Revised Syllabus

for

Bachelor of Technology *(B.Tech.)* **Programme**

in

Electronics and Communication Engineering

North-Eastern Hill University, Mawkynroh,

Umshing, Shillong – 793 022

Revised B.Tech. ECE Syllabus

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1. ACRONYMS USED IN SUBJECT CODING:

1.1 Subject Nomenclature and Coding

MA – Mathematics

PH – Physics

CH – Chemistry

HU – Humanities

ES – Environmental Science

EE – Electrical Engineering

CE – Civil Engineering

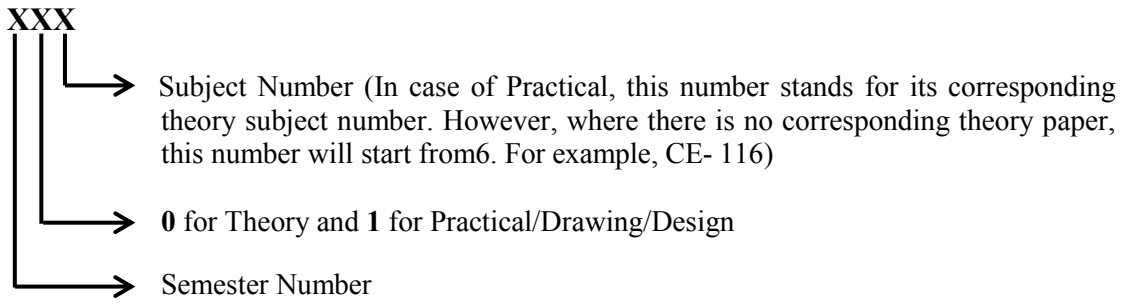
ME – Mechanical Engineering

EC – Electronics and Communication Engineering

IT – Information Technology

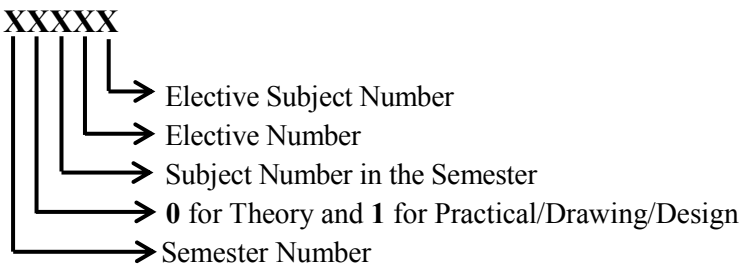
Subject Coding for *Core Paper*:

Three Digit Numeric Numbers Used inSubjectCode (e.g.EC –XXX):



Subject Coding for *Elective Paper*:

Five Digit Numeric Numbers Used in Subject Code (e.g. EC –XXXXX)



For example, EC – 70412: It is a Seventh (7) Semester First (1) Elective Theory (0) Paper. Paper serial number in the Seventh Semester Paper List is four (4) while elective serial number two (2) in the First Elective Paper List of the Semester.

1.2 GP – GENERAL PROFICIENCY:

Under this paper, the students shall be evaluated through seminars/viva in internal evaluation method. The topics have to be selected by the students/department from the papers taught in the particular semester/year as per the case.

However, GP – III would be based on the industrial training the students shall have to undergo during Vacation/Break after Second Year of B.Tech. curriculum while GP – V would be evaluated through the Grand Viva.

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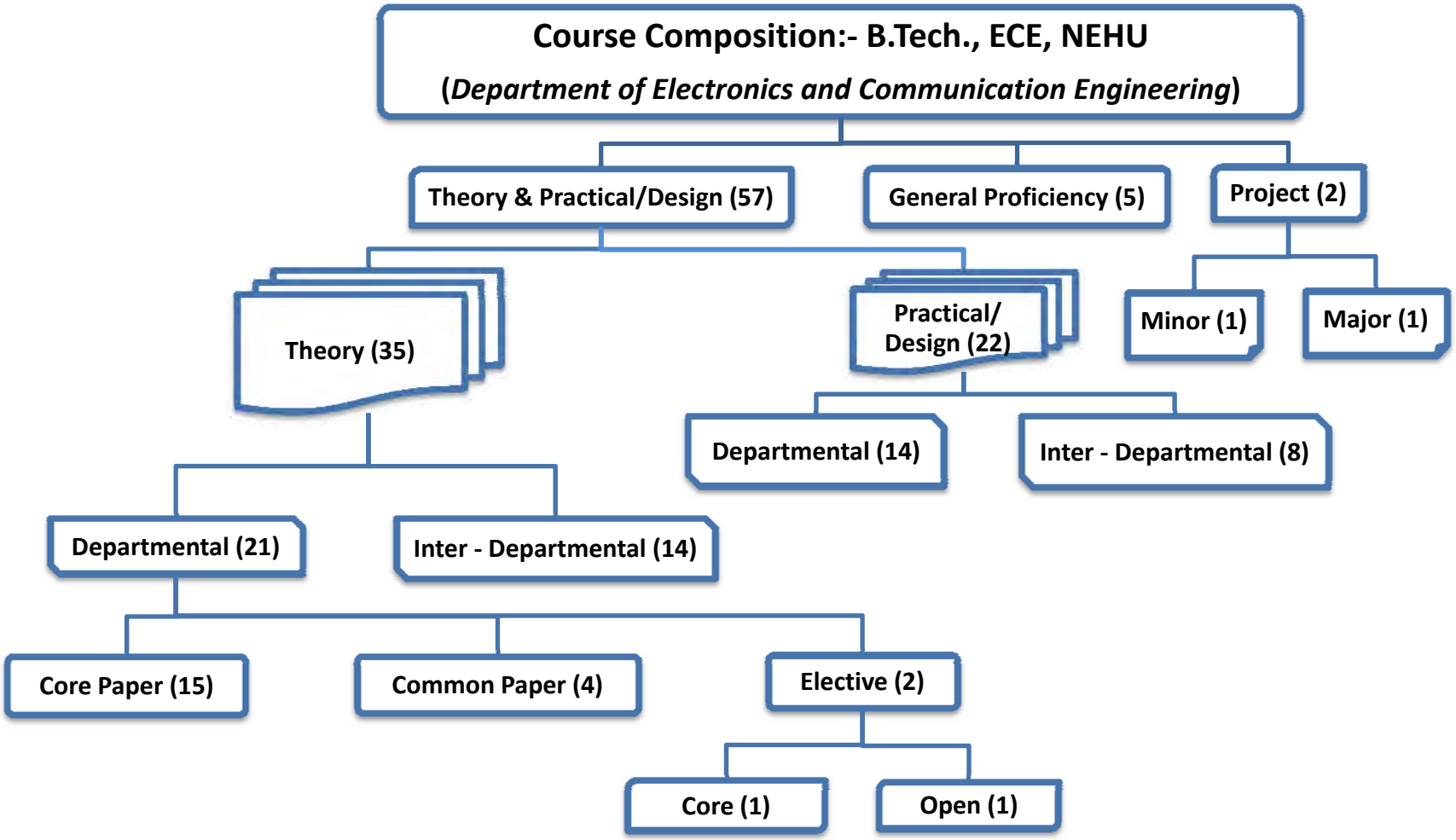
1.3 COURSE COMPOSITION AT A GLANCE



Note: Number inside brackets represents total number of Papers.

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BRANCH: Common to all branches **Year: I** **Semester I**

Sl. No	Subject Code	SUBJECT NAME	PERIODS (contact hour(s))			EVALUATION SCHEME (distribution of marks)					**Credits**
(**THEORY**)			L	T	P	Internal Works			ESE	SUB TOTAL	
						TA	CT	TOT			
1	HU – 101	Professional Communication Skills	2	1	-	20	20	40	60	100	**3**
2	MA – 102	Engineering Mathematics - I	3	1	-	30	30	60	90	150	**4**
3	PH – 103	Engineering Physics	3	1	-	30	30	60	90	150	**4**
4	ME – 104	Engineering Mechanics	3	1	-	30	30	60	90	150	**4**
5	EE – 105	Basic Electrical Engineering	3	1	-	30	30	60	90	150	**4**
(**PRACTICAL / DRAWING / DESIGN**)											
6	HU – 111	Digital English Language Laboratory	-	-	3	20	-	20	30	50	**2**
7	PH – 113	Engineering Physics Laboratory	-	-	3	20	-	20	30	50	**2**
8	EE – 115	Basic Electrical Laboratory	-	-	3	20	-	20	30	50	**2**
9	ME – 116	Workshop Practice	-	-	3	20	-	20	30	50	**2**
		Total	14	5	12					900	**27**

Total Contact Hours: 31

L – Lecture **T** – Tutorial **P** – Practical **TA** – Teachers' Assessment **Total Marks**: 900

CT – Class Test **TOT** – Total Internal Marks **ESE** – End Semester Examination **Total Credits**: **27**

BRANCH: Common to all branches **Year: I** **Semester II**

Sl. No	Subject Code	SUBJECT NAME	PERIODS (contact hour(s))			EVALUATION SCHEME (distribution of marks)					**Credits**
(**THEORY**)			L	T	P	Internal Works			ESE	SUB TOTAL	
						TA	CT	TOT			
1	ES – 201	Elements of Environmental Science	2	1	-	20	20	40	60	100	**3**
2	MA – 202	Engineering Mathematics - II	3	1	-	30	30	60	90	150	**4**
3	CH – 203	Engineering Chemistry	3	1	-	30	30	60	90	150	**4**
4	IT – 204	Computer Systems and Programming	3	1	-	30	30	60	90	150	**4**
5	EC – 205	Basic Electronics	3	1	-	30	30	60	90	150	**4**
(**PRACTICAL / DRAWING / DESIGN**)											
6	CH – 213	Engineering Chemistry Lab	-	-	3	20	-	20	30	50	**2**
7	IT – 214	Computer Programming Laboratory	-	-	3	20	-	20	30	50	**2**
8	EC – 215	Basic Electronics Laboratory	-	-	3	20	-	20	30	50	**2**
9	CE – 216	Engineering Graphics	-	-	3	20	-	20	30	50	**2**
10	GP – I	General Proficiency – I				-	-	50	-	50	**2**
		Total	14	5	12					950	**29**

Total Contact Hours: 31

L – Lecture **T** – Tutorial **P** – Practical **TA** – Teachers' Assessment **Total Marks**: 950

CT – Class Test **TOT**– Total Internal Marks **ESE** – End Semester Examination Marks **Total Credits**: **29**

BRANCH: Electronics and Communication Engineering **Year: II** **Semester III**

Sl. No	Subject Code	SUBJECT NAME	PERIODS (contact hour(s))			EVALUATION SCHEME (distribution of marks)					**Credits**
(**THEORY**)			L	T	P	Internal Works TA	CT	TOT	ESE	SUB TOTAL	
1	MA – 301	Engineering Mathematics – III	3	1	-	30	30	60	90	150	**4**
2	EC – 302	Electronic Devices and Circuits	3	1	-	30	30	60	90	150	**4**
3	EC – 303	Signals and Systems	3	1	-	30	30	60	90	150	**4**
4	EE – 304	Electrical Network Theory	3	1	-	30	30	60	90	150	**4**
5	IT – 305	Data Structures and Algorithms	3	1	-	30	30	60	90	150	**4**
(**PRACTICAL / DESIGN**)											
6	EC – 312	Electronic Devices and Circuits Laboratory	-	-	3	20	-	20	30	50	**2**
7	IT – 315	Data Structure using C Laboratory	-	-	3	20	-	20	30	50	**2**
8	EC – 316	PCB Design Laboratory	-	-	3	20	-	50	-	50	**2**
		Total	15	5	9					900	**26**

Total Contact Hours: 29

L – Lecture **T** – Tutorial **P** – Practical **TA**– Teachers' Assessment **Total Marks**: 900

CT– Class Test **TOT**– Total Internal Marks **ESE**– End Semester Examination Marks **Total Credits**: **26**

BRANCH: Electronics and Communication Engineering **Year: II** **Semester IV**

Sl. No	Subject Code	SUBJECT NAME	PERIODS (contact hour(s))			EVALUATION SCHEME (distribution of marks)					**Credits**
(**THEORY**)			L	T	P	Internal Works TA	CT	TOT	ESE	SUB TOTAL	
1	MA – 401	Statistics and Random Processes	3	1	-	30	30	60	90	150	**4**
2	EC – 402	Electromagnetic Theory	3	1	-	30	30	60	90	150	**4**
3	EC – 403	Digital Electronics	3	1	-	30	30	60	90	150	**4**
4	EC – 404	Linear Integrated Circuits and Systems	3	1	-	30	30	60	90	150	**4**
5	EC – 405	Electronics Measurements and Instrumentation	3	1	-	30	30	60	90	150	**4**
(**PRACTICAL / DESIGN**)											
6	EC – 413	Digital Electronics Laboratory	-	-	3	20	-	20	30	50	**2**
7	EC – 414	Linear Integrated Circuits Laboratory	-	-	3	20	-	20	30	50	**2**
8	EC – 415	Electronics Measurements and Instrumentation Laboratory	-	-	3	20	-	20	30	50	**2**
9	GP – II	General Proficiency – II				-	-	50	-	50	**2**
		Total	15	5	9					950	**28**

Total Contact Hours: 29

L – Lecture **T** – Tutorial **P** – Practical **TA**– Teachers' Assessment **Total Marks**: 950

CT– Class Test **TOT**– Total Internal Marks **ESE**– End Semester ExaminationMarks **Total Credits**: **28**

BRANCH: Electronics and Communication Engineering **Year: III** **Semester V**

Sl. No	Subject Code	SUBJECT NAME	PERIODS (contact hour(s))			EVALUATION SCHEME (distribution of marks)					Credits
(**THEORY**)			L	T	P	Internal Works TA	CT	TOT	ESE	SUB TOTAL	
1	HU – 501	Industrial Economics and Management	3	1	-	30	30	60	90	150	**4**
2	EC– 502	Microprocessor	3	1	-	30	30	60	90	150	**4**
3	EC – 503	Principles of Communication Systems	3	1	-	30	30	60	90	150	**4**
4	EE – 504	Power Electronics	3	1	-	30	30	60	90	150	**4**
5	EC – 505	Basic Control Engineering	3	1	-	30	30	60	90	150	**4**
(**PRACTICAL / DESIGN**)											
6	EC – 512	Microprocessor Laboratory	-	-	3	20	-	20	30	50	**2**
7	EC – 513	Communication Systems Laboratory	-	-	3	20	-	20	30	50	**2**
8	EC – 516	Simulation using MATLAB	-	-	3	20	-	20	30	50	**2**
		Total	15	5	9					900	**26**

Total Contact Hours: 29

L – Lecture **T** – Tutorial **P** – Practical **TA** – Teachers' Assessment **Total Marks**: 900

CT – Class Test **TOT** – Total Internal Marks **ESE** – End Semester Examination Marks **Total Credits**: **28**

BRANCH: Electronics and Communication Engineering **Year: III** **Semester VI**

Sl. No	Subject Code	SUBJECT NAME	PERIODS (contact hour(s))			EVALUATION SCHEME (distribution of marks)					Credits
(**THEORY**)			L	T	P	Internal Works TA	CT	TOT	ESE	SUB TOTAL	
1	EC – 601	Embedded Systems and Microcontrollers	3	1	-	30	30	60	90	150	**4**
2	EC – 602	Digital Signal Processing	3	1	-	30	30	60	90	150	**4**
3	EC – 603	Microwave Engineering	3	1	-	30	30	60	90	150	**4**
4	EC – 604	Computer Communications and Networks	3	1	-	30	30	60	90	150	**4**
5	EC – 605	Antenna	3	1	-	30	30	60	90	150	**4**
(**PRACTICAL / DESIGN**)											
6	EC – 611	Embedded Systems and Microcontrollers Laboratory	-	-	3	20	-	20	30	50	**2**
7	EC – 612	Digital Signal Processing Laboratory	-	-	3	20	-	20	30	50	**2**
8	EC – 613	Microwave Engg. Laboratory	-	-	3	20	-	20	30	50	**2**
9	GP – III	General Proficiency –III				-	-	50	-	50	**2**
		Total	15	5	9					950	**28**

Total Contact Hours: 29

L – Lecture **T** – Tutorial **P** – Practical **TA** – Teachers' Assessment **Total Marks**: 950

CT – Class Test **TOT** – Total Internal Marks **ESE** – End Semester Examination Marks **Total Credits**: **28**

BRANCH: Electronics and Communication Engineering **Year: IV** **Semester VII**

Sl. No	Subject Code	SUBJECT NAME	PERIODS (contact hour(s))			EVALUATION SCHEME (distribution of marks)					**Credits**
(**THEORY**)			L	T	P	Internal Works TA	CT	TOT	ESE	SUB TOTAL	
1	HU – 701	Professional Ethics and IPR	3	1	-	30	30	60	90	150	**4**
2	EC – 702	Low dimensional Electronics and VLSI Design	3	1	-	30	30	60	90	150	**4**
3	EC – 703	Digital Communication	3	1	-	30	30	60	90	150	**4**
4	EC – 7041x	Elective – I	3	1	-	30	30	60	90	150	**4**
5	EC – 7052x	Elective – II	3	1	-	30	30	60	90	150	**4**
(**PRACTICAL / DESIGN**)											
6	EC – 712	Low dimensional Electronics and VLSI Design Laboratory	-	-	3	20	-	20	30	50	**2**
7	EC – 713	Digital Communication Laboratory	-	-	3	20	-	20	30	50	**2**
8	EC – 716	Minor Project*	-	-	5	20	20	40	60	100	**3**
9	GP – IV	General Proficiency – IV				-	-	50	-	50	**2**
		Total	14	5	11					950	**29**

Total Contact Hours: 30

L – Lecture **T** – Tutorial **P** – Practical **TA** – Teachers' Assessment **Total Marks** : 950

CT – Class Test **TOT** – Total Internal Marks **ESE** – End Semester Examination Marks **Total Credits**: **29**

Elective - I:

1. Fundamentals of MEMS
2. Information Theory and Coding
3. Optical Fiber Communication
4. Architecture of Advanced Microprocessors
5. Cipher System
6. Optical Networks

Elective– II(Open):

1. Satellite and Mobile Communications
2. Fundamentals of Artificial Intelligence
3. Data Communication
4. Nanotechnology
5. Biomedical Instrumentation
6. Digital Image Processing

BRANCH: Electronics and Communication Engineering **Year: IV** **Semester VIII**

Sl. No	Subject Code	SUBJECT NAME	PERIODS (contact hour(s))			EVALUATION SCHEME (distribution of marks)					**Credits**
(**THEORY**)			L	T	P	Internal Works TA	CT	TOT	ESE	SUB TOTAL	
(**PRACTICAL / DESIGN**)											
1	EC – 816	Major Project*	-	-	20	60	60	120	180	300	**15**
2	GP – V	General Proficiency – V				-	-	50	-	50	**2**
		Total	-	-	20					350	**17**

Total Contact Hours: 20

L – Lecture **T** – Tutorial **P** – Practical **TA** – Teachers' Assessment **Total Marks**: 350

CT – Class Test **TOT** – Total Internal Marks **ESE** – End Semester Examination Marks **Total Credits**: **17**

*****_In the case of projects,TA = Assessment from the Guide(s), CT = Internal Seminar, and ESE = Seminar with External/Inter Departmental Experts._

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HU - 101 PROFESSIONAL COMMUNICATION SKILLS **2-1-0 = 3**

Subject Code: *HU - 101.*
Subject Name: *Professional Communication Skills.*
No. of Hours Per Week: *Lectures-2, Tutorial-1*
Marks Distribution: *Sessional Works = 40, End Semester Examination = 60.*
Questions to be set: *Six (one from each unit and remaining three from the combination of more than one unit).*
Questions to be answered: *Any four.*
Duration of End Semester Examination: *Two and half Hours.*

UNIT I

General Principles of Communication and Oral Communication:

The Process of Communication, Principles of Communication (communication barriers, levels of Communication, Communication network, verbal, non-verbal) and Professional Communication. The Speech Mechanism, IPA symbols (vowel and consonant sounds), minimal pairs, word transcription, stress and intonation , active listening, types of listening, traits of a good listener, active versus passive listening,

UNIT II

Constituents of Effective Writing and Vocabulary:

The sentence and its parts, articles, the verb phrase, tense and aspect, the active and passive, the adjective, interrogative and negative sentences, concord, preposition. Paragraph development, summary writing and reading comprehension. word formation processes: affixation, compounding, converting, use of words in different parts of speech, idioms and phrases.

UNIT III

Business Correspondence and Communication Strategies:

Characteristics of Business Letters, Drafting: Bio-data/ Resume/Curriculum vitae (theory). Report Writing**:** Structure, Types of Reports (theory). Presentation Skills, public speaking and group discussion (theory) and Soft Skills (theory).

Text Books:

1. Das, B. K., Samantray K., et.al., *An Introduction to Professional English and Soft Skills,* CUP, New Delhi, 2009.
2. Sharma R.C, Mohan K., *Business correspondence and Report Writing*, Tata Mcgraw Hill, New Delhi, 2002.
3. Doff, A., Jones, C.*, Language In Use, Upper- Intermediate Classroom Book, Classroom Book,* CUP, New Delhi, 2004.

Reference Books:

1. O'Connor, J. D., *Better English Pronunciation*, CUP, London, 2006.
2. Patnaik, P., *Group Discussion and Interview Skills*, CUP, New Delhi, 2011.
3. Greenbaum, Sidney, *Oxford English Grammar*, OUP, 1996.
4. Seely, John, *Oxford Guide to Effective Writing and Speaking*, OUP, India, 2000.
5. Eastwood, John, *Oxford guide to English Grammar,* OUP, India, 1994.

MA - 102 ENGINEERING MATHEMATICS – I **3-1-0 = 4**

Subject Code: *MA - 102.*
Subject Name: *Engineering Mathematics - I.*
No. of Hours Per Week: *Lectures-3, Tutorial-1*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT -I

Functions, continuity and differentiability**,** graphs of f(x) = |x| + |x-1| + |x-2|; |x| - |y| = n. Properties of continuous functions on closed intervals. Intermediate value theorem and Uniform continuity in [a, b]. Functions of Bounded Variation, L'Hospital Rule (statements only with applications) and indetermediate forms; Leibnitz's theorem.

UNIT-II

Mean value theorems and Taylor's theorem with Lagrange's form and Cauchy's form of remainders. Taylor's and Maclaurin's series of functions $log_e(1+x)$, e^x, sin x, cos x; curvature, radius of curvature and centre of curvature of plane curves,Fundamental theorem of integral calculus. Reduction formulae.

UNIT-III

Convergence of sequences, series and improper integral: Convergence of real sequences; monotone sequences, Cauchy's criterion, convergence of infinite series of real numbers. Cauchy's criterion. Convergence of improper integrals. Beta and Gamma functions and their properties.

UNIT-IV

*Ordinary Differential Equations***:** Order and degree, exactness and integrating factors. Solutions of first order and first degree O.D.E. of types- variable separable, homogeneous , linear, Bernoulli; and Second order L.D.E. $a_0y`` + a_1y` + a_1y = 0$ where a_i's are constants. Nonlinear equations and Clairaut's equations.

Text Books:

1. Mendelson, E., *CALCULUS with 3000 examples*, TMH, reprint 2010.
2. Kreyszig, E., *Advanced Engineering Mathematics*, 9/e, J. Wiley & Co., 2009.
3. S.C. Malik and Savita Arora, *Mathematical Analysis*, 6/e, Wiley Eastern Ltd., 2002.
4. B.S. Grewal, *Higher Engineering Mathematics*, 40/e, Khanna Publication, 2008.

Reference Books:

1. B. K. Pal and K. Das, *Engineering Mathematics-1 & 2*, 3/e, U.N.Dhur & Sons Pvt. Ltd., 2010.
2. H.K. Dass, *Advance Engineering Mathematics,* 12/e, S. Chand & Co., 2010.
3. M. C. Potter, J. L Goldberg and E.F. Aboufadel, *Advance Engineering Mathematics*, 3/e, Oxford University Press, 2008.
4. B.S.Grewal, *Engineering Mathematics*, 12/e, Khanna Publications, 2009.

PH - 103 ENGINEERING PHYSICS **3-1-0 = 4**

Subject Code: *PH - 103.*
Subject Name: *Engineering Physics.*
No. of Hours Per Week: *Lectures-3, Tutorial-1*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Classical mechanics-I, Acoustic and General Properties of matter: Component of velocity and acceleration in two dimension in Cartesian and polar coordinates. Moment of inertia, theorems of parallel and perpendicular axes (proof) for both laminar and three dimensional bodies. Compound pendulum and its theory. Free and forced vibration, resonance and sharpness of resonance, Reverberation, Sabine's law of reverberation. Ultrasonic, production and applications. Problems.
Interrelation of elastic constants.Torsion of a cylinder.Bending of beams- cantilever and beam supporting at both ends. Problems.

UNIT – II

Electromagnetism and Physical optics: Gradient, divergence, curl; Electrostatic field **E** and potential φ, their relation. Short electric dipole, Gauss law and its applications for finding **E** for various symmetric charge distribution, Maxwell's equations (statement and significance).
Interference: Newton rings: theory and wavelength determination
Diffraction: Fraunhofer diffractions at a single slit, Fresnel half period zone, zone plate. Polarization, half and quarter wave plates. Problems.

UNIT – III

Quantum Mechanics and Solid State Physics: De Broglie's hypothesis, Uncertainty principle, Schrödinger's equations, particle in a one dimensional box of rigid walls. Problems.
Free electron gas in one and three dimensions, F-D distribution function- its variation with energy at different temperatures: Band theory of solids (a qualitative treatment), distinction of metals, semi-metals and insulators. Preliminary ideas of superconductivity. Problems.

UNIT – IV

Atomic, molecular and nuclear Physics: Compton effect and Compton shift, vector atom model; one electron atomic spectra, molecular spectra and selection rules. Brief theory of laser, Spontaneous emission, stimulated emission and absorption, Applications of Laser.Problems.
Nuclear reaction and Q value, Nuclear fission, chain reaction, nuclear fusion and stellar energy. Problems.

Text Books:

1. Hugh D. Young and Lewis Ford, *University Physics with Modern Physics*, 12/e, Pearson, 2008.
2. P K Chakrabarthy, *Mechanics and General Properties of Matter*, Books & Allied Ltd., 2001.
3. G S Raghuvanshi, *Engineering Physics*, Prentice Hall of India Pvt Ltd., 2008.
4. H K Malik and A K Singh, *Engineering Physics*, Tata McGraw Hill, New Delhi, 2010.

Reference Books:

1. H J Pain, *The Physics of Vibrations and Waves*, 6/e, Wiley Student Edition, 2005.
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. A Beiser, *Perspective of Modern Physics*, McGraw- Hill, 1969.

ME - 104 ENGINEERING MECHANICS **3-1-0 = 4**

Subject Code: *ME - 104.*
Subject Name: *Engineering Mechanics.*
No. of Hours Per Week: *Lectures-3, Tutorial-1*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT-I

Force Systems: Moment of a force about a point and about an axis; couple moment; reduction of a force system to a force and a couple. Equilibrium: Free body diagram; equations of equilibrium; problems in two and three dimensions; plane frames and trusses.

UNIT–II

Friction: Laws of Coulomb friction, problems involving large and small contact surfaces; square threaded screws; belt friction; rolling resistance. *Properties of Areas*: Moments of inertia and product of inertia of areas, polar moment of inertia, principal axes and principal moments of inertia.

UNIT–III

Kinematics and Kinetics of particles: Particle dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables; central force motion.

UNIT–IV

Rigid Body Dynamics: Relative velocity, Translation, Pure rotation and plane motion of rigid bodies, D'Alembert's principle, linear momentum, principle of conservation of momentum, Impact of solid bodies, work, energy, power, principle of conservation of energy.

Text Books:

1. R. K. Bansal, *A textbook of Engineering Mechanics,* Laxmi Publication, 1992.
2. I. H. Shames, *Engineering Mechanics: Statics and Dynamics*, 4/e, PHI, 1996.
3. F. P. Beer and F. R. Johnston, *Mechanics for Engineering*, TMH, 1987.
4. S. Ramamurtham, *Engineering Mechanics*, Dhanpatrai Publishing Company, 2003.

Reference Books:

1. R.C. Hibbler, *Engineering Mechanics: Static*, McMillan, 1998.
2. R.C. Hibbler, *Engineering Mechanics: Dynamic*, PHI, 1997.
3. K.L. Kumar, *Engineering Mechanics*, S. Chand, 1997.
4. Timoshenko and Young, *Engineering Mechanics*, McGraw Hill, 1956.
5. A.Nelson, Engineering Mechanics-Statics & Dynamics, McGraw Hill Publications, reprint 2010.

EE – 105 BASIC ELECTRICAL ENGINEERING **3-1-0 = 4**

Subject Code: *EE - 105.*
Subject Name: *Basic Electrical Engineering.*
No. of Hours Per Week: *Lectures-3, Tutorial-1*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *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*, 6/e, TMH, 2006.
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.

HU - 111 DIGITAL ENGLISH LANGUAGE LABORATORY 0-0-3 = 2

Subject Code: *HU - 111.*
Subject Name: *Digital English Language Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Practical Exercises:

1. Articulation and practice of Vowel sounds and Diphthongs.

2. Articulation and practice of consonant sounds.

3. Practice word and sentence stress with intonation.

4. Practice Oral Presentation skills.

5. Handling telephone calls.

6. Vocabulary practice through situational dialogues.

7. Reporting.

8. Debating.

9. Appearing for personal interview.

10. Writing E-mails.

11. Writing business letter.

12. Drafting Curriculum Vitae/ Resume/Biodata.

13. Using situational dialogues in situations like requests, asking and giving directions, leaving a message.

Resource Materials:–

A. *Books*:

1. Jones, Daniel, *Cambridge English Pronouncing Dictionary with CD*, New Delhi, 2009.
2. Roach, Peter, *English Phonetics and Phonology with CD*, CUP, India, 1983.
3. *Cambridge Learners Dictionary with CD*, CUP, New Delhi, 2009.
4. Rajeevan, Dutt, Sasikumar, *A course in Listening and Speaking I & II with CD*, CUP, New Delhi, 2007.
5. Rajeevan and Dutt, *Basic Communication Skills,* CUP, New Delhi, 2007.

B. *Software*: *Orell Digital Language Lab Software.*

PH - 113 ENGINEERING PHYSICS LABORATORY **0-0-3 = 2**

Subject Code: *PH - 113.*
Subject Name: *Engineering Physics Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Experiments:

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 micrometer method/ of a bar by flexural method.
3. To determine rigidity modulus of a wire by statical method/dynamical method.
4. To determine the focal length & power of a concave lens by combination with auxiliary convex lens by the displacement method.
5. To find the wavelength of monochromatic light by using Newton's ring method.
6. To determine the wavelength of sodium light by Michelson's interferometer.
7. To determine the wavelength of prominent lines of mercury by plane diffraction grating.
8. To determine he specific rotation of sugar solution by polarimeter.
9. To determine the magnetic moment of a bar magnet (M) and the earth's horizontal intensity (H) (by deflection and vibration magnetometers).
10. To determine the resistance per unit length of a meter bridge wire by Carey- Foster Method.
11. To study decay of current in RC circuit.
12. To determine frequency of a tuning fork by Melde's method.
13. To determine the thermal conductivity of a bad conductor Lee's method.
14. To obtain the hysteresiscurves (B-H) for a ferromagnetic material (thin rod or wire) on a CRO using solenoid and then to determine the related magnetic constants.
15. To study the Hall Effect and determine the Hall Coefficient.
16. To determine the Planck's constant by a Photocell.
17. To determine the e/m value of an electron by any method.

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.

EE - 115 BASIC ELECTRICAL ENGINEERING LABORATORY 0-0-3 = 2

Subject Code: *EE - 115.*
Subject Name: *Basic Electrical Engineering Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Experiments:

1. To verify Thevenin'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. W. H. Hayt, J. E. Kemmerly and S.M. Durbin, *Engineering Circuit Analysis*, 6/e, TMH, 2006.
2. B. L. Thereja and A.K. Thereja, *Electrical Technology,* Vol-II, S. Chand & Co., Reprint 2006.

ME - 116 WORKSHOP PRACTICE **0-0-3 = 2**

Subject Code: *ME - 116.*
Subject Name: *Workshop Practice.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

I. Theory (*about various components involved in Workshop Practice)*

(a) Carpentry: Timber, definition, Engineering applications, seasoning and preservation, plywood and ply-boards

(b) Metal Joining Definitions of welding, brazing and soldering processes, and their applications. Oxy-acetylene glass welding process, equipment and techniques, types of flames and their applications. Manual metal arc welding technique and equipment, AC and DC welding, electrodes, constituents and functions of electrode coating. Welding positions. Types of weld joint. Common welding defects such as cracks, undercutting, slag inclusion, porosity.

(c) Metal Cutting: Introduction to machining and common machining operations. Cutting tool materials. Definition of machine tools, specification and block diagram of lathe, shaper, milling, drilling machine and grinder. Common lathe operations such as turning, parting, chamfering and facing. Quick return mechanism of shaper. Difference between drilling and boring. Files-material and classification.

II. Experiments : *At least eight (8) experiments need to be conducted*
List of Jobs to be made in the Workshop

(a) Carpentry:
1. T-Lap & L-joints
2. Bridle joint

(b) Metal Joining: Welding Practice.
1. Gas welding practice on mild steel flat
2. Lap joint by Gas welding
3. MMA welding practice by students
4. Square butt joint by MMA Welding
5. Lap joint by MMA Welding
6. Demonstration of brazing
7. Tin smithy for making mechanical joints and soldering of joints

(c) Metal Cutting:
1. Job on lathe with one step turning and chamfering operations
2. Job on shaper and milling machine for finishing two sides of a job
3. Drilling two holes of size 5 and 12 mm diameter on job used / to be used for shaping
4. Grinding a corner of above job on bench grinder
5. Finishing of two sides of a square piece by filing.

Text Books:

1. Hajra Choudhary, *Elements of Workshop Technology*, Vol. I & II, Media Promoters & Publishers, 2002.
2. M.L. Begeman and B.H. Amstead, *Manufacturing Process*, John Wiley, 1968.
3. W.A.J. Chapman and E.Arnold, *Workshop Technology*, Vol. I & III, Viva Low Priced Student Ed., 1998.
4. B.S. Raghuwanshi, *Workshop Technology*, Vol. I & II, Dhanpat Rai and Sons, 1998.
5. Khanna , O.P., *Workshop Technology*, Dhanpat Rai Publications, 1998.
6. S. Crawford, *Basic Engineering Processes*, Hodder & Stoughton, 1985.
7. T. Jeyapoovan, *Workshop Practics*, Vikas Publication, 2001.
8. Juneja B.L., *Fundamentals of Metal Cutting & Machine Tools*, New Age International, 1995.
9. Kuppuswamy, G., *Principle of Metal Cutting*, Universities Press/Orient Longman, 1996.

ES - 201 ELEMENTS OF ENVIRONMENTAL SCIENCE **2-1-0 = 3**

Subject Code: *ES - 201.*
Subject Name: *Elements of Environmental Science.*
No. of Hours Per Week: *Lectures-2, Tutorial-1*
Marks Distribution: *Sessional Works = 40, End Semester Examination = 60.*
Questions to be set: *Six (one from each unit and remaining three from the combination of more than one unit).*
Questions to be answered: *Any four.*
Duration of End Semester Examination: *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 bio-remediation; 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.

MA - 202 ENGINEERING MATHEMATICS - II **3-1-0 = 4**

Subject Code: *MA - 202.*
Subject Name: *Engineering Mathematics - II.*
No. of Hours Per Week: *Lectures-3, Tutorial-1*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT - I

*Functions of several variables***:** Partial derivatives. Chain rule, Standard Jacobians for change of variables. Gradient and directionalderivatives. Tangent planes and normal. Exact differentials. Euler's theorem on homogeneous functions. Repeated and multiple integrals, maxima and minima for several variables, method of Lagranges 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 and physical 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 ,Spherical and Cylindrical polar coordinates (statements only with applications).

UNIT - III

Complex Analysis: Analytic functions, Cauchy-Riemann equations, Laplace equations. Elementary functions, Conformal mappings.Cauchy's integral theorem, Cauchy's integral formula, Taylor series and Laurent series. Residues and its applications to evaluating real integrals.

UNIT - IV

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

Text Books:

1. Mersden, J.E., *Basic Complex Analysis*, 4/e, W.H.Freeman, Houndmills, Hampshire, 2008.
2. Spiegel, *Fourier Analysis with application and Laplace Transforms*, TMH, reprint, 2010.
3. E. Kreyszig, *Advance Engineering Mathematics*, 9/e, J. Willey & Co, 2009.
4. B. C. Das and B.N. Mukherjee, *Differential Calculus*, 5/e, U.N.Dhur & Sons Pvt. Ltd., 2010.

Reference Books:

1. S. Narayan, *Vector Calculus*, S. Chand & Co, 1974.
2. T. M. Apostol, *Calculus*, 2/e, J. Willey, 1969.
3. *Schuams outline: Complex Variable*, TMH, 2009.
4. B. K. Pal and K. Das, *Engineering Mathematics*, Vol. 1 & 2, 3/e, U.N.Dhur & Sons Pvt. Ltd., 2010.

CH - 203 ENGINEERING CHEMISTRY **3-1-0 = 4**

Subject Code: *CH - 203.*
Subject Name: *Engineering Chemistry.*
No. of Hours Per Week: *Lectures-3, Tutorial-1*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT - I

Chemical Thermodynamics: Second law of thermodynamics, entropy and its physical significance, entropy change of ideal gases, free energy (Gibbs and Helmholtz), thermodynamic properties for reversible and irreversible processes, equilibrium constant from thermodynamic considerations, Maxwell's relationships, Gibbs-Helmholtz equation, Clapeyron-Clausius equation, concept of chemical potential with examples, Van't Hoff reaction isotherm, third law of thermodynamics and its applications.
Fundamentals of Instrumental analysis: UV-VIS, IR and Fluorescence spectrophotometry.

UNIT - II

Organic Chemistry: Structures and functions of biologically important molecules (Carbohydrates, Amino acids, Proteins and Nucleic acids), E-Z and R-S systems of nomenclature of organic molecules, conformation and conformation analysis for certain organic systems.
Polymers: Classification and structures of polymers, commercially important polymers like teflon, bakelite, nylon, polyester, polyurethane, Silicon resins, etc.).

UNIT - III

Electrochemistry: Behaviour of strong electrolytes with concentration, electrochemical cells, EMF and applications of EMF measurements, commercially important cells and corrosion (its chemistry and remedial methods).
Chemical Kinetics: General discussion on the reactions of different orders including their rate laws with examples, problems based on first and second order reactions, pseudo-uniorder reactions, theories of reaction rates (collision and transition state theories), activation energy and catalytic reactions. Lasers in chemistry and its applications.

UNIT - IV

Coordination Chemistry: Structure of coordination compounds corresponding to coordination no. up to 6, types of ligands, EAN, isomerisms, bonding in coordination compounds (VBT and MOT), Application of organometallic chemistry in biomolecules (Vitamin B_{12} and Heamoglobin).
Water and its hazard in industry – Hard and soft waters, disadvantages of hard water in industries, estimation of hardness of water, treatment of industrial water (external and internal methods).

Text Books:

1. Prakash, Tuli, Basu and Madan, *Advanced Inorganic Chemistry*, Vol. I & 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), Tata McGraw Hill, 2006.

Reference Books:

1. Shriver, Atkins and Langford, *Inorganic Chemistry*, 2/e, ELBS, 1994.
2. S.H.Pine, *Organic Chemistry*, 5/e (special Indian ed.), TMH, 2007.
3. Banwell and McCash, *Fundamentals of Molecular Spectroscopy*, 4/e, Tata Mc-Graw Hill, 1962.
4. Cotton, Wilkinson and Gaus, *Basic Inorganic Chemistry*, 3/e, John Wiley & Sons, Inc., 1996.
5. I. L. Finar, *A Textbook of Organic Chemistry*, 6/e, Vol. I & II, ELBS, 2006.

IT - 204 COMPUTER SYSTEMS AND PROGRAMMING **3-1-0 = 4**

Subject Code: *IT - 204.*
Subject Name: *Computer Systems and Programming.*
No. of Hours Per Week: *Lectures-3, Tutorial-1*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT - I

*Digital computer fundamentals***:** Functional components of computer, Von Newman Architecture, Algorithm and flowcharts, Data representation, Programming languages, Function of system software.

UNIT - II

*Imperative programming (Using C)***:** Overview of C, Constants, Variables and Data Types, Operators and Expressions, Input and Output Operations, Branching and looping operation.

UNIT - III

*Functions***:** Defining a function, accessing a function, passing arguments to a function, specifying argument data types, function prototypes and recursion, storage classes. *Arrays***:** Defining an array, processing an array, passing arrays to a function, multidimensional arrays, strings, string handling functions.

UNIT - IV

*Structures and Unions***:** Defining and processing of structure and union, Array of structure, array within structure, passing of structure as argument.
*Pointers***:** Fundamentals, pointer declarations, passing pointers to a function, pointer and one dimensional arrays, pointer as function arguments, Functions returning Pointer, Pointer to functions, pointers and structures.

UNIT - V

*File Management***:** Introduction, Defining and Opening a File, Closing a File, Input/Output Operations on Files, Error Handling
during I/O Operations, Random Access to Files, *Command Line Arguments*.

Text Books:

1. V. Rajraman, *Fundamental of Computer*, 4/e, PHI, 2006.
2. E. Balaguruswami, *Programming in ANSI C*, 2/e, Tata McGraw Hill, 2004

Reference Books:

1. Y. Kanetkar, *Let us C*, BPB Publication, 2004.
2. A. Kelley and I. Pohl, *A Book on C*, 4/e, Pearson Education, 1998.
3. B. W. Kernighan and D. Ritchie, *The C Programming Language*, 2/e, PHI, 2005.

EC - 205 BASIC ELECTRONICS **3-1-0 = 4**

Subject Code: *EC - 205.*
Subject Name: *Basic Electronics.*
No. of Hours Per Week: *Lectures-3, Tutorial-1*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Passive components: Resistors, capacitors and inductors: types and characteristics and their applications.
Semiconductors: Energy bands in silicon, intrinsic and extrinsic, carriers transport in silicon: diffusion current, drift current, mobility and resistivity. Generation and recombination of carriers, Semiconductor materials.
PN junction diode: General idea of a PN junction diode, Reverse and forward biased characteristics, Transition capacitance and diffusion capacitance.

UNIT – II

PN Junction diode applications: Half wave rectifier, full wave center- tapped and bridge rectifier Clipping and clamping circuits.
Introduction to Special purpose diode characteristics and applications: Zener diode, Photo diode, Varactor diode, Light emitting diode, Schottky diode, Tunnel diode.

UNIT – III

BJT, FET (JFET & MOSFET) and UJT: Construction, symbols, principle of operation, different configurations, study of characteristics, limitations and applications, Application of BJT as amplifiers.
Biasing and stabilization of BJT: Q point, Graphical analysis (DC and AC load line), fixed bias, collector bias, self bias.

UNIT – IV

Digital Electronics: Number systems and codes, logic gates, Boolean theorems, De-morgan's theorems, Boolean algebra, minimization of Boolean functions; Karnaugh map up to four variables.

Text Books:

1. Boylestead and Nashelsky, *Electronic Devices and Circuits Theory*, 9/e, PHI, 2006.
2. Bernard Grob and Mitchel Schultz, *Basic Electronics*, 9/e, TMH, 2003.
3. Morris Mano, *Digital Design*, 3/e, PHI, 2006.
4. J. Millman and C. C. Halkias, *Integrated Electronics, 42nd Reprint,* TMH, 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.

CH - 213 ENGINEERING CHEMISTRY LABORATORY 0-0-3 = 2

Subject Code: *EC - 213.*
Subject Name: *Engineering Chemistry Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Experiments:

1. Volumetric estimation of Mg^{2+} and Ca^{2+} ions by EDTA titration (Hardness of water).
2. Volumetric estimation of Fe^{2+} ions by permanganatometry.
3. Preparation of an inorganic complex like, potassium chlorochromate, sodium cobaltinitrate, $Fe(acac)_3$, etc.
4. Determination of concentration of the given liquid mixture by viscosity measurement.
5. Determination of partition-coefficient of iodine between carbon tetrachloride and water.
6. Determination of integral heats of dilution of the sulphuric acid solutions, and to determine the strength of the given unknown acid solution.
7. Standardisation of a strong acid by conductometric titration with a strong base.
8. Experimental verification of Hasselbach-Henderson equation by pH measurement for a buffer mixture.
9. Determination of rate constant of the acid-catalysed hydrolysis of methyl acetate.
10. Verification of Beer-Lambert's law with potassium permanganate and the estimation of potassium present in the given solution.
11. 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, $-NO_2$, -OH (alcoholic or phenolic), >CO carbonyl, $-NH_2$ group.
12. Synthesis and characterization (by m.p. method) of para-nitro acetanilide.

Text Books:

1. Pandey, Bajpai and Giri, *Practical Chemistry*, 8/e (reprinted), S. Chand & Co. Ltd., 2006.
2. Gurtu & 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.

IT - 214 COMPUTER PROGRAMMING LABORATORY **0-0-3 = 2**

Subject Code: *IT - 214.*
Subject Name: *Computer Programming Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Programs:

1. Assignments on Operators and Expressions: At least three C programs using operators and expressions.
2. Assignments on Branching: At least five C programs using if, switch-case construct of C.
3. Assignments on Looping: At least three C programs (each), incorporating for loop, while loop and do-while loop.
4. Assignments on Array: At least three C programs using array (1D and 2D)
5. Assignments on String: string manipulation and use of standard library functions in C.
6. Assignments on Function: At least three C programs using function, Demonstration call-by-value and call-by-address, passing array (1D and 2D) to a function, at least two C programs related to recursive function.
7. Assignments on Pointer: At least three C programs using pointer, function and array.
8. Assignments on Structure & Union: At least one C program using structure, demonstration of difference between structure and union.
9. Assignments on File handling and Commands line arguments: C programs involving opening, closing, reading/writing a file. Copy content of one file to another file using commands line arguments.

Text Books:

1. B. S. Gotfried, *Programming in C*, Schuam Outline Series, TMH, 2005.

EC - 215 BASIC ELECTRONICS LABORATORY **0-0-3 = 2**

Subject Code: *EC - 215.*
Subject Name: *Basic Electronics Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Experiments:

1. To Study the VI Characteristics of Silicon Diode.

2. To Study the VI Characteristics of Zener Diode.

3. Design and Analysis of a Half wave Rectifier using Diode.

4. Design and Analysis of a center-tap Full wave Rectifier using Diodes

5. Design and Analysis of a Bridge Rectifier Circuit.

6. Design and Analysis of a Clipping Circuit with one voltage source. (*Different possible configurations*)

7. Design and Analysis of a Clipping Circuit with two voltage source. (*Different possible configurations*)

8. Design and Analysis of a Clamper Circuit.

9. Analysis of the characteristics of BJT (CE and CB mode)

10. Design and Analysis of fixed bias circuit using NPN transistor (DC)

11. Design and Analysis of emitter bias circuit using NPN transistor (DC)

12. Study of the characteristics of JFET.

13. Study of the characteristics of MOSFET.

14. Verification of truth tables of logic gates.

Text Books:

1. Boylestead and Nashelsky, *Electronic Devices and Circuits Theory*, 9/e, PHI, 2006.
2. R. P. Jain, *Modern Digital Electronics*, 3/e, TMH, 2003.

CE - 216 ENGINEERING GRAPHICS **0-0-3 = 2**

Subject Code: *CE - 216.*
Subject Name: *Engineering Graphics.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four 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. K.Venugopal, *Engineering Drawing and Graphics*, New Age, 2005.
2. Dhananjay A. Johle, *Engineering Drawings*, McGraw Hill Education Pvt. Ltd., 2008.

MA – 301 ENGINEERING MATHEMATICS – III **3-1-0 = 4**

Subject Code: *MA - 301.*
Subject Name: *Engineering Mathematics - III.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination =90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introductory Linear Algebra: Vector spaces (over the field of real and complex numbers). Matrices and determinants, linear transformation. Rank of system of linear equations and their solutions. Inverse of matrix. Equivalent, Elementary, Echelon, normal matrices. Eigen values and eigenvectors. Similarity Matrices. Bilinear and quadratic forms. Diagonalisation of Hermitian matrices, Matrices in Physical science- Rotational, Pauli spin, Dirac matrices.

UNIT – II

Applied Linear Algebra: Classification of quadrics in space. Variation of Parameters for second order linear O.D.E. with variable coefficients, Ordinary linear differential equations of nth order, solutions of homogeneous equations, Operator method. Methods of undetermined coefficients and variation of parameters (simple problems only), Applications to physical sciences and engineering problems. Frobenius method.

UNIT – III

Numerical Methods – I: Bisection method, Newton-Rapson's and Secant methods for roots of nonlinear equations. Polynomial interpolation, divided differences, summation of series, errors in polynomial interpolation, interpolation by spline functions. Numerical integration, trapezoidal and Simpson's rules, error formulae, Gaussian quadrature, numerical differentiation.

UNIT – IV

Numerical Methods – II: Solution of linear systems, Gaussian elimination, LU factorization, ill-conditioning and error bounds, Eigen value problems, f-computation of eigen values and eigen vectors by power and inverse iterations.

Text Books:

1. T.M. Apostol, *Calculus, Volume II*, 2/e, Wiley, 1969.
2. Krishnamurty, Mainra and Arora, *Linear Algebra*, Affiliated East-West Pvt. Ltd., 2007.
3. K.E. Atkinson, *Introduction of Numerical Analysis,* 2/e, John Wiley, 1989.

Reference Books:

1. S. D. Conte and Carl de Boor, *Elementary Numerical Analysis- An Algorithmic Approach*, 3/e, McGraw Hill, New York, 1980.
2. B. S. Grewal, *Numerical Methods for Engineers and Scientist*, Khanna Publications, 2010.
3. Bhattacharya, Jain and Nagpaul, *First Course in linear algebra*, Wiley Eastern, 1991.
4. Lipschutz and Symour, *3000 Solved Problems Linear Algebra*, TMH, 2004.

EC – 302 ELECTRONIC DEVICES AND CIRCUITS **3-1-0 = 4**

Subject Code: *EC - 302.*
Subject Name: *Electronic Devices and Circuits.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination =90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Voltage regulators: Zener regulator, emitter follower regulator, feedback voltage regulator, voltage regulator using ICs.
Low frequency transistor amplifier: Equivalent circuit of BJT using h parameters for CB, CE and CC configurations.

UNIT – II

High frequency response of transistor amplifier: High frequency π model, approximate CE high frequency model with resistive load, CE short circuit current gain.
Multi stage amplifiers: General cascaded system, RC coupled amplifier, cascode amplifier, Darlington pair, and Frequency response characteristics.

UNIT – III

Large signal amplifier: Analysis of class A, B, AB, C amplifiers, Class B push pull amplifiers.
FET Amplifiers: CS, CD and CG configurations and biasing.
Feedback amplifiers: Concept of feedback, characteristics of negative and positive feedback, Topological classification (Voltage series, Voltage shunt, Current series, Current shunt).

UNIT –IV

Oscillators: Classification of Oscillators, frequency stability of oscillatory circuits, Tuned based oscillators, R-C phase shift oscillator, Wien bridge oscillators, Colpitts Oscillator, crystal oscillator.
Multivibrators using transistors: Monostable, Astable, Bistable and Schmitt trigger.

Text Books:

1. A. P. Malvino, *Electronics Principles*, 6/e, TMH, 2005.
2. Sedra and Smith, *Microelectronic circuits,* , 5/e, ISE, Oxford University Press, Seventh impression, 2010.
3. R. L. Boylestead and L. Nashelsky, *Electronic Devices and Circuit Theory*, 9/e, PHI, 2006.
4. Jacob Millman, Christos C. Halkias , *Integrated Electronics*, 2/e, TMH, 1972.

Reference Books:

1. S. Salivahanan, N Suresh Kumar, A Vallavaraj , *Electronic Devices and Circuits*, 4/e, TMH, 2006.
2. J. Milman and A. Grabel, *Microelectronics*, 2/e, McGraw Hill, 1988.
3. L. K. Maheshwari and MMS Anand, *Analog Electronics*, PHI, 2005.

EC – 303 SIGNALS AND SYSTEMS **3-1-0 = 4**

Subject Code: *EC- 303.*
Subject Name: *Signals and Systems.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works =60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT– I

Introduction: signals and systems, examples of signals and systems; signal types: energy and power signals, continuous and discrete time signals, analog and digital signals, deterministic and random signals; signal properties: Symmetry, periodicity, and absolute integrability. Systems and system properties: linearity, shift-invariance, causality, stability, realizability; Continuous time and discrete time linear shift-invariant (LSI) systems: the impulse response and step response; response to arbitrary inputs: convolution, interconnections; characterization of causality and stability of linear shift-invariant systems;

UNIT– II

Signal representation: signal space and orthogonal bases of signals, Fourier series representation; Fourier Transform and properties, Parseval's Theorem, time-bandwidth product; Phase and group delays; Hilbert transform, pre- envelope. Spectral Analysis: Energy, power, Parseval's theorem, Energy, Power Spectral density functions (PSDF), the autocorrelation function, Cross correlation function, relationship between PSD function and the auto correlation function.

UNIT– III

Complex Frequency, Laplace Transforms, Shifting theorems, initial value theorem, final value theorem, effects of differentiation and integration in time domain. System transfer function, poles and zeroes, impulse response convolution, transient and steady state analysis (R-L-C circuit), solution of linear differential equations.

UNIT– IV

Discrete signals, z-transform and Inverse z-transforms, relation between s–plane and z–plane. Shifting theorem. Initial value theorem and final value theorem, Transfer function of delay unit, realization of z-domain transfer function, unit sample response convolution. Solution of difference equations.

Text Books:

1. A.V.Opponheim, A.S.Willsky and Nawab, *Signals and Systems*, 2/e, PHI, 2006.
2. Robert A. Grabel and Richard A.Roberts, *Signals and Linear System*, John Willey and Sons, 1987.

Reference Books:

1. R.F. Ziemer,W.H. Tranter and D.R. Fannin, *Signals and Systems – Continuous and Discrete*, 4/e, PHI, 2005.
2. I. J.Nagrath, S.N. Saran, R.Ranjan and S. Kumar, *Signals and Systems*, TMH, 2001.
3. Roberts, *Signal and Systems: Analysis using Transformed Method and MATLAB*, TMH, 2003.
4. Ronald Bracewell, *The Fourier Transform and Its Applications*, 3/e, TMH, 2003.

EE – 304 ELECTRICAL NETWORK THEORY **3-1-0 = 4**

***Subject Code**: EE - 304.*
***Subject Name**: Electrical Network Theory.*
***No. of Hours Per Week**: Lectures-3, Tutorial-1.*
***Marks Distribution**: Sessional Works = 60, End Semester Examination = 90.*
***Questions to be set:** Eight (one from each unit and remaining four from the combination of more than one unit).*
***Questions to be answered:** Any Five.*
***Duration of End Semester Examination:** Three Hours.*

UNIT – I

Networks Topology: Graph of a network, Concepts of tree and links; Matrices associated with graphs: Incidence, fundamentals of cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. superposition, Thevenins and Nortons theorems, Maximum power transfer, Equivalent Wye-Delta connections,

UNIT – II

Sinusoidal circuit analysis: Sinusoidal voltage and current, element responses, series RL sinusoidal response, series RC sinusoidal response. Sinusoidal steady state in the frequency domain, impedance, admittance, voltage and current division in the frequency domain. Impedance angle, analysis of network circuits using Laplace transform.

UNIT – III

Resonance and Frequency response: Series and parallel resonance. Network functions for 2-port networks, calculations of network functions for Ladder and general network, Poles and zeroes of network functions, Restrictions on poles and zeroes locations for driving point functions, Restrictions on poles and zeroes locations for transfer functions; stability of active networks.

UNIT – IV

Power transfer, insertion loss, optimization, Tellegen's theorem. 2-port Circuits: network variables, short circuit and open circuit parameters, transmission and hybrid parameters, relationships between parameter sets, parallel connection of 2-port network.

Text Books:

1. M. E. Van Valkenburg, *Network Analysis*, 3/e, PHI, 2005.
2. W.H. Hayt, J.E. Kemmerly and S.M. Durbin, *Engineering Circuit Analysis*, 6/e, TMH, 2006.

Reference Books:

1. D. Roy Choudhury, *Networks and Systems*, New Age Publishers, 1998.
2. Sudhakar, *Circuits and Networks: Analysis and Synthesis*, 2/e, TMH, 2002.
3. Bell, *Electric Circuits*, 6/e, PHI, 2005.
4. J. D. Ryder, *Networks, Lines and Fields*, 2/e, PHI, 2005.
5. Nahvi and J.A. Edminister, *Schuam's Outline Electric Circuits*, 4/e, TMH, 1997.

IT – 305 DATA STRUCTURES AND ALGORITHMS 3-1-0 = 4

***Subject Code**: IT - 305.*
***Subject Name**: Data Structures and Algorithms.*
***No. of Hours Per Week**: Lectures-3, Tutorial-1.*
***Marks Distribution**: Sessional Works = 60, End Semester Examination = 90.*
***Questions to be set:** Eight (one from each unit and remaining three from the combination of more than one unit).*
***Questions to be answered:** Any Five.*
***Duration of End Semester Examination:** Three Hours.*

UNIT - I

Introduction to Data structure, Time and Space analysis of Algorithms, Order Notations, *Linear Data Structures***:** *List:* array and link list representation, insertion, deletion and searching elements in a list, traversing a list, Sparse matrices, doubly link lists- traversing, inserting, deleting, searching in a doubly link list, *Stack:*- Array and Link list representation, operations on stacks, its application in prefix, postfix and infix expression, *Queue***:** array and link list representation, insertion and deletion operations on queue, Dequeues, and Circular queue implementation and operations associated.

UNIT - II

*Non-linear Data Structure***:** Introduction to Tree, Representation of Tree, Binary Trees, Tree traversals, Introduction and representation of binary search tree.

UNIT - III

*Binary Search Tree***:** Searching, insertion and deletion operation in a Binary Search Tree. *AVL tree***:** representation, searching, inserting and deleting in AVL tree, B-trees- representation, searching, insertion and deletion in a B Tree

UNIT - IV

*Graphs***:** Introduction to graph theory, array and link list representations, Breadth-first and Depth-first Search. Minimum Spanning tree algorithms-Kruskal's algorithms, shortest path algorithms- Warshall's algorithms.

UNIT - V

*Sorting and Searching Algorithms***:** Bubble sort, Selection Sort, Insertion Sort, Quick sort, Merge Sort, Heap sort. Linear Search, Binary Search, *Hashing:* Hashing functions, searching using hash technique, Collision avoidance techniques- linear probing, separate chaining.

Text Books:

1. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., *Data Structures and Algorithms*, Addison Wesley**, YP.**
2. S. Lipschutz, *Data Structures*, 4/e, TMH, 2006.
3. Horowitz Ellis and Sartaj Sahni, *Fundamentals of Data Structures*, Galgotia Publ., **YP**.

Reference Books:

1. Y. Langsum, M J Augenstein, and A M Tenenbaum, *Data Structures using C and C++*, 2/e, PHI, **YP**.
2. M. Radhakrishnan and V.Srinivasan, *Data Structure Using C*, ISTE/EXCEL BOOKS, **YP**.

EC – 312 ELECTRONIC DEVICES AND CIRCUITS LABORATORY 0-0-3 = 2

Subject Code: *EC - 312.*
Subject Name: *Electronic Devices and Circuits Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Experiments:

1. Design and Analysis of regulator circuits using Zener diode.

2. Design and Analysis of shunt and series regulator.

3. Design of voltage regulators using ICs: 78xx and 79xx

4. Design of Feedback amplifiers: Voltage series and Voltage shunt.

5. Design of Feedback amplifiers: Current series and Current shunt

6. Design of oscillators: RC phase shift oscillator, Wien bridge oscillator (using BJTs and FETs).

7. Design of oscillators: Hartley and Colpitts (using BJTs and FETs)

8. Design of a multistage transistor amplifier.

9. Design of amplifiers: Class A, Class B Push-Pull and Class C amplifier.

10. Design of Mono stable Multivibrator circuits using BJT.

11. Design of Astable Multivibrator circuits using BJT.

12. Design of Bistable Multivibrator circuits using BJT.

Text Books:

1. A. P. Malvino, *Electronics Principles*, 6/e, TMH, 2005.
2. R. L. Boylestead and L. Nashelsky, *Electronic Devices and Circuit Theory*, 9/e, PHI, 2006.

IT – 315 DATA STRUCTURE LABORATORY **0-0-3 = 2**

Subject Code: *IT - 315.*
Subject Name : *Data Structure Using C Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
***Question to be set*:** *All Questions.*
***Question to be answered*:** *One will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Programs:

1. Array implementation of Stacks, Queue, and Circular queue and dequeue data structures.
2. Link List implementation of Stacks, Queue, Circular queue and dequeue data structures.
3. Implementation on conversion of infix expression to prefix and postfix using Stack,
4. Implementation on evaluation of expression using Stack.
5. Link list representation of binary tree and perform insertion, deletion operation on it.
6. Implementation of tree traversals techniques (in order, preorder and post order traversals).
7. Implementation of binary search tree and perform searching on it.
8. Implementation of Breath first search in a graph.
9. Implementation of Depth first search in a graph.
10. Implementation of Kruskal's algorithms.
11. Implementation of Warshall's algorithms.
12. Implementation of Insertion sort techniques.
13. Implementation of Bubble sort techniques.
14. Implementation of Selection sort techniques.
15. Implementation of Heap sort techniques.
16. Implementation of Binary search techniques.
17. Implementation of Hashing using chaining and linear probing technique.

Text Book:

1. S. Lipschutz, *Data Structures*, 4/e, TMH, 2006.

EC – 316 PCB DESIGN LABORATORY **0-0-3 = 2**

Subject Code: *EC - 116.*
Subject Name: *PCB Design Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 50.*
Design to be carried out: *One.*
Examination: *Internal (Evaluation on the Designed PCB and Viva Voce).*

Theory:

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.

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.

MA – 401 STATISTICS AND RANDOM PROCESSES **3-1-0 = 4**

Subject Code: *MA - 401.*
Subject Name: *Statistics and Random Processes.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introduction to probability: Events, Set, set operations, sigma and Borel fields, classical and relative frequency based definitions of probability, axiomatic definition of probability, conditional probabilities, independence, total probability, Baye'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. *Some special distributions*: Binomial and Poisson discrete distributions, Uniform, exponential, Gaussian and Raleigh continuous distributions.

UNIT – II

Two dimensional random variables: joint distribution and density functions, marginal probability distribution, conditional probability distribution, independence. Functions of random variable, functions of two random variables, n - varaite random variables. Expected value of a random variable(s), mean, variances and moments of random variables, Joint moments, conditional expectation, covariance and correlations, independence, uncorrelated and. Random vector: mean vector, covariance matrix and properties, Multivariate Gaussians distributions, vector- space representation of random variables, linear independence, inner product, Schwarz inequality.

UNIT – III

Sequence of random variables: almost sure and mean square convergence, convergence in probability and distribution, law of large numbers, central limit theorem. *Elements of estimation theory* orthogonal random variables - Linear minimum mean-square error and orthogonality principle in estimation, Bounds and approximations- Chebyshev's inequality and chernoff bounds. Hypothesis testing, Moment generating and characteristic functions and their applications.

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. Ergodicity, spectral representation of a real WSS process, Spectral factorization theorem. White noise process and white noise sequence. Gaussian process, Poison process and Markov processes.

Text Books:

1. A, Papoulis and S.U. Pillai, *Probability, Random Variables and Stochastic Process*, 4/e, McGraw Hill, 2002.
2. H. Stark and J.W. Woods, *Probability and Random Processes with Applications to Signal Processing*, Prentice Hall, 2002.

Reference Books:

1. P.Z, Pebbles, *Probability, Random Variables and Random Signals Principles*, 4/e, McGraw Hill, 2000.
2. T, Veerarajan, *Probability, Statistics and Random Processes*, 2/e, McGraw Hill, 2003.

EC – 402 ELECTROMAGNETIC THEORY **3-1-0 = 4**

Subject Code: *EC - 402.*
Subject Name: *Electromagnetic Theory.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *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.

EC – 403 DIGITAL ELECTRONIC CIRCUITS **3-1-0 = 4**

Subject Code: *EC - 403.*
Subject Name: *Digital Electronic Circuits.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Signed numbers; Cannonical representations-minterm, maxterm; Karnaugh map simplification up to six variables, Quine- McCluskey minimization, r's and r-1's complement arithmetics, binary coded decimal codes; Gray codes; error detection and correction codes – parity check 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, de-multiplexers and their applications; code converter.

UNIT – III

Sequential logic devices and circuits: latches; flip-flops, SR, JK, D and T flip-flops; shift-registers; synchronous and asynchronous 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 behaviour of logic circuits – noise margins, fan-in, fan-out, propagation delay, power dissipation.
Microprocessor (8085): architecture, instruction sets and addressing modes.

Text Books:

1. R. P. Jain, *Modern Digital Electronics,* 3/e, TMH, 2009.
2. M. Mano, *Digital Logic and Computer Design*, PHI, 1996
3. Tocci and Widmer, *Digital Systems: Principles and Applications*, 8/e, PHI, 2006.
4. Ramesh S. Gaonkar, *Microprocessor architecture, programming and applications with 8085*, 5/e, Penram International Publishing (India) Pvt. Ltd., 2005.

Reference Books:

1. A. Anand Kumar, *Fundamental of Digital Circuits*, 2/e, PHI, 2009.
2. V. Rajaraman and T. Radhakrishnan, *Digital Logic and Computer Organization*, PHI, 2006.
3. M. Mano, *Digital Design*, 3/e, PHI, 2006.
4. Donald P. Leach, *Digital Principles and Applications*, 6/e, TMH, 2006.
5. D. D. Gajski, *Principles of Digital Design,* Prentice Hall, 1996.
6. P. K. Lala, *Practical Digital Logic Design and Testing,* Prentice-Hall, 1996.

EC – 404 LINEAR INTEGRATED CIRCUITS AND SYSTEMS **3-1-0 = 4**

Subject Code: *EC - 404.*
Subject Name: *Linear Integrated Circuits And Systems.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *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, phase shifter, voltage to current converter, instrumentation amplifier. 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: Comparator, 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.

EC – 405 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION 3-1-0 = 4

Subject Code: *EC - 405.*
Subject Name: *Electronic Measurements and Instrumentation.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Art of measurement: Accuracy and precision, types of Errors, Classification of standards of measurements, Electrical standards, IEEE standards. Bridges and their applications: Maxwell Bridge, Maxwell Wein Bridge, Andersons Bridge, Schering Bridge, Desauty Bridge, Applications of AC bridges.

UNIT – II

Electronic Measuring Instruments: Construction, Principle and application of: Digital voltmeters, Multimeters, Cathode ray oscilloscopes, wave analyzer, spectrum analyzer.

UNIT – III

Display devices and recorders: Light emitting diode, Liquid crystal displays, Graphic Recorders: strip chart recorder, circular chart recorder, 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 transducer.

Text Books:

1. Rangan Mani Sharma, *Instrumentation Devices and Systems*, 2/e, TMH, 1999.
2. A.K.Sawhney, *A course in Electrical measurement and measuring instruments,* Dhanpat Rai, 2001.
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. 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.

EC – 413 DIGITAL ELECTRONICS LABORATORY **0-0-3 = 2**

Subject Code: *EC - 413.*
Subject Name: *Digital Electronics Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered: *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four 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. J. F. Wakerly, *Digital Design – Principles and Practices*, 4/e, PHI, 2006.
2. M. Mano, *Digital Design*, 3/e, PHI, 2006.
3. R.P.Jain, *Modern Digital Electronics*, 3/e, THM, 2003.

EC – 414 LINEAR INTEGRATED CIRCUITS LABORATORY **0-0-3 = 2**

Subject Code: *EC - 414.*
Subject Name: *Linear Integrated Circuits Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered: *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four 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.

EC – 415 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION LABORATORY 0-0-3 = 2

Subject Code: *EC - 415.*
Subject Name: *Electronics Measurements and Instrumentation Laboratory.*
No. of Hours Per Week ***:*** *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered**:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four 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).
12. Study of Energy meter
13. Measurement of power by Wattmeter method

Text Books:

1. A.K.Sawhney, *A course in Electrical Measurement and Measuring Instruments,* Dhanpat Rai, 2001.

HU –501 INDUSTRIAL ECONOMICS AND MANAGEMENT **3-1-0 = 4**

Subject Code: *EC- 501.*
Subject Name: *Industrial Economics and Management.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works =60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit). .*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

Unit – I

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.

Unit – II

Production process, types of production, plant layout, production planning and control processes, human resource functions, emotional intelligence, inventory control techniques, work and method study, productivity concept.

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. Chary, S.N, *Production and Operations Management*, TMH, 2007.
6. Kotler, Keller, Koshy, Jha, *Marketing Management-A South Asian Perspective*, Pearson Ltd., 2009.
7. Luthans, Fred, *Organizational Behaviour*, TMH, New Delhi, 2003.

EC –502 MICROPROCESSOR **3-1-0 = 4**

Subject Code: *EC - 502.*
Subject Name: *Microprocessor.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works =60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

8085 Programming. Stacks and subroutines, counters, time delays, Interrupts, Instruction cycle, machine cycle, timing diagrams. Memory Interfacing with 8085, Interfacing I/O, memory mapped I/O and I/O mapped I/O. Interfacing A/D and D/A converters. Stepper motor interface with 8085

UNIT – II

8155-Programmable I/O; 8255-Programmable Peripheral Interface; 8355-ROM ; 8253 – Timer; 8251 – USART; 8257 – DMAC, 8259 – PIC.

UNIT – III

8086/8088 architecture, instruction sets, addressing mode. Assembler directives and Advanced programming. Min and Max mode of operation.

UNIT – IV

8086 Programming, Interrupts and DOS interrupt 21H functions. Interfacing A/D converters, data acquisition. Interfacing D/A converters, wave form generation.

Text Books:

1. Ramesh S. Gaonkar, *Microprocessor architecture, programming and applications with 8085*, 5/e, Penram International Publishing (India) Pvt. Ltd., 2002.
2. B. Ram, *Fundamentals of microprocessors and microcomputers*, 3/e, Dhanpat Rai Publication, 1989.
3. Douglas V.Hall, *Microprocessor and interfacing*, McGraw Hill International Ed.,2/e, 2006.

Reference Books:

1. Rajasree, *Advanced Microprocessors*, 2/e, New Age Publishers, 2005.
2. Intel Corp., *The 8080/8085 Microprocessor Book: Intel marketing communications*, Wiley Inter science publications, 1980.
3. Adam Osborne and O. Kane, *An introduction to microcomputers, Vol. 2 – Some real microprocessors,* Galgotia Book source, New Delhi, 1980.
4. Triebel and Singh, *The 8088 and 8086 Microprocessors*, 4/e, Pearson Education, 2003.

EC – 503 PRINCIPLES OF COMMUNICATION SYSTEMS **3-1-0 = 4**

Subject Code: *EC- 503.*
Subject Name: *Principles of Communication Systems.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works =60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit). .*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Continuous wave linear modulators: Amplitude Modulation (AM), Time domain expression and modulation index, Frequency domain (spectral) representations, transmission bandwidth for AM, AM for a single tone message, phasor diagram of an AM signal, transmission requirements for AM, normalized power and its use in communication carrier power and side band power, methods of generating AM and DSB, square law modulators, balanced modulators, ring modulators, generation of SSB using a side band filter, indirect generation of SSB,transmission requirements for SSB, vestigial side band modulation (VSB).

UNIT –II

Demodulation for linear modulation: demodulation of AM signals, square law and envelope detectors, the super heterodyne receiver for standard AM radio, synchronous demodulation of AM, DSB and SSB using synchronous detection, effects of frequency and phase errors in the local oscillator in DSB and SSB, demodulation of SSB using carrier reinsertion and the use of SSB in telephony, carrier recovery circuits, introduction to PLL.

UNIT –III

FM and PM, Instantaneous frequency and instantaneous phase time common representation for FM and PM, Phasor diagram for FM and PM, FM and PM signals for a single tone message, Spectral representation of FM and PM for a single tone message, Bessel's functions and the Fourier series, Transmission bandwidth for FM, Carson's rule, narrow band and wide band FM and PM signals, Generation of FM using Armstrong method, Demodulation of FM and PM signals, Demodulation of FM using PLL.

UNIT-IV

Noise: Introduction, Thermal Noise, Shot Noise, white noise, Equivalent Input Noise Generators and Comparison of BJT" s and FET's Signal to Noise ratio, Noise: AM, DSBSC, SSBSC and FM; Noise Factor, Amplifier Noise in terms of Noise Factor, Noise Factor of Amplifiers in Cascade.

Text Books:

1. S. Haykin, *An Introduction to Analog and Digital Communications,* Willey Eastern, New York, 1989.
2. B.P. Lathi, *Communication Systems*, John Wiley & Sons, 1968.
3. B.P. Lathi, *Modern Digital and Analog Communication Systems*, 3/e, Oxford University Press, 1998.
4. Dennis Roddy and John Coolen*, Electronic Communication,* 4/e*,* PHI,1989.

Reference Books:

1. C.W. Couch II, *Digital and Analog Communication Systems*, 2/e, Macmillan Publishing Co., New York,1987.
2. Taub and D.L.Shilling, *Principles of Communication Systems*, 2/e, TMH,1986.
3. A. Bruce Carlson, *Communication Systems*, 4/e, TMH, 2002.
4. George Kennedy, *Electronic Communication Systems*, 4/e, TMH,1999.

EE – 504 POWER ELECTRONICS **3-1-0 = 4**

Subject Code: *EE - 504.*
Subject Name: *Power Electronics.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Power Electronic devices: Thyristor, BJT, MOSFET, IGBT, MCT, turn on and turn off mechanisms, device ratings, safe operating area, secondary breakdown, snubber circuits, DC-DC switch mode converter topologies: buck, boost, buck- boost and Cuk converter,

UNIT – II

DC-AC switches mode inverters, single phase inverter, SPWM inverter, three phase inverter. Resonant converters, zero voltage and zero current switching, load resonant converter, resonant switch converter.

UNIT – III

Switched mode DC power supplies, forward converter, fly back converter, half bridge and full bridge converter power supplies.

UNIT – IV

Controlled rectifiers, half controlled and full controlled, single phase and three phase rectifiers, dual converters ,Uninterruptible power supplies (UPS): online and offline (Qualitative only).

Text Books:

1. V. Subramanyam, *Power Electronics*, 2/e, New Age Publishers, 1997.
2. M.R. Rashid, *Power Electronic Circuits, Devices and Applications*, 3/e, PHI, 2006.

Reference Books:

1. N. Mohan, T.M. Underloned and W.P. Robbins, *Power electronic Converters, Applications and Design*, John Wiley and Sons, 1989.
2. G.K. Dubey and C.R.K. Asarabada, *Power Electronic Devices*, IETE book series Vol I, TMH 1993.
3. Asghar, *Power Electronics*, PHI, 2005.

EC – 505 BASIC CONTROL SYSTEM **3-1-0 = 4**

Subject Code: *EC - 505.*
Subject Name: *Basic Control System.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT-I

Introduction to Control Systems: Classification of control systems, Examples of control systems, Basic properties of Feedback Control Systems: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness. Steady-state errors and error constants. Type of systems and its effect on error function. Control system components: Potentiometer, tachogenerator, synchro and resolver, dc and ac servomotor. System Modelling: Transfer function and impulse response function, modelling of electrical and mechanical systems, Basic control system components: Block diagram development of system, block diagram reduction and signal flow graph.

UNIT II

Time response of system: Transient and steady state response of first order and second-order LTI systems, Performance specifications in time-domain, stability concept, relative stability, Routh-Hurwitz stability criterion. Root locus techniques: Root Loci and complementary root loci rules for root locus plots, typical examples,

UNIT-III

Frequency response analysis: Bode plot, Minimum and non-minimum phase systems, stability in frequency domain, Nyquist plots, Nyquist stability criterion, Gain margin and Phase margin. Control system compensators: lead, lag and lead-lag compensator.

UNIT IV

Control actions: Proportional, integral, derivative, and their combinations. State variable analysis: Concept of state, state variable, state model. State variable formulation of control system, diagonalization, Relating transfer function with state model. Time response of state model of linear time-invariant system. Elementary concept of controllability and observability. Eigen values and Eigen vectors.

Text Books:

1. Nagrath and Gopal, *Modern Control Engineering*, 5/e, New Ages International, 2007.
2. Kuo, B.C., *Automatic Control System*, 6/e, Prentice Hall, 1993.

Reference Books:

1. Ogata, K., *Modern Control Engineering*, 2/e, Prentice Hall, 1991.
2. Gopal. M., *Control Systems: Principles and Design*, Tata McGraw-Hill, 1997.

EC – 512 MICROPROCESSOR LABORATORY **0-0-3 = 2**

Subject Code: *EC - 512.*
Subject Name: *Microprocessor Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered: *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four 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.

EC – 513 COMMUNICATION SYSTEM LABORATORY **0-0-3 = 2**

Subject Code: *EC - 513.*
Subject Name: *Communication System Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered: *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Experiments:

1. Study the generation and detection of Amplitude Modulation (AM).
2. Study the generation and detection of Frequency Modulation (FM).
3. Study the generation and detection of Double sideband modulation (BSB).
4. Study the generation and detection of single side band modulation (SSB).
5. Study of synchronous demodulation and the super heterodyne receiver for standard AM radio.
6. Study the effect of noise in standard AM and FM waves
7. Study the Satellite receiver.
8. Study the Auto-correlation functions, PSDF of random signals
9. Study the effect of white noise on a LTI Systems.
10. Study the Demodulation of FM using PLL

Text Books:

1. S. Haykin, *An Introduction to Analog and Digital Communications,* Willey Eastern, New York, 1989.
2. B.P. Lathi, *Modern Digital and Analog Communication Systems*, 3/e, Oxford University Press, 1998.

EC – 516 SIMULATION USING MATLAB **0-0-3 = 2**

Subject Code: *EC - 516.*
Subject Name: *Simulation using MATLAB.*
No. of Hours Per Week : *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
***Question to be answered*:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of experiments:

1. Generation of Continuous- and Discrete- Time Signals (Time-domain representation).
2. Generation of Continuous- and Discrete- Time Signals (Frequency-domain representation).
3. Perform convolution of two sequences.
4. Determination of Laplace transform and inverse Laplace transformation using MATLAB
5. Representation of poles and zeros in z-plane, determination of partial fraction expansion in z-domain and cascade connection of second order system using MATLAB
6. Spectrum analysis of different signals
7. Determination of step response for 1st order & 2nd order system with unity feedback and calculation of time response specifications for different value of damping ratio.
8. Simulation of step response & impulse response for Type-I and Type-II system with unity feedback using MATLAB.
9. Determination of root locus of using MATLAB control system toolbox for a given transfer function value of 10. Determination of Bode Plot of using MATLAB control system toolbox for a given transfer function.
11. Determination of Nyquist Plot of using MATLAB control system toolbox for a given transfer function.
12. Determination of PI, PD, and PID controller action on first order and second order simulated process.

Text Books:

1. S K Mitra, *Digital Signal Processing*, 3/e, TMH, 2006.
2. K.Ogata, *Modern Control Engineering*, 4/e, PHI, 2006.

EC – 601 EMBEDDED SYSTEMS AND MICROCONTROLLERS **3-1-0 = 4**

Subject Code: *EC - 601.*
Subject Name: *Embedded Systems and Microcontrollers.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *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.

UNIT – II

8051 Assembly Language Programming, Jump, Loop and Call Instructions, I/O Port Programming, 8051 Addressing Modes, Arithmetic Instructions , Logical Instructions, Single Bit Instructions,

UNIT – III

8051 programming in C, Counter/Timer Programming in the 8051, 8051 Serial Communication, 8051 interrupts, Interrupt Enable Register, TCON Register, Interrupt Priority.

UNIT – IV

Interfacing: LCD, ADC, DAC and Sensors, Stepper Motor and External Memory. 8051 Interfacing with 8255.

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 Code™*, Wiley Publishing Inc., 2002.
2. FTP websites involved with embedded systems and software.

EC – 602 DIGITAL SIGNAL PROCESSING **3-1-0 = 4**

Subject Code: *EC - 602.*
Subject Name: *Digital Signal Processing.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Discrete Fourier Transform: Introduction, Definition of DFT, Properties of DFT: Linearity, Circular shift of a sequence, Symmetry properties, Circular convolution, Linear Convolution using DFT. Computation of DFT: Introduction, FFT algorithms: Decimation in time and Decimation in frequency, in place computations

UNIT – II

Analog filters Design: The filter design problem, Approximation problem in network theory, maximally flat low pass filter approximation, Chebyshev filter approximation, Frequency transformation.

UNIT – II

Digital Filter Design-I: IIR Filter design: Design of IIR filters from analog filters. Impulse invariance, Design based on numerical solution of differential equations, bilinear transformations, applications of above techniques to the design of Butterworth, and Chebyshev filters.

UNIT – IV

Digital Filter Design-II: FIR Filter design: Properties of FIR digital filters, Gibbs phenomenon, different types of window functions: Rectangular, Hamming, Hanning, Barlett, Blackman and Kaiser windows, design of FIR filters using above windows.
Implementation of Discrete-Time Systems: block diagram representation, equivalent structures, basic FIR digital structures: direct forms, cascade form, basic IIR digital structures: direct forms, cascade and parallel realizations.

Text 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.
3. P. Ramesh Babu, *Digital Signal Processing*, 2/e, Scitech, 13th Reprint, 2004.

Reference Books:

1. A V Oppenheim and R.W Schafer, *Discrete-Time Signal Processing*, 3/e, Pearson, 2010.
2. L R Rabinar and Gold, *Theory and applications of Digital Signal Processing*, PHI, 1999.
3. S. Salivahanan, A. Vallavaraj and C. Gnanapriya, *Digital Signal Processing*, TMH, 19th reprint, 2006.

EC – 603 MICROWAVE ENGINEERING **3-1-0 = 4**

Subject Code: *EC - 603.*
Subject Name: *Microwave Engineering.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Microwave Transmission lines: Transmission line equations and Solutions, Reflection and Transmission Co-efficient, 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.

UNIT – IV

Microwave solid state devices: Transistors, Tunnel Diodes, FETs, Gunn diodes, InP, CdTe diodes, Avalanche transit time devices-Read Diode, IMPATT, TRAPATT, BARITT Diodes, Parametric devices. Radar: Basic principles, Range equation, radar types- Pulsed radar system, PPI, CWD, MTI Displays.

Text Books:

1. R. E. Collin, *Foundations for Microwave Engineering*, 2/e, McGraw Hill, 1992.
2. D. M. Pozar, *Microwave Engineering*, 2/e, John Wiley, 1998.
3. S. M. Liao, *Microwave Devices and Circuits*, 3/e, PHI, 1995.
4. Skolnik M.I, *Radar Systems*, TMH, 2006

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.

EC – 604 COMPUTER COMMUNICATION AND NETWORKS **3-1-0 = 4**

Subject Code: *EC - 604.*
Subject Name: *Computer Communication and Networks.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introduction to Computer Networks, Connection Types: Point-to-Point and Multipoint/Multidrop, Network topology, Classification of Networks (LAN, MAN and WAN); Protocols and standards; Message-, Packet-, and Circuit- Switching; Reference models: OSI reference model, TCP/IP reference model and their comparison; Example Networks.

UNIT – II

Physical layer: introduction, physical connection, services provided to Data link layer, functions within the Physical layer, Physical layer interface and standards; Data link layer: services provided by Data link layer, framing, flow-and error- control, and their mechanisms: Stop-and-Wait ARQ, Go-Back-N ARQ and Selective-Repeat ARQ. Network layer, basic design issues, network layer services, connection oriented and connection less services, routing, shortest path routing, flooding.

UNIT – III

Queuing theory and delay analysis: Little's theorem, analytical treatment of M/M/1 and M/M/m queuing systems, simulation of queuing systems, delay analysis for ARQ system, Multi-access protocols and techniques: Aloha systems, CSMA, IEEE-802 standards, routing and flow control.

UNIT – IV

Protocols- Introduction to TCP/IP, IBM, SNA, Bit oriented (BSC) and Character oriented Protocol (SDLC, LAPB, LAPD, LLC), HDLC- frame format, station, states, configuration, access control, introduction to ad hoc networks, security issues.

Text Books:

1. D. Bertsekas and R. Gallagar, *Data Networks*, 2/e, PHI, 1992.
2. A. S. Tanenbaum, *Computer Networks*, 4/e, PHI, 2003.
3. A. Leon-Garcia and I. Widjaja, *Communication Network,* 2/e, TMH, 2004.
4. Gallager, *Data Network*, PHI, 2004.
5. T. Viswanathan, *Telecommunication Switching Systems and Networks,* PHI, 2004.

Reference Books:

1. W. Stallings, *Data and Computer Communication,* PHI, 1997.
2. J. T. Geier and J. Geier, *Wireless LANS*, Macmillan, 2001.
3. B. A. Forouzan, *Data Communications and Networking*, 3/e, TMH, 2005.

EC – 605 ANTENNA **3-1-0 = 4**

Subject Code: *EC - 605.*
Subject Name: *Antenna.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

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. Vector potential functions and electric and magnetic fields for electric and magnetic current sources. Solution of vector potential wave equation, duality, reciprocity and reaction theorems.

UNIT – II

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 – III

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, N-element linear array, and planar and circular arrays.

UNIT – IV

Traveling 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.

Text Books:

1. C. A. Balanis, *Antenna Theory*, 3/e, John Wiley and Sons, 2005.
2. F.E. Terman, *Electronic and Radio Engineering*, 4/e, McGraw Hill Book Co. ISE, 1955.
3. Albert A. Smith, *Radio Frequency Principles and its Applications* – The generation, propagation and reception of signal and noise, McGraw Hill, 2006.
4. Jordan and Balmain: *Electromagnetic Wave and Radiating Systems*, John Wiley, 2002.

Reference Books:

1. R.E. Collin, *Antennas and Radio Wave Propagation,* McGraw Hill Book Co., ISE, 1985.
2. J.D. Kraus, *Antennas*, 2/e, McGraw Hill Book Co., 1988.

EC – 611 EMBEDDED SYSTEMS AND MICROCONTROLLERS LABORATORY **0-0-3 = 2**

Subject Code: *EC - 611.*
Subject Name: *Embedded Systems and Microcontrollers Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered: *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four 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. Write an 8051 ALP to search a byte in an array of bytes stored in external RAM.
9. Write an 8051 ALP to illustrate addition, subtraction, multiplication and division of two 8 bit numbers.
10. Write an 8051ALP to illustrate hexadecimal up counter with a given starting and ending value.
11. Write an 8051 ALP to illustrate hexadecimal down counter with a given starting and ending value.
12. Write an 8051 ALP to illustrate decimal up counter with a given starting and ending value.
13. Write an 8051 ALP to illustrate decimal down counter with a given starting and ending value.
14. Write an 8051 ALP to demonstrate call and return instruction using a program to find factorial of a number.
15. Write an 8051 ALP to convert hexadecimal number to its equivalent decimal number.
16. Write an 8051 ALP to convert decimal number to its equivalent ASCII code.
17. Write a program using 8051 to convert ASCII code to its equivalent decimal number.
18. Write a program using 8051 to toggle all the bits of port 1. Put a time delay in between each issuing of data to port 1.
19. Write a program in 8051 to perform the following
    a) Keep monitoring the port P2.2 bit until it becomes high
    b) When it becomes high write a value 40H to port and send a high to low pulse to P3.3.
20. Write a Program in C to interface stepper motor to 8051 microcontroller and to rotate stepper motor in a clockwise and anti-clockwise direction.

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.

EC – 612 DIGITAL SIGNAL PROCESSING LABORATORY 0-0-3 = 2

Subject Code: *EC - 612.*
Subject Name: *Digital Signal Processing Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered: *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Experiments:

Computation of DFT:

1. Perform DFT and IDFT of any sequence.

Design of analog IIR filters:

2. Design a fourth-order maximally flat(Butterworth) analog lowpass filter with a 3-dB cutoff frequency at Ω=1 with characteristics of 1-dB cutoff frequency at 1kHz and a minimum attenuation of 40-dB at 5kHz.
3. Repeat 2. for a lowpass Type 1 and 2 Chebyshev filters.

Design of digital IIR filters design:

4. Design a Butterworth filter with the following specifications: Stop band edge frequency F_s=800kHz with stop band ripple of 30dB, Pass band edge frequency F_p=1kHz with pass band ripple of 0.5dB. Assume the sampling frequency 8 kHz.
5. Design a Type 1 Chebyshev IIR high pass filter with normalized pass band edge at 0.7π, normalized edge at 0.5π, pass band ripple of 1dB, and minimum stop band attenuation of 32dB. Take the sampling frequency to be 8kHz.
6. Design an IIR Butter band pass filter with following specifications: Stop band edge frequencies F_{s1}=800Hz and F_{s2}=3kHz with stop band ripple of 40dB, Pass band edge frequencies F_{p1}=900Hz and F_{p2}=2.8kHz with pass band ripple of 1dB. Assume the sampling frequency 12kHz.

Design of digital IIR filters design using Bilinear Transformation Method:

7. Design a Butterworth low pass digital filter operating at a sampling rate of 80kHz with a 0.5dB cutoff frequency at 4kHz and a minimum stopband attenuation of 45dB at 20kHz using the bilinear transformation method. Plot the gain responses of a) the prototyped analog LPF and b) the transformed digital filter.
8. Design a Type 1 Chebyshev IIR highpass digital filter with following specifications: Passband edge F_p=700Hz with passband ripple of α_p=1dB, Stopband edge F_s=500Hz with minimum stopband attenuation α_s=32dB. Plot the gain responses of a) the prototyped analog LPF and b) the transformed digital HPF filter. Take T=2sec. Use spectral transformation method.

Design of digital FIR filter design:

9. Design an equiripple linear-phase filter with the following specifications: Pass band edge frequency F_p=1kHz with pass band ripple of 0.5dB, Stop band edge frequency F_s=1.5kHz with stop band ripple of 30dB. Assume the sampling frequency 5kHz.

Design of digital FIR filters design using Window Method:

10. Design a linear phase FIR highpass filter with the following specifications: stopband edge ω_s=0.45π, passband edge at ω_p=0.6π, maximum passband attenuation of α_p=0.2dB, and minimum stopband attenuation of α_s=45dB. Use Rectangular window for the design. Plot the gain response of the designed filter.
11. Repeat 10. using Hamming window.
12. Repeat 10. using Hanning window.
13. Repeat 10. using Blackman window.
14. Speech Processing: Processing of Speech Signal at different sampling rate e.g. 8bit-PCM coding, 16bit-PCM coding and analyse their waveforms. Also perform their spectral analysis.

Text 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. B. P. Kumar, *Digital Signal Processing Laboratory*, CRC Press, 2005.

EC – 613 MICROWAVE ENGINEERING LABORATORY **0-0-3 = 2**

Subject Code: *EC - 613.*
Subject Name: *Microwave Engineering Laboratory.*
No. of Hours Per Week ***:*** *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered**:** *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Experiments:

1. Study the characteristics of rectangular waveguide.
2. Determine the standing wave ratio and reflection coefficient.
3. Measurement of unknown impedance using Smith Chart.
4. Study the characteristics of Gunn diode.
5. Study the characteristics of 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 cavity resonator.
10. Study the characteristics of microwave filter.
11. Study the characteristics of Klystron amplifier.
12. Study the characteristics of Reflex Klystron amplifier.
13. Study the characteristics of Magnetron.
14. Study the characteristics of TWT.
15. Study the characteristics of microwave BJT.
16. Study the characteristics of microwave FET.
17. Study the characteristics of microwave avalanche diode oscillator.
18. To design a single stage microwave amplifier.
19. To design a single stage microwave oscillator.

Text Book:

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

HU – 701 PROFESSIONAL ETHICS AND IPR **3-1-0 = 4**

Subject Code: *HU - 701.*
Subject Name: *Professional Ethics and IPR.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

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.

UNIT-II

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- III

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- IV

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.

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.

EC – 702 LOW DIMENSIONAL ELECTRONICS AND VLSI DESIGN 3-1-0 = 4

Subject Code: *EC - 702.*
Subject Name: *Low Dimensional Electronics and VLSI DESIGN.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introduction: VLSI technology trends, Moore's law, MOS transistor characteristics, types of MOS transistors, NMOS and CMOS inverter circuits, pass transistors and transmission gates, structure of NMOS and CMOS inverter. Scaling of MOS circuits. NMOS and CMOS circuits for combinational and sequential logic, Design rules, specification of layers, stick notation, mask layout, delay and timing calculation, realization of Boolean functions,

UNIT – II

Pseudo n-MOS, dynamic CMOS and clocked CMOS logic realization of combinational circuits using these logics, stick notation and mask layout, simple flip-flop realization using NMOS and CMOS. Shift registers, dynamic shift registers, super buffers, RAM and ROM, Twin tub and SOI process. Design example: parity generator, bus arbitration logic, code converters, incrementer/decrementer, PLA. CAD tools: Design steps, CIF representation.

UNIT – III

System partitioning, placement and routing: basic partitioning methods, random selection, cluster growth, hierarchical clustering, in cut partitioning, simulated annealing, placement algorithms, routing algorithms.

UNIT – IV

Quantum cell, binary wires, basic logic gates, clocking, fault and fault tolerance: Hadamard gate, controlled-NOT gate, Toffoli gate, Quantum circuits. Reversible and Conservative logic gates, Simple inverter, standard inverter, fault- tolerant inverter, simulation techniques.

Text Books:

1. Neil H.E. Weste and David Harris, *CMOS VLSI Design: A Circuits and Systems Perspective*, 3/e, Addison Wesley, 2004.
2. K. Eshraghian, D. A. Pucknell and S. Eshraghian, *Essentials of VLSI Circuits and Systems*, PHI, 2005.
3. M. A. Nielsen and I. A. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, New Delhi, 2002.

Reference Books:

1. Pucknell and Eshrangian, *Basic VLSI Design Systems and Circuits*, 3/e, PHI, 2003.
2. Neil H. E. Weste, Kamran Eshraghian, *Principles of CMOS VLSI Design*, 2/e, Addison Wesley, 1994.
3. Wayne Wolf, *Modern VLSI Design: System-on-Chip Design*, 3/e, Pearson Education Asia, 2002.
4. Rabey, Chandrakasan and Nikolic, *Digital Integrated Circuits*, 2/e, Pearson Education Asia, 2004.
5. D.A.Hodges, H.G.Jackson and R.A.Saleh, *Analysis and Design Digital Integrated Circuits*, 3/e, TMH, 2005.
6. Volnei A. Pedroni, *Circuit Design with VHDL*, MIT Press, 2004.
7. Peter J. Ashenden, *The Designer's Guide to VHDL (Systems on Silicon)*, 2/e, Morgan Kaufmann, 2002.
8. R. P. Feynman, R. B. Leighton, and M. Sands, *The Feynman Lectures on Physics*, vol. 3, Addison Wesley/Narosa, New Delhi, 1998.

EC – 703 DIGITAL COMMUNICATION **3-1-0 = 4**

Subject Code: *EC - 703.*
Subject Name: *Digital Communication.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any Five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Sampling and quantisation, frequency domain signal representation, filtering, probability and random processes, introductory information theory and channel models.

UNIT – II

Modulation and Demodulation: Representation of bandpass signals, vector representation of signals, 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

Source and channel coding: Source coding techniques (arithmetic, Ziv-Lempel, Shannon-Fano-Elias, Huffman), Lossy source coding, Channel coding (parity, Huffman, cyclic codes)

UNIT – IV

Communication through band-limited channels: ISI-free communication, equalisation, decision feedback equalisation, adaptive equalisation, synchronisation. Orthogonal Frequency Division, Multiplexing (OFDM), CDMA and Spread Spectrum, MIMO.

Text Books:

1. J. G. Proakis and S. Salehi, *Contemporary Communication Systems Engineering*, 2/e, PHI, 2005.
2. S. Haykin, *Communication Systems*, 3/e, John Wiley and Sons, 1994.
3. F. Xiang, *Digital Modulation Techniques*, Artech House, 2000.
4. B. Sklar, *Digital Communication- Fundamentals and Applications*, 2/e, Pearson, 2001.
5. J. Proakis, *Digital Communication*, 4/e, McGraw-Hill, 1995.

Reference Books:

1. M. K. Simon, S. M. Hinedi and W. C. Lindsey, *Digital Communication Techniques: Signal Design and Detection*, PHI, 1994.
2. S. Benedetto and E. Biglieri, *Principle of Digital Transmissions*, Kluwer, 1999.
3. J. D. Gibson, *The Mobile Communication Handbook*; CRC, 1999.
4. H. Taub and D. L. Schilling, *Principles of Communication Systems*, 2/e, McGraw-Hill, 1986.
5. K. Sam Shanmugam, *Digital and Analog Communication Systems*, John Wiley and Sons, 1979.

Elective – I

EC – 70411 FUNDAMENTALS OF MEMS **3-1-0 = 4**

Subject Code: *EC - 70411.*
Subject Name: *Fundamentals of MEMS.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introduction To Fabrication Techniques: Basic fabrication techniques (lithography, thin film deposition and doping) MEMS fabrication techniques-Nano fabrication techniques (E-Beam nano-imprint fabrication, Epitaxy and strain engineering. Scanning probe techniques).

UNIT – II

Machining and Transport Property: Introduction to Micromachining and MEMS – Essential technical background for lithography-based micromachining - Photolithography, vacuum systems, etching methods, deposition methods.

UNIT – III

MEMS Device Physics and Design: Critical understanding of various transduction principles -Design, production, and characterization of MEMS devices - Sensing (piezoelectric, capacitive, magnetic, etc.) - Actuation (electrostatic, electromagnetic, thermal, piezoelectric, SMA, etc.) Layout and design rules Experimental Mechanics for Microelectromechanical Systems (MEMS) - Methods, techniques.

UNIT - IV

Applications: Sensors, Actuators, and Signal Processing - Principles and performance of micro transducers - Design of experiments - Sensor and actuator spatial/temporal resolution, error analysis, uncertainty - propagation, and data acquisition - Applications of micro transducers for distributed real-time control of systems.

Text Books:

1. J. A. Pelesko and D. H. Bernstein, *Modeling MEMS and NEMS*, CRC, 2002,.
2. N. Cleland, *Foundations of Nanomechanics: From Solid-State Theory to Device Applications*. *Advanced Texts in Physics.* Berlin: Springer, 2003.
3. V. Kaajakari, *Practical MEMS*, Las Vegas, Nevada: Small Gear, 2009.
4. Liu, *Foundations of MEMS. Illinois ECE Series*, Upper Saddle River, New Jersey: Pearson/Prentice Hall, 2006.

Elective – I

EC – 70412 INFORMATION THEORY AND CODING **3-1-0 = 4**

Subject Code: *EC - 70412.*
Subject Name: *Information Theory and Coding.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Concept of mutual information, Entropy and their properties, Entropy based techniques of feature extraction , Noiseless coding, Huffman coding and its optimality.

UNIT – II

Kraft and McMillan's inequality, Shannon-Fano code, Elias code, Arithmetic coding and universal coding. Ergodic and Markov sources and their entropy.

UNIT – III

Algebraic codes-Linear Block codes, cyclic codes-BCH codes, perfect code, galley codes, Finite geometry codes, Hadamard codes, Maximal distance separable codes, sphere packing and singleton bounds.

UNIT – IV

Codes for random access memories, tapes and disc, fault tolerant computation with arithmetic codes and redundant number systems. Exact techniques of decoding, introduction to Cryptographic codes-Random number generation, Public Key Crypto systems.

Text Books:

1. R. E. Blahut, *Theory and Practice of Error Correcting Codes,* Addison Wesley, 2002.
2. R.E. Blahut, *Principles of Transmission of Digital Information,* Addison Wesley, 2002.
3. D. Hankerson, G.A. Harris and P.D. Johnson, *Introduction to Information theory and Data Compression*, CRC Press, 2003.

Reference Books:

1. J. Das, S.K. Mullick and P.K. Chatterjee, *Principles of Digital Communications,* Wiley Eastern, 1992.
2. T.M. Gover and J.A. Thomas, *Elements of Information Theory*, John Wiley and Sons, 2006.
3. Shu Lin and Daniel J. Costello, *Error Control Coding*, PHI, 2004.

Elective – I

EC – 70513 OPTICAL FIBER COMMUNICATION **3-1-0 = 4**

Subject Code: *EC - 70513.*
Subject Name: *Optical Fiber Communication.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *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, modes in a planar waveguide, 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, waveguide dispersion, micro bending, bending and scattering Dispersion Characteristics: Intra and intermodal dispersion, dispersion modified fibers,

UNIT – III

Optical sources- LED and laser diode- Principles of operation, concepts of line width, phase noise, switching and modulation characteristics. Optical detectors- pn detector, pin detector, avalanche photodiode- Principles of operation, concepts of responsivity, sensitivity and quantum efficiency, noise in detection, typical receiver configurations (high impedance and trans-impedance receivers).

UNIT – IV

Coherent systems- Homodyne and heterodyne systems, coherent systems using PSK, FSK, ASK and DPSK modulations, System Design: Power budgets and rise time budget, Operating principle of Optical Amplifiers (EDFA, Raman and Brillouin), WDM Techniques, Fiber fabrication techniques, optical couplers and connectors.

Text Books:

1. John Senior, *Optical Fiber Communications*, 2/e, PHI, 1992.
2. Ghatak and Thyagrajan, *Introduction to fiber Optics*, 4/e, Cambride University Press,USA, 2002.
3. Gred Keiser, *Optical Fiber Communications*, 3/e, McGraw Hill, 2000.

Reference Books:

1. G.P. Agarwal, *Nonlinear fiber Optics*, 2/e, Academic Press, 2000.
2. G. P. Agarwal, *Optical Fiber Communication System*, 2/e, John Wiley & Sons, New York, 1997
3. Bishnu P. Pal, *Fundamental of fiber optics in Telecommunication and sensor systems*, Wiley Eastern Ltd, New Delhi, 1994

Elective – I

EC – 70414 ARCHITECTURE OF ADVANCE MICROPROCESSORS 3-1-0 = 4

Subject Code: *EC - 70414.*
Subject Name: *Architecture of Advance Microprocessors.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT I

Internal Microprocessor Architecture-Real mode memory addressing – Protected Mode Memory addressing –Memory paging – Data, Stack memory & Program memory addressing modes– Data movement instructions – Program control instructions- Arithmetic and Logic Instructions.

UNIT II

Introduction to 80186/188/286/386/486 register set, Data types. Overview of instruction set, segmentation, Privilege levels, Paging. Multitasking, Context switching, Task scheduling, Extension and I/O permission, interrupts and exception. Pentium-Pro, MMX, Hyper Threading. Concepts of RISC vs CISC.

UNIT III

Introduction to Pentium Microprocessor: Special registers, memory management, New Pentium Instructions, Processor, Special processor features – Pentium 4 processor, introduction to recent processors.

UNIT IV

Application of microprocessors in (i) data acquisition systems, (ii) process control, (iii) signal processing and data communication, (iv) distributed computing and networking.

Text Books:

1. Douglas V.Hall, *Microprocessor and interfacing*, 2/e,McGraw Hill International Ed., 2006.
2. A.K. Ray and K.M. Burchandi, *Advanced Microprocessors and Peripherals*, 2/e, TMH, 2006
3. Walter A.Tribel and Avtar Singh , 68000 Microprocessors, 4/e, Prentice Hall, 2002.
4. Bary B. Brey, *The Intel Microprocessors: 8086/8088, 80286, 80386, 80486*, 7/e, PHI, 2006.

Reference Books:

1. Alan R. Miller, *Assembly language programming the IBM PC*, Sybex Inc., 1987.
2. Intel Corporation, *Microcontroller Handbook*, Intel Publication, 1984.
3. Kenneth Ayala, *8086 Microprocessor: Programming and Interfacing the PC*, Thomson Delmar Learning, 1995.
4. Deniel Tabak, *Advance Microprocessor*, 2/e, TMH, 1994.

Elective – I

EC – 70415 CIPHER SYSTEM **3-1-0 = 4**

Subject Code: *EC - 70415.*
Subject Name: *Cipher System.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Number theory: Time estimates, divisibility and Euclidean algorithm, Congruencies, finite field theory, quadratic residues and reciprocity. Simple crypto systems, Linear shift ciphers, Affine transformation on monograph and digraph, transformation matrices cipher, Non alphabetic, poly alphabetic.

UNIT – II

Viginere and Beaufort systems – theoretical and practical security, Diffusion and Confusion – stream cipher and block cipher systems.

UNIT – III

Public key Cryptography: Knapsack problem – Fermat's theorem – Euler's theorem – Euler's generalization of Fermat's theorem, Mercle-Hellman, RSA, El-Gamal systems – public key distribution protocols.

UNIT –IV

New Data Encryption Standards: DES-IDEA-Blowfish-RC5-CAST-128 and Rijndael algorithms; Introduction to Elliptic Curve Cryptography.

Text Books:

1. H. Bekker and F. Piper, *Cipher Systems: The Protection of Communication,* North-Wood Publication, 1982.
2. Bruce Schneier, *Applied Cryptography, Protocols, Algorithms and Source Code in C*, John Wiley and sons,1994
3. Neal Koblitz, *A Course in number theory and cryptography*, Springer-Verlag NY, 1987.

Reference Books:

1. Der Denning, *Cryptography and data Security*, Addison Wesley Publishing Co., 1982.
2. A.J. Menezes, Oorschot Paul C. van, Vanstone Scott A, *Handbook of Applied Cryptography*, CRC, 1996.
3. William Stallings, *Cryptography and Network Security principles and Practice*, 3/e, PHI, 2002.
4. Johannes A. Buchman, *Introduction to Cryptography*, 2/e, Springer-Verlag, 2004

Elective – I

EC – 70416 OPTICAL NETWORKS **3-1-0 = 4**

Subject Code: *EC - 70416.*
Subject Name: *Optical Networks.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introduction to optical networks; Optical components: Multimode and Single mode fiber joints, Couplers (three and four port, start and WDM), Application of Fiber Couplers, Fiber Connectors (Cylindrical ferrule, Biconical connectors etc), Isolators, and Circulators, multiplexer & Filter (Grating, Fiber Bragg circuits, FP filter, Dielectric Filter, Acoustic optic filter etc.,)

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: Introduction to computer data networks, Diagrams and virtual circuits, ISO - OSI model, MAC layer protocols, Fibre optic LAN architecture and protocols- ring, star, and bus structures, Fibre distributed data interface (FDDI) ATM JP high speed bus protocols – RATO net, tree net.

UNIT – IV

Wavelength division multiplexed networks (WDM) LAMBDANET. Coherent star, PAS-NET, Shuffle net, all optical networks SONET and SDH- Functional architecture, timing aspects, ESCON, Metropolitan area; Broadcast and select network, Networks, layered architecture Photonic packet Switching: OTDM, MUX, DMUX, Synchronization etc

Text Books:

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

Reference Books:

1. John Senior, *Optical Fiber Communications*, 2/e, PHI, 1992.
2. Gred Keiser, *Optical Fiber Communications*, 3/e, McGraw Hill, 2000.
3. Bishnu P. Pal, *Fundamental of fiber optics in Telecommunication and sensor systems*, Wiley Eastern Ltd, New Delhi, 1994.

Elective – II (Open)

EC – 70521 SATELLITE AND MOBILE COMMUNICATIONS **3-1-0 = 4**

Subject Code: *EC - 70521.*
Subject Name: *Satellite and Mobile Communications.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introduction to satellite communication systems, Orbital Mechanics and Launchers, Spacecraft subsystems, AOCS, TT and C, Space Craft antennas and equipment reliability. Multiple Accesses: TDMA, FDMA, CDMA.

UNIT – II

Estimation of Channel Requirements, SPADE, Inmarsat Satellite System, Demand access in INTEL, sat TDMA Subsystem, Earth Station technology, Design of antennas. Tracking, Equipments for earth station, Direct Video Broadcasting, DTH technology. Representation of a mobile radio signal.

UNIT – III

Introduction to wireless communication: Evolution of mobile communications, mobile radio systems- examples, trends in cellular radio and personal communications. Cellular Concept: Frequency reuse, channel assignment, hand off, Mobile Radio Interference: Co-channel and Adjacent-channel Interference, Inter-modulation, Inter-symbol and Simulcast Interference. and system capacity, tracking and grade of service, Improving Coverage and capacity in Cellular systems. Microcell zone concept.

UNIT – IV

Free space propagation model, reflection, diffraction, scattering, link budget design, propagation models- Outdoor, Indoor. Small scale Multipath propagation, Impulse model, Small scale Multipath measurements, parameters of Mobile multipath channels. Fading, types of fading, bit error rate and word error rate, Coding: Vocoders, Linear Predictive Coders, Selection of Speech Coders for Mobile Communication, GSM Codec, RS codes for CDPD, spectral efficiency.

Text Books:

1. Pratt, Bostian, *Satellite Communications*, John Wiley and Sons, 2002.
2. W. C. Y. Lee, *Mobile Communications Design Fundamentals*, 2/e, Wiley, 1993.
3. T. S. Rappaport, *Wireless Communications,* Prentice-Hall, 1996.
4. G. H. Stuber, *Principles of Mobile Communications*, Kluwer, 1996.

Reference Books:

1. R. Steele and L. Manzo, *Mobile Radio Communications*, 2/e, John Wiley, 1999.
2. P. Wong and D. Britland, *Mobile Data Communication Systems*, Artech House, 1995.
3. W. C. Y. Lee, *Mobile Cellular Telecommunications*, 2/e, McGraw Hill, 1995.

Elective – II (Open)

EC – 70422 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE **3-1-0 = 4**

Subject Code: *EC - 70422.*
Subject Name: *Fundamentals of Artificial Intelligence.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Fundamental issues in intelligent systems: History of artificial intelligence; philosophical questions; fundamental definitions; philosophical questions; modelling the world; the role of heuristics. *Problem Solving:* Problem solving by searching; constraint satisfaction problems.

UNIT – II

Knowledge representation and reasoning: propositional and predicate logic; resolution and theorem proving; non-monotonic inference; probabilistic reasoning; non-monotonic reasoning; reasoning on action and change; temporal and spatial reasoning; uncertainty; basic concept of qualitative representation and reasoning .

UNIT – III

Machine learning: Definition and examples of machine learning; supervised learning; unsupervised learning; reinforcement learning; learning from observation.

UNIT – IV

AI Planning: Definition and examples of AI planning systems, planning as search; strips.
Introduction to Robotics: Introduction to robot manipulation, architectures, Control Paradigms, Sensors and actuators, perception; application domains.

Text Books:

1. S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, 2/e, Pearson Edu., 2003.

Reference Books:

1. Nilsson, N. J, *Principle of AI*, Narosa Publishing House, 1990.
2. E. Rich and K. Knight, *Artificial Intelligence*, McGraw Hill, 1991.
3. R. J. Schilling, *Fundamentals of Robotics: Analysis and Control*, Prentice-Hall India 1996.
4. K. S. Fu, R. C. Gonzalez and C. S. G. Lee, *Robotics: Control, Sensing, Vision and Intelligence*, McGraw-Hill, 1987.
5. R. P. Paul, *Robot Manipulators: Mathematics, Programming and Control*, MIT Press, 1981.
6. P. H. Winston and B. K. P. Horn, *Lisp*, 3rd Ed, Addison-Wesley, 1989.
7. Clocksm and Mellish, *Programming in PROLONG*, 3/e, Narosa Publishing House, 2001.

Elective – II (Open)

EC – 70523 DATA COMMUNICATION **3-1-0 = 4**

Subject Code: *EC - 70523.*
Subject Name: *Data Communication.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *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

Elective – II (Open)

EC – 70524 NANOTECHNOLOGY **3-1-0 = 4**

Subject Code: *EC - 70524.*
Subject Name: *Nanotechnology.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introduction: why nanotechnology, limits of size reduction, Moore‟s law. Physics of the solid state: structure, energy bands, and localized particles. Properties of individual nanoparticles: introduction, semiconducting nanoparticles.

UNIT – II Carbon nanostructures: introduction, carbon molecules-nature of the Carbon Bond, new Carbon Structures, carbon clusters, carbon nanotubes, application of carbon nanotubes. CNTFET. Basic characterization equipment: AFM, STM.

UNIT – III

Quantum Wells, Wires (nanowires), and Dots: Introduction, preparation of Quantum nanostructures, size and dimensionality effects, excitons, single electron tunneling. Cavity QED, NMR, Josephson junction, and Quantum dot devices.

UNIT – IV

Nanofabrication Techniques: basic microfabrication techniques:- lithography, thin film deposition and doping, etching and substrate removal, substrate bonding; nanofabrication techniques:- e-beam and nanoimprint fabrication.

Text Books:

1. Charles P. Poole, Jr., Frank J Owens, *Introduction to Nanotechnology*, John Wiley and Sons Inc, 2003.

Reference Books:

1. Bharat Bushan, *Handbook of Nanotechnology*, 2/e, Springer-Verlag Heidelberg, 2007.
2. K.E. Drexler, *Nanosystems*, John-Wiley Inc, 1992.
3. Morinubo Endo, Sumio Iijima, MS.Dresselhaus, *Carbon Nanotubes*, Pargamon, Elsevier Science, 1996.
4. Edward L Wolf, *Nanophysics and Nanotechnology*, Wiley-VCH Verlag, 2004.
5. S. D. Lyshevski, *Nano- and Microelectromechanical Systems*, CRC Press, 2001.
6. *Internet resources and research papers.*

Elective – II (Open)

EC – 70525 BIOMEDICAL ENGINEERING **3-1-0 = 4**

Subject Code: *EC - 70525.*
Subject Name: *Biomedical Engineering.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introduction to action potential, ECG, EEG and EMG signals, their origin and applications in medical diagnosis. Electrodes for recording ECG, EEG and EMG signals.

UNIT – II

Signal conditioners, instrumentation amplifiers, A/D and D/A converter interfaces to the PC, computerized automatic analysis. Diagnostic methods, ultrasound, CT and MRI.

UNIT – III

Transducers for physiological parameter reading, their characteristics, measurements of body temperature, blood pressure and heart rate. Lasers and applications of lasers in medical diagnostics and therapy

UNIT – IV

Prosthesis and prosthetic devices, Patient safety, electrical shock hazards, incorporation of safety aspects in biomedical instruments. Biotelemetry, monitoring biological parameters from a distance.

Text Books:

1. R.S. Khandput, *Handbook of Biomedical Engineering*, Tata McGraw Hill, 2003.
2. Leslie Cromwell, Freds Weibell and Erich A. Pfiffer, *Biomedical Instruments and Measurements*, Prentice Hall, 2007.
3. C. Raja Rao and S.K. Guha, *Principles of Medical Electronics and Biomedical Instrumentation*, Universities Press, India, 2004.

Reference Books:

1. John R.Hampton, *The E.C.G. made easy*, 5/e, Longman, Singapore Publishers Pvt. Ltd, 2004.
2. Geddes and Baker, *Applied Biomedical Instruments*, 3/e, Wiley, 1983.
3. Cobbold, *Biomedical Transducers*, Krieger Publishing Co., 1997

Elective – II (Open)

EC – 70526 DIGITAL IMAGE PROCESSING **3-1-0 = 4**

Subject Code: *EC - 70526.*
Subject Name: *Digital Image Processing.*
No. of Hours Per Week: *Lectures-3, Tutorial-1.*
Marks Distribution: *Sessional Works = 60, End Semester Examination = 90.*
Questions to be set: *Eight (one from each unit and remaining four from the combination of more than one unit).*
Questions to be answered: *Any five.*
Duration of End Semester Examination: *Three Hours.*

UNIT – I

Introduction to Digital Signal processing, Fourier- and z-Transformed multidimensional sequences, Digital image processing in practice: digitalizing images, characteristic of an image digitiliser, types of image digitisers, components, electronic image tubes, other systems, Film scanning digital image displays, display characteristics technologies.

UNIT – II

Histogram: Introduction to Histograms, Uses of histograms, Relations between histogram and image. Point Operations, linear point operations, point operations and the histogram, applications of point operations. Introduction to Algebraic operations, applications, geometric operations, grey level Interpolation, spatial transformation and its applications, geometric operations,

UNIT – III

2-D signals and systems; image transforms- 2D DFT, DCT, KLT, Harr transform and discrete wavelet transform; Linear filtering theory Harmonic signals and complex signal analysis, Convolution operation. Digital image filtering: Convolution filtering, Filter design, examples of common filters, optional filter, design, processing sampled data, computing data, truncation.

UNIT – IV

Image restoration: Approaches and models, super resolution, system identification DTF from degraded image Spectrum, Noise modeling. Image segmentation by thresholding, optimal threshold selection, gradient optimal threshold selection, and gradient based structure.

Text Books:

1. Kenneth R. Castleman, *Digital Image processing*, PHI, 2005.
2. Gonzalez and Woods, *Digital Image Processing*, 2/e, PHI, 2005.
3. Chanda and Majumdar, *Digital Image Processing and Analysis*, PHI, 2005.
4. Oppenheim and Schaffer, *Discrete Time signal Processing*, PHI, 2006.

Reference Books:

1. Joshi, *Digital Image Processing- An Algorithmic Approach*, PHI, 2006.
2. R.C. Gonzalaz and P. Wint, *Digital Image Processing*, Addison Wesley, 1994.
3. J.R. Jensen, *Introducing Digital Image Processing*, 3/e, Prentice Hall, 2004.
4. Lim, *Digital Image* processing, McGraw Hill, 1992.

EC – 712 LOW DIMENSIONAL ELECTRONICS AND VLSI DESIGN LABORATORY 0-0-3 = 2

Subject Code: *EC - 712.*
Subject Name: *Low dimensional Electronics and VLSI Design Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered: *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of Experiments:

1. Write a VHDL code to model a JK Flip Flop (clocked).
2. Write VHDL code with "*generate*" statement to model a 8-bit Shift Register.
3. Using a "*block*" statement in VHDL, model a 16-bit Shift Register.
4. Using concurrent statements in VHDL, write a code to model a BCD to 7 Segment Encoder.
5. Design a Decade counter. Write the VHDL code for the same and verify the output.
6. Design a retriggerable monostable output pulse for duration of 10 mS. For sine wave input, write the VHDL code to verify the output.
7. Design a monostable pulse at the start of the pulse train of duration 2 mS. Write a VHDL code for the same.
8. Design a BCD decoder to accept transmitted data serially, decode the data and if any error, detect it and ask for retransmission.
9. Design a PLA circuit.
10. QCA Simulation of reversible logic gates.

Text Books:

1. J. Bhaskar, *VHDL Primer*, 3/e, PHI EEE, 1998.
2. W. Brown, *Fundamentals of Digital Logic with VHDL Design*, TMH, 2002.
3. Douglas L. Perry, *VHDL: Programming By Example*, 4/e, McGraw-Hill Professional, 2002.

EC – 713 DIGITAL COMMUNICATION LABORATORY **0-0-3 = 2**

Subject Code: *EC - 713.*
Subject Name: *Digital Communication Laboratory.*
No. of Hours Per Week: *Practicals-3.*
Marks Distribution: *Sessional Works = 20, End Semester Examination = 30.*
Minimum number of Experiments to be carried out: *Eight.*
Question to be answered: *One experiment will be allotted to a student on lottery basis.*
Duration of End Semester Examination: *Four Hours.*

List of 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.
3. Taub H., Schilling D L. and Saha G., *Principles of Communication Systems*, 3/e, TMH Publishing Company Ltd, New Delhi, 2008.