems; Conformational properties of polynucleotide and polysaccharides; Secondary and tertiary structural features of proteins and their analysis; Protein folding; Physical techniques in protein, nucleic acids and polysaccharide structural analysis: Gas Chromatography, HPLC, Crystallography, electron microscopy, electrophoresis and centrifugation

Unit III:
Structure of DNA and its properties; Sequence component of eukaryotic genome; Prokaryotic and eukaryotic DNA replication; Mechanism of transcription and post-transcriptional modifications of RNAs; Features of genetic code; Prokaryotic and eukaryotic translation. Regulation of gene expression: Prokaryotic Gene expression with reference to inducible and repressible operons; Concept of eukaryotic gene regulation.

Unit IV:
Milestones in Genetic Engineering; Molecular tools and their applications; The use of reverse transcriptase, cDNA; Transgenic organisms; Importance of genome project; Introduction to Bioinformatics and its applications; human genome project and role of computational biology; Targated gene replacement; Gene Therapy; Sequence analysis: Paired, multiple and dotplot methods of alignment; concept of database; Tools/algorithms: Basic Local Alignment Search Tool, FASTA; Biotechnology and engineering; Concept of safety and ethics associated with gene manipulation.

Text Books:

1. Albert, B. et al. Molecular Biology of Cell, Garland Publishers, 2001 or latest
2. Lodish et al., Molecular Cell Biology, Scientific American Books, 2000.
3. Lewin, B., Gene VIII, Oxford University Press, 2003.
4. D. M. Grover and B. D. Hames, DNA Cloning: a practical approach, IRL Press, Oxford 1995
5. P. Mehrotra, K. Sarin and S.K. Srivastav, The New Handbook of Bioinformatics,Vikash Publishing House Pvt Ltd, New Delhi, 2005

2.7.5.2 EO - 7052 Advanced Digital Signal Processing

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 7052*
Paper Name	:	*Advanced Digital Signal Processing.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
sufficiency of the Fourier Transform for causal Sequences, Discrete Hilbert transforms (HT), Real & Imaginary Part, Sufficiency Theorems for Finite length Sequences, Relationship between Magnitude & Phase, HT Relation for complex sequences.

Unit II:
Multirate signal processing, The basic sample rate conversion, Multistage Design of Decimator & interpolator. The polyphase Decomposition, Digital filter banks, Nyquist filters, two channel quadrature mirror filter bank.

Unit III:
Introduction to Adaptive filters, Examples of Adaptive filtering, The minimum mean Square Error Criterion, The windrow LMS algorithm, Recursive Least Square Algorithm, Forward & Backward Lattice method, Gradient adaptive Lattice method.

Unit IV:
Definition of complex cepstrum, Homomorphic Deconvolution, Properties of complex Logarithm, The complex cepstrum of exponential sequences, Realization of the Characteristic system for homomorphic deconvolution, Examples of Homomorphic Filtering, Application to speech processing.

Text Books:

1. A V Oppenheim and R.W Schafer, "Discrete-Time Signal Processing", PHI, 1999.
2. P.P.Vidyanathan, "Multirate signal processing and filter banks", PHI, 2000.
3. Simon Haykin, " Adaptive Filter Theory", 5/e John Wiley, 2013.

Reference Books:

1. S K Mitra, "Digital Signal Processing", 3/e, TMH, 2006.
2. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing", 3/e, PHI, 2000.

2.7.5.3 EO - 7053 Digital Image Processing

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 7053*
Paper Name	:	*Digital Image Processing*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I
Fundamentals of digital image processing, image perception, Image sensing and acquisition, sampling and Quantization, image representation.

Unit II:
Introduction to Image Transforms, Multi-dimentional Fourier and z-transfroms, Discrete Fourier Transform, Cosine Transform, Walsh transform Haar transform, discrete wavelet transform.

Unit III:
Histogram processing of digital image, Basic grey level transformations, Histogram equalization, Algebraic and Geometric operations in Image processing. Spatial domain and frequency domain filtering, Smoothing, sharpening filters, Laplacian filters, Optimal filters.

Unit IV:
Image Segmentation, Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation, Introduction to various Image Compression Algorithms and standards.

Text Books:

1. Rafael C. Gonzalez, Richard E Woods, "Digital Image Processing", 2/e, Pearson Education, 2003.
2. A. K. Jain, "Fundamentals of Digital Image Processing", PHI, 1995.

Reference Books:

1. William K Pratt, "Digital Image Processing", John Willey, 2001.
2. Kenneth R. Castleman "Digital Image processing", PHI, 2005.

2.7.5.4 EO - 7054 Fundamentals of Speech Processing

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 7054*
Paper Name	:	*Fundamentals of Speech Processing.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

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

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

Unit - IV:
Speech Synthesis: Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, subword units for TTS, intelligibility and naturalness – role of prosody, Applications and present status. *Speech Modeling*: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

Text Books:

1. Lawrence Rabinerand 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*, 2/e, Pearson Education, 2008.

Reference Books:

1. Ben gold and Nelson Morgan, *Speech and Audio Signal Processing, Processing and Perception of Speech and Music*, Wiley- India Edition, 2006.
2. Claudio Becchetti and Lucio Prina Ricotti, *Speech Recognition*, John Wiley and Sons, 2008.
3. Steven W. Smith, *The Scientist and Engineer's Guide to Digital Signal Processing*, Elsevier, 2005.
4. Thomas F Quatieri, *Discrete-Time Speech Signal Processing – Principles and Practice*, Pearson Education, 2001.
5. Frederick Jelinek, *Statistical Methods of Speech Recognition*, MIT Press, 1998.

2.7.5.5 EO - 7055 Advanced Communication Theory

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 7055*
Paper Name	:	*Advanced Communication Theory*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Wireless Channel Models: Types of the channels, Central limit theorem, Statistical modelling of the channels: Rayleigh, Rice, Nakagami-m. Diversity types, Diversity receivers, Performance of the diversity receivers over fading channels.

Unit II:
Spread Spectrum Techniques: Wireless Channel Parameters (Delay Spread and Doppler Spread), Direct Sequence and Frequency Hopped Spread Spectrum Techniques: Walsh Code, Pseudo Random Code, Mean and Variance of Random Codes, Synchronous CDMA, Auto and Cross Correlations of Spreading Codes and Signals, Synchronous Code Division Multiple Access (CDMA) Systems, Bit-Error-Rate Analysis of Synchronous CDMA Systems.

Unit III:
OFDM transmission: Basic principles of OFDM, OFDM demodulation, OFDM implementation using IFFT/FFT processing, Cyclic-prefix insertion, Frequency-domain model of OFDM transmission, Channel estimation and reference symbols, Frequency diversity with OFDM: importance of channel coding, Selection of basic OFDM parameters, OFDM subcarrier spacing, Number of subcarriers, OFDM as a user-multiplexing and multiple-access scheme, Multi-cell broadcast/multicast transmission and OFDM

Unit IV:
LTE introduction and design targets: LTE design targets - Capabilities, System performance, Deployment-related aspects, Architecture and migration, Radio resource, Complexity, General aspects, SAE design targets. LTE radio interface architecture, LTE states.

Text Books:

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, 3G Evolution HSPA and LTE for Mobile Broadband, Published by Elsevier Ltd., 2007.
2. M.R. Karim and M. Sarraf, W-CDMA and cdma2000 for 3G Mobile Networks, McGraw-Hill, 2002.
3. Erik Dahlman , Stefan Parkvall , Johan Skold, 4G: LTE/LTE-Advanced for Mobile Broadband, 2/e, Published by Elsevier Ltd, 2014.

Reference Books:

1. Savo G. Glisic, Advanced Wireless Communications 4G Cognitive and Cooperative Broadband Technology, Second Edition, Jhon Wiely and Sons, 2007.
2. Henrik Schulze and Christian Luders, Theory and Applications of OFDM and CDMA Wideband Wireless Communications, Jhon Wiely and Sons, 2005.

2.7.5.6 EO - 7056 Optical Networks

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 7056*
Paper Name	:	*Optical Networks.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Six.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Introduction to Optical Networks: Telecommunication Network Architechure,Circuit and Packet Switching, communication windows, and different generations, Transmission Characteristics of optical Multiplexing techniques,Optical Layer, Transmission Basics, Network Evolution, single mode fiber and optical amplifier

Unit II:
Transmission system: System model, Power Penalty, Transmission Receiver, Optical amplifiers (EDFA, RA, SOA etc): Basic operating principle of optical amplifiers, comparative study and its application in Optical communication and networks, Crosstalk, Dispersion: Intra and intermodal dispersion, dispersion modified fibers,

Unit III:
Photonic Networks: SONET/SDH- Multiplexing,optical layers, SONET fram structure,optical transport network-hierarchy, frame structure, multiplexing,Generic Framing Procedure-GFP frame, GFP Common Aspects,Ethernet-MAC, switches, Ethernet physical layer,carrier transport,IP, routing and forwarding, quality of service,storage area of network

Unit IV:
WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers-OADM architechures, Reconfigurable OADMs, Optical Crossconnects-All optical OXC configurations

Text Books:

1. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A Practical Perspective, 3/e, Morgan Kaufmann Publishers, 2010.
2. Debra Cameron, Optical Networking, Wiley, December, 2001.
3. John Senior, Optical Fiber Communications, 2/e, PHI, 1992.

Reference Books:

1. Gred Keiser, Optical Fiber Communications, 3/e, McGraw Hill, 2000.
2. G.P. Agarwal, Nonlinear fiber Optics, 2/e, Academic Press, 2000.
3. R. P. Khare, Fiber Optic and Optoelectronics, 1/e, Oxford University Press India,2004
4. Bishnu P. Pal, Fundamental of fiber optics in Telecommunication and sensor systems, Wiley Eastern Ltd, New Delhi, 1994.

2.7.5.7 EO - 7057 Smart Systems

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 7057*
Paper Name	:	*Smart Systems.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 40, End Semester Examination = 60.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Smart Systems : Basic concepts; Evolution of smart systems.
Application Domains: Consumer electronics, vehicle, defense, safety, healthcare, signal processing,embedded systems.

Unit II:
Smart Materials: Structures and features of smart materials; smart devices and systems. Smart Electronics Systems: Intelligent electronic systems; Architectures.

Unit III:
Smart System Integration: MEMS and embedded intelligence; Design Challenges; Simulation.

Unit IV:
Smart Systems and Internet of Things(IOT): Overview; Smart sensors and IOT.

Text Books:

1. Editors: Bombieri, Nicola, Poncino, Massimo, Pravadelli, Graziano (Eds.), Smart Systems Integration and Simulation,Springer,2016.
2. Donald J. Leo,Engineering Analysis of Smart Material Systems, Wiley,2007.
3. L.L. Hench and J.K. West, Principles of Electronic Ceramics, A Wiley-Interscience Publication, NY, 1990
4. V.K.Varadan, K.J.Vinoy, S.Gopalakrishnan, Smart Material Systems and MEMS, Wiley India,2013.

Reference Books:

1. Solymar, D. Walsh, Lectures on the Electrical Properties of Materials, Oxford University Press, Oxford, 1993.
2. V.K.Varadan, K.J.Vinoy, S.Gopalakrishnan, Smart Material Systems and MEMS, Wiley India,2013.
3. E. Gaura and R. Newman, Smart MEMS and Sensor Systems, Imperial College Press, 2006.
4. Internet of Things, web resouces: https://www.internetsociety.org/iot

2.7.5.8 EO - 7058 Social Robotics

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EO – 7058*
Paper Name	:	*Social Robotics.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 60, End Semester Examination = 90.*
Questions to be Set	:	*Eight.*
Questions to be Answered	:	*Any 5(Five).*
Duration of End Semester Examination	:	*3(Three) Hours.*

Unit I:
Introduction to Robotics: Definition; Evolution and applications; Classifications; Design principles.

Unit II:
Social Robotics: Definition; Evolution ; Application Domains; Social Roles; Artificial Intelligence, Machine Learning.

Unit III:
Human-Robot Interaction: Ethical Issues for HRI; Evaluation;Social Interaction.

Unit IV:
Designing Challenges:Design and Human Factors; Hardware and software requirements; case studies.

Text Books:

1. C. Breazeal, Designing sociable robots, MIT Press, 2004.
2. T. Kanda and H. Ishiguro, Human-Robot Interaction in Social Robotics, CRC Press, 2012.

Reference Books:

1. S. Kelsey and K.S. Amant, The Handbook of Research on Computer Mediated Communication, IGI Global, 2008.

2.7.6 EC - 713 VLSI Systems Laboratory

L	-	T	-	P	Cr
3	-	1	-	0	4

Paper Code	:	*EC – 714*
Paper Name	:	*VLSI Systems Lab.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 20, End Semester Examination = 30.*
Questions to be Set	:	*Minimum Ten.*
Questions to be Answered	:	*Any 1(One) on Lottery Basis.*
Duration of End Semester Examination	:	*3(Three) Hours.*

List of experiments:

1. Design and Simulation of 2D NMOS Device using TCAD.
2. Design and Simulation of 2D PMOS Device using TCAD.
3. Design and implementation of CMOS Inverter by using 2D NMOS and PMOS Device using TCAD.
4. Spice Simulation of Digital Logic Gates.
5. Spice Simulation of CMOS Full adder.
6. Design Full Adder in VHDL and implement in FPGA kit.
7. Using concurrent statements in VHDL design 8:1 Multiplexer implement in FPGA kit.
8. Using concurrent statements in VHDL, write a code to model a BCD to 7 Segment Encoder and implement in SPARTAN FPGA kit.
9. Write a VHDL code to model a JK Flip Flop (clocked) and implement in FPGA kit.
10. Design a Decade counter. Write the VHDL code for the same and verify the output and implement in FPGA kit.
11. Write VHDL code with generate statement to model a 8-bit Shift Register and implement in FPGA kit.

Text Books:

1. W.Wolf,Modern VLSI Design: Systems on silicon,Pearson,1998
2. Douglas L. Perry, VHDL: Programming By Example, 4/e, McGraw-Hill Professional,2002.
3. J. Bhaskar, VHDL Primer, 3/e, PHI EEE, 1998.
4. C.K. Sarkar, Technology Computer Aided Design: Simulation for VLSI MOSFET, CRC Press, 2013.

Reference Books:

1. Meares, Lawrence G, Hymowitz, Charles E, Simulating with SPICE, Intusoft, San Pedro, CA, 1988,
2. M. Morris Mano,Digital Logic and Computer Design, Pearson,2004.

2.8 Eighth Semester Papers

L	-	T	-	P	Cr
0	-	0	-	4	2

2.8.1 EC - 816 PCB Laboratory and Electronics Workshop

Paper Code	:	*EC – 816*
Paper Name	:	*PCB Laboratory and Electronics Workshop.*
Contact Hours per Week	:	*4(Four) Hours.*
Marks Distribution	:	*Sessional Works = 50, End Semester Examination = -.*
Questions to be Set	:	*Minimum Ten.*

List of experiments:

1. Familiarization of available CAD Tools,
2. Familiarization of PCB Layout Design and Planning,
3. Design of an Analog Circuit PCB,
4. Design of a Digital Circuit PCB,
5. Film Master Preparation [brief introduction],
6. Printing [brief introduction],
7. Plating and Etching [brief introduction],
8. PCB Technology Trends,
9. Introduction Multilayer Boards,
10. Fabrication of the designed PCB (Design Project) using Prototype machine.
11. Soldering Techniques.
12. Assembling of electronic circuit/system on general purpose PCB, test and show the functioning:

    Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator. LED blinking circuit using a stable multi-vibrator with transistor BC 107. Square wave generation using IC 555 timer in IC base. Sine wave generation using IC 741 OP-AMP in IC base. RC coupled amplifier with transistor BC 107. 6. AND and NAND gates in diode transistor logic.
13. Setting up of a PA system with different microphones, loud speakers, mixer etc.
14. Identify the subsystems of TV, DTH, CCTV, Cable TV, CRO, Function generator etc.

Practice:
Students will work in groups. A Design Project (medium PCB Design: comprising around 15 components) will be chosen and its synopsis is submitted to the subject coordinator by each group at the beginning of the semester.
Project and its internal evaluation must be completed before the start of the end semester theory examination.

Text Books:

1. R. S. Khandpur, Printed Circuits Boards, TMH, 2006.
2. Clyde F. Coombs, Printed Circuits Handbook, 5/e, McGraw Hill, 2001.