



**Revised Syllabus to be implemented from the Academic Year 2010**  
**(for the new batch only)**  
 First Year First Semester

<b>A. THEORY</b>							
Sl. No.	Field	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	<b>HU101</b>	ENGLISH LANGUAGE & TECHNICAL COMMUNICATION	2		0	0	2
2	<b>PH101/CH101</b>	Chemistry -1 (Gr-B) / Physics – 1 (Gr-A)	3	1	0	4	4
3	<b>M101</b>	Mathematics-1	3	1	0	4	4
4	<b>ES101</b>	Basic Electrical & Electronic Engineering – 1 (GrA+GrB)	3	1	0	4	4
5	<b>ME101</b>	Engg. Mechanics	3	1	0	4	4
<b>Total of Theory</b>						<b>18</b>	<b>18</b>
<b>B. PRACTICAL</b>							
6	<b>PH191/CH191</b>	Chemistry -1 (Gr-B)/ Physics – 1 (Gr-A)	0	0	3	3	2
7	<b>ES191</b>	Basic Electrical & Electronic Engineering -1	0	0	3	3	2
8	<b>ME191/192</b>	Engg Drawing & Computer Graphics (Gr-B) / Workshop Practice (Gr-A)	1	0	3	4	3
<b>Total of Practical</b>						<b>10</b>	<b>7</b>
<b>C. SESSIONAL</b>							
9	<b>HU181</b>	Language Laboratory	0	0	2	2	1
10	<b>XC181</b>	Extra Curricular Activities(NSS/NCC/NSO etc)	0	0	2	2	1
<b>Total of Sessional</b>						<b>4</b>	<b>2</b>
<b>Total of Semester</b>						<b>32</b>	<b>27</b>

**Physics based branches divided in to Gr-A & Gr-B, Gr-A= Phys in sem-I , Gr-B = Phys in sem-II; Chemistry based branches Physics in sem-1.**

**Group division:**

**Group-A:** Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

**Group-B:** All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]



First Year Second Semester

<b>A. THEORY</b>							
Sl. No.	Field	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	<b>CS201</b>	Basic Computation & Principles of Computer Programming	3	1	0	4	4
2	<b>PH201/CH201</b>	Physics - 1(Gr-B) / Chemistry-1(Gr-A)	3	1	0	4	4
3	<b>M201</b>	Mathematics-2	3	1	0	4	4
4	<b>ES201</b>	Basic Electrical & Electronic Engineering-II	3	1	0	4	4
5	<b>ME201</b>	Engineering Thermodynamics & Fluid Mechanics	3	1	0	4	4
<b>Total of Theory</b>						<b>20</b>	<b>20</b>
<b>B. PRACTICAL</b>							
7	<b>CS291</b>	Basic Computation & Principles of Computer Programming	0	0	3	3	2
8	<b>PH291/CH291</b>	Physics – 1 (Gr-B) /Chemistry-1 (Gr-A)	0	0	3	3	2
9	<b>ES291</b>	Basic Electrical & Electronic Engineering- II	0	0	3	3	2
10	<b>ME291/292</b>	Workshop Practice (Gr-B) / Basic Engg Drawing & Computer Graphics (Gr-A)	1	0	3	4	3
<b>Total of Practical</b>						<b>13</b>	<b>9</b>
<b>Total of Semester</b>						<b>32</b>	<b>29</b>

	<b>Group-A</b>	<b>Group-B</b>
<b>1<sup>st</sup> Sem</b>	Physics-I; Workshop Practice	Chemistry –1; Engg Drawing & Computer Graphics
<b>2<sup>nd</sup> Sem</b>	Chemistry –1; Engg Drawing & Computer Graphics	Physics-I; Workshop Practice



**Syllabus**  
**First Semester**  
**Theory**

**HU**

**English**

**PAPER CODE: HU 101**

**CONTACT: 2L**

**CREDIT: 2**

**PAPER NAME: ENGLISH LANGUAGE & TECHNICAL COMMUNICATION**

Guidelines for Course Execution:

Objectives of the Course: This Course has been designed

1. To impart advanced skills of Technical Communication in English through Language Lab. Practice Sessions to 1<sup>st</sup> Semester UG students of Engineering & Technology.
2. To enable them to communicate confidently and competently in English Language in all spheres.

Desired Entry Behaviour:

The students must have basic command of English to  
Talk about day-to-day events and experiences of life.  
Comprehend Lectures delivered in English.  
Read and understand relevant materials written in English.  
Write grammatically correct English.

Strategies for Course Execution:

1. It is a Course that aims to develop Technical Communication Skills. It is, therefore, *Lab-* based and practical in orientation. Students should be involved in Practice Sessions.
2. The content topics should be conveyed through real-life situations. Lecture classes should be conducted as Lecture cum Tutorial classes.
3. Keeping in view the requirements of students, the teachers may have to prepare some learning aids task materials.
4. Some time should be spent in teaching stress and intonation.
5. In teaching 'Speaking skill,' emphasis should be on *clarity, intelligibility, fluency, (as well as accepted pronunciation)*.
6. Micro Presentation and Group Discussion Sessions should be used for developing Communicative Competence
7. The Language Lab, device should be used for giving audio-visual inputs to elicit students' responses by way of Micro-Presentation, Pair Conversation, Group Talk and Class Discussion.
8. The teacher must function as *a creative monitor in the Language Lab for the following:*
  - A. Developing Listening Comprehension Skill;
    1. Developing Listening Comprehension through Language Lab Device
    2. Developing sub skills of the Listening Skill by Conversational Practice Sessions
    3. Focusing on intelligent and advanced Listening Sessions e.g. Seminars, Paper Presentation, Mock Interviews etc.
    4. Conducting Conversational Practice: Face to Face & Via Media (Telephone, Audio, Video + Clips)
  - B. Developing Speaking Competence:
    - a) Helping students in achieving *clarity and fluency* ; manipulating paralinguistic features of speaking (*voice modulation ,pitch , tone stress , effective pauses* )  
Conducting *Task oriented interpersonal ,informal and semiformal Speaking / Classroom Presentation*



- b) *Teaching strategies for Group Discussion*  
*Teaching Cohesion and Coherence*  
*Teaching effective communication & strategies for handling criticism and adverse remarks*  
*Teaching strategies of Turn-taking, effective intervention, kinesics (use of body language) and courtesies and all components of soft skills.*

C. Developing Reading Comprehension Skill:

- a) Developing Reading Skill through Non Technical (Literary) Texts  
(See Recommended Book 5)

1. The Thief by Ruskin Bond
2. The Open Window by Saki
3. Marriage is a private Affair by Chinua Achebe
4. The Moon in the Earthen Pot by Gopini Karunakar

- b) Developing Reading Skill through Radio Commentary, Technical Texts and Case Studies (Refer to Recommended Book 1.)

\* Freedom by G. B. Shaw (Radio Commentary)

- a) Guiding students for Intensive & Extensive Reading (See Recommended Book 1)

D. Developing Writing Competence:

- a) Teaching all varieties of Technical Report, Business Letters and Job Application (Expressing Ideas within restricted word limit through paragraph division, Listing Reference Materials through Charts, Graphs, Tables and Diagrams);

- b) Teaching correct Punctuation & Spelling, Semantics of Connectives, Modifiers and Modals, variety of sentences and paragraphs

- c) Teaching Organizational Communication: Memo, Notice, Circular, Agenda / Minutes etc.

SYLLABUS -- DETAILED OUTLINES

A. ENGLISH LANGUAGE GRAMMAR:

5L

Correction of Errors in Sentences  
Building Vocabulary  
Word formation  
Single Word for a group of Words  
Fill in the blanks using correct Words  
Sentence Structures and Transformation  
Active & Passive Voice  
Direct & Indirect Narration  
(MCQ Practice during classes)

B. READING COMPREHENSION:

Strategies for Reading Comprehension 1L  
Practicing Technical & Non Technical Texts for Global/Local/Inferential/Referential comprehension; 3L  
Précis Writing

C. TECHNICAL COMMUNICATION

The Theory of Communication –Definition & Scope  
Barriers of Communication  
Different Communication Models  
Effective Communication (Verbal / Non verbal)  
Presentation / Public Speaking Skills  
(MCQ Practice during classes)

5L



#### D. MASTERING TECHNICAL COMMUNICATION

Technical Report (formal drafting)	3L
Business Letter (formal drafting)	4L
Job Application (formal drafting)	3L
Organizational Communication (see page 3)	3L
Group Discussion –Principle & Practice	3L

Total Lectures 30

MARKS SCHEME (Written Examination) Total Marks 70

1. 10 Multiple Choice Questions(Communication & Eng. Language-Vocabulary & Syntax)  
Marks 10
2. Short Questions & Précis writing on unseen passages  
Marks 15 (10+5)
3. 3 Essay type Questions on Technical Communication (Technical Report / Business Letter / Job Application / Organizational Communication etc,)  
Marks 45-15\*3

MARKS SCHEME (Internal Examination) Total Marks 30

1. Attendance  
Marks 5
2. Testing Speaking Ability  
Marks 5
3. Testing Listening Ability  
Marks 5
4. 2 Unit Tests  
Marks 15

#### BOOKS -- RECOMMENDED:

1. Board of Editors: Contemporary Communicative English for Technical Communication  
Pearson Longman,2010
2. Dr. D. Sudharani: Manual for English Language Laboratory  
Pearson Education (W.B. edition), 2010
3. Technical Communication Principles and Practice by Meenakshi Raman, Sangeeta Sharma( Oxford Higher Education )
4. Effective Technical Communication by Barun K.Mitra( Oxford Higher Education )
5. V. Sashikumar (ed.): Fantasy- A Collection of Short Stories  
Orient Black swan (Reprint 2006)

#### References:

1. D. Thakur: Syntax Bharati Bhawan , 1998
2. Longman Dictionary of Contemporary English (New Edition) for Advanced Learners
3. Internet



## Basic Science

**Chemistry-1(Gr-A/Gr-B)**

**Code: CH101**

**Contacts: 3L + 1T = 4**

**Credits: 4**

### Module 1

#### **Chemical Thermodynamics -I**

**Concept of Thermodynamic system:** Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property.

**Introduction to first law of thermodynamics:** different statements, mathematical form.

**Internal energy:** Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas.

**Enthalpy:** Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas. 3L

**Heat Capacity:** Definition, Classification of Heat Capacity ( $C_p$  and  $C_v$ ): Definition and General expression of  $C_p - C_v$ . Expression of  $C_p - C_v$  for ideal gas.

**Reversible and Irreversible processes:** Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas,

Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, V and T), slope of P-V curve in adiabatic and isothermal process.

**Application of first law of thermodynamics to chemical processes:** exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation, Kirchoff's law. 3L

**2<sup>nd</sup> law of thermodynamics:** Statement, Mathematical form of 2<sup>nd</sup> law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature.

Evaluation of entropy: characteristics and expression, entropy change in irreversible cyclic process, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases. 2L

Work function and free energy: Definition, characteristics, physical significance, mathematical expression of  $\Delta A$  and  $\Delta G$  for ideal gas, Maxwell's Expression (only the derivation of 4 different forms), Gibbs Helmholtz equation.

Condition of spontaneity and equilibrium reaction. 2L



## **Module 2**

### **Reaction Dynamics**

Reaction laws: rate and order; molecularity; zero, first and second order kinetics. Pseudomolecular reaction, Arrhenius equation.

Mechanism and theories of reaction rates (Transition state theory, Collision theory: ).

Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics). 3L

### **Solid state Chemistry**

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency).

Role of silicon and germanium in the field of semiconductor. 2L

## **Module 3**

### **Electrochemistry**

#### ***Conductance***

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration (Strong and Weak electrolyte).

Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions.

Conductometric titrations: SA vs SB & SA vs WB; precipitation titration KCl vs AgNO<sub>3</sub>. 2L

#### ***Electrochemical cell***

Cell EMF and its Thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half cell, quinhydrone half cell and calomel half cell (construction, representation, cell reaction, expression of potential, Discussion, Application)

Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, Discussion, Application).

Application of EMF measurement on a) Ascertain the change in thermodynamic function ( $\Delta G$ ,  $\Delta H$ ,  $\Delta S$ ) b) ascertain the equilibrium constant of a reversible chemical reaction c) ascertain the valency of an ion.

3L

## **Module 4**

### **Structure and reactivity of Organic molecule**

Electronegativity, electron affinity, hybridisation, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals.

Brief study of some addition, eliminations and substitution reactions. 3L

### **Polymerization**

Concepts, classifications and industrial applications.



Polymer molecular weight (number avg. weight avg. viscosity avg.: Theory and mathematical expression only), Poly dispersity index (PDI).

Polymerization processes (addition and condensation polymerization), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of  $T_m$ ) and amorphicity (Concept of  $T_g$ ) of polymer.

Preparation, structure and use of some common polymers: plastic (**PE**: HDPE, LDPE, LLDPE, UHMWPE)), rubber (natural rubber, SBR), fibre(nylon 6.6). Vulcanization.

Conducting and semi-conducting polymers. 5L

### **Module 5**

#### **Industrial Chemistry**

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), Coal analysis: Proximate and ultimate analysis.

Liquid fuel: Petroleum, classification of petroleum, Refining, Petroleum distillation, Thermal cracking, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Bio-diesel.

Gaseous fuels: Natural gas, water gas, Coal gas, bio gas. 5L

#### **Reference Books**

1. P. C. Rakshit, Physical Chemistry, Sarat Book House (7<sup>th</sup> Edition).
2. S. Glasston, Text Book of Physical Chemistry, Macmillan India Limited.
3. S. Pahari, Physical Chemistry, New Central Book Agency.
4. S. Sarkar, Fuels and Combustion, Taylor & Francis (3<sup>rd</sup> Edition), 2009
5. P. Ghosh, Polymer Science and Technology of Plastics and Rubbers, Tata McGraw Hill Publishing Company Limited.
6. F.W.Billmeyer : Textbook of Polymer Science is published by Wiley India ( is now an Indian Imprint.)
7. Joel R. Fried, Polymer Science and Technology, Pearson Education (2<sup>nd</sup> Edition).
8. I. L. Finar, Organic Chemistry, Addison Wesley Longman, Inc.
9. Physical Chemistry, Atkins, 6th Edition, Oxford Publishers.
10. Organic Chemistry, Mark Loudon, 4th Edition, Oxford Publishers.

**Or**

#### **Physics-1(Gr-B/Gr-A)**

**Code: PH-101**

**Contacts: 3+1**

**Credit: 4L**

#### **Module 1:**

##### **Oscillations:**

1.1 Simple harmonic motion: Preliminary concepts, Superposition of S. H. Ms in two mutually perpendicular directions: Lissajous figure 2L





1.2 Damped vibration: Differential equation and its solution, Logarithmic decrement, Quality factor. 3L

1.3 Forced vibration: Differential equation and its solution, Amplitude and Velocity resonance, Sharpness of resonance. Application in L-C-R Circuit 3L

## **Module 2:**

### **Optics 1:**

2.1 Interference of electromagnetic waves: Conditions for sustained interference, double slit as an example. Qualitative idea of Spatial and Temporal Coherence, Conservation of energy and intensity distribution, Newton's ring 3L

2.2 Diffraction of light: Fresnel and Fraunhofer class. Fraunhofer diffraction for single slit and double slits. Intensity distribution of N-slits and plane transmission grating (No deduction of the intensity distributions for N-slits is necessary), Missing orders. Rayleigh criterion, Resolving power of grating and microscope. (Definition and formulae) 5L

## **Module 3:**

### **Optics 2**

3.1 Polarization: General concept of Polarization, Plane of vibration and plane of polarization, Qualitative discussion on Plane, Circularly and Elliptically polarized light, Polarization through reflection and Brewster's law, Double refraction (birefringence) -Ordinary and Extra-ordinary rays . Nicol's Prism, Polaroid. Half wave plate and Quarter wave plate 4L

3.2 Laser : Spontaneous and Stimulated emission of radiation, Population inversion, Einstein's A & B coefficient (derivation of the mutual relation), Optical resonator and Condition necessary for active Laser action, Ruby Laser, He-Ne Laser- applications of laser. 4L

3.3 Holography: Theory of holography, viewing the hologram, Applications 3L

## **Module 4:**

### **Quantum Physics:**

4.1 Concept of dependence of mass with velocity, mass energy equivalence, energy- momentum relation (no deduction required). Blackbody radiation: Rayleigh Jeans' law (derivation without the calculation of number of states), Ultraviolet catastrophe, Wien's law, Planck's radiation law (Calculation of the average energy of the oscillator), Derivation of Wien's displacement law and Stephan's law from Planck's radiation law. Rayleigh Jean's law and Wien's law as limiting cases of Planck's law. Compton Effect (calculation of Compton wavelength is required). 5L



4.2 Wave-particle duality and de Broglie's hypothesis, Concept of matter waves, Davisson-Germer experiment, Concept of wave packets and Heisenberg's uncertainty principle.

4L

### **Module 5:**

#### **Crystallography:**

5.1 Elementary ideas of crystal structure : lattice, basis, unit cell, Fundamental types of lattices = Bravais lattice, Simple cubic, f.c.c. and b.c.c. lattices, (use of models in the class during teaching is desirable) Miller indices and miller planes, Co-ordination number and Atomic packing factor. 4L

5.2 X-rays : Origin of Characteristic and Continuous X-ray, Bragg's law (No derivation), Determination of lattice constant. 2L

#### **Recommended Text Books and Reference Books:**

##### **For Both Physics I and II**

1. B. Dutta Roy (Basic Physics)
2. R.K. Kar (Engineering Physics)
3. Mani and Meheta (Modern Physics)
4. Arthur Baiser (Perspective & Concept of Modern Physics)

##### **Physics I (PH101/201)**

##### **Vibration and Waves**

- a) Kingsler and Frey
- d) D.P. Roychoudhury
- e) N.K. Bajaj (Waves and Oscillations)
- f) K. Bhattacharya
- g) R.P. Singh ( Physics of Oscillations and Waves)
- h) A.B. Gupta (College Physics Vol.II)
- i) Chattopadhyaya and Rakshit (Vibration, Waves and Acoustics)

##### **Optics**

- 10 Møler (Physical Optics)
- 11 A.K. Ghatak
- 12 E. Hecht (Optics)
- 13 E. Hecht (Schaum Series)
- 14 F.A. Jenkins and H.E. White
- 15 G. Chita Ranjan Dasgupta ( Degree Physics Vol 3)

##### **Quantum Physics**

- 2 Eisberg & Resnick is published by Wiley India
- 3 A.K. Ghatak and S. Lokenathan
- 4 S.N. Ghoshal (Introductory Quantum Mechanics)
- 5 E.E. Anderson (Modern Physics)
- 6 Haliday, Resnick & Krane : Physics Volume 2 is Published by Wiley India
- 7 Binayak Dutta Roy [Elements of Quantum Mechanics]



### Crystallography

1. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)
2. A.J. Dekker
3. Ashcroft and Mermin
4. Ali Omar
5. R.L. Singhal
6. Jak Tareen and Trn Kuty (Basic course in Crystallography)

### Laser and Holography

- 1 A.K. Ghatak and Thyagarajan (Laser)
- 2 Tarasov (Laser)
- 3 P.K. Chakraborty (Optics)
- 4 B. Ghosh and K.G. Majumder (Optics)
- 5 B.B. Laud (Laser and Non-linear Optics)
- 6 Bhattacharyya [Engineering Physics] Oxford

### Mathematics

Code: M101

Contacts: 3L + 1T = 4

Credits: 4

**Note 1: The whole syllabus has been divided into five modules.**

**Note 2: Structure of the question paper**

There will be three groups in the question paper. In Group A, there will be one set of multiple choice type questions spreading the entire syllabus from which 10 questions (each carrying one mark) are to be answered. From Group B, three questions (each carrying 5 marks) are to be answered out of a set of questions covering all the three modules. Three questions (each carrying 15 marks) are to be answered from Group C. Each question of Group C will have three parts covering not more than two topics (marked in bold italics face). Sufficient questions should to be set covering all modules.

### Module I

**Matrix:** Determinant of a square matrix, Minors and Cofactors, Laplace's method of expansion of a determinant, Product of two determinants, Adjoint of a determinant, Jacobi's theorem on adjoint determinant. Singular and non-singular matrices, Adjoint of a matrix, Inverse of a non-singular matrix and its properties, orthogonal matrix and its properties, Trace of a matrix.

Rank of a matrix and its determination using elementary row and column operations, Solution of simultaneous linear equations by matrix inversion method, Consistency and inconsistency of a system of homogeneous and inhomogeneous linear simultaneous equations, Eigen values and eigen vectors of a square matrix (of order 2 or 3), Eigen values of  $AP^{TP}$ ,  $kA$ ,  $AP^{-1P}$ , Caley-Hamilton theorem and its applications.

**9L**



## Module II

**Successive differentiation:** Higher order derivatives of a function of single variable, Leibnitz's theorem (statement only and its application, problems of the type of recurrence relations in derivatives of different orders and also to find  $(y_n)_0$ ). **2L**

**Mean Value Theorems & Expansion of Functions:** Rolle's theorem and its application, Mean Value theorems – Lagrange & Cauchy and their application, Taylor's theorem with Lagrange's and Cauchy's form of remainders and its application, Expansions of functions by Taylor's and Maclaurin's theorem, Maclaurin's infinite series expansion of the functions:  $\sin x$ ,  $\cos x$ ,  $e^x$ ,  $\log(1+x)$ ,  $(a+x)^n$ ,  $n$  being an integer or a fraction (assuming that the remainder  $R_n \rightarrow 0$  as  $n \rightarrow \infty$  in each case). **5L**

**Reduction formula:** Reduction formulae both for indefinite and definite integrals of types  $\int \sin^n x$ ,  $\int \cos^n x$ ,  $\int \sin^m x \cos^n x$ ,  $\int \cos^m x \sin^n x$ ,  $\int \frac{dx}{(x^2 + a^2)^n}$ ,  $m, n$  are positive integers.

**2L**

## Module III

**Calculus of Functions of Several Variables:** Introduction to functions of several variables with examples, Knowledge of limit and continuity, Partial derivatives and related problems, Homogeneous functions and Euler's theorem and related problems up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their related problems, Jacobians up to three variables and related problems, Maxima, minima and saddle points of functions and related problems, Concept of line integrals, Double and triple integrals. **9L**

## Module IV

**Infinite Series:** Preliminary ideas of sequence, Infinite series and their convergence/divergence, Infinite series of positive terms, Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test and Raabe's test (statements and related problems on these tests), Alternating series, Leibnitz's Test (statement, definition) illustrated by simple example, Absolute convergence and Conditional convergence. **5L**

## Module-V

**Vector Algebra and Vector Calculus:** Scalar and vector fields – definition and terminologies, dot and cross products, scalar and vector triple products and related problems, Equation of straight line, plane and sphere, Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions,



Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative. Related problems on these topics. Green's theorem, Gauss Divergence Theorem and Stoke's theorem (Statements and applications). **8L**

**Total 40 Lectures**  
**Suggested Reference Books**

1. Advanced Engineering Mathematics 8e by Erwin Kreyszig is published by Wiley India
2. **Engineering Mathematics:** B.S. Grewal (S. Chand & Co.)
3. **Higher Engineering Mathematics:** John Bird (4th Edition, 1st Indian Reprint 2006, Elsevier)
4. **Mathematics Handbook:** for Science and Engineering, L. Rade and B. Westergren (5P<sup>th</sup> edition, 1P<sup>st</sup> Indian Edition 2009, Springer)
5. **Calculus:** M. J. Strauss, G. L. Bradley and K. L. Smith (3P<sup>rd</sup> Edition, 1P<sup>st</sup> Indian Edition 2007, Pearson Education)
6. **Engineering Mathematics:** S. S. Sastry ( PHI, 4P<sup>th</sup> Edition, 2008)
7. **Advanced Engineering Mathematics, 3E:** M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.

**Engineering Science**

**Basic Electrical and Electronics Engineering-I**

**Code: ES101**

**Contacts: 3L + 1T = 4**

**Credits: 4**

**Basic Electrical Engineering-I**

**DC Network Theorem:** Definition of electric circuit, network, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, Kirchhoff's law, Principle of superposition. Source equivalence and conversion, Thevenin's theorem, Norton Theorem, nodal analysis, mesh analysis, star-delta conversion. Maximum power transfer theorem with proof. **7L**

**Electromagnetism:** Biot-savart law, Ampere's circuital law, field calculation using Biot-savart & ampere's circuital law. Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faraday's law, Self and mutual inductance. Energy stored in a magnetic field, B-H curve, Hysteretic and Eddy current losses, Lifting power of Electromagnet. **5L**

**AC fundamental:** Production of alternating voltage, waveforms, average and RMS values, peak factor, form factor, phase and phase difference, phasor representation of alternating quantities, phasor diagram, behavior of AC series, parallel and series parallel circuits, Power factor, Power in AC circuit, Effect of frequency variation in RLC series and parallel circuits, Resonance in RLC series and parallel circuit, Q factor, band width of resonant circuit. **9L**

**Basic Electronics Engineering-I**

**Instruction: 1 credit means 1 hour; 1 lecture means a lecture of 1 hour duration.**

**Basic Electronics Engineering - I: 18L + 2L = 20L**

**Pre-requisites:** Knowledge of Class XII level electronics, Physics & Mathematics.



**Recapitulation and Orientation lectures:** 2L

**Module – 1: Semiconductors:** 4L

Crystalline material: Mechanical properties, Energy band theory, Fermi levels; Conductors, Semiconductors and Insulators: electrical properties, band diagrams. Semiconductors: intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers.

**Module – 2: Diodes and Diode Circuits:** 3L+3L = 6L

Formation of P-N junction, energy band diagram, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance and Varactor diode.

Simple diode circuits, load line, linear piecewise model;

Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

**Module – 3: Bipolar Junction Transistors:** 6L+2L = 8L

Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, base transport factor and current amplification factors for CB and CE modes.

Biasing and Bias stability: calculation of stability factor;

**Outcome:**

Students will be able to identify semiconductor materials, draw band-diagrams, distinguish between intrinsic and extrinsic semiconductors, n- and p- type semiconductors, calculate drift and diffusion current components.

Students must be able to explain the junction properties and the phenomenon of rectification, draw the I-V characteristics and identify operating points; Calculate ripple factors, efficiency of power supplies.

Students will be able to draw and explain the I-V characteristics of BJTs – both input and output; learn to bias transistors, both as amplifiers and switches; identify operating points.

**Recommended Books:**

Text:

9. Sedra & Smith: Microelectronics Engineering.
10. Millman & Halkias: Integrated Electronics.

References:

- b) Malvino: Electronic Principle.
- c) Schilling & Belove: Electronics Circuits.
- d) Millman & Grabal: Microelectronics.
- e) Salivahanan: Electronics Devices & Circuits.
- f) Boylestad & Nashelsky: Electronic Devices & Circuit Theory



**Engineering Mechanics**

**Code: ME101**

**Contacts: 3L + 1T = 4**

**Credits: 4**

Sl. No.	Syllabus	Contact Hrs.	Reference Books & Chapters and Problems for practice
<b>Mo d-I</b>	Importance of Mechanics in engineering; Introduction to Statics; Concept of Particle and Rigid Body; Types of forces: collinear, concurrent, parallel, concentrated, distributed; Vector and scalar quantities; Force is a vector; Transmissibility of a force (sliding vector).	2L	Meriam & Kraig: Vol-I Chapt: 1/1, 2/2,1/3
	Introduction to Vector Algebra; Parallelogram law; Addition and subtraction of vectors; Lami's theorem; Free vector; Bound vector; Representation of forces in terms of i,j,k; Cross product and Dot product and their applications.	4L+1T	1. Meriam & Kraig: Vol-I Chapt: 1/3, 2/4, 2/7 2. I.H. Shames Chapt: 2.1 to 2.8 Probs: 2.1, 2.2, 2.3,2.6, 2.10, 2.48, 2.52, 2.54, 2.64, 2.68
	Two dimensional force system; Resolution of forces; Moment; Varignon's theorem; Couple; Resolution of a coplanar force by its equivalent force-couple system; Resultant of forces.	4L+2T	1. Meriam & Kraig: Vol-I Chapt: 2/3, 2/4, 2/5, 2/6, 2/9 Probs: 2/1 to 2/8; 2/13, 2/16, 2/20; 2/27, 2/31 to 2/33, 2/35, 2/37, 2/39; 2/53, 2/55, 2/57, 2/61, 2/66; 2/75, 2/77, 2/79, 2/78 to 2/82; 2/135 to 2/137, 2/139, 2/141, 2/146, 2/147,2/151, 2/157
<b>Mo d-II</b>	Concept and Equilibrium of forces in two dimensions; Free body concept and diagram; Equations of equilibrium.	3L+1T	Meriam & Kraig: Vol-I Chapt: 3/2, 3/3 Probs: 3/1, 3/3, 3/4 to 3/7, 3/11, 3/13, 3/15, 3/21, 3/25, 3/27, 3/31,3/39
	Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.	3L+1T	Meriam & Kraig: Vol-I Chapt: 6/1, 6/2, 6/3 Probs: 6/1 to 6/6, 6/13, 6/15, 6/17; 2. I.H. Shames; Chapt: 7.1,7.2
<b>Mo d-III</b>	Distributed Force: Centroid and Centre of Gravity; Centroids of a triangle, circular sector, quadrilateral, composite areas consisting of above figures.	4L+1T	1. Meriam & Kraig: Vol-I Chapt: 5/1, 5/2, 5/3 Sample probs: 5/1 to 5/5 Probs: 5/2, 5/5, 5/7, 5/9, 5/12, 5/20, 5/25, 5/30, 5/43,5/47
	Moments of inertia: MI of plane figure with respect to an axis in its plane, MI of plane figure with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem; Mass moment of inertia of symmetrical bodies, e.g. cylinder, sphere, cone.	3L+1T	1. Meriam & Kraig: Vol-I Chapt: Appendix A/1, A/2 Sample Probs: A/1 to A/5; Probs: A/1, A/5, A/9, A/15, A/20



Sl. No.	Syllabus	Contact Hrs.	Reference Books & Chapters and Problems for practice
	Concept of simple stresses and strains: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety.	2L+1T	1. Elements of strength of Materials by Timoshenko & Young Chapt: 1.1, 1.2, 1.3, 2.2 Prob set 1.2 : Prob: 3, 4, 5, 8, 9, 10 Prob set 1.3: Prob: 1, 3, 5, 7 2. Nag & Chanda -3 <sup>rd</sup> Part Chapt: 1.1, 1.2.1 to 1.2.3, 1.2.6, 1.2.7
<b>Mo d- IV</b>	Introduction to Dynamics: Kinematics and Kinetics; Newton's laws of motion; Law of gravitation & acceleration due to gravity; Rectilinear motion of particles; determination of position, velocity and acceleration under uniform and non-uniformly accelerated rectilinear motion; construction of x-t, v-t and a-t graphs.	3L+1T	Meriam & Kraig: Vol-II Chapt: 1/3, 1/5, 1/7, 2/1, 2/2 Probs: 1/1 to 1/10; 2/1 to 2/14; 2/15, 2/17, 2/19, 2/25, 2/27;
	Plane curvilinear motion of particles: Rectangular components (Projectile motion); Normal and tangential components (circular motion).	3L+1T	Meriam & Kraig: Vol-II Chapt: 2/3, 2/4, 2/5, Probs: 2/59 to 2/65, 2/67, 2/71, 2/81, 2/84, 2/89; 2/97, 2/99 to 2/103;
<b>Mo d- V.</b>	Kinetics of particles: Newton's second law; Equation of motion; D'Alembert's principle and free body diagram; Principle of work and energy ; Principle of conservation of energy; Power and efficiency.	5L+2T	Meriam & Kraig: Vol-II Chapt: 3/2, 3/3, 3/4, 3/6, 3/7; Probs: 3/1, 3/3, 3/4, 3/7, 3/11, 3/12; 3/17, 3/19, 3/23; 3/103 to 3/107, 3/113, 3/115, 3/116; Sample probs: 3/16, 3/17; Probs: 3/143, 3/145, 3/158

#### Books Recommended

1. Engineering Mechanics [Vol-I & II] by Meriam & Kraige, 5<sup>th</sup> ed. – Wiley India
2. Engineering Mechanics: Statics & Dynamics by I.H. Shames, 4<sup>th</sup> ed. – PHI
3. Engineering Mechanics by Timoshenko, Young and Rao, Revised 4<sup>th</sup> ed. – TMH
4. Elements of Strength of Materials by Timoshenko & Young, 5<sup>th</sup> ed. – E.W.P
5. Fundamentals of Engineering Mechanics by Debabrata Nag & Abhijit Chanda– Chhaya Prakashani
6. Engineering Mechanics by Basudeb Bhattacharyya– Oxford University Press.
7. Engineering Mechanics: Statics & Dynamics by Hibbeler & Gupta, 11<sup>th</sup> ed. – Pearson

#### Sessional

#### HU

#### **HU 181 (Practical)**

#### **LANGUAGE LABORATORY**

**CONTACTS: 2P**

**CREDIT: 1**

#### **LANGUAGE LABORATORY PRACTICE**

- |   |    |
|---|----|
| a) Honing 'Listening Skill' and its sub skills through Language Lab Audio device;   | 3P |
| b) Honing 'Speaking Skill' and its sub skills;  | 2P |
| c) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech; | 2P |





j) Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone , Mobile phone & Role Play Mode);	2P
k) Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success;	2P
f) G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD;	4P
g) Honing 'Reading Skills' and its sub skills using Visual / Graphics/Diagrams /Chart Display/Technical/Non Technical Passages; Learning Global / Contextual / Inferential Comprehension;	2P
h) Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions	2P
Total Practical Classes	17

Books Recommended:

Dr. D. Sudharani: Manual for English Language Laboratory  
Pearson Education (WB edition),2010  
Board of Editors: Contemporary Communicative English  
for Technical Communication  
Pearson Longman, 2010

**Wxtra Curricular Activities(NSS/NCC/NSO etc)**

**Code: XC181**

**Code Credits: 1**

- Creating awareness in social issues
- Participating in mass education programmes
- Proposal for local slum area development
- Waste disposal
- Environmental awareness
- Production Oriented Programmes
- Relief & Rehabilitation work during Natural calamities

Creating awareness in social issues:

- Women's development – includes health, income-generation, rights awareness.
- Hospital activities – Eg. writing letters for patients, guiding visitors
- Old age home – visiting the aging in-mates, arranging for their entertainment.
- Children's Homes - visiting the young in-mates, arranging for their entertainment
- Linking with NGOs to work on other social issues. (Eg. Children of sex-workers)
- Gender issues- Developing an awareness, to link it with Women's Cell of college

Participating in mass education programmes

- Adult education
- Children's education

Proposal for local slum area development

One or two slums to be identified and according to the needs, activities to be developed and proposals and reports are to be submitted.

Environmental awareness

- Resource conservation – Awareness to be developed on water, energy,soil.
- Preservation of heritage monuments- Marches, poster campaigns



- Alternative energy consciousness amongst younger school-children.
- Plantation and beautification- Plantation of trees, their preservation and upkeep, developing NSS parks.
- Waste disposal- Proper methods of domestic waste disposal.

#### Production Oriented Programmes

5. Working with people and explaining and teaching improved agricultural practices
6. Rodent control and pest control practices;
7. Soil-testing, soil health care and soil conservation;
8. Assistance in repair of agriculture machinery;
9. Work for the promotion and strengthening of cooperative societies in villages;
10. Assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
11. Popularization of small savings and
12. Assistance in procuring bank loans

#### Relief & Rehabilitation work during Natural calamities

- g) Assisting the authorities in distribution of rations, medicine, clothes etc.;
- h) Assisting the health authorities in inoculation and immunization, supply of medicine etc.;
- i) Working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
- j) Assisting and working with local authorities in relief and rescue operation;  
Collection of clothes and other materials, and sending the same to the affected areas;

### **Practical** **Basic Science**

#### **Chemistry-1(Gr-A/Gr-B)**

**Code: CH191**

**Contacts:**

**Credits: 2**

1. To Determine the alkalinity in a given water sample.
2. Red-ox titration (estimation of iron using permanganometry)
3. To determine calcium and magnesium hardness of a given water sample separately.
4. To determine the value of the rate constant for the hydrolysis of ethyl acetate catalyzed by hydrochloric acid.
5. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water)
6. Viscosity of solutions (determination of percentage composition of sugar solution from viscosity)
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
9. Determination of dissolved oxygen present in a given water sample.
10. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)



At least **Six** experiments must perform in a semester out of above **Ten** experiments.

Or

Physics-1(Gr-B/Gr-A)

Code: PH191

Contacts: 3P

Credits: 2

**Group 1: Experiment from Higher Secondary knowledge of Physics**

13. Determination of thermal conductivity of a good conductor by Searle's method.
14. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.
15. Determination of dispersive power of the material of given prism.
16. Use of Carry Foster's bridge to determine unknown resistance.

**Group 2: Experiments on General Properties of matter**

17. Determination of Young's modulus by Flexure method and calculation of bending moment and shear force at a point on the beam.
18. Determination of modulus of rigidity by static/ dynamic method.
19. Determination of co-efficient of viscosity by Poiseuille's capillary flow method.

**Group 3: Optics**

7. Determination of wavelength of light by Newton's ring method.
8. Determination of wavelength of light by Fresnel's bi-prism method
9. Determination of wavelength of light by Laser diffraction method.
10. Determination of numerical aperture and the energy losses related to optical fibre experiment

**a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the data taken.**

**b) In addition, a student should perform one more experiments where he/she will have to convert the non-electrical signals (viz. Temperature, Intensity of Light, Pressure etc.) present in an Experiment into electrical signals and measure them with the help of Multi-meters/ Oscilloscopes. Student should calibrate the Sensor for Experiment before use.**

**c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.**

Note:

- i. Failure to perform each experiment mentioned in b) and c) should be compensated by *two* experiments from two different groups mentioned in the above list.
- ii. At the end of the semester report should sent to the board of studies regarding experiments, actually performed by the college, mentioned in b) and c)
- iii. Experiment in b) and c) can be coupled and can be parts of a single experiment.



## Engineering Science

### **Basic Electrical and Electronics Engineering-I**

**Code: ES191**

**Contacts:**

**Credits: 2**

#### **Basic Electrical Engineering Laboratory-I**

List of Experiments:

Sl. No Name of the Experiments

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. (a) Verification of Thevenin's theorem.  
(b) Verification of Norton's theorems.
4. Verification of Maximum power theorem.
5. Verification of Superposition theorem
6. Study of R-L-C Series circuit
7. Study of R-L-C parallel circuit

#### **Basic Electronics Engineering Laboratory-I**

There will be a couple of familiarization lectures before the practical classes are undertaken where basic concept of the instruments handled Eg: CRO, Multimeters etc will be given. Lectures on measurement techniques and error calculation will also have to be organized.

3 hours per week must be kept, initially for practical lectures, and later for tutorials.

List of Experiments:

Familiarisation with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc.

Familiarisation with measuring and testing equipment like CRO, Signal generators etc.

Study of I-V characteristics of Junction diodes.

Study of I-V characteristics of Zener diodes.

Study of Half and Full wave rectifiers with Regulation and Ripple factors.

Study of I-V characteristics of BJTs.

### **Engineering Drawing & Computer Graphics(Gr-A/GrB)**

**Code: ME191**

**Contacts: 1L+3P**

**Credits: 3**

#### **A. THEORETICAL PART**

- |  |      |
|--|------|
| 1. Introduction to Lines, Lettering, Dimensioning, Scales. | - 1L |
| 2. Geometrical Construction and Curves                     | - 1L |
| 3. Projection of Points, Lines and Surfaces                | - 2L |
| 4. Projection of Solids                                    | - 2L |
| 5. Isometric Views   | - 1L |
| 6. Sectional Views   | - 1L |
| 7. Development of Surfaces                                 | - 1L |
| 8. Introduction to Computer Aided Drafting                 | - 3L |



## B. PRACTICAL PART

1. LINES, LETTERING, DIMENSIONING, SCALES; Plain scale, Diagonal scale. - 6hrs
2. GEOMETRICAL CONSTRUCTION AND CURVES; Construction of polygons, Parabola, Hyperbola, Ellipse. - 6hrs
3. PROJECTION OF POINTS, LINES, SURFACES; Orthographic projection- 1<sup>st</sup> and 3<sup>rd</sup> angle projection, Projection of lines and surfaces– Hexagon. - 3hrs
4. PROJECTION OF SOLIDS; Cube, Pyramid, Prism, Cylinder, Cone. - 6hrs
5. DRAWING ISOMETRIC VIEW FROM ORTHOGONAL/ SECTIONAL VIEWS OF SIMPLE SOLID OBJECTS. - 3hrs
6. FULL AND HALF SECTIONAL VIEWS OF SOLIDS. - 3hrs
7. DEVELOPMENT OF SURFACES; Prism, Cylinder, Cone. - 3hrs
8. COMPUTER AIDED DRAFTING (Using AutoCAD and/or similar softwares); Introduction: Cartesian and Polar coordinate system, Absolute and Relative coordinates; Basic editing commands: Line, Point, Trace, Rectangle, Polygon, Circle, Arc, Ellipse, Polyline; Editing methods; Basic object selection methods, Window and crossing window, Erase, Move, Copy, Offset, Fillet, Chamfer, Trim, Extend, Mirror; Display commands: Zoom, Pan, Redraw, Regenerate; Simple dimensioning and text, Simple exercises. - 6hrs

### References / Books:

- Narayana, K.L. and Kannaiah, P. Text Book of Engineering Drawing“Engineering Graphics”, Scitech Publication
- Bhatt, N.D. “Elementary Engineering Drawing”, Charotar Book Stall, Anand, 1998
- Lakshminarayanan, V. and Vaish Wanar, R.S., “Engineering Graphics”, Jain Brothers, New Delhi, 1998
- Chandra, A.M. and Chandra Satish, “Engineering Graphics”, Narosa, 1998
- Jolhe, “Engineering Graphics”, Tata McGraw-Hill- WBUT Series
- Gill, P.S., “A Text Book of Engineering Drawing”, Katson Publishing House (Kataria and Sons)
- Venugopal, K., “Engineering Drawing & Graphics + AutoCAD”, New Age International
- Ventaka Reddy K., “Text Book of Engineering Drawing (2<sup>nd</sup> Edition)”, BS Publication.

**Or**

### **Workshop Practice(Gr-B/GrA)**

**Code: ME192**

**Contacts:**

**Contact Hours Per week: 1L+3P= 4**

**Credits: 3**

## A. THEORETICAL PART



1. INTRODUCTION TO MANUFACTURING; Socio-economic role, Definition, Major grouping and Examples. - 1L

2. ENGINEERING MATERIALS; Classification / Major grouping, Physical, Chemical and Mechanical properties, Applications - 1L

3. DIFFERENT CONVENTIONAL MANUFACTURING PROCESSES MAINLY COVERING BASIC PRINCIPLES, DIFFERENT METHODS AND GENERAL APPLICATIONS; Manufacturing by forming /shaping from solid (input) to solid (product); Forging, Rolling, Drawing, Extrusion; Press tool work-Bending, Shearing, Drawing and Coining. - 3L

4. FORMING / SHAPING FROM LIQUID TO SOLID- CASTING; General principles, General classification or Types of casting; Sand mould casting- procedural steps and requirements; Pattern, Mould, Melting, Pouring, Solidification, Extracting and Fettling. Other casting processes (for larger volume and quality); Centrifugal casting, Investment casting, Die casting. -3L

5. JOINING PROCESSES; Welding (Permanent Joining)- General classification and basis; Gas welding, Arc welding, Friction welding and Resistance welding, w.r.t. Principle, Requirements, Relative Advantages and Applications; Brazing and soldering.

- 2L

6. REMOVAL (MACHINING) PROCESS; Principle and purpose of machining, Machining requirements, Machine tools- Definition, General classification w.r.t, functional principles and applications; Major machining parameters (and responses)- Speed, Feed and Depth of cut; Tool geometry (Rake, Clearance and Cutting angles), Cutting fluid application; Elementary machining operations- Facing, Centering, Turning, Threading, Drilling, Boring, Shaping and Milling.

-2L



## B. SCHEDULE OF PRACTICAL CLASSES

Suggested apportionment / weigtage:

- Machining (and fitting)- 50% (6 days ) 18 hrs
- Casting (including pattern making molding and preparation) - 25% (3 days 9hrs)
- Welding (gas, arc and resistance) (2 days 6hrs) and Sheet Metal Working (1 day 3hr)- 25% (3 days 9hrs)

### FEASIBLE TYPES / MODELS OF ASSIGNMENTS

i) FITTING (in 2 days or 6 hours); Making a gauge from MS plate as shown in Fig.1.

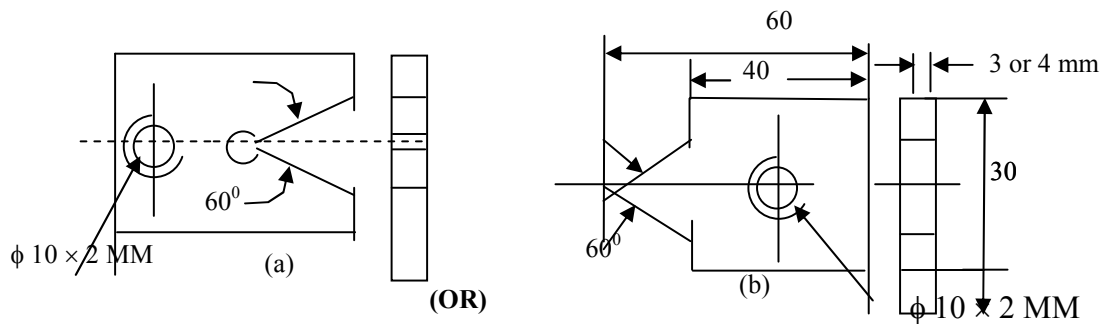


Fig.1: Job for fitting practice

Operations required:

11. Squaring and finishing of the blank by filing
12. Making the Vee-portion by sawing and filing
13. Drilling (in machine) and tapping (hand)

ii) MACHINING (in 3 days or 9 hours); To make a pin as shown in Fig.2 from a  $\square 20$ mm mild steel rod in a lathe.

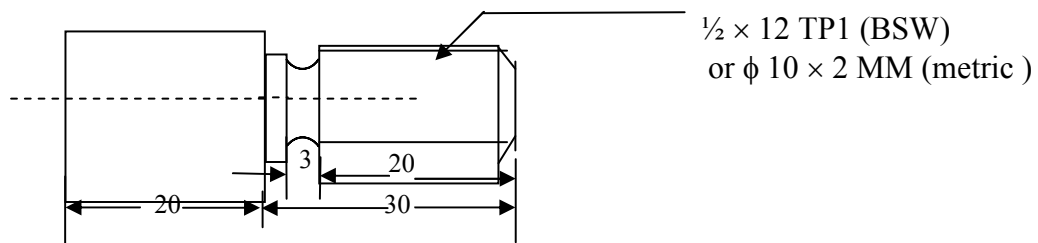


Fig.2: Job for practice on a lathe



iii) MACHINING (in 1 day or 3 hours); To make a MS prism as shown in Fig.3 from a  $\square 20$ mm mild steel rod in a shaping and / or milling machine.

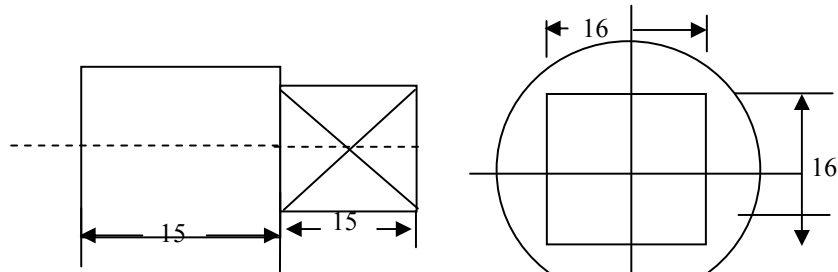


Fig.3: Job for practice on a shaping and/or milling machine

iv) PATTERN MAKING, SAND MOULDING AND CASTING (in 3 classes or 9 hours); To make a wooden pattern and a sand mould with that pattern for casting a cast iron block as shown in Fig.4.

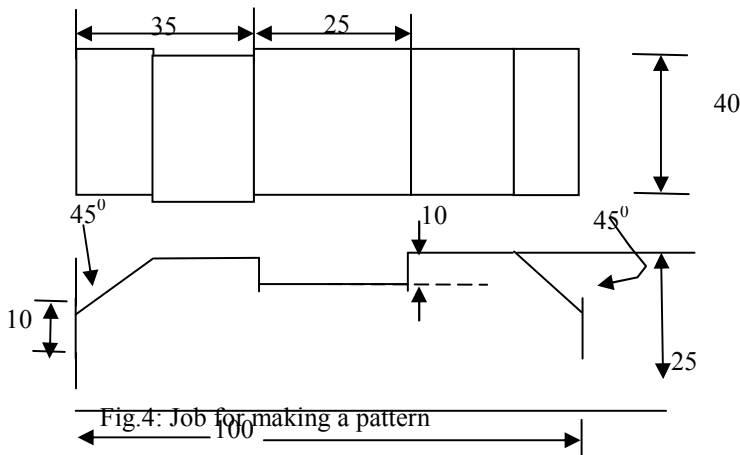


Fig.4: Job for making a pattern

v) WELDING (GAS WELDING) (in 1 class or 3 hours); To join two thin mild steel plates or sheets (1 to 3 mm thick) as shown in Fig. 5 by gas welding.

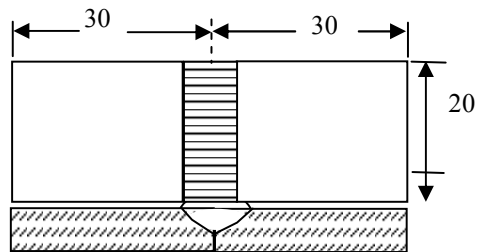


Fig.5: Welding specimen for practice

- vi) WELDING (ARC WELDING) (in 1 day or 3 hours); To join two thick (6mm) MS plate as shown in Fig. 5 by arc welding.
- vii) SHEET METAL WORK (in 1 day or 3 hours); Forming a cone, for example.





**Second Semester**

**Theory**

**Basic Science**

**Basic Computation & Principles of Computer Programming**

**Code: CS 201**

**Contacts: 3L + 1T = 4**

**Credits: 4**

**Fundamentals of Computer:**

History of Computer, Generation of Computer, Classification of Computers 2L

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices 3L

Binary & Allied number systems representation of signed and unsigned numbers. BCD, ASII. Binary Arithmetic & logic gates 6L

Assembly language, high level language, compiler and assembler (basic concepts) 2L

Basic concepts of operating systems like MS DOS, MS WINDOW, UNIX, Algorithm & flow chart 2L

**C Fundamentals:**

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements 3L

**Operators & Expressions:**

Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Input and Output: Standard input and output, formatted output -- printf, formatted input scanf. 5L

**Flow of Control:**

Statement and blocks, if - else, switch, loops - while, for do while, break and continue, go to and labels 2L

**Fundamentals and Program Structures:**

Basic of functions, function types, functions returning values, functions not returning values, auto, external, static and register variables, scope rules, recursion, function prototypes, C preprocessor, command line arguments. 6L

**Arrays and Pointers:**

One dimensional arrays, pointers and functions, multidimensional arrays. 6L

**Structures Union and Files:**

Basic of structures, structures and functions, arrays of structures, bit fields, formatted and unformatted files. 5L

**Recommended reference Books:**

Introduction To Computing (TMH WBUT Series), E. Balagurusamy, TMH

Kerninghan, B.W.

The Elements of Programming Style

Yourdon, E.

Techniques of Program Structures and Design

Schied F.S.

Theory and Problems of Computers and Programming

Gottfried

Programming with C Schaum

Kerninghan B.W. & Ritchie D.M.

The C Programming Language

Rajaraman V.

Fundamental of Computers

Balaguruswamy

Programming in C

Kanetkar Y.

Let us C

M.M.Oka

Computer Fundamentals, EPH



Leon	Introduction to Computers, Vikas
Leon-Ram B.	Fundamental of Information Technology, Vikas
Ravichandran D.	Computer Fundamentals, New Age International
Xavier C.	Programming in C, New Age International
Xavier C.	C Language & Numerical Methods, New Age Inter.
Rao S.B.	Introduction to Computers, New Age International
	Numerical Methods with Programs in Basic Fortran Pascal & C++, Universities Press
Dutta N.	Computer Programming & Numerical Analysis, Universities Press
Bhanu Pratap	Computer Fundamentals
Rajaram	Computer Concepts & C Program, Scitech

**Chemistry-1(Gr-B/Gr-A)**

**Code: CH201**

**Contacts: 3L + 1T = 4**

**Credits: 4**

**Or**

**Physics-1(Gr-A/Gr-B)**

**Code: PH201**

**Contacts: 3L + 1T = 4**

**Credits: 4**

**Mathematics**

**Code: M201**

**Contacts: 3L + 1T = 4**

**Credits: 4**

**Note 1: The whole syllabus has been divided into five modules.**

**Note 2: Structure of the question paper**

**There will be three groups in the question paper. In Group A, there will be one set of multiple choice type questions spreading the entire syllabus from which 10 questions (each carrying one mark) are to be answered. From Group B, three questions (each carrying 5 marks) are to be answered out of a set of questions covering all the three modules. Three questions (each carrying 15 marks) are to be answered from Group C. Each question of Group C will have three parts covering not more than two topics (marked in bold italics faces). Sufficient questions should to be set covering all modules.**

**Module I**

**Ordinary differential equations (ODE)- First order and first degree:** Exact equations, Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear equation, Bernoulli's equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation). **5L**

**Module II**

**ODE- Higher order and first degree:** General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Euler equations, Solution of simultaneous linear differential equations. **6L**



### Module III

**Basics of Graph Theory:** Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph,; Walks, Paths, Circuits, Euler Graph, Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph. **10L**

### Module IV

**Tree:** Definition and properties, Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees, Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using DFS, BFS, Kruskal's and Prim's algorithms. **6L**

### Module V

**Improper Integral:** Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations. **3L**

**Laplace Transform (LT):** Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of  $\frac{f(t)}{t}$ , LT of  $t^n f(t)$ , LT of derivatives of  $f(t)$ , L.T. of  $\int f(u)du$ . Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT. **10L**

**Total 40 Lectures**

### Suggested Reference Books:

1. **Advanced Engineering Mathematics**, Erwin Kreyszig, (Wiley Eastern)
2. **Graph Theory:** V. K. Balakrishnan, (Schaum's Outline, TMH)
3. **A first course at Graph Theory:** J. Clark and D. A. Holton (Allied Publishers LTD)
4. **Introduction to Graph Theory:** D. B. West (Prentice-Hall of India)
5. **Graph Theory:** N. Deo (Prentice-Hall of India)
6. **Engineering Mathematics:** B.S. Grewal (S. Chand & Co.)
7. **Higher Engineering Mathematics:** John Bird (4th Edition, 1st Indian Reprint 2006, Elsevier)
8. **Calculus:** Strauss, Bradley and Smith (3<sup>rd</sup> edition, Pearson Education)
9. **Engineering Mathematics (Volume 2):** S. S. Sastry (Prentice-Hall of India)
10. **Advanced Engineering Mathematics, 3E:** M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition
11. **An Introduction to Differential Equations**, R.K. Ghosh and K.C. Maity ( New Central Book Agency )



## Engineering Science

### **Basic Electrical and Electronics Engineering-II**

**Code: ES201**

**Contacts: 3L + 1T = 4**

**Credits: 4**

### Basic Electrical Engineering-II

**Electrostatics:** Coulomb's law, Electric Field Intensity, Electric field due to a group of charges, continuous charge distribution, Electric flux, Flux density, Electric potential, potential difference, Gauss's law, proof of Gauss's law, its applications to electric field and potential calculation, Capacitor, capacitance of parallel plate capacitor, spherical capacitor, isolated spheres, concentric conductors, parallel conductors. Energy stored in a capacitor. 5L

**DC Machines:** Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Speed-torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control) 6L

**Single phase transformer:** Core and shell type construction, EMF equation, no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation. 4L

**3 phase induction motor:** Types, Construction, production of rotating field, principle of operation, equivalent circuit and phasor diagram, rating, torque-speed characteristics (qualitative only). Starter for squirrel cage and wound rotor induction motor. Brief introduction of speed control of 3 phase induction motor (voltage control, frequency control, resistance control) 5L

**Three phase system:** Voltages of three balanced phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two watt meters method. 3L

**General structure of electrical power system:** Power generation to distribution through overhead lines and under ground cables with single line diagram. 1L

#### **Text books:**

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
2. Fundamental of electrical Engineering, Rajendra Prasad, PHI, Edition 2005.
3. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
4. Basic Electrical Engineering, J.P. Tewari, New age international publication

#### **Reference books:**

1. Basic Electrical Engineering(TMh WBUT Series), Abhijit Chakrabarti & Sudipta Nath, TMH
2. Electrical Engineering Fundamental, Vincent.D.Toro, Pearson Education, Second Edition.
2. Hughes Electrical & Electronics Technology, 8/e, Hughes, Pearson Education.
3. Basic Electrical Engineering, T.K. Nagsarkar & M.S. Sukhija, Oxford
4. Introduction to Electrical Engineering, M.S. Naidu & S, Kamakshaiah, TMH
5. Basic Electrical Engineering, J.J. Cathey & S.A Nasar, TMH, Second Edition.



## Basic Electronics Engineering-II

### **Basic Electronics Engineering - II: 20L**

**Pre-requisites:** Knowledge of Basic Electronics Engineering – I.

**Module – 1: Field Effect Transistors:** 5L  
Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles.

**Module – 2: Feed Back Amplifier, Oscillators and Operational Amplifiers:** 5L+5L = 10L  
Concept (Block diagram), properties, positive and negative feed back, loop gain, open loop gain, feed back factors; topologies of feed back amplifier; effect of feed back on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feed back: instability and oscillation, condition of oscillation, Barkhausen criteria.  
Introduction to integrated circuits, operational amplifier and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier, Voltage follower, Comparator, Integrator, Differentiator.

**Module – 3: Digital Electronics:** 5L  
Introduction to binary number; Basic Boolean algebra; Logic gates and function realization with OPAMPs.

#### **Outcomes:**

Students will be able to distinguish the different Gate isolation techniques; draw and explain the I-V characteristics of FETs; Appreciate the utility of CMOS.

Student will analyse the different OPAMP circuits and apply the knowledge of network theory to OPAMP circuits.

Student must acquire the proficiency to express binary numbers, convert binary to decimal and vice versa, draw truth tables for different logic operations, design Gates and simple digital circuits using the Gates.

#### **Recommended Books:**

Text:

- Sedra & Smith: Microelectronics Engineering.
- Millman & Halkias: Integrated Electronics.

References:

- Malvino: Electronic Principle.
- Schilling & Belove: Electronics Circuits.
- Millman & Grabal: Microelectronics.
- Salivahanan: Electronics Devices & Circuits.
- Boyelstad & Nashelsky: Electronic Devices & Circuit Theory.

#### **Engineering Thermodynamics & Fluid Mechanics**

**Code: ME201**

**Contacts: 3L + 1T = 4**

**Credits: 4**

#### **Module 1 :**

##### **Basic Concepts of Thermodynamics**

Introduction: Microscopic and Macroscopic viewpoints

Definition of Thermodynamic systems: closed, open and isolated systems

Concept of Thermodynamics state; state postulate.

8L+3T



Definition of properties: intensive, extensive & specific properties.  
Thermodynamic equilibrium  
Thermodynamic processes; quasi-static, reversible & irreversible processes; Thermodynamic cycles.  
Zeroth law of thermodynamics. Concept of empirical temperature.

### Heat and Work

Definition & units of thermodynamic work.  
Examples of different forms of thermodynamic works; example of electricity flow as work.  
Work done during expansion of a compressible simple system  
Definition of Heat; unit of Heat  
Similarities & Dissimilarities between Heat & Work

### Ideal Equation of State, processes; Real Gas

Definition of Ideal Gas; Ideal Gas Equations of State.  
Thermodynamic Processes for Ideal Gas; P-V plots; work done, heat transferred for isothermal, isobaric, isochoric, isentropic & polytropic processes.  
Equations of State of Real Gases: Van der Waal's equation; Virial equation of state.

### Properties of Pure Substances

p-v & P-T diagrams of pure substance like H<sub>2</sub>O  
Introduction to steam table with respect to steam generation process; definition of saturation, wet & superheated status.  
Definition of dryness fraction of steam, degree of superheat of steam.

### Module 2 :

4L+3T

#### 1st Law of Thermodynamics

Definition of Stored Energy & Internal Energy  
1st Law of Thermodynamics for cyclic processes  
Non Flow Energy Equation  
Flow Energy & Definition of Enthalpy  
Conditions for Steady State Steady flow: Steady State Steady Flow Energy Equation

### Module 3 :

6L+3T

#### 2nd Law of Thermodynamics

Definition of Sink, Source Reservoir of Heat.  
Heat Engine, heat Pump & Refrigerator; Thermal efficiency of Heat Engines & co-efficient of performance of Refrigerators  
Kelvin – Planck & Clausius statements of 2nd Law of Thermodynamics  
Absolute or Thermodynamic scale of temperature  
Clausius Integral  
Entropy  
Entropy change calculation for ideal gas processes.  
Carnot Cycle & Carnot efficiency  
PMM-2; definition & its impossibility

### Module 4:

6L+3T

#### Air standard Cycles for IC engines

Otto cycle; plot on P-V, T-S planes; Thermal efficiency  
Diesel cycle; plot on P-V, T-S planes; Thermal efficiency

#### Rankine cycle of steam

h-s chart of steam (Mollier's Chart)  
Simple Rankine cycle plot on P-V, T-S, h-s planes  
Rankine cycle efficiency with & without pump work  
(Problems are to solved for each module)

### Module 5:

9L+3T

#### Properties & Classification of Fluids

Ideal & Real fluids  
Newton's law of viscosity; Newtonian and Non-Newtonian fluids



Compressible and Incompressible fluids

**Fluid Statics**

Pressure at a point

**Measurement of Fluid Pressure**

Manometers : simple & differential

U-tube

Inclined tube

**Fluid Kinematics**

Stream line

laminar & turbulent flow

external & internal flow

Continuity equation

**Dynamics of ideal fluids**

Bernoulli's equation

Total head; Velocity head; Pressure head

Application of Bernoulli's equation

**Measurement of Flow rate : Basic principles**

Venturimeter

Pilot tube

Orifice meter

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**33L+15T**  
**=48P**

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(Problems are to be solved for each module)

**Engineering Thermodynamics**

Text :

1 Engineering Thermodynamics - P K Nag, 4<sup>th</sup> edn, TMH.

References :

- 1 "Fundamentals of Thermodynamics" 6e by Sonntag & Van Wylin published by Wiley India.
- 2 Engineering Thermodynamics – Russel & Adeliyi (Indian edition), OUP
- 3 Engineering Thermodynamics – Onkar Singhh, New Age International Publishers Ltd.
- 4 Basic Engineering Thermodynamics – R Joel, 5<sup>th</sup> Ed., Pearson

**Fluid Mechanics**

Text :

- 1 Fluid Mechanics and Hydraulic Machines - R K Bansal

References :

- 1 Introduction to Fluid Mechanics and Fluid Machines - S.K.Som and G.Biswas. 2<sup>nd</sup> edn, TMH
- 2 Fluid Mechanics by A.K.Jain.



## Practical

### Basic Science

#### **Basic Computation & Principles of Computer Programming Lab**

**Code: CS 291**

**Contacts: Credits: 2**

Exercises should include but not limited to:

1. DOS System commands and Editors ( Preliminaries)
2. UNIX system commands and vi ( Preliminaries)
3. Simple Programs: simple and compound interest. To check whether a given number is a palindrome or not, evaluate summation series, factorial of a number , generate Pascal's triangle, find roots of a quadratic equation
4. Programs to demonstrate control structure : text processing, use of break and continue, etc.
5. Programs involving functions and recursion
6. Programs involving the use of arrays with subscripts and pointers
7. Programs using structures and files.

#### **Chemistry-1(Gr-B/Gr-A)**

**Code: CH291**

**Contacts:**

**Credits: 2**

Or

#### **Physics-1(Gr-A/Gr-B)**

**Code: PH291**

**Contacts:**

**Credits: 2**

### Engineering Science

#### **Basic Electrical and Electronics Engineering-II**

**Code: ES291**

**Contacts:**

**Credits: 2**

#### **Basic Electrical Engineering Laboratory-II**

List of Experiments:

Sl. No Name of the Experiments

1. Calibration of ammeter and voltmeter.
2. Open circuit and Short circuit test of a single phase Transformer.
3. No load characteristics of D.C shunt Generators
4. Starting and reversing of speed of a D.C. shunt
5. Speed control of DC shunt motor.
6. Measurement of power in a three phase circuit by two wattmeter method.

#### **Basic Electronics Engineering Laboratory-II**

There will be a couple of familiarization lectures before the practical classes are undertaken where basic concept of the instruments handled will be given.

3 hours per week must be kept, initially for practical lectures, and later for tutorials.





List of Experiments:

1. Study of I-V characteristics of Field Effect Transistors.
2. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
3. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
4. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.
5. Study of Logic Gates and realization of Boolean functions using Logic Gates.
6. Study of Characteristic curves for CB, CE and CC mode transistors.

**Engineering Drawing & Computer Graphics(Gr-B/Gr-A)**

**Code: ME291**

**Contacts:**

**Credits: 3**

**Or**

**Workshop Practice(Gr-A/Gr-B)**

**Code: ME292**

**Contacts:**

**Credits: 3**

# Syllabus for B.Tech(Electronics & Communication Engineering) Up to Fourth Year

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)



## ECE SECOND YEAR: THIRD SEMESTER

A. THEORY							
Sl.No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
1	M(CS)301	Numerical Methods	2	1	0	3	2
2	M302	Mathematics-III	3	1	0	4	4
3	EC301	1. Circuit Theory & Networks	3	1	0	4	4
4	EC302	2. Solid State Device	3	0	0	3	3
5	EC303	1. Signals & Systems	3	0	0	3	3
	EC304	2. Analog Electronic Circuits	3	1	0	4	4
6							
<b>Total of Theory</b>						<b>21</b>	<b>20</b>
B. PRACTICAL							
7	M(CS)391	Numerical Lab	0	0	2	2	1
8	EC391	Circuit Theory & Network Lab	0	0	3	3	2
9	EC392	Solid State Devices	0	0	3	3	2
10	EC393	1. Signal System Lab	0	0	3	3	2
11	EC394	2. Analog Electronic Circuits Lab	0	0	3	3	2
<b>Total of Practical</b>						<b>14</b>	<b>9</b>
<b>Total of Semester</b>						<b>35</b>	<b>29</b>

## ECE SECOND YEAR: FOURTH SEMESTER

A. THEORY							
Sl.No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
1	HU401	Values & Ethics in Profession	3	0	0	3	3
2	PH401	Physics-II	3	1	0	4	4
3	CH401	Basic Environmental Engineering & Elementary Biology	2+1	0	0	3	3
4	EC401	1. EM Theory & Transmission Lines	3	1	0	4	4
5	EC402	2. Digital Electronic & Integrated Circuits	3	1	0	4	4
<b>Total of Theory</b>						<b>18</b>	<b>18</b>
B. PRACTICAL							
6	HU481	Technical Report Writing & Language Lab Practice	0	0	3	3	2
7	PH491	Physics-II Lab	0	0	3	3	2
8	EC491	1. EM Theory & Tx Lines Lab	0	0	3	3	2
9	EC492	2. Digital Electronic & Integrated Circuits Lab	0	0	3	3	2
<b>Total of Practical</b>						<b>12</b>	<b>8</b>
<b>Total of Semester</b>						<b>30</b>	<b>26</b>

# Syllabus for B.Tech(Electronics & Communication Engineering) Up to Fourth Year

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)



## Third Year - Fifth Semester

A. THEORY							
Sl.No	Paper Code	Theory	Contact Hours/Week				Cr. Pts
			L	T	P	Total	
1	HU-501	Economics for Engineers	3	0	0	3	3
2	EC-501	Analog Communication	3	1	0	4	4
3	EC-502	Microprocessors & Microcontrollers	3	1	0	4	4
4	EC-503	Control System	3	0	0	3	3
5	F. E.- EC 504A	Computer Architecture	3	1	0	4	3/4
	EC-504B	Data structure & C					
Total of Theory						18	18
B. PRACTICAL							
6	EC-591	Analog Communication*	0	0	3	3	2
7	EC-592	Microprocessors & Microcontrollers*	0	0	3	3	2
8	EC -593	Control System*	0	0	3	3	2
9	F.E. EC-594A	Computer Architecture	0	0	3	3	2
	EC-594B	Data structure & C					
Total of Practical						12	8
Total of Semester						30	26

Laboratories to have both physical experiments and simulation. Only virtual laboratory is not accepted

## Third Year - Sixth Semester

A. THEORY							
Sl.No.	Field	Theory	Contact Hours/Week				Cr. Pts
			L	T	P	Total	
1	HU-601	Principles of Management	2	0	0	2	2
2	EC601	Digital Communications	3	0	0	3	3
3	EC602	Digital Signal Processing	3	0	0	3	3
4	EC 603	Telecommunication System	3	0	0	3	3
5	(No Lab) EC-604A	Antenna Theory & Propagation	3	0	0	3	3
	EC-604B	Information Theory & Coding					
6	(With Lab) EC-605A	Object Oriented Programming (IT)	3	0	0	3	3
	EC-605B	Programming Language (CSE)					
	EC-605C	Electronic Measurement & Instrumentation(EI)					
Total of Theory						17	17
B. PRACTICAL							
8	EC691	Digital Communications	0	0	3	3	2
9	EC 692	Digital Signal Processing	0	0	3	3	2
10	F.E. EC-695A	Object Oriented Programming (IT)	0	0	3	3	2
	EC-695B	Programming Language (CSE)					
	EC-695C	Electronic Measurement & Instrumentation					
11	EC-681	Seminar	0	0	3	3	2
Total of Practical						12	8
Total of Semester						29	25



Proposed

Fourth Year - Seventh Semester

A. THEORY							
Sl. No.	Field	Theory Name of Paper	Contact Hours/Week				Cr. Pts
			L	T	P	Total	
1	EC701	Wireless Communication & N/W	3	0	0	3	3
2	EC702	Microelectronics & VLSI Designs	3	0	0	3	3
3	EC703 (With Lab)	A. RF & Microwave Engg. B. Optical Communication & N/W C. Computer Networks D. FPGA & Reconfigurable Computing	3	0	0	3	3
4	EC704 (No Lab)	A. Radar Engg B. Embedded Systems C. Biomedical Instrumentation	3	0	0	3	3
5	F. E. EC705	A. Artificial Intelligence (CSE) B. Robotics (CSE ) C. Data Base Management System D. Power Electronics	3	0	0	3	3
<b>Total of Theory</b>						<b>15</b>	<b>15</b>
B. PRACTICAL							
Name of Paper							
6	HU781	Group Discussion	0	0	3	3	2
7	EC792	VLSI Design Lab	0	0	3	3	2
8	EC793	A. RF & Microwave Engg. Lab B. Optical Communication & N/W Lab C. Computer Networks Lab D. FPGA & Reconfigurable Computing lab	0	0	3	3	2
9	F.E. EC795	A. Artificial Intelligence Lab(CSE) B. Robotics lab(CSE) C. Data Base Management System Lab (CSE) D. Power Electronics Lab(EE)	0	0	3	3	2
10	EC781	<b>Industrial training</b>	<b>4 wks during 6<sup>th</sup> -7<sup>th</sup> Sem-break</b>				2
11	EC782	<b>Project part 1</b>				3	2
<b>Total of Practical</b>						<b>15</b>	<b>12</b>
<b>Total of Semester</b>						<b>30</b>	<b>27</b>

Fourth Year - Eighth Semester

A. THEORY							
Sl. No.	Field	Theory Paper Name	Contact Hours/Week				Cr. Pts
			L	T	P	Total	
1	HU801A	Organisational Behaviour	2	0	0	2	2
3	EC801 (No Lab)	A. Smart Antenna B. Digital Image Processing C. Satellite Communication & Remote Sensing	3	0	0	3	3
	EC802 (No Lab)	A. Neural N/W & Applications (CSE) B. Material Sc. & Engg (Mat. Sc) C. Renewable Energy (EE) D. Audio & Speech Processing (CSE)	3	0	0	3	3
<b>Total of Theory</b>						<b>8</b>	<b>8</b>
B. PRACTICAL							
	EC881	Design Lab / Industrial problem related practical training	0	0	6	6	4
	EC882	Project part-2	0	0	12	12	6
	EC893	Grand viva					3
<b>Total of Practical</b>						<b>18</b>	<b>13</b>
<b>Total of Semester</b>						<b>26</b>	<b>21</b>



## SEMESTER - III

### Theory

#### NUMERICAL METHODS

Code : M(CS) 301

Contacts : 2L+1T

Credits :2

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. (4)

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. (5)

Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. (3)

Numerical solution of a system of linear equations:

Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. (6)

Numerical solution of Algebraic equation:

Bisection method, Regula-Falsi method, Newton-Raphson method. (4)

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. (6)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar, & Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

#### MATHEMATICS

Code: M 302

Contacts: 3L +1T = 4

Credits: 4

Note 1: The entire syllabus has been divided into four modules.

Note 2: Structure of Question Paper

There will be two groups in the paper:

**Group A:** Ten questions, each of 2 marks, are to be answered out of a total of 15 questions, covering the entire syllabus.

**Group B:** Five questions, each carrying 10 marks, are to be answered out of (at least) 8 questions.

Students should answer at least one question from each module.

[At least 2 questions should be set from each of Modules II & IV.

At least 1 question should be set from each of Modules I & III. Sufficient questions should be set covering the whole syllabus for alternatives.]

#### Module I: Fourier Series & Fourier Transform [8L]

Topic: Fourier Series:

Sub-Topics: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave. (1)

Euler's Formulae for Fourier Series, Fourier Series for functions of period  $2\pi$ , Fourier Series for functions of period  $2l$ , Dirichlet's conditions, Sum of Fourier series. Examples. (1)

Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only). Examples. (2)

Topic: Fourier Transform:

Sub-Topics: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms of elementary functions. (1)

Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples. (1)

Convolution Theorem (statement only), Inverse of Fourier Transform, Examples. (2)



## Module II : Calculus of Complex Variable [13L]

### Topic: Introduction to Functions of a Complex Variable.

**Sub-Topics:** Complex functions, Concept of Limit, Continuity and Differentiability. (1)

Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. (1)

Construction of Analytic functions: Milne Thomson method, related problems. (1)

### Topic: Complex Integration.

**Sub-Topics:** Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples. (2)

Cauchy's theorem (statement only). Cauchy-Goursat theorem (statement only). Examples. (1)

Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function. Examples. (2)

Taylor's series, Laurent's series. Examples (1)

### Topic: Zeros and Singularities of an Analytic Function & Residue Theorem.

**Sub-Topics:** Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m. Examples on determination of singularities and their nature. (1)

Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals:

$$\int_0^{\infty} \frac{\sin x}{x} dx, \int_0^{2\pi} \frac{d\theta}{a + b \cos \theta + c \sin \theta}, \oint_C \frac{P(z)}{Q(z)} dz \quad (\text{elementary cases, } P(z) \text{ \& } Q(z) \text{ are polynomials of } 2^{\text{nd}} \text{ order or less}).$$

(2)

### Topic: Introduction to Conformal Mapping.

**Sub-Topics:** Concept of transformation from z-plane to w-plane. Concept of Conformal Mapping. Idea of some standard transformations. Bilinear Transformation and determination of its fixed point. (1)

## Module III: Probability [8L]

### Topic: Basic Probability Theory

**Sub-Topics:** Classical definition and its limitations. Axiomatic definition.

Some elementary deduction: i)  $P(O)=0$ , ii)  $0 \leq P(A) \leq 1$ , iii)  $P(A')=1-P(A)$  etc. where the symbols have their usual meanings. Frequency interpretation of probability. (1)

Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems.

Conditional probability & Independent events. Extension to more than 2 events (pairwise & mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems. (3)

### Topic: Random Variable & Probability Distributions. Expectation.

**Sub-Topics:** Definition of random variable. Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof). Examples. Definitions of Expectation & Variance, properties & examples. (2)

Some important discrete distributions: Binomial & Poisson distributions and related problems.

Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only. (2)

## Module IV: Partial Differential Equation (PDE) and Series solution of Ordinary Differential Equation (ODE) [13L]

### Topic: Basic concepts of PDE.

**Sub-Topics:** Origin of PDE, its order and degree, concept of solution in PDE. Introduction to different methods of solution: Separation of variables, Laplace & Fourier transform methods. (1)

### Topic: Solution of Initial Value & Boundary Value PDE's by Separation of variables, Laplace & Fourier transform methods.

### Sub-Topics:

PDE I: One dimensional Wave equation. (2)



PDE II: One dimensional Heat equation. (2)  
 PDE III: Two dimensional Laplace equation. (2)

**Topic: Introduction to series solution of ODE.**

**Sub-Topics:** Validity of the series solution of an ordinary differential equation.  
 General method to solve  $P_0 y'' + P_1 y' + P_2 y = 0$  and related problems. (2)

**Topic: Bessel's equation.**

**Sub-Topics:** Series solution, Bessel function, recurrence relations of Bessel's  
 Function of first kind. (2)

**Topic: Legendre's equation.**

**Sub-Topics:** Series solution, Legendre function, recurrence relations and  
 orthogonality relation. (2)

**TOTAL LECTURES : 42**

**Text Books:**

1. Brown J.W and Churchill R.V: Complex Variables and Applications, McGraw-Hill.
2. Das N.G: Statistical Methods, TMH.
3. Grewal B S: Higher Engineering Mathematics, Khanna Publishers.
4. James G: Advanced Modern Engineering Mathematics, Pearson Education.
5. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.

**References:**

1. Bhamra K. S.: Partial Differential Equations: An introductory treatment with applications, PHI
2. Dutta Debashis: Textbook of Engineering Mathematics, New Age International Publishers.
3. Kreyzig E.: Advanced Engineering Mathematics, John Wiley and Sons.
4. Potter M.C, Goldberg J.L and Aboufadel E.F: Advanced Engineering Mathematics, OUP.
5. Ramana B.V.: Higher Engineering Mathematics, TMH.
6. Spiegel M.R. , Lipschutz S., John J.S., and Spellman D., : Complex Variables, TMH.

**CIRCUIT THEORY & NETWORKS**

**Code : EC 301**

**Contacts : 3L+1T=4hrs**

**Credits :4**

Module	Content	Hrs
1.	<p><b>a) Resonant Circuits:</b> Series and Parallel resonance [1L], (*) <i>Impedance and Admittance Characteristics, Quality Factor, Half Power Points, Bandwidth [2L], Phasor diagrams, Transform diagrams [1L], Practical resonant and series circuits, Solution of Problems [Tutorial - 1L].</i></p> <p><b>b) Mesh Current Network Analysis:</b> Kirchoff's Voltage law, Formulation of mesh equations [1L], Solution of mesh equations by Cramer's rule and matrix method [2L], Driving point impedance, Transfer impedance [1L], Solution of problems with DC and AC sources [1L].</p>	4 6
2.	<p><b>a) Node Voltage Network Analysis:</b> Kirchoff's Current law, Formulation of Node equations and solutions [2L], driving point admittance, transfer Admittance [1L], Solution of problems with DC and AC sources [1L].</p> <p><b>b) Network Theorems:</b> Definition and Implication of Superposition Theorem [1L], Thevenin's theorem, Norton's theorem [1L], Reciprocity theorem, Compensation theorem [1L], maximum Power Transfer theorem [1L], Millman's theorem, Star delta transformations [1L], Solutions and problems with DC and AC sources [1L].</p>	4 6
3.	<p><b>Graph of Network:</b> Concept of Tree and Branch [1L], tree link, junctions, (*) <i>Incident matrix, Tie set matrix [2L], Determination of loop current and node voltages [2L].</i></p> <p><b>Coupled Circuits:</b> Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems.</p> <p><b>Circuit transients:</b> DC transients in R-L and R-C Circuits with and without initial charge, (*) <i>R-L-C Circuits, AC Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems [2L].</i></p>	4 4 2
4.	<p><b>Laplace transform:</b> Concept of Complex frequency [1L], transform of <math>f(t)</math> into <math>F(s)</math> [1L], transform of step, exponential, over damped surge, critically damped surge, damped and un-damped sine functions [2L], properties of Laplace transform [1L], linearity, real differentiation, real integration, initial value theorem and final value theorem [1L], inverse Laplace transform [1L], application in circuit analysis, Partial fraction expansion, Heaviside's expansion theorem, Solution of problems [1L].</p> <p>(*) <i>Laplace transform and Inverse Laplace transform [2L].</i></p> <p><b>Two Port Networks:</b> Relationship of Two port network variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, relationship between parameter sets, network functions for ladder network and general network.</p>	8 4

Old module 9 viz. SPICE deleted for consideration in Sessional Subject.

**Problems for Module 1a:**

- Ex. 1.** A parallel RLC Circuit has  $R= 100 \text{ K Ohms}$ ,  $L= 10 \text{ mH}$ ,  $C= 10 \text{ nF}$ . Find resonant frequency, bandwidth and Quality factor.
- Ex. 2.** Two coils one of  $R= 0.51 \text{ Ohms}$ ,  $L= 32 \text{ mH}$ , other of  $R= 1.3 \text{ Ohms}$ ,  $L= 15 \text{ mH}$ , and two capacitors of  $25 \text{ micro F}$  and  $62 \text{ micro F}$  are in series with a resistance of  $0.24 \text{ Ohms}$ . Determine resonance frequency and  $Q$  of each coil.
- Ex. 3.** In a series circuit with  $R= 50 \text{ Ohms}$ ,  $L= 0.05 \text{ Ohms}$  and  $C= 20 \text{ micro F}$ , frequency of the source is varied till the voltage across the capacitor is maximum. If the applied voltage is  $100 \text{ V}$ , find the maximum voltage across the capacitor and the frequency at which this occurs. Repeat the problem with  $R= 10 \text{ Ohms}$ .

**Problems for Module 1b and 2:**



Examples for mesh current in networks like T,  $\pi$ , bridged T and combination of T and  $\pi$ .

**See Annexure-1 for the figures**

**Problems for Module- 2a:**

**Ex.1.** The network of Fig.1 – Mod.4 is in the zero state until  $t=0$  when switch is closed. Find the current  $i_1(t)$  in the resistor  $R_3$ .  
Hints: the Fig.1 – Mod.4 shows the same network in terms of transform impedance with the Thevenin equivalent network.

**Ex.2.** Find the Norton's equivalent circuit for the circuit Fig.2 – Mod.4.

Hints: As a 1<sup>st</sup>. step, short the terminals ab. This results in the Circuit of Fig.2.(a). By applying KCL at node a, we have,  $(0-24)/4 + i_{sc} = 0$ ; i.e  $i_{sc} = 9$  A. To find out the equivalent Norton's impedance  $R_N$ , deactivate all the independent sources, resulting in a circuit of Fig.2.(b),  $R_N = (4 \times 12)/(4+12) = 3$  Ohms. Thus we obtain Norton equivalent circuit of Fig.2 (c).

**Problems for Module – 2b:**

**Ex.1.** Draw the graph, one tree and its co tree for the circuit shown in Fig.1 – mod.5.

Hints: In the circuit there are four nodes ( $N=4$ ) and seven branches ( $B=7$ ). The graph is so drawn and appears as in Fig. 1 (a). Fig.1(b) shows one tree of graph shown in Fig. 1(a). The tree is made up of branches 2, 5 and 6. The co tree for the tree of Fig.1 (b) is shown in Fig. 1(c). The co tree has  $L = B - N + 1 = 7 - 4 + 1 = 4$  Links.

**Ex.2. (a).** For the circuit shown in Fig.2- Mod.5, construct a tree so that  $i_1$  is a link current. Assign a complete set of link currents and find  $i_1(t)$ .

**(b).** Construct another tree in which  $v_1$  is a tree branch voltage. Assign a complete set of tree branch voltages and  $v_1(t)$ .

Take  $i(t) = 25 \sin 1000t$  A,  $v(t) = 15 \cos 1000t$ .

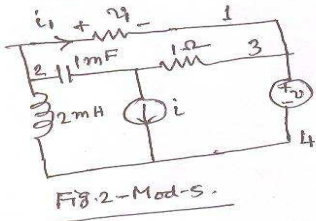
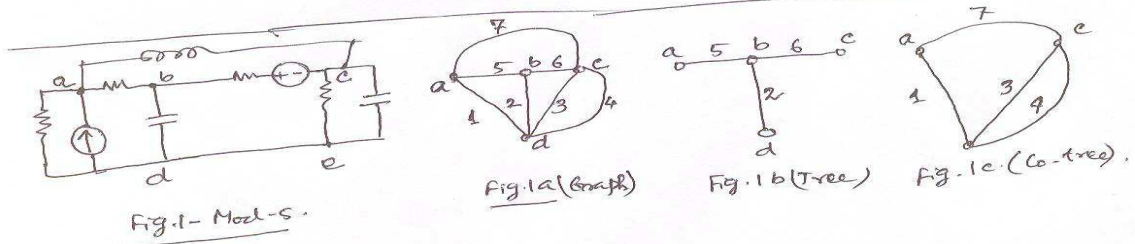
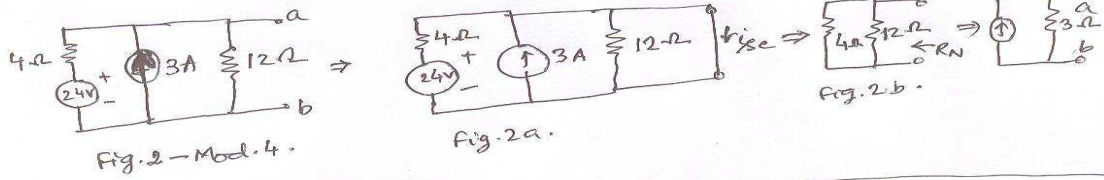
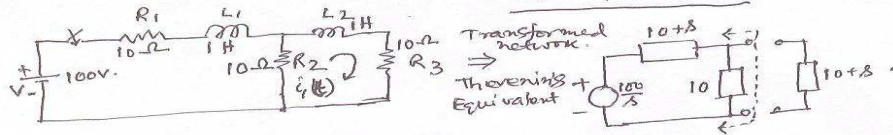
**Tutorials: (\*) : Bold and Italics.**

Text Books:

1. Valkenburg M. E. Van, "Network Analysis", Prentice Hall./Pearson Education
2. Hayt "Engg Circuit Analysis" 6/e Tata McGraw-Hill
3. D.A.Bell- Electrical Circuits- Oxford



Annexure-1.



Reference Books:

1. A.B.Carlson-Circuits- Cenage Learning
2. John Bird- Electrical Circuit Theory and Technology- 3/e- Elsevier (Indian Reprint)
3. Skilling H.H.: "Electrical Engineering Circuits", John Wiley & Sons.
4. Edminister J.A.: "Theory & Problems of Electric Circuits", McGraw-Hill Co.
5. Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.
6. R.A.DeCarlo & P.M.Lin- Linear Circuit Analysis- Oxford
7. P.Ramesh Babu- Electrical Circuit Analysis- Scitech
8. Sudhakar: "Circuits & Networks:Analysis & Synthesis" 2/e TMH
9. M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford
10. Sivandam- "Electric Circuits and Analysis", Vikas



11. V.K. Chandna, "A Text Book of Network Theory & Circuit Analysis", Cyber Tech
12. Reza F. M. and Seely S., "Modern Network Analysis", Mc.Graw Hill .
13. M. H. Rashid: "Introduction to PSpice using OrCAD for circuits and electronics", Pearson/PHI
14. Roy Choudhury D., "Networks and Systems", New Age International Publishers.
15. D.Chattopadhyay and P.C.Rakshit: "Electrical Circuits" New Age

### SOLID STATE DEVICES

Code : EC 302

Contacts : 3L +9T =3hrs

Credits :3

**Module - 1: Energy Bands and Charge Carriers in Semiconductors-** Energy-band (E-k) diagram, effective mass, wave vector, Debye length, Direct & indirect band-gap semiconductors; Carrier distribution, Fermi-level, Intrinsic & Extrinsic semiconductors, Non-equilibrium in carrier distribution; drift, diffusion, scattering; Piezo & Hall effects. [8]

**Details:** [Recapitulation of Conductor, Insulator & Semiconductor with special emphasis on the concept of energy bands and band-gaps, E-k diagrams for direct and indirect band-gap semiconductors (IL)];

Concept of the effective mass & crystal momentum, concept of wave-vector 'k'; Intrinsic & extrinsic semiconductors, idea about degeneracy and non-degeneracy. (2L)

Carrier concentration in terms of bulk Density of states and Fermi-Dirac distribution (no derivation, expression and significance only); Concept of Fermi level, F.L. shift with doping & temperature; (2L)

Non-equilibrium condition: Drift & diffusion of carriers with simple expressions; Hall effect & Piezo-electric effect, Carrier scattering (basic idea only). Generation and re-combination, quasi-Fermi energy level (concept only) (3L)

**Module - 2: Rectifier and detector diodes:** P-N junction & Schottky junction physics, I-V relation, Junction capacitances, Diode switching, Optical devices & Solar cells, Tunnel diode. [10]

**Details:** Homo- and Hetero-junctions – examples of semiconductor-semiconductor junction (Homo) & Metal-metal, Metal-S.C. junctions (Hetero-) (IL);

[Recapitulation of the rectifying properties of these two types of junctions;] Homo-junction – Semiconductor-semiconductor p-n junction & rectification (recapitulation) (IL); Plot of junction voltage, field and depletion charge with distance by solving simple 1D Poisson's Equation (Gradual Channel & Depletion Approximations) (IL); Schottky contact & Schottky diode (IL); Junction capacitances in p-n diodes (recapitulation) and their expressions; Application of Diode capacitance in Varactor Diodes (IL); Derivation for Forward and Reverse current, piece-wise linear diode-characteristics, concept of Diode resistance & Differential diode resistance, (IL); Diode switching & diode switch, properties of rectifier and switching diodes (IL); Importance of reverse current in optical detectors, photo-diodes, solar cells (IL); Spontaneous emission & Stimulated emission - optical devices (basic idea only) (IL).], Tunnel diode -(basic principle only - importance of negative resistance) (IL).

**Module - 3: Bipolar Junction Transistors:** Physical mechanism, current gain, minority current distribution; Punch-through and avalanche effect; High voltage and high power transistors; Frequency limitations, high frequency transistors, Power transistors. [8]

**Details:** [Emphasis on BJT as a current controlled device, amplification property of BJT (IL); I-V characteristics (input & output) with derivation, input & output characteristics for CB, CE & CC mode, current amplification factors  $\alpha$  for CB mode and  $\beta$  for CE mode (2L); Eber's Moll model for Static behaviour & Charge controlled model (without derivation) for dynamic behaviour, equivalent circuits. (2L); Basic idea about Photo-transistors & Power transistors (only their features Vis-à-vis the ordinary transistors) (IL); PNP transistors - simple working principle, I-V characteristics, triggering, mention of Triacs, Diacs & Thyristors. (2L) ]

**Module - 4: Field Effect Transistors:** JFETS, IJFETS and MOSFETs; MOS-capacitors, flat band and threshold voltages; P and N-channel MOSFETS, CMOS and VLSI MOSFETS, Semiconductor sensors and detectors. [9]

**Details:** [Concept of Field effect device (recapitulation), channel modulation & channel isolation (IL)]; JFET - behaviour, characteristics (IL); MOSFET - channel inversion, Ideal Threshold voltage (IL), MOS capacitances, depletion width, surface field and potential (by solving Poisson's equation with gradual channel & depletion approximations) (2L); Real MOSFET & Threshold voltage for real MOSFET, (IL); I-V characteristics with expressions for saturation and non-saturation regions (concepts but no detail derivations, empirical relations to be used for solving problems) (IL); Equivalent circuit for MOSFET (IL); MOSFET for VLSI - scaling issues (basic concept of Short Channel Effects only) (IL); ]

#### Text Books :

Neamen- Semiconductor Physics and Devices TMH  
Bhattacharya & Sharma- Solid State Electronic Devices- Oxford  
Maini & Agrawal- Electronics Devices and Circuits- Wiley

#### Reference Books :

Milman, Halkias & Jit- Electronics Devices and Circuits- TMH  
Bell-Electronics Devices and Circuits-Oxford  
Bhattacharya & Sharma- Solid State Electronic Devices- Oxford  
Singh & Singh- Electronics Devices and Integrated Circuits –PHI  
Bogart, Bisley & Rice- Electronics Devices and Circuits- Pearson  
Kasap-Principles of Electronic Materials and Devices- TMH  
Boylestad & Nashelsky- Electronics Devices and Circuit Theory- Pearson  
Salivahanan, Kumar & Vallavaraj- Electronics Devices and Circuits- TMH

#### Learning Outcome:

**Module - 1:** Student gains the ability to *identify semiconductors* which are elemental or compound type; Direct and indirect band-gap type so that



they may be used in optical and non-optical devices; this empowers the student to *explain the importance of Fermi level* in identifying intrinsic and extrinsic n- and p-type semiconductors, to predict how Fermi-level changes with doping; *identify degenerate and non-degenerate* semiconductors; indicate the *effect of temperature on carrier concentration*.

**Module - 2:** Focus is on understanding the junction phenomena including alignment of Fermi-level at the interface of a p-n junction and Schottky junction, and its non-alignment due to the application of junction potential. The student will be able to *draw the I-V characteristics*; acquire the ability to *evaluate the dependence of reverse saturation (drift) current on minority carrier concentration and forward diffusion component on potential barrier*; the student will *calculate the junction capacitances* and *compare the switching capability* of the minority carrier p-n diode with the majority carrier based Schottky diode; to highlight the importance of peak-inverse voltage for a diode and compare the peak inverse voltages of Si and Ge diodes.

**Practical ability:** Diode specification; Diode numbers and lead specification; Drawing diode characteristics and calculation of differential resistance; load-line analysis of simple diode circuits. [To be practiced in the laboratory]

**Module - 3:** The student will appreciate the importance of varying the reverse saturation current across the reverse biased base-collector junction by varying the minority carrier concentration using electrical means i.e. forward biased emitter-base junction; acquire the ability to *treat the BJT as a two port device* and *explain transistor action* for output current control by changing input current; The student will be able to *use CE, CB and CC modes* for different applications and *design biasing circuits* with BJTs.

**Practical ability [For Laboratory Practice]:** Transistor lead testing and transistor testing; Transistor biasing for different classes of amplifiers; [To be practiced in the laboratory]

**Module - 4:** Ability to *calculate the threshold voltages* for different MOSFETs; ability to *compute the effect of Gate voltages on the junction capacitances*; ability to *bias MOSFETs and JFETs*.

**Practical ability [For Laboratory Practice]:** JFET and MOSFET specifications; Biasing of FETs. [To be practiced in the laboratory]

### SIGNALS AND SYSTEMS

Code : EC 303

Contacts : 3L +0T =3hrs

Credits :3

**Pre requisite:** First year courses (semester I & II) covering

- (1) Concepts in electrical and electronics circuits (Basic Electrical and Electronics Engg I & II).
- (2) Knowledge in algebra and calculus with problem solving capability (studied in Mathematics-I).
- (3) Fundamental concepts on Laplace Transformation (studied in Mathematics-II)
- (4)

**Genesis:** The scope of this paper is to introduce a panoramic view of signals & systems so that the students may understand the basic concepts of various systems and signal processing and the way the signals interact with the physical systems. This understanding is not only the prerequisite to study the subject DSP (to be introduced in the higher semester), but also crucial for understanding fundamental concepts in communication engineering in general and to some extent for other upcoming subjects such as control engineering and circuit analysis/ synthesis.

**Outcome:** The course will enable the students to study the various tools of signal analysis and acquire confidence in studying all other communication related subjects (in particular DSP) in the subsequent semesters.

Module No	Topic	Hrs
3.	<b>Introduction to signal and systems:</b> Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals – periodicity –unit impulse – unit step – Transformation of independent variable of signals: time scaling, time shifting. System properties: Linearity, Causality, time invariance and stability. Dirichlet's conditions, Determination of Fourier series coefficients of signal.	8
4.	<b>Signal Transformation:</b> Fourier transformation of continuous and discrete time signals and their properties. Laplace transformation- analysis with examples and properties. Parseval's theorem; Convolution in time (both discrete and continuous) and frequency domains with magnitude and phase response of LTI systems.	8
5.	<b>Laplace Transform:</b> Recapitulation, Analysis and characterization of LTI systems using Laplace transform: Computation of impulse response and transfer function using Laplace transform.	2
6.	<b>Sampling Theorem:</b> Representation of continuous time signals by its sample –Types of sampling, Sampling theorem. Reconstruction of a Signal from its samples, aliasing –sampling of band pass signals.	4
7.	<b>Z-Transforms:</b> Basic principles of z-transform - z-transform definition –, Relationship between z-transform and Fourier transform, region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion	6
8.	<b>Random Signals &amp; Systems:</b> Definitions, distribution & density functions, mean values & moments, function of two random variables, concepts of correlation, random processes, spectral densities, response of LTI systems to random inputs.	4

Total: 32 hrs

**Text Books:**

3. A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals & Systems, Pearson
4. S.Haykin & B.V.Veen, Signals and Systems- John Wiley
5. A.Nagoor Kani- Signals and Systems- McGraw Hill

**References:**

1. J.G.Proakis & D.G.Manolakis- Digital Signal Processing Principles, Algorithms and Applications, PHI.
2. C-T Chen- Signals and Systems- Oxford
3. E WKamen &BS Heck- Fundamentals of Signals and Systems Using the Web and Matlab- Pearson
4. B.P.Lathi- Signal Processing & Linear Systems- Oxford
5. P.Ramesh Babu & R.Anandanatarajan- Signals and Systems 4/e- Scitech
6. M.J.Roberts, Signals and Systems Analysis using Transform method and MATLAB, TMH
7. S Ghosh- Signals and Systems- Pearson
8. M.H.Hays- Digital Signal Processing “, Schaum's outlines, TMH
9. Ashok Ambardar, -Analog and Digital Signal Processing- Thomson.
10. Phillip, Parr & Riskin- Signal, Systems and Transforms- Pearson



## ANALOG ELECTRONIC CIRCUITS

Code : EC 304

Contacts : 3L +1T =4hrs

Credits :4

Module-1: [10]

- a) Filters and Regulators: Capacitor filter,  $\pi$ -section filter, ripple factor, series and shunt voltage regulator, percentage regulation, 78xx and 79xx series, concept of SMPS. [4]
- b) Transistor Biasing and Stability: Q-point, Self Bias-CE, Compensation techniques, h-model of transistors. Expression for voltage gain, current gain, input and output impedance, trans-resistance & trans-conductance; Emitter follower circuits, High frequency model of transistors. [6]

Module -2: [10]

1. Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier. [6]
2. Feedback Amplifiers & Oscillators: Feedback concept, negative & positive feedback, voltage/current, series/shunt feedback, Barkhausen criterion, Colpitts, Hartley's, Phase shift, Wein bridge and crystal oscillators. [4]

Module -3: [10]

1. Operational Amplifier: Ideal OPAMP, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, voltage follower/buffer circuit. [6]
2. Applications of Operational Amplifiers: adder, integrator & differentiator, comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Anti-log amplifiers, Trans-conductance multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running oscillator. [6]

Module -4: [8]

1. Power amplifiers – Class A, B, AB, C, Conversion efficiency, Tuned amplifier [4]
2. Multivibrator – Monostable, Bistable, Astable multivibrators; Monostable and astable operation using 555 timer. [2]
3. Special Functional Circuits: VCO and PLL. [2]

Total: 40 hrs

Text Books:

1. Sedra & Smith-Microelectronic Circuits- Oxford UP
2. Franco—Design with Operational Amplifiers & Analog Integrated Circuits , 3/e, McGraw Hill
3. Boylested & Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI

Reference Books:

1. Millman & Halkias – Integrated El;ectronics, McGraw Hill.
2. Rashid-Microelectronic Circuits-Analysis and Design- Thomson (Cenage Learning)
3. Schilling & Belove—Electronic Circuit:Discrete & Integrated , 3/e , McGraw Hill
4. Razavi- Fundamentals of Microelectronic s- Wiley
5. Malvino—Electronic Principles , 6/e , McGraw Hill
6. Horowitz & Hill- The Art of Electronics; Cambridge University Press.
7. Bell- Operational Amplifiers and Linear ICs- Oxford UP
8. Tobey & Grame – Operational Amplifier: Design and Applications, Mc GrawHill.
9. Gayakwad R.A -- OpAmps and Linear IC's, PHI



10. Coughlin and Driscoll – Operational Amplifier and Linear Integrated Circuits – Pearson Education  
 Tutorial Guidance:

**Prerequisite:** Basic knowledge about components R,L,C, Network Theorems(Kirchoffs law, Thevenin's theorem, Miller theorem etc.). Basic knowledge about the operation of semiconductor devices ( Transistor, Diode, UJT, SCR etc.), Ohms Law, Voltage current equations. Basic knowledge of Differentiation , Integration, Differential equation, matrix etc.

**Basic level of understanding:** Current Voltage equation. Direction of current flow. Device limitations, Power consumptions and their limits, usage of appropriate device in the problem. Device selection and comparison, advantages and disadvantages.

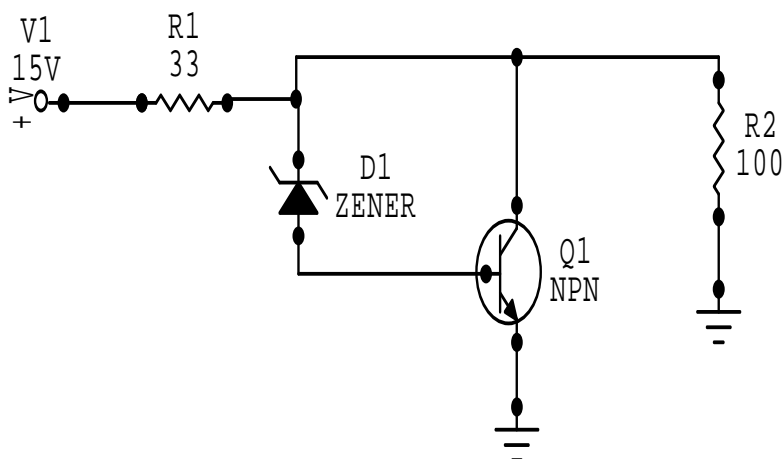
**Outcome of learning:** Students will be able to design, test and examine simple circuits with transistor, op-amp, amplifiers, oscillators etc. They will be able to test, repair, modify and take-up design exercise. They will have clear knowledge of basic circuit analysis and its functions and their limitations. Most importantly they will be able to recognize, understand, modify and repair majority of circuits used in professional equipment design.

**Module:1 Filter and regulator**

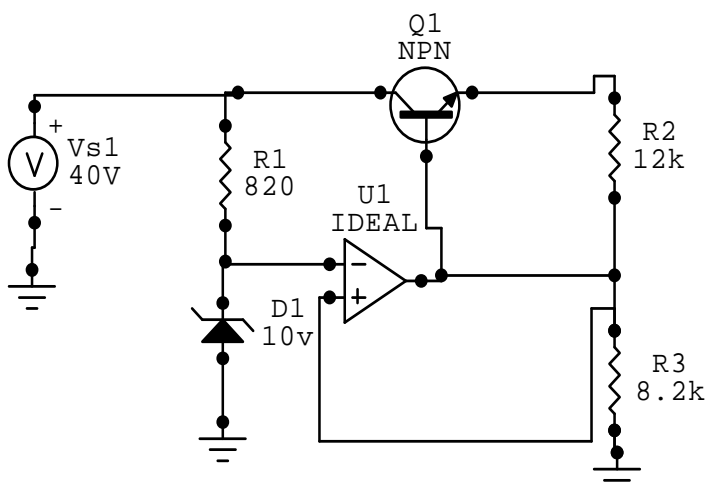
Topic	Reference book (optional)
Capacitor filter, II section filter ripple factor, series and shunt voltage regulator, percentage regulator, 78xx and 79xx series, concepts of smps	Linear integrated circuits-D.Roy Choudhury, Shail B. Jain(Chapter 6&7) Electronic Devices and Circuit Theory-Boylested Chapter 18)

**Assignment:** (These are typical examples, indicative of the type of problems to be set for tutorials. )

1. Determine the regulated voltage and circuit currents for the shunt regulator.



2. Calculate the regulated output voltage in the ckt of fig.



3. A 500  $\mu$ F capacitor provides a load current of 200 mA at 8% ripple; calculate the peak rectified voltage obtained from the 60 Hz supply and the dc voltage across the filter capacitor.

4. Calculate the size of the filter capacitor needed to obtain a filtered voltage with 7% ripple at a load of 200mA. The full wave rectified voltage is 30v, and the supply is 60 Hz



## Module-2 : Transistor Biasing and stability

Topic	Reference Book (optional)
Q Point, self – Bias – CE, compensation technique, h-module of transistors. Expression for voltage gain, current, gain Input and output impedance, trans- resistance and Tran conductance emitter follower circuits	Electronics –fundamental— D Chattopadhaya & P.C. Rakhit  (Chapter---8)
High frequency modes of transistor	Microelectronic circuits---Sedra & Smith (Chapter---3)

**Assignment:** (These are typical examples, indicative of the type of problems to be set for tutorials.)

(1) Find the Q point of a self–bias transistor circuit with the following specification:-  $V_{cc} = 22.5$  volt,  $R_L = 5.6$  K $\Omega$ ,  $R_E = 1$  K $\Omega$ ,  $R_1 = 90$  K $\Omega$ ,  $R_2 = 10$  K $\Omega$ ,  $V_{BE} = 0.7$  volt and  $\beta = 55$  Assume  $I_b \gg I_{C0}$

(2) A CE transistor amplifier is characterised by  $h_{ie} = 2$  K $\Omega$ ,  $h_{re} = 2 \times 10^{-4}$ ,  $h_{fe} = 50$  and  $h_{oe} = 20 \times 10^{-6}$  A/V. If the load resistance is 4 K $\Omega$  and the source resistance is 200  $\Omega$  determine the input resistance, the output resistance and the voltage, current and power gain.

(3) A particular BJT operating at  $I_c = 2$  mA has  $C_{\mu} = 1$  pf,  $C_{\pi} = 10$  pf and  $\beta = 150$ . What are  $f_r$  &  $f_{\beta}$  for this situation?

## Module -3: Transistor Amplifiers:

Topic	Reference Book.(optional)
_RC coupled amplifier, function of all components equivalent circuit, derivation of voltage gain, current gain, input impedance, frequency response characteristics, lower and upper half frequencies, bandwidth and concept of wide band amplifier.	Electronics Devices and Circuits---  S Salivahanan N. Suresh kumar A. Vallavaraj

**Assignment:**

1. A CE-RC coupled amplifier uses transistors with the following h-parameters:  $h_{fe} = 50$ ,  $h_{ie} = 1100$   $\Omega$ ,  $h_{oe} = 10 \times 10^{-6}$  mhos,  $h_{re} = 2.5 \times 10^{-4}$ . The value of  $g_m$  at the operating point is  $200$  mhos. The biasing resistor  $R_1$  &  $R_2$  may be neglected being large in comparison with  $R_L$ . The load resistor  $R_c = 5$  K $\Omega$ . Let the total shunt capacitance  $C = 200$   $\mu$ f in the input Ckt. and the coupling capacitor  $C_c = 7$   $\mu$ f. Calculate for one stage of the amplifier (a) mid band current gain (b) mid band voltage gain (c) lower and higher 3 db frequencies and (d) gain-bandwidth product.

## Module – 4: Feed back Amplifier and Oscillator

Topic	Reference Book(optional)
Feed back concept, negative and positive feed back, voltage/current, series / shunt feed back, bark house ,ulprits, Hartley's , phase shift, Wein bridge and crystal oscillator.	(1) Electronics devices and circuits (Chapter 14& 15) S Salivahanan N. Suresh kumar A. Vallavaraj (2) Electronics-Fundamentals and Applications----- D Chattopadhayay P. C. Rakhit ( Chapter—10)

**Assignment:** (These are typical examples, indicative of the type of problems to be set for tutorials. )

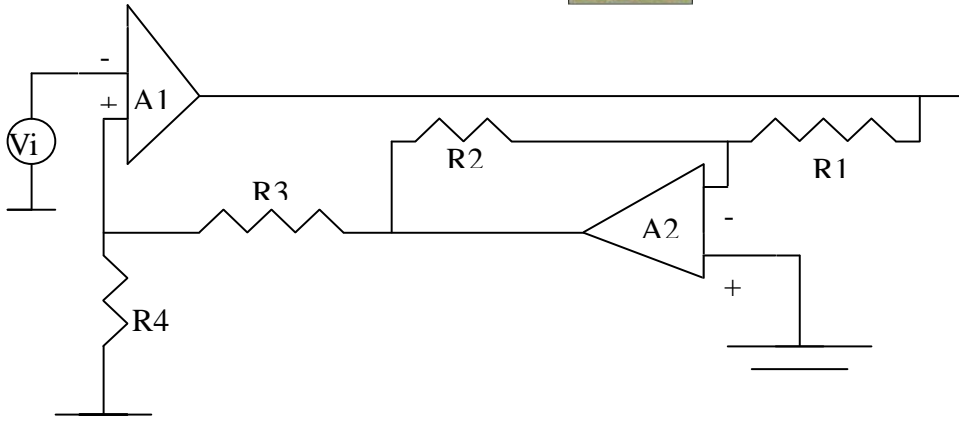
- An Hartley oscillator is designed with  $L_1 = 20$   $\mu$ H,  $L_2 = 2$  mH and a variable capacitance. Determine the range of capacitance values if the frequency is varied between 950 and 2050 Khz.
- A Colpitts oscillator is designed with  $C_2 = 100$  pf and  $C_1 = 7500$  pf. The inductance is variable. Determine the range of inductance values, if the frequency of oscillator is vary between 0.950 and 2050 Khz
- In an RC phase shift oscillator, if its frequency of oscillation is 955 Hz and  $R_1 = R_2 = R_3 = 680$  K $\Omega$ , Find the value of capacitors.
- In the Wein –Bridge oscillator, if the RC network consists of resistance of 200 K $\Omega$  and the capacitance of 300 pf, find its frequency of oscillation.
- A crystal has the following parameters:  $L = 0.33$  H,  $C_1 = 0.065$  pf,  $C_L = 1.0$  pf and  $R = 5.5$  K $\Omega$ . Find the series resonant frequency and Q factor of the crystal.
- The open loop gain of an amplifier is -200. A voltage series negative feed back is used with a feed back ratio of -0.02. The input and the output impedance of the amplifier are 2 K $\Omega$  and 40 K $\Omega$ , respectively in the absence of feedback. Determine the closed loop gain, and the input and the output impedance when the feed back circuit is completed.

## Module: 5 Operation Amplifier:

Topic:	Reference: (optional)
Ideal opAmp, CMRR, Open & Closed loop circuit, Importance of feedback loop(+ve&-ve), Inverting & Non inverting Amplifier	(1) Op amps and linear Integrated Circuits - R. A. Gayakwad
Constant Current source(Current mirror etc), Level shifter, Voltage follower/Buffer Circuit, Differential Amplifier	(2) Linear integrated circuits-D.Roy Choudhury, shail B.Jain

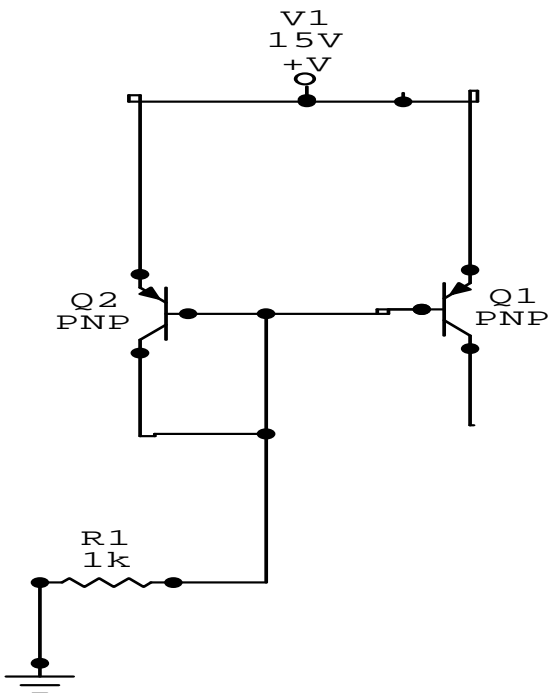
**Assignment:** (These are typical examples, indicative of the type of problems to be set for tutorials. )

(1) For the ckt shown in figure , calculate the expression of  $v_o / v_i$



(2) Design a current source (current Mirror) for generating  $I_o=25\mu A$ . Assume:  $v_{cc}=15v$ ,  $\beta=100$

(3) For the current mirror shown in figure , determine R so that  $I_o=100\mu A$

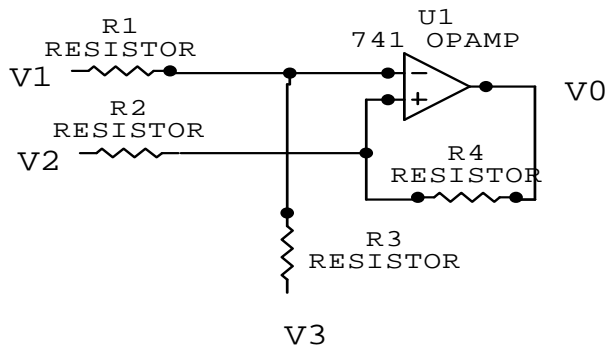


#### Module:6 Application of operational amplifier

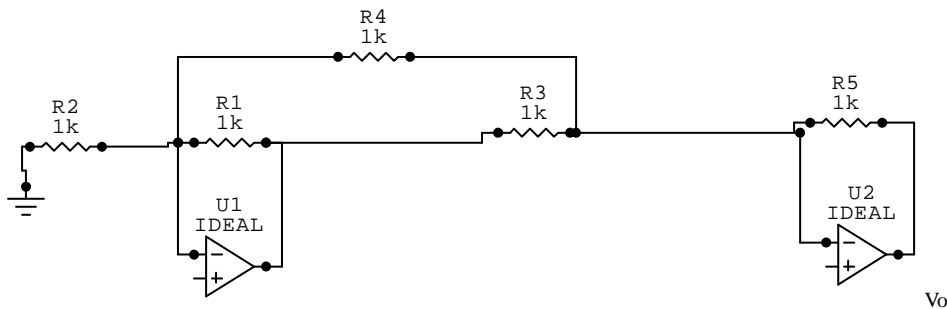
Topic	Reference: book(optional)
Adder, Integrator, differentiator, comparator, schmitt trigger, instrumentation amplifier, log & anti log amplifier, Transconductance multiplier, precision rectifier, v to I and I to v converter, free running oscillator	Linear integrated circuits-D Roy choudhury, shail B. Jain

#### Assignment:

(1) in the ckt of figure, it can be shown that  $V_o = a_1V_1 + a_2V_2 + a_3V_3$ . Find the values of  $a_1$ ,  $a_2$  and  $a_3$ . Also find the value of  $V_o$ , if (1)  $R_4$  is short ckt (2)  $R_4$  removed (3)  $R_1$  is short circuited.

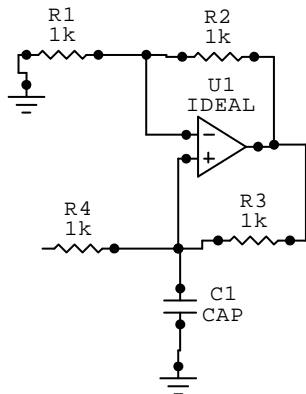


(2) For the instrumentation amplifier shown in figure, verify that  $V_o = (1 + R_2/R_1 + 2R_2/R_1)(V_2 - V_1)$



[note-  $R_1=R_3$ ,  $R_2=R_5$ ]

(3) Prove that the circuit shown in figure is a non inverting integrator with  $V_o = 2/R_c \int V_i dt$ ; where  $R_1=R_2=R_3=R_4=R$



**Module: 7 power Amplifier**

**Assignment:**

1. A transformer coupled class A power Amplifier supplies power to an  $80 \Omega$  load connected across the secondary of a step-down transformer having a turn ratio 5:1. Determine the maximum power output for a zero signal collector of 120 mA.
2. A CE power amplifier operates under Class A condition with a collector supply of 46 volt. The load line passes through the point (i)  $V_c=46$  volt,  $I_c=0$  and (ii)  $V_c=0$ ,  $I_c=2A$ . The Q-point is chosen at  $I_{cq}=0.8A$  and  $V_{cq}=27.6$  volt, calculate the maximum ac power output, the dc power input and the efficiency.
3. A single turned amplifier has the following parameters:  $L=120\mu A$ ,  $C=100P_f$ ,  $R=10 \Omega$ ,  $h_{oe}=50 \times 10^{-6}$ ,  $h_{re}=100$ ,  $h_{ie}=2.5K\Omega$ ,  $R_T=10K\Omega$ . Calculate (i) The resonant frequency (ii) The bandwidth (iii) the maximum voltage gain.

**Module: 8 Multivibrator**

**Assignment:**

1. In an Astable multivibrator,  $R_A=2.2 K\Omega$ ,  $R_B=6.8 K\Omega$ , and  $C=0.01\mu F$ , calculate (i)  $t_{HIGH}$ , (ii)  $t_{LOW}$ , (iii) free running freq, (iv) duty cycle.
2. In a monostable multivibrator, the frequency of the input triggering is 15 KHz. If the value of  $C=0.01\mu F$ , calculate the value of resistance R.

**Module: 9 Special Functional Circuit**

1. In the VCO, calculate the change in output Frequency if the supply voltage is varied between 9 volt and 11 volt. Assume  $V_{CC}=12V$ ,  $R_T=6.8 K\Omega$ ,  $C_T=75P_f$  and  $R_1=15 K\Omega$ , and  $R_2=100 K\Omega$ .
2. Determine the dc control voltage  $V_c$  at lock if signal frequency  $f_s=10KHz$ . VCO free running frequency is 10.66KHz, and the voltage to frequency transform coefficient of VCO is 6600Hz/V.
3. Calculate the output frequency  $f_o$ , lock range  $\Delta f_L$  and capture range  $\Delta f_c$  of a 565 PLL if  $R_T=10 K\Omega$ ,  $C_T=0.01\mu F$ , and  $C=10\mu F$ .





Reference Book(optional)

- a) Linear Integrated Circuit:-----D.Roy Choudhary  
S.B. Jain (Chapter-9)
- b) Electronics Devices and Circuit Theory: ----- Boylestad & Nashelsky.
- c) Electronics Devices and Circuits: ----- Salivahanan,N.S.Kumar

**Practical Detailed manuals will be uploaded later.**

### **NUMERICAL METHODS**

**Code : M(CS) 391**

**Credits :1**

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runge-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

### **Circuits and Networks\_Laboratory**

**Code: EC391**

**Contacts: 3P**

**Credits: 2**

1. Characteristics of Series & Parallel Resonant circuits
2. Verification of Network Theorems
3. Transient Response in R-L & R-C Networks ; simulation / hardware
4. Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware
5. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
6. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB
7. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain and cascade connection of second-order systems using MATLAB
8. Determination of Laplace Transform, different time domain functions, and Inverse Laplace
9. Transformation using MATLAB

Note: An Institution / college may opt for some other hardware or software simulation wherever possible in place of MATLAB

### **Solid State Devices Laboratory**

**Code: EC392**

**Contacts: 3P**

**Credits: 2**

#### **Perform any four experiments:**

Ex 1: Study input characteristics of BJT in common-emitter configuration.

Ex 2: Study output characteristics of BJT in common-emitter configuration for different base currents and hence determine hybrid parameters.

Ex 3: Study output characteristics of BJT in common-emitter configuration and find performance parameters (Voltage Gain, Current Gain, Input Impedance, Output Impedance).

Ex 4: Study the variation of small-signal voltage gain with frequency of a common-emitter RC coupled amplifier.

Ex 5: Study of drain characteristics and transfer characteristics of a JFET and hence determine the FET parameters (drain resistance, transconductance & amplification factor).

Ex 6: Study the variation of small-signal voltage gain with frequency of a JFET.

#### **Module 2:**

#### **Perform any two experiments**

Ex 1: Study of C-V characteristics of a Varactor diode by appropriate software.

Ex 2: Study of C-V characteristics of a MOS structure by appropriate software.

Ex3: Study of drain characteristics and transfer characteristics of a MOSFET and hence determine the FET parameters (drain resistance, transconductance & amplification factor).

### **Signals and Systems Laboratory**

**Code: 393**

**Contacts: 3P**

**Credits: 2**

1. To study Z- transform of: a) Sinusoidal signals b) Step functions.



2. To compare Fourier and Laplace transformations of a signal.
3. To study convolution theorem in time and frequency domain.
4. To Study Signal Synthesis via sum of harmonics.
5. To study LPF &HPF, band pass and reject filters using RC circuits.
6. To demonstrate how analog signals are sampled and how different sampling rates affect the outputs.
7. To study sampling theorem for low pass signals and band pass signals .
8. To determine the components of: a) Square wave b) Clipped sine wave.

### **Analog Electronic Circuits Laboratory**

**Code:EC394.**

**Contacts: 3P**

**Credits: 2**

Any 8 experiments. A College has to design a new design oriented experiment.

1. Study of Diode as clipper & clamper
2. Study of Zener diode as a voltage regulator
3. Study of ripple and regulation characteristics of full wave rectifier without and with capacitor filter
4. Study of characteristics curves of B.J.T & F.E.T .
5. Design a two-stage R-C coupled amplifier & study of it's gain & Bandwidth.
6. Study of class A & class B power amplifiers.
7. Study of class C & Push-Pull amplifiers.
8. Realization of current mirror & level shifter circuit using Operational Amplifiers.
9. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.
10. Design a Bistable multivibrator using NE 555.
11. Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
12. Design a simple function generator using IC.
13. Realization of a V-to-I & I-to-V converter using Op-Amps.
14. Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).
15. Study of D.A.C & A.D.C.

## **SEMESTER - IV**

### **Theory**

#### **VALUES & ETHICS IN PROFESSION**

**HU-401**

**Contracts:3L**

**Credits- 3**

Science, Technology and Engineering as knowledge and as Social and Professional Activities

#### ***Effects of Technological Growth:***

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development  
Energy Crisis: Renewable Energy Resources  
Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics  
Appropriate Technology Movement of Schumacher; later developments  
Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.  
Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

#### ***Ethics of Profession:***

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

#### ***Profession and Human Values:***

Values Crisis in contemporary society  
Nature of values: Value Spectrum of a good life  
Psychological values: Integrated personality; mental health  
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.  
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity  
Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

#### **Books:**

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2<sup>nd</sup> Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.



Ph 401 : :Physics  
Contacts : 3L + 1T  
Credits : 4

**Module 1:**

**Vector Calculus:**

1.1 Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates. 2L

**Module 2 :**

**Electricity**

2.1 Coulombs law in vector form. Electrostatic field and its curl. Gauss's law in integral form and conversion to differential form . Electrostatic potential and field, Poisson's Eqn. Laplace's eqn (Application to Cartesian, Spherically and Cylindrically symmetric systems – effective 1D problems) Electric current, drift velocity, current density, continuity equation, steady current. 5L

2.2 Dielectrics-concept of polarization, the relation  $D=\epsilon_0E+P$ , Polarizability. Electronic polarization and polarization in monoatomic and polyatomic gases. 3L

**Module 3:**

**Magnetostatics & Time Varying Field:**

3. Lorentz force, force on a small current element placed in a magnetic field. Biot-Savart law and its applications, divergence of magnetic field, vector potential, Ampere's law in integral form and conversion to differential form. Faraday's law of electro-magnetic induction in integral form and conversion to differential form. 3L

**Module 4:**

**Electromagnetic Theory:**

4.1 Concept of displacement current Maxwell's field equations, Maxwell's wave equation and its solution for free space. E.M. wave in a charge free conducting media, Skin depth, physical significance of Skin Depth, E.M. energy flow, & Poynting Vector. 6L

**Module 5:**

**Quantum Mechanics:**

5.1 Generalised coordinates, Lagrange's Equation of motion and Lagrangian, generalised force potential, momenta and energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion. 4L

Course should be discussed along with physical problems of 1-D motion

5.2 Concept of probability and probability density, operators, commutator. Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Physical interpretation of wave function  $\psi$  (normalization and probability interpretation), Expectation values, Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels. 9L

**Module 6:**

**Statistical Mechanics:**

3.1 Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Calculation of Fermi level in metals, also total energy at absolute zero of temperature and total number of particles, Bose-Einstein statistics – Planck's law of blackbody radiation.. 7L



**CH401: Basic Environmental Engineering & Elementary Biology**

**Contacts : 3L**

**Credits : 3**

**General**

Basic ideas of environment, basic concepts, man, society & environment, their interrelationship.

1L

Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development.

2L

Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function.

1L

Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.

2L

**Ecology**

Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem-components types and function. 1L

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. 2L

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. 1L

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.

2L

**Air pollution and control**

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause.

1L

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. 1L

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget. 1L

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).

2L

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.

2L

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.

Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN.

2L

Smog, Photochemical smog and London smog.

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification.

1L

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

1L

**Water Pollution and Control**

Hydrosphere, Hydrological cycle and Natural water.



Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. 2L

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. 2L

Lake: Eutrophication [Definition, source and effect]. 1L

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 1L

Standard and control: Waste water standard [BOD, COD, Oil, Grease],

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]

Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. 2L

Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic

1L

### Land Pollution

Lithosphere; Internal structure of earth, rock and soil 1L

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.

Solid waste management and control (hazardous and biomedical waste). 2L

### Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]

1L

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level,  $L_{10}$  (18 hr Index),  $Ld_n$ .

Noise pollution control. 1L

### Environmental Management:

Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. 2L

### References/Books

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. De, A. K., "Environmental Chemistry", New Age International.

## ELECTROMAGNETIC THEORY & TRANSMISSION LINES

Code : EC 401

Contacts : 3L +1T =4hrs

Credits :4

### Electromagnetic Theory

1. Vector calculus - orthogonal Coordinate System, Transformations of coordinate systems; Del operator; Gradient, Divergence, Curl - their physical interpretations; Laplacian operator. [3]
2. Coulomb's law, electric field intensity, charge distribution; Gauss' law, flux density and electric field intensity. Divergence theorem. Current Densities, Conductors, Poisson's & Laplace's equations. Uniqueness theorem, Biot-Savart law, Ampere's law, Relation between J & H, Vector magnetic Potential, Stokes' theorem. [5]
3. Faraday's law & Lenz's law. Displacement Current,  $J_c$  - JD Relation, Maxwell's equations, Time-harmonic fields, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave; Plane Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Good Conductor, Free space; Poynting Theorem, Power flow, Poynting vector, Skin Depth, Surface Resistance; Reflection and Transmission for normal incidence.[10]



### Transmission Lines

4. Transmission Lines; Concept of Lumped parameters and Distributed parameters. Line Parameters, Transmission line equations and solutions, Physical significance of the solutions, Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation; Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith Chart -Applications; Load Matching Techniques / Quarter wave Matching, Bandwidth problem; Low loss RF transmission lines, line as circuit elements. [10]
5. Types of transmission line (open 2-wire, coaxial line, micro strip coplanar waveguide), applications and limitations: Design principle, Power handling capacity, Power Dissipation, Breakdown with coaxial line and micro strip line as examples. [4]

### Radiation of E M Waves

6. Antenna Concepts, Antenna Characteristic; Hertzian dipole (Radiation Fields, Radiation Resistance, Radiation patterns, Directive Gain); Properties and typical applications of Half-wave dipole, Loop antenna, Yagi-Uda array, Array Antennas. [6]

#### Text Books

1. Principles of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press.
2. Electromagnetic Field Theory & Transmission Lines, G.S.N. Raju, Pearson Education
3. Electromagnetic Waves Shevgaonkar, Tata-McGraw-Hill -R K

#### Reference Books

1. Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India
2. Fields & Waves in Communication Electronics, S. Ramo, J. R. Whinnery & T. Van Duzer, John Wiley

3. Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
4. Electromagnetics, 2ed Edition – J A Edminister, Tata-McGraw-Hill.
5. Engineering Electromagnetics, 7th Edition-W.H.Hayt & J.A.Buck, Tata-McGraw-Hill

Electromagnetic Waves and Transmission Lines- by G.Prasad, J.Prasad and J.Reddy- Scitech

### **DIGITAL ELECTRONICS & INTEGRATED CIRCUITS**

**Code : EC 402**

**Contacts : 3L +1T =4hrs**

**Credits :4**

#### Module1.

- a) Data and number systems; Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, EBCDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic. [5]
- b) Venn diagram, Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method [6]

#### Module-2:

- a) Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator. [5]
- b) Memory Systems: RAM, ROM, EPROM, EEROM [4]
- c) Design of combinational circuits-using ROM, Programming logic devices and gate arrays. (PLAs and PLDs) [4]

#### Module-3:

Sequential Circuits- Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology. [6]

#### Module-4:

- a) Different types of A/D and D/A conversion techniques. [4]
- b) Logic families- TTL, ECL, MOS and CMOS, their operation and specifications. [6]

Total: 40 hours



Textbooks:

1. A.Anand Kumar, Fundamentals of Digital Circuits- PHI
2. A.K.Maini- Digital Electronics- Wiley-India
3. Kharate- Digital Electronics- Oxford

Reference:

1. Morries Mano- Digital Logic Design- PHI
2. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
3. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
4. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
5. Givone—Digital Principles & Design, Mc Graw Hill
6. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
7. S.K.Mandal, Digital Electronics Principles and Applications- Mc Graw Hill.
8. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
9. Leach & Malvino—Digital Principles & Application, 5/e, Mc Graw Hill
10. Floyd & Jain- Digital Fundamentals-Pearson.
11. P.Raja- Digital Electronics- Scitech Publications
12. S.Aligahanan, S.Aribazhagan, Digital Circuit & Design- Bikas Publishing

Practical

**TECHNICAL REPORT WRITING & LANGUAGE LABORATORY PRACTICE**

Code: HU481

Cr-2

**Guidelines for Course Execution:**

**Objectives of this Course: This course has been designed:**

1. To inculcate a sense of confidence in the students.
2. To help them become good communicators both socially and professionally.
3. To assist them to enhance their power of Technical Communication.

Detailed Course Outlines:

A. **Technical Report Writing :** 2L+6P

1. Report Types (Organizational / Commercial / Business / Project )
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)

B. **Language Laboratory Practice**

**I. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory**

**Practice Sessions**

2L

2. **Conversation Practice Sessions: (To be done as real life interactions)**

2L+4P

- a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed
- b) Introducing Role Play & honing over all Communicative Competence

3. **Group Discussion Sessions:**

2L+6P

- a) Teaching Strategies of Group Discussion
- b) Introducing Different Models & Topics of Group Discussion
- c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure

**Interview Sessions;**

2L+6P

- a) Training students to face Job Interviews confidently and successfully
- b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication

4. **Presentation:**

2L+6P

- a) Teaching Presentation as a skill
- b) Strategies and Standard Practices of Individual /Group Presentation
- c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids

5. **Competitive Examination:**

2L+2P

- a) Making the students aware of Provincial /National/International Competitive Examinations
- b) Strategies/Tactics for success in Competitive Examinations
- c) SWOT Analysis and its Application in fixing Target

**Books – Recommended:**

Nira Konar: *English Language Laboratory: A Comprehensive Manual*

PHI Learning, 2011

D. Sudharani: *Advanced Manual for Communication Laboratories & Technical Report Writing*  
Pearson Education (W.B. edition), 2011

**References:**

Adrian Duff et. al. (ed.): *Cambridge Skills for Fluency*  
A) *Speaking (Levels 1-4 Audio Cassettes/Handbooks)*



**B) Listening (Levels 1-4 Audio Cassettes/Handbooks)  
Cambridge University Press 1998**

**Mark Hancock: English Pronunciation in Use  
4 Audio Cassettes/CD'S OUP 2004**

**Physics Lab-2**

**Code: PH-491**

**Contacts: (3P)**

**Credit: (2)**

Group 1: Experiments on Electricity and Magnetism

1. Determination of dielectric constant of a given dielectric material.
3. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
4. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
5. Determination of specific charge (e/m) of electron by J.J. Thomson's method.

Group 2: Quantum Physics

6. Determination of Planck's constant using photocell.
7. Determination of Lande's g factor using Electron spin resonance spectrometer.
8. Determination of Stefan's radiation constant
9. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
10. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum

Group 3: Modern Physics

11. Determination of Hall coefficient of semiconductors.
12. Determination of band gap of semiconductors.
13. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the data taken.

b) In addition a student should perform one more experiments where he/she will have to transduce the output of any of the above experiments or the experiment mentioned in c) into electrical voltage and collect the data in a computer using phoenix or similar interface.

c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.

Note:

- i. Failure to perform each experiment mentioned in b) and c) should be compensated by two experiments mentioned in the above list.**
- ii. At the end of the semester report should sent to the board of studies regarding experiments, actually performed by the college, mentioned in b) and c]**
- iii. Experiment in b) and c) can be coupled and parts of a single experiment.**

Recommended Text Books and Reference Books:

For Both Physics I and II

1. B. Dutta Roy (Basic Physics)
2. R.K. Kar (Engineering Physics)
3. Mani and Meheta (Modern Physics)
4. Arthur Baiser (Perspective & Concept of Modern Physics)

Physics I (PH101/201)

Vibration and Waves

6. Kingsler and Frey
7. D.P. Roychaudhury
8. N.K. Bajaj (Waves and Oscillations)
9. K. Bhattacharya
10. R.P. Singh ( Physics of Oscillations and Waves)
11. A.B. Gupta (College Physics Vol.II)
12. Chattopadhyaya and Rakshit (Vibration, Waves and Acoustics)

Optics

3. Möler (Physical Optics)
4. A.K. Ghatak
5. E. Hecht (Optics)
6. E. Hecht (Schaum Series)
7. F.A. Jenkins and H.E. White
8. Chita Ranjan Dasgupta ( Degree Physics Vol 3)





#### Quantum Physics

4. Eisberg and Resnick
5. A.K. Ghatak and S. Lokenathan
6. S.N. Ghoshal (Introductory Quantum Mechanics)
7. E.E. Anderson (Modern Physics)
8. Haliday, Resnick and Crane (Physics vol.III)
9. Binayak Dutta Roy [Elements of Quantum Mechanics]

#### Crystallography

1. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)
2. A.J. Dekker
3. Aschroft and Mermin
4. Ali Omar
5. R.L. Singhal
6. Jak Tareen and Trn Kutty (Basic course in Crystallography)

#### Laser and Holography

2. A.K. Ghatak and Thyagarajan (Laser)
3. Tarasov (Laser)
4. P.K. Chakraborty (Optics)
5. B. Ghosh and K.G Majumder (Optics)
6. B.B. Laud (Laser and Non-linear Optics)
7. Bhattacharyya [Engineering Physics] Oxford

#### Physics II(PH 301)

##### Classical Mechanics (For Module 5.1 in PH 301)

- H. Goldstein  
A.K. Roychaudhuri  
R.G. Takwal and P.S. Puranik  
Rana and Joag  
M. Spiegel (Schaum Series)  
J.C. Upadhyya (Mechanics)

##### Electricity and Magnetism

9. Reitz, Milford and Christy
10. David J. Griffith
11. D. Chattopadhyay and P.C. Rakshit
12. Shadowitz (The Electromagnetic Field)

##### Quantum Mechanics

10. Eisberg and Resnick
11. A.K. Ghatak and S. Lokenathan
12. S.N. Ghoshal (Introductory Quantum Mechanics)
13. E.E. Anderson (Modern Physics)
14. Haliday, Resnick and Crane (Physics vol.III)
15. Binayak Dutta Roy [Elements of Quantum Mechanics]

##### Statistical Mechanics

1. Sears and Sallinger (Kinetic Theory, Thermodynamics and Statistical Thermodynamics)
2. Mondal (Statistical Physics)
3. S.N. Ghoshal (Atomic and Nuclear Physics)
4. Singh and Singh
5. B.B. Laud (Statistical Mechanics)
6. F. Reif (Statistical Mechanics)

##### Dielectrics

8. Bhattacharyya [Engineering Physics] Oxford

#### Electromagnetic Wave and Transmission Lines

**Code: EC491**

**Contacts: 3P**

**Credits: 2**

**[At least THREE experiments from Module I and FOUR experiments from Module II]**

#### Module I:

1. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the loadend.



2. Input Impedance of a terminated coaxial line using shift in minima technique.
3. Study of Smith chart on Matlab platform.
4. Simulation study of Smith chart - Single and double stub matching.

**Module II:**

5. Radiation Pattern of dipole antenna.
6. Radiation Pattern of a folded-dipole antenna.
7. Radiation pattern of a 3-element Yagi-Uda Antenna.
8. Beam width, gain and radiation pattern of a 3-element, 5-element and 7-element. Yagi-Uda antenna - Comparative study.
9. Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.
10. Study of Spectrum Analyzer.

**Digital Electronic & Integrated Circuits Laboratory**

**Code: EC492**

**Contacts: 3P**

**Credits: 2**

1. Realization of basic gates using Universal logic gates.
2. Code conversion circuits- BCD to Excess-3 and vice-versa.
3. Four-bit parity generator and comparator circuits.
4. Construction of simple Decoder and Multiplexer circuits using logic gates.
5. Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.
6. Construction of simple arithmetic circuits-Adder, Subtractor.
7. Realization of RS-JK and D flip-flops using Universal logic gates.
8. Realization of Universal Register using JK flip-flops and logic gates.  
Realization of Universal Register using multiplexer and flip-flops.
- 9.
10. Construction of Adder circuit using Shift Register and full Adder.
11. Realization of Asynchronous Up/Down counter.
12. Realization of Synchronous Up/Down counter.
13. Design of Sequential Counter with irregular sequences.
14. Realization of Ring counter and Johnson's counter.
15. Construction of adder circuit using Shift Register and full Adder.



**SEMESTER - V**  
**Theory**

**Economics for Engineers**

**HU-501**

**Contracts: 3L**

**Credits- 3**

**Module-I**

1. Economic Decisions Making – Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.

**Module-II**

3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.
4. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.

**Module-III**

5. Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.

**Module-IV**

8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.
10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

**Readings**

1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case, David B.Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

**EC501 - Analog Communication**

**EC 501**

**Contacts: 3-1-0**

**Credits: 4**

Sr No	Topic	Hrs
Mod-1	<p><b>Introduction to Analog Communication:</b> Elements of communication system - Transmitters, Transmission channels &amp; receivers (1), Concept of modulation, its needs (1).</p> <p><b>Continuous Wave Linear Modulation:</b> a) Amplitude modulation(AM-DSB/TC): Time domain representation of AM signal (expression derived using a single tone message), modulation index [1], frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM; Phasor diagram of an AM signal; [2] Calculation of Transmitted power &amp; sideband power &amp; Efficiency ; concept of under, over and critical modulation of AM-DSB-TC.[2] b) Other Amplitude Modulations: Double side band suppressed carrier (DSBSC) modulation: time and frequency domain expressions, bandwidth and transmission power for DSB.[1] Single side band modulation (SSB) both TC &amp; SC and only the basic concept of VSB, Spectra and band-width. [2]</p>	9
Mod-2	<p><b>Generation &amp; Detection of Amplitude Modulation:</b> a) Generation of AM: Concept of i) Gated and ii) Square law modulators, Balanced Modulator. [2] b) Generation of SSB: Filter method, Phase shift method and the Third method [2]</p> <p><b>Demodulation for Linear Modulation:</b> Demodulation of AM signals: Detection of AM by envelope detector [1], Synchronous detection for AM-SC, Effects of Frequency &amp; Phase mismatch, Corrections. [2]</p> <p><b>Principle of Super heterodyne receivers:</b> Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency. [2]</p>	9
Mod-3	<p><b>Angle Modulation:</b> a) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM and PM for a single tone message, Bessel's functions and Fourier series. (2); Phasor diagram (1); b) <b>Generation of FM &amp; PM:</b> Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM &amp; PM, Concept of VCO &amp; Reactance modulator (2) c) <b>Demodulation of FM and PM:</b> Concept of frequency discriminators (1), Phase Locked Loop (2)</p>	8
Mod - 4	<b>Multiplexing</b>	10



- a) Frequency Division Multiplexing, Time Division Multiplexing, (FDM) (1)
- b) Stereo – AM and FM: Basic concepts with block diagrams (2)
- c) **Random Signals and Noise in Communication System:**
  - i) Noise in Communication systems – Internal & External noise, Noise Temperature, Signal-to-Noise ratio, White noise, thermal noise, Figure of Merit. (2)
  - iii) Noise performance in Analog Communication systems: SNR calculation for DSB/TC, DSB-SC, SSB-TC, SSB-SC & FM. (5)

**Total 36 Hours**

**Text Books:**

- 7. Taub and Schilling , “Principles of Communication Systems”, 2<sup>nd</sup> ed., Mc-Graw Hill
- 8. B.P.Lathi -Communication Systems- BS Publications
- 2. V Chandra Sekar – Analog Communication- Oxford University Press

**References:**

- 9. Carlson—Communication System,4/e , Mc-Graw Hill
- 10. Proakis & Salehi Fundamentals of Communication Systems- Pearson
- 11. Singh & Sapre—Communication Systems: 2/e, TMH
- 12. P K Ghosh- Principles of Electrical Communications- University Press
- 13. L.W.Couch li, “Digital and Analog Communication Systems”, 2/e, Macmillan Publishing
- 14. Blake, Electronic Communication Systems- Cengage Learning
- 15. S Sharma, Analog Communication Systems- Katson Books

**Learning outcome:**

Module – 1: The learner must be able to appreciate the need for modulation and calculate the antenna size for different carrier frequencies. From the functional representation of the modulated carrier wave, the learner must be able to identify the type of modulation, calculate the side-band frequencies, identify the modulating and carrier frequencies, decide the type of generation method to be adopted. Solve problems.

Module – 2: After understanding the basic concepts the learner must be able to compare between the different demodulation methods, design an envelope detector, calculate the IF and image frequencies for the superheterodyne receivers given the carrier and modulating frequencies, calculate the oscillator frequency.

Module – 3: From the functional representation of the modulated carrier wave, the learner must be able to identify the type of modulation, calculate the side-band frequencies, identify the modulating and carrier frequencies, decide the type of generation method to be adopted. Solve problems.

Module – 4: Appreciate the importance of Multiplexing, find out their application areas. The learner must be able to calculate the Noise temperature & SNR for different systems, also compare between the performance of the different modulation methods by comparing their SNR.

**Microprocessor & Microcontroller**

**Code: EC502**

**Contact: 3L + 1T**

**Credits: 4**

1.	Introduction to Microcomputer based system. History Evolution of Microprocessor and microcontrollers and their advantages and disadvantages. Architecture of 8085 Microprocessor. Address / Data Bus multiplexing and demultiplexing. Status and Control signal generation. Instruction set of 8085 Microprocessor. Classification of instructions, addressing modes, timing diagram of the instructions. <b>Assembly language programming:</b> Addition, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number, Look-up table etc. Interrupts of 8085 processor: classification of interrupts, Programming using interrupts (programming using INTR is not required) Serial and parallel data transfer – Basic concept of serial I/O, DMA, Asynchronous and synchronous serial transmission using SID and SOD pins of 8085 Microprocessor.	1  8  2
2	<b>8051 architecture:</b> 8051 micro controller hardware, input/output pins, ports, external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts. <b>Assembly language Programming using 8051</b> <u>Moving data:</u> External data moves, code memory read only data moves, PUSH and POP opcodes, data exchanges.  <u>Logical operations:</u> Byte-level, bit-level, rotate and swap operations. <u>Arithmetic operations:</u> Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic. <u>Jump and call instructions:</u> Jump and call program range, jumps, calls and subroutines, interrupts and returns.	7
3	The 8086 microprocessor: Architecture, Pin details, memory segmentation, addressing modes, Familiarization of basic Instructions, Interrupts. Assembly language programming: Addition, Multiplication, Block Transfer, Ascending order, Descending order, Finding largest & smallest number etc.	7
4	Support IC chips: 8255, 8253 and 8251: Block Diagram, Pin Details, Modes of operation, control word(s) format. Interfacing of support IC chips with 8085, 8086 and 8051. Memory interfacing with 8085, 8086 & 8051. ADC / DAC interfacing with 8085, 8086 & 8051.	6  4
	Brief introduction to PIC microcontroller (16F877): Architecture, PIN details, memory layout etc.	1



#### TEXT BOOKS:

13. Microprocessor architecture, programming and application with 8085 – R. Gaonkar (Penram International) (strongly recommended)
14. The 8051 microcontroller - K. Ayala (Thomson)
15. Microprocessors & interfacing – D. V. Hall (Tata McGraw-hill)
16. Ray & Bhurchandi, Advanced Microprocessors & Peripherals, TMH
17. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)
18. An Introduction to Microprocessor and Applications –Krishna Kant (Macmillan)

#### References:

- Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan (Oxford university press).  
8086 Microprocessor –K Ayala (Cengage learning)  
Microprocessors – The 8086/8088, 80186/80386/80486 and the Pentium family – N. B. Bahadure (PHI).  
The 8051 microcontrollers – Uma Rao and Andhe Pallavi (PEARSON).

#### Learning outcome:

On completion of this course, students are expected to be capable of understanding the history and need of microprocessor, the internal architecture details, instruction sets, their timing diagram and various addressing modes of 8085/8086 microprocessor and 8051 microcontroller. They will also learn the basic concept of serial and parallel data communication of 8085. Students become able to understand various Interrupts and their uses using 8085/8086 Microprocessor and 8051 Microcontroller. Students will also learn to interface 8255/8253/8251 peripheral chips and I/O devices with the same processors and controller. A basic introductory concept on PIC microcontroller also developed through this course. It is expected that students will be able to design systems based on above mentioned processors and controller by means of efficient assembly language programmings.

#### CONTROL SYSTEMS

**Code: EC503**

**Contact: 3L**

**Credits: 3**

#### Module – I:

##### a) INTRODUCTION

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems [4L]

#### Module – I:

##### b) TRANSFER FUNCTION REPRESENTATION

Transfer Function of linear systems, Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula. [5L]

#### Module – II:

##### a) TIME RESPONSE ANALYSIS

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants. [5L]

##### b) STABILITY ANALYSIS IN S-DOMAIN

The concept of stability – Routh's stability criterion – limitations of Routh's stability. Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to  $G(s)H(s)$  on the root loci.[5L]

#### Module – III:

##### a) FREQUENCY RESPONSE ANALYSIS

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots. [6L]

##### b) : STABILITY ANALYSIS IN FREQUENCY DOMAIN

Polar Plots, Nyquist Plots Stability Analysis. [4L]

#### Module - IV :

##### a) CLASSICAL CONTROL DESIGN TECHNIQUES

Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers. [5L]

##### b) STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability [6L]

#### TEXT BOOKS:

1. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John Wiley and son's.,
2. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.

#### REFERENCE BOOKS:

1. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. Control Systems Engg. by NISE 3rd Edition – John Wiley

# Syllabus for B.Tech(ECE) Second Year

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)



## Computer Architecture

Code: EC504A

Contact: 3L + 1T

Credits: 4

**Pre-requisite:** Basic Electronics in First year, Introduction to Computing in second semester, Digital Electronic & Integrated Circuits in 4<sup>th</sup> semester.

**Module 1:** Computer Organization & Architecture, Basic functional Unit, Computer component structure [Eg. Structure of IAS Computer, IBM Machine configuration], Harvard & Von Neumann architecture, BUS architecture, ALU designs [combinational ALU & sequential ALU], Instruction set: Instruction format & types. [8L]

[**Learning Outcome:** Students will come to know about basic of computer organization & architecture]

**Module 2:** Memory Organization: Memory system overview, Cache memory organizations, Techniques for reducing cache misses; Hierarchical memory technology: Inclusion, Coherence and locality properties; Virtual memory organization, mapping and management techniques, memory replacement policies [10L]

[**Learning Outcome:** Students will come to know about basic of computer memory structure & different mapping technique]

**Module 3:** CPU Organization: Fundamentals, Processor-memory communication [Clock cycles and Timing Diagram], Instruction cycle, RISC & CISC based architecture. [4L]

[**Learning Outcome:** Students will come to know about different CPU architecture & Processor-memory communication technique ]

**Module 4:** Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards, Flynn's classification –SISD, SIMD, MISD, MIMD architectures, Pipeline optimization techniques. [7L]

[**Learning Outcome:** Students will come to know about pipelining architecture]

**Module 5:** Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures, Array and Vector processors. [6L]

[**Learning Outcome:** Students will come to know about parallelism]

**Module 6:** Overview of HDL: VHDL basics programming concept, Structural, dataflow, behavioural & mixed style modeling techniques. [3L]

[**Learning Outcome:** Students will come to know about VHDL programming techniques]

[**Overall Learning Outcome:** This course is a formidable prerequisite for the course Operating System, Embedded System to be offered in the subsequent semester.]

### Text & Reference books:

1. William Stallings —“ Computer Organization & Architecture Designing for performance” , 8/e , Pearson
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky —“Computer Organization”, 5/e, MGH
3. Mano M.M—“Computer System Architecture”, 3/e,Pearson
4. Kai Hwang & Naresh Jotwani-- “ Advanced Computer Architecture Parallelism, Scalability,Programmability”,2/e, MGH
5. Pedroni---“Circuit Design And Simulation With VHDL”, 2/e, PHI

## Data Structure & C

Code: EC504B

Contact: 3L + 1T

Credits: 4

**Pre-requisites:** CS 201 (Basic Computation and Principles of C), M101 & M201 (Mathematics), basics of set theory

### Module -I. [8L] Linear Data Structure

#### Introduction (2L):

Why we need data structure?

Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.

Algorithms and programs, basic idea of pseudo-code.

Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.

#### Array (2L):

Different representations – row major, column major.

Sparse matrix - its implementation and usage. Array representation of polynomials.

#### Linked List (4L):

Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

### Module -II: [7L] Linear Data Structure

#### [Stack and Queue (5L):

Stack and its implementations (using array, using linked list), applications.

Queue, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications.

#### Recursion (2L):

Principles of recursion – use of stack, differences between recursion and iteration, tail recursion.

Applications - The Tower of Hanoi, Eight Queens Puzzle.

# Syllabus for B.Tech(ECE) Second Year

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## Module -III. [15L] Nonlinear Data structures

### Trees (9L):

Basic terminologies, forest, tree representation (using array, using linked list).

Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree.

Binary search tree- operations (creation, insertion, deletion, searching).

Height balanced binary tree – AVL tree (insertion, deletion with examples only).

B- Trees – operations (insertion, deletion with examples only).

### Graphs (6L):

Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism).

Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list.

Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications.

Minimal spanning tree – Prim's algorithm (basic idea of greedy methods).

## Module - IV. Searching, Sorting (10L):

**Sorting Algorithms (5L):** Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort.

**Searching (2L):** Sequential search, binary search, interpolation search.

**Hashing (3L):** Hashing functions, collision resolution techniques.

### Recommended books:

19. “Data Structures And Program Design In C”, 2/E by Robert L. Kruse, Bruce P. Leung.
20. “Fundamentals of Data Structures of C” by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
21. “Data Structures in C” by Aaron M. Tenenbaum.
22. “Data Structures” by S. Lipschutz.
23. “Data Structures Using C” by Reema Thareja.
24. “Data Structure Using C”, 2/e by A.K. Rath, A. K. Jagadev.
25. “Introduction to Algorithms” by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

### *Learning outcome:*

Ideally this course should act as a primer/pre-requisite for CS 503 (Design and Analysis of Algorithms). On completion of this course, students are expected to be capable of understanding the data structures, their advantages and drawbacks, **how to implement them in C**, how their drawbacks can be overcome and **what the applications are** and **where they can be used**. Students should be able to learn about the data structures/ methods/algorithms mentioned in the course with a comparative perspective so as to make use of the most appropriate data structure/ method/algorithm in a program to enhance the efficiency (i.e. reduce the run-time) or for better memory utilization, based on the priority of the implementation. Detailed time analysis of the graph algorithms and sorting methods are expected to be covered in CS 503 but it is expected that the students will be able to understand at least the efficiency aspects of the graph and sorting algorithms covered in this course. The students should be able to convert an inefficient program into an efficient one using the knowledge gathered from this course.

## Practical

### Analog Communication Lab

**Code: EC591**

**Contact: 3P**

**Credits: 2**

1. Measurement of modulation index of an AM signal.
2. measurement of output power with varying modulation index an AM signal(for both DSB- & SSB).
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).
4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design a PLL using VCO & to measure the lock frequency.
6. Design a FM demodulator using PLL.
7. Measurement of SNR of a RF amplifier.
8. Measurement of selectivity ,sensitivity,fidelity of a superhetrodyne receiver.
9. Study of waveforms of various functional points (output of RF,IF & video) of a B/W TV receiver.
10. Study of the vertical & horizontal sweep of the time base unit of a B/W TV.
11. One innovative experiment.

### Microprocessors & Microcontrollers Lab

**Code:EC-592**

**Contact: 3P**

**Credits: 2**

Sl. No.	Name of the Experiments	No.of hours
c)	Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical) Assignments based on above.	3
d)	a) Familiarization with 8085 & 8051 simulator on PC. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator. Assignments based on above	3
e)	<b>Programming using kit and simulator for:</b>	6
i)	Table look up	

## Syllabus for B.Tech(ECE) Second Year

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)



	ii) Copying a block of memory iii) Shifting a block of memory iv) Packing and unpacking of BCD numbers v) Addition of BCD numbers vi) Binary to ASCII conversion vii) String Matching, Multiplication using shift and add method and Booth's Algorithm	
f)	Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly.	3
g)	<b>:Study of timing diagram of an instruction on oscilloscope..</b>	3
h)	<b>Interfacing of 8255: Keyboard and Multi-digit Display with multiplexing using 8255</b>	6
i)	Study of 8051 Micro controller kit and writing programs as mentioned in S/L3. Write programs to interface of Keyboard, DAC and ADC using the kit.	3
j)	Serial communication between two trainer kits	3

**Total 30 hours (10 classes each of 3 periods)**

### Control System Lab

**Code: EC583**

**Contact: 3P**

**Credits: 2**

Sl.No.	Name of the Experiment	Periods
4.	Familiarization with MATLAB Control System tool Box, MATLAB- SIMULINK tool box & pSPICE.	3
5.	Determination of step response for 1 <sup>st</sup> order & 2 <sup>nd</sup> order system with unity feedback on CRO & calculation of control system specifications for variations of system design.	3
6.	Simulation of step response & impulse response for Type-I & Type-II system with unity feedback using MATLAB & pSPICE.	3
7.	Determination of root locus, Bode-plot, Nyquist Plot, using MATLAB control system toolbox for a given 2 <sup>nd</sup> order transfer function & determination of different control system specifications.	6
8.	Determination of PI, PD, and PID controller action on 1 <sup>st</sup> order simulated process.	3
9.	Determination of approximate transfer function experimentally using Bode Plot.	3
10.	Evaluation of steady-state error, setting time, percentage peak overshoots, gain margin, phase margin with addition of lead compensator in forward path transfer functions using MATLAB & pSPICE.	3
11.	Study of position control system using servomotor.	3
12.	Design and hardware implementation of a temperature controller using microprocessor/microcontroller.	6

**Total 33 hours (11 classes each of 3 periods)**

### Computer Architecture Lab

**Code: EC594A**

**Contact: 3P**

**Credits: 2**

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation.

[**Pre-requisite:** The hardware based design has been done in the Digital Electronic & Integrated Circuits in 4<sup>th</sup> semester.]

HDL introduction  
Basic digital logic base programming with HDL  
8-bit Addition, Multiplication, Division  
8-bit Register design  
Memory unit design and perform memory operations.  
2-bit, 4-bit, 8-bit simple ALU design  
8-bit simple CPU design  
Interfacing of CPU and Memory

### Data Structure & C Lab

**Code: EC594B**

**Contact: 3P**

**Credits: 2**

Experiments should include but not limited to :

Implementation of array operations:

Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem :

Evaluation of expressions operations on Multiple stacks & queues :

Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues



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using linked lists:

Polynomial addition, Polynomial multiplication

Sparse Matrices : Multiplication, addition.

Recursive and Nonrecursive traversal of Trees

Threaded binary tree traversal. AVL tree implementation

Application of Trees. Application of sorting and searching algorithms

Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

(Detailed instructions for Laboratory Manual to follow for further guidance. The details will be uploaded in the website from time to time)

## SEMESTER - VI

### Theory

#### **Principles of Management**

**HU-601**

**Contracts: 2L**

**Credits- 2**

#### **Module-I**

1. Basic concepts of management: Definition – Essence, Functions, Roles, Level.
2. Functions of Management: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organisation Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organisational Effectiveness.

#### **Module-II**

3. Management and Society – Concept, External Environment, CSR, Corporate Governance, Ethical Standards.
4. People Management – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management.
5. Managerial Competencies – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

#### **Module-III**

6. Leadership: Concept, Nature, Styles.
7. Decision making: Concept, Nature, Process, Tools & techniques.
8. Economic, Financial & Quantitative Analysis – Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.

#### **Module-IV**

9. Customer Management – Market Planning & Research, Marketing Mix, Advertising & Brand Management.
10. Operations & Technology Management – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

#### ***Readings:***

1. Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP).
2. Essentials for Management – Koontz, Revised edition, Tata McGraw Hill (TMH)
3. Management – Stoner, James A. F. (Pearson)
4. Management - Ghuman, Tata McGraw Hill(TMh)

#### **Digital Communication**

**EC-601**

**Contracts: 3L**

**Credits- 3**

#### **MODULE – I:**

##### ***Probability Theory and Random Processes:***

Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, probability density function – Gaussian, Rayleigh and Rician, mean, variance, random process, stationary and ergodic

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processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density.

6L

## MODULE – II:

### Signal Vector Representation:

Analogy between signal and vector, distinguishability of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point, signal constellation, geometric interpretation of signals, likelihood functions, Schwartz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error, error function, complementary error function, Type-I and Type-II errors.

6L

## MODULE – III:

### Digital Data Transmission:

Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and  $\mu$ -law companding, differential PCM, delta modulation and adaptive delta modulation.

Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding – polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction. 10L

## MODULE –IV:

### Digital Modulation Techniques:

Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, basic digital carrier modulation techniques: ASK, FSK and PSK,

Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK.

Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-ary PSK, power spectra of MPSK,

Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset Quadrature Phase shift Queuing (OQPSK),

Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal,

Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying: GMSK, basic concept of OFDM, constellation diagram,

Some performance issues for different digital modulation techniques - Error Vector Magnitude (EVM), Eye Pattern and Relative Constellation Error (RCE),

Conceptual idea for Vector Signal Analyzer (VSA)

14L

### TEXT BOOKS:

k) Digital Communications, S. Haykin, Wiley India.

l) Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.

m) Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.

n) Digital Communications, J.G.Proakis, TMH Publishing Co.

### o) REFERENCE BOOKS:

d) Digital Communications Fundamentals and Applications, B. Sklar and P.K.Ray, Pearson.

e) Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.

f) Digital Communication, A. Bhattacharya, TMH Publishing Co.

## Digital Signal Processing

EC- 602

Contracts: 3L

Credits- 3

## MODULE – I:

### Discrete-time signals:

Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences – periodic, energy, power, unit-sample, unit-step, unit-ramp, real & complex exponentials, arithmetic operations on sequences. 3L

### LTI Systems:

Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercises, properties of convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems. 6L

## MODULE –II:

### Z-Transform:

Definition, mapping between s-plane and z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples and exercises, characteristic families of signals along with ROCs, convolution, correlation and multiplication using Z-transform, initial value theorem, Perseval's relation, inverse Z-transform by contour integration, power series & partial-fraction expansions with examples and exercises. 6L

### Discrete Fourier Transform:

Concept and relations for DFT/IDFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods with examples and exercises. 5L

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**Fast Fourier Transform:**

Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises. 4L

**MODULE – III:**

**Filter Design:**

Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transforms, design of linear phase FIR filters, no. of taps, rectangular, Hamming and Blackman windows. 5L

**MODULE – IV:**

**Digital Signal Processor:**

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in Assembly Language. 4L

**FPGA:**

Architecture, different sub-systems, design flow for DSP system design, mapping of DSP algorithms onto FPGA. 3L

**TEXT BOOKS:**

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. VLSI Digital Signal Processing Systems Design and Implementation, Wiley International Publication.
5. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer.

**REFERENCE BOOKS:**

13. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
14. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
15. Digital Signal Processing; A Hands on Approach, C. Schuler & M.Chugani, TMH Publishing Co.
16. Digital Signal Processing, A. Nagoor Kani, TMH Education
17. Digital Signal Processing S. Poornachandra & B. Sasikala, MH Education
18. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
19. Texas Instruments DSP Processor user manuals and application notes.
20. Xilinx FPGA user manuals and application notes.

**Telecommunication System**

**EC-603**

**Contracts: 3L**

**Credits- 3**

(to be modified as per workshop decision)

Module No.	Topic	Periods/Credits
1.	<b>Introduction to Telephone Systems:</b> Evolution of Telecommunication; Components and Examples of Telecommunication systems; Pulse dialing & Tone dialing; Telephone Instruments -rotary dial and push button types.	3
2.	<b>Telecommunication Transmission Lines:-</b> Copper, Co-axial, and Fiber optic cables; Transmission Bridge - Hybrid circuit for 2-wire to 4-wire conversion and vice versa. PCM Carriers; American and European standards of carrier channels.	6
3.	<b>Subscriber Loop Systems:</b> BORSCHT Functions; Switching hierarchy & routing, signaling techniques-in channel & common channel signaling, SS7.	4
4.	<b>Switching System:</b> Electro-mechanical switching-Strowger & Crossbar; Circuit Switching & Packet Switching, Digital Switching systems - Time division Time switch, Time multiplexed Space switch, Time multiplexed Time switch, Hybrid switching, ; TS, ST, STS, TST systems; Architecture of 5ESS systems;	6
5.	<b>Stored Program Control:</b> Software architecture, Application software;. Electronic Exchanges, Introduction to cordless telephones and Digital PABX	4
6.	<b>Traffic Engineering:</b> Blocking network, blocking probability, grade of service, traffic load, Erlang-B and C-congestion formulas-case studies	4
7.	<b>Modems and Their Standards:</b> RS 232C; DTE and DCE, Facsimile Transmission, Broad band transmission-ISDN, DSL and ADSL, ISDN and B-ISDN	4
8.	<b>IP Telephony:</b> Voice over IP, Session initiation protocol, H.323 signaling, IP multimedia service	4

**TOTAL LECTURE HOURS: 35**

**Text Books:**

- b) T. Viswanathan, “ Telecommunications Switching Systems & Networks”, PHI
- c) J.C.Bellamy “Digital Telephony”- Wiley-India

**Reference Books:**

1. O Hersent, D Gurle, J P Petit “IP Telephony” Pearson
2. J.E.Flood “Telecommunications Switching, Traffic and Networks” Pearson
3. R L Freeman “Telecommunication System Engineering”- Wiley-India
4. A Gokhale “Introduction to Telecommunication”- Cengage Learning

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## Professional Elective

### Antenna Theory & Propagation

EC-604A

Contracts: 3L

Credits- 3

<b>Module-I</b>	A. Review of Maxwell's Equation; Radiation of e.m waves and introducing Antenna; Vector Potential and Retarded Vector Potential; Radiation fields of a Hertzian dipole(electric); Duality Principle, Radiation fields due to short magnetic dipole. B. Antenna Characteristics: Radiation Pattern, Beam Width; Radiation Resistance and efficiency; Directivity and Gain; Impedance, VSWR, Polarization; Effective height and Receive Aperture; Noise Temperature of Antenna.	7
<b>Module-II</b>	A. Radiation fields and Characteristics of $\lambda/2$ dipole; discussion on $\lambda/4$ monopole antenna; Current distribution and Radiation patterns of center-fed dipoles of length $\lambda$ , $3\lambda/2$ and $2\lambda$ . Horizontal and Vertical antennas over a plane ground. B. Antenna Arrays: electric Field due to 2 element arrays, 3 element Arrays; Pattern Multiplication; Uniform Linear Array: End fire and Broad side; Phased array.	9
<b>Module-III</b>	A. Characteristics and properties of :Travelling Wave Antenna, Helical Antenna, Folded Dipole, Yagi-Uda Array, Loop Antenna, Electrically Short Antennas, Broad Band Antenna (Log periodic Antenna), Microstrip Patch Antenna. B. Radiation from an aperture: Sectoral and Pyramidal Horn Antennas, Design of Optimum Horn Antenna; Parabolic and Corner Reflectors and feed systems. [Major stress on Characteristics features, applications (including frequency at which used), advantages and disadvantages, major design principles and equations (without long and detailed derivations)]	10
<b>Module-IV</b>	A. Methods of Propagation: Ground Wave Propagation, Components of ground wave, Field strength dependence on physical factors. Sky wave Propagation; Ionospheric Layers; Virtual Height, Critical Frequency, MUF, Skip distance, Sporadic Reflections. Space wave propagation: Tropospheric Scatter, Ducting Super refraction, Sub refraction. B. Friss Transmission Formula, SNR of a Radio Link. Physical (Medium) effects on Radio wave Propagation: Absorption, Refraction and Radio Horizon, Diffraction, Multipath Propagation and fading, Noise, Doppler effect.	10

### Recommended (Text Books)

1. Antenna (for all application), John D. Kraus and Ronald J. Marhefka; Tata- MacGraw Hill, 3<sup>rd</sup> Edition
2. Antenna & Wave Propagation, K.D Prasad; Satya Prakashan, New Delhi, 3<sup>rd</sup> Edition
3. Antenna Theory: Analysis & Design, Constantine A. Balanis; Willey, 3<sup>rd</sup> Edition

### Reference Book

1. Elements of Electromagnetics; Mathew N.O. Sadiku, Oxford University Press, 5<sup>th</sup> Edition(2010)
2. Electromagnetic Waves & Radiating Systems, EC Jordan & K.G. Balmain; Pearson Education, 2<sup>nd</sup> Edition (2009)
3. Microstrip Antenna Design Handbook- Ramesh Garg; Artech House (2001)

### Information Theory & Coding

EC604B

Contracts: 3L

Credits- 3

#### Source Coding [7L]

Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes.

#### Channel Capacity And Coding [7L]

Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

#### Linear And Block Codes For Error Correction [8L]

Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

#### Cyclic Codes [7L]

Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.

#### BCH Codes [8L]

Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

#### Convolutional Codes [8L]

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Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

## Books

4. Information theory, coding and cryptography - Ranjan Bose; TMH.
5. Information and Coding - N Abramson; McGraw Hill.
6. Introduction to Information Theory - M Mansurpur; McGraw Hill.
7. Information Theory - R B Ash; Prentice Hall.
8. **Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.**

## Free Elective

### Object Oriented Programming

Code: EC605A

Contact: 3L

Credits: 3

#### Object oriented design [10 L]

Concepts of object oriented programming language, Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation, using, instantiation, meta-class, grouping constructs.

#### Object oriented concepts [4 L]

Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism

#### Basic concepts of object oriented programming using Java [22 L]

Implementation of Object oriented concepts using Java.

##### Language features to be covered:

##### Class & Object properties [6L]

Basic concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts- String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods), concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes.

Reusability properties[6L] – Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages.

Exception handling & Multithreading [6L] – Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes.

Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.

Applet Programming (using swing) [4L] – Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.

Textbooks/References:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

### Programming Languages

Code: EC605B

Contacts: 3L

Credits: 3

#### Introduction [3L]

Programming paradigms, Language translator, Basics of OOP, Structure of C++ program, Class and object, Abstraction and encapsulation, Polymorphism, Inheritance, Static and dynamic binding.

#### Declaration, Expression and statements [4L]

Data types, Variables, Constants, Operator and expression, Operator precedence and associativity. Statements: Labelled, Expression, Compound, Control, Jump, Declaration, Try-throw-catch.

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## Array, pointer and function [4L]

Array, Addresses, Pointer. Function: Declaration, Definition and call, Inline function, Main function argument, Reference variable, Function overloading, Default argument, Parameter passing, Recursion, Scope of variable, Return-by-value and Return-by-reference, Pointer to function

## Data abstraction through classes and user defined data types [6L]

Class, Members, Constructor and destructor, Copy constructor.  
Dynamic memory management: Operators new and delete, Malloc and free, Static member, Scope of class names, Scope of variables.

## Operator Overloading [5L]

Overloading unary and binary operator, Overloaded function calls, Subscripting, class member access, Non-member operator, New and delete, Cast operator.

## Class relationships [6L]

Introduction, Polymorphism, Coercion, Overloading, Parametric and inclusion polymorphism  
Inheritance: direct and indirect superclasses, Multiple inheritance, Virtual base class, Friend, Virtual function, Abstract class, Overriding and hiding, Dynamic binding of functions, Virtual destructor and operators.

## Template and Exception Handling [5L]

Class template, Member function inclusion, Function template, Specialization, Inheritance, Namespace.  
Concept of exception handling, Catch block, Nested try-catch block, Condition expression in throw expression, Constructor & destructor, Runtime standard exception

## Standard Library in C++ [3L]

Standard library function, Input and output, Iostream class hierarchy, Class ios, Other stream classes.

## Object oriented design and modelling [4L]

Software development, Qualities of software system, Software architecture, Process life cycle, phases, Modularity, OO methodology, Modeling, UML overview, Object oriented design patterns.

### Textbooks/References:

1. Schildt, H., *The Complete Reference C++*, McGraw – Hill.
2. C++ object oriented programming paradigm, Debasish Jana, PHI
3. Pooley, R and P. Stevens, *Using UML*, Addison-Wesley.
4. Programming In C++, Y.I. Shah and M.H. Thaker, ISTE/EXCEL BOOKS
5. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
6. Rajaram: Object Oriented Programming and C++, New Age International

## ELECTRONIC MEASUREMENT AND INSTRUMENTATION

Code: EC605C

Contact: 3L

Credits: 3

Module	Topic	Hrs
Module I	<b>Basic Measurement Concepts:</b> Measurement systems – Static and Dynamic Characteristics – Units and Standards of measurements, –errors analysis, – moving iron meters, dynamometer, wattmeter– multimeter, – True rms meters– Bridge measurements, Wheatstone Bridge, Kelvin, Wein, Maxwell, Hay, Schering and Anderson Bridges.	6
Module II	<b>Basic Measurement Concepts:</b> Electronic Multimeter Current measurement with analog electronic instruments. Chopper stabilized amplifier for measurement of very low voltage and currents. Cathode Ray Oscilloscopes- Block Schematic, Principles and applications. Dual Trace and Dual Beam Oscilloscopes, Digital Storage Oscilloscopes	7
Module III	<b>Signal Generator and Analysis</b> Function Generators- RF Signal Generators- Sweep Generators – Frequency Synthesizer-Wave Analyzer- Harmonic Distortion Analyzer – Spectrum Analyzer	7
Module IV	<b>Digital Instruments</b> Comparison of analog & digital techniques- digital voltmeter- mutlimeter – frequency counters- measurement of frequency and time interval – extension of frequency range- measurement errors.	7
Module V	<b>Data Acquisition Systems</b> Elements of digital data acquisition system- interfacing of transducers –multiplexing – computer controlled instrumentation : IEEE 488 Bos. Optical Power Measurement, Optical Time Domain Reflectometer.	7

**Total Lecture Hours 34**

### Books:

9. Modern Electronic Instrumentation & Measurement Techniques – Albert D. Helfrick & William D. Copper, Prentice Hall of India, 2003
10. Elements of Electornics Instrumentation & Measurement, Pearson Education 2003
11. Measurement System- Application & Design – Ernest O.Doeblin, Tata McGraw Hill 2004

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## Practical

### Digital Communication Lab

Code: EC691

Contact: 3P

Credits: 2

- c) Design, implementation and study of all the properties of 7-length and 15-length pn sequences using shift register.
- d) Study of PAM and demodulation.
- e) Study of PCM and demodulation.
- f) Study of line coders: polar/unipolar/bipolar NRZ, RZ and Manchester.
- g) Study of delta modulator and demodulator.
- h) Study of adaptive delta modulator and demodulator.
- i) Study of BPSK modulator and demodulator.
- j) Study of BFSK modulator and demodulator.
- k) Study of ASK modulator and demodulator.
- l) Study of QPSK modulator and demodulator.
- m) Simulation study of probability of symbol error for BPSK modulation.
- n) Simulation study of probability of symbol error for BFSK modulation.

### Digital Signal Processing Lab

Code: EC692

Contact: 3P

Credits: 2

#### Simulation Laboratory using standard Simulator:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
3. Z-transform of various sequences – verification of the properties of Z-transform.
4. Twiddle factors – verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

#### Hardware Laboratory using either 5416 or 6713 Processor and Xilinx FPGA:

1. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C 5416/6713 Processor, study of MAC instruction.
2. Writing of small programs in VHDL and downloading onto Xilinx FPGA.
3. Mapping of some DSP algorithms onto FPGA.

#### Object Oriented Programming Laboratory

EC695A

L-0, T-0, P-3;

Cr 2

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming
6. Assignments on applet programming

#### Note: Use Java for programming

Preferably download "java\_ee\_sdk-6u4-jdk7-windows.exe" from

<http://www.oracle.com/technetwork/java/javase/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html>

#### Programming Language Laboratory:

EC695B

l-0, t-0, p-3

Cr 3

To be uploaded later.

#### ELECTRONIC MEASUREMENT AND INSTRUMENTATION

Code: EC695C

Contact: 3P

Credits: 2

1. Study of Static Characteristics of a Measuring Instrument

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2. Study of Dynamic Characteristics of a Measuring Instrument
3. Acquaintance with basic structure of DMM and measurement of different electrical parameters
4. Realization of Data Acquisition system
5. Wave and spectrum analysis using Q meter
6. Realization of a V-to-I & I-to-V converter.
7. Statistical analysis of errors in measurement .
8. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).



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**Proposed  
Syllabus  
VII Semester  
Theory**

## WIRELESS COMMUNICATION AND NETWORKS

EC701

Contacts: 3L

Credits: 3

### MODULE – I:

#### *Cellular Mobile Wireless Networks: Systems and Design Fundamentals:*

Brief introduction to mobile wireless communication and systems, Description of cellular system, Cellular Structure, Frequency Reuse, Cell clustering, Capacity enhancement techniques for cellular networks, cell splitting, antenna sectoring, Co-channel and Adjacent channel interferences, Channel assignment schemes – Fixed channel, Dynamic channel and Hybrid channel, mobility management – location management and handoff management, handoff process, different types of handoff. 6L

Characteristics of wireless channel and propagation path loss models:

Different Multi-path propagation mechanisms, Multi-path effects on mobile communication, Fading, different types of fading, small and large scale fading, slow and fast fading, narrowband and wideband fading, Inter symbol interference, fast fading model, Doppler effect due to velocity of mobiles, Rayleigh envelop, free space propagation model, two ray ground reflection model, log distance path loss model, log normal shadowing model, macro and micro cell propagation models, types of base stations and mobile station antennas. 6L

### MODULE – II:

#### *Modern Mobile Wireless Communication Systems*

Evolution strategies – First Generation (1G) to Fourth Generation (4G), Personal Area Networks :PAN, Low Tier Wireless System: Cordless Telephone, Second Generation (2G), Digital European Cordless Telecommunications (DECT), Public wide-area Wireless Networks: 1 G to 3G cellular networks 2L

Multiple Access Technologies in cellular communication

Time division multiple access (TDMA), narrowband and wideband TDMA, synchronous and asynchronous TDMA, Frequency division multiple access (FDMA), Code Division Multiple Access (CDMA), Direct-sequence CDMA, spread spectrum technique, spectral efficiency of different wireless access technologies:

Spectral Efficiency in FDMA system, Spectral Efficiency in TDMA system, Spectral Efficiency for DS-SS system 3L

Cellular Communication Networks and Systems

Second generation (2G) Network: Global system for mobile communication (GSM): Architecture and Protocols Air Interface, GSM spectrum, GSM Multiple Access Scheme, GSM Channel Organization, Traffic Channel multi-frame, Control (Signaling) Channel Multi-frame, Frames, Multi-frames, Super-frames and Hyper-frames, GSM Call Set up Procedure, Location Update Procedure, Routing of a call to a Mobile Subscriber 3L

The concept of packet data services The 2.5 G General Packet Radio Services: GPRS Networks Architecture, GPRS Interfaces and Reference Points, GPRS Mobility Management Procedures, GPRS Attachment and Detachment Procedures, Session Management and PDP Context, Data Transfer through GPRS Network and Routing, The IP Internetworking Model 3L

Overview of CDMA systems: IS-95 Networks and 3G – The Universal Mobile Telecommunication System (UMTS)

CDMA based IS-95 Systems, forward link and reverse link for IS-95, handoff process in CDMA based IS-95 network. UMTS Network Architecture –Release 99, UMTS Interfaces, UMTS Network Evolution UMTS Release 4 and 5, UMTS FDD and TDD, UMTS Channels, Logical Channels, UMTS Time Slots 3L

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## MODULE – III:

### Wireless Local Area Networks (WLAN): IEEE 802.11 Standards and Protocols

IEEE 802.11 standards, WLAN family, WLAN transmission technology, WLAN system architecture, Collision Sense Multiple Access with Collision Detection (CSMA/CD) and CSMA collision avoidance (CSMA/CA), Frequency Hopping Spread Spectra, 802.11 PHY and MAC layers, IEEE 802.11 Distributed Coordination function (DCF) and Point coordination function (PCF), Back off algorithm, Virtual carrier sense, MAC frame format. Security and QoS issues, WLAN applications 4L

### Wireless Broadband Networks and Access

Evolution of broadband wireless, IEEE 802.16 standards : **WiMAX** , Spectrum Allocation, IEEE 802.16 Standard Architecture, Overview of WiMAX PHY, IEEE 802.16 MAC Layer, IEEE 802.16 Scheduling Services, Unsolicited Grant Service (UGS), Real-time Polling Service (rtPS), Non-real-time Polling Service (nrtPS), Best Effort (BE) Overview of 3G Long Term Evolution (3G LTE) for broadband wireless communication, Orthogonal Frequency Division Multiple Access (OFDMA) 3L

## MODULE – IV:

### Mobile Internet Protocol

Basic Mobile IP, Mobile IP Type-MIPv4 and MIPv6, Mobile IP: Concept, Four basic entities for MIPv4, Mobile IPv4 Operations, Registration, Tunneling, MIPv4 Reverse Tunneling, MIPv4 Triangular Routing, Configuring PDP Addresses on Mobile Station, Mobility Classification, Seamless Terminal Mobility Management, Limitations of current TCP/IP networks for mobility support, Mobility solution, Accessing External PDN through GPRS/UMTS PS Domain, Transparent Access, Use of Mobile IP for Non-transparent access, Dynamically accesses IP address from External Network. 3L

### TEXT BOOKS:

1. Wireless Networks: Applications and Protocols, T. S. Rappaport, Pearson Education
2. Wireless Communication and Networks : 3G and Beyond, I. Saha Misra, TMH Education.
3. Wireless Communications : Principles and Practice, T.S.Rappaport, PHI Learning.
4. Wireless Communications, A. Goldsmith, Cambridge University Press.

### REFERENCE BOOKS:

1. Lee's Essentials of Wireless Communications, MH Prof. Med/Tech
2. Wireless Digital Communications: Modulations and Spread Spectrum Applications, K. Feher, Prentice Hall.
3. Wireless Communications and Networking, J.W.Mark and W. Zhuang, PHI.

### Microelectronics & VLSI Designs

EC702

Contacts: 3L

Credits: 3

**Pre-requisite:** Knowledge about MOS, MOS-Characteristics, MOS Capacitors, Short Channel MOS, CMOS inverters, MOS Gates etc done in ES201 (Basic Electronics of second semester), EC302 (solid state devices of third semester), Analog Circuit Theory and Digital Circuits done in semesters 3 & 4 respectively.

### Module 1: Introduction to VLSI Design: [6L]

VLSI Design Concepts, Moor's Law, Scale of Integration

(SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA)(2L), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structu12L);

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## Module 2: Micro-electronic Processes for VLSI Fabrication: [10]

Silicon Semiconductor Technology- An

Overview, Wafer processing (1L), Oxidation, Epitaxial deposition, Ion-implantation & Diffusion (1L), Cleaning, Etching (1L), Photo-lithography – Positive & Negative photo-resist (1L); Basic CMOS Technology – (Steps in fabricating CMOS (1L)), Basic n-well CMOS process, p-well CMOS process, Twin tub process (1L), Silicon on insulator (1L); Layout Design Rule: Stick diagram with examples (2L), Layout rules (1L).

## Module – 3: CMOS for Digital VLSI Circuits: [10]

Recapitulation of MOS (2L); CMOS, CMOS inverter characteristics (1L); CMOS logic circuits, NAND & NOR Gates (1L), Complex logic circuits (1L), CMOS Full Adder (1L), CMOS Transmission GATE (1L), Advanced CMOS Logic circuits; Sequential CMOS logic circuits (1L); SR Latch circuit, clocked JK Latch/ Master-Slave JK (1L), CMOS D-latch & Edge triggered flip-flop (1L);

## Module – 4: Analog VLSI Circuits: [8L]

Analog VLSI design steps (1L); Basic building blocks of Analog VLSI chips (1L); MOS switch (1L); Active load / resistors; Voltage dividers (1L); CMOS Current source & sink; CMOS Voltage references/voltage dividers [Basic circuits only] (1L); CMOS Differential amplifier; Output amplifiers [Basic circuits only] (1L); CMOS OPAMP (1L); Switched capacitor filter (1L)

Text Books:

1. Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuit, S.M.Kang & Y.Leblebici, TMH.
3. Modern VLSI Design, Wayne Wolf, Pearson Education.
4. VHDL, Bhaskar, PHI.
5. Advance Digital Design Using Verilog , Michel D. Celliti, PHI

References:

1. Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons .
2. Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher
3. Basic VLSI Design, Douglas A. Pucknell & Kamran Eshranghian, PHI
4. CMOS Circuit Design, Layout & Simulation, R.J.Baker, H.W.Lee, D.E. Boyee, PHI
5. CMOS Analog Circuit Design by P.E. Allen & D.R. Holberg; OUP

## RF & Microwave Engg

EC703A

Contacts: 3L

Credits: 3

**Total Lectures: 39 periods (minimum) :**

Module	Topics	Hours
1	<b>26. Introduction</b> RF & Microwave Spectrum, Typical applications of RF and Microwave, Safety considerations.	1
	<b>27. Microwave Waveguide and Waveguide Resonator</b> Rectangular Waveguide- Design consideration, TE & TM modes, TE <sub>10</sub> mode analysis, cut-off frequency, propagation constant, intrinsic wave impedance, phase and group velocity, power transmission, attenuation, waveguide excitation, wall current; Introduction of circular waveguide; Rectangular waveguide resonator- Design consideration, resonant frequency, Q-factor, excitation.	6
	<b>28. Planar Transmission line</b> Micro-strip lines, Coplanar waveguide, Slot line-design consideration, field patterns, propagation characteristics, Comparison for different characteristics of the above mentioned lines.	3
2	<b>4.High frequency Circuit Elements:</b> Difference in High frequency and relatively low frequency behavior of Lumped circuit components. Miniaturization and Design of Lumped components at High RF. Realization of reactive elements as Waveguide and Planar Circuit components.	4

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	<p><b><u>5.Waveguide Passive Components and their S-matrix Representation</u></b>                  N-port networks-Properties of S matrix, Transmission matrix &amp; their relationships; Microwave passive components and their S matrix representation: Attenuators, Phase shifter, Directional coupler, Bethe-hole coupler, Magic tee, hybrid ring, Circulators, Isolators; Design procedure of filter (maximally flat and equal ripple) using insertion loss method-specification, low-pass prototype design, scaling and conversion, implementation.</p>	<b>8</b>
<b>3</b>	<p><b><u>6.Microwave Tubes</u></b>                  Electron beam &amp; Field interaction for energy exchange in resonant (two cavity klystron, Reflex Klystron, Magnetron) and non-resonant (TWT &amp;BWO) microwave active devices: Typical characteristics &amp; applications (only physical explanation is required, no mathematical derivation required).</p>	<b>4</b>
	<p><b><u>7.Semiconductor Microwave devices</u></b>                  TED (Gunn diode) &amp; Avalanche Transit Time (IMPATT) device, Schottky diode, PIN diode-characteristics &amp; applications; Microwave bipolar transistor, Microwave field effect transistor(MESFET).</p>	<b>5</b>
	<p><b><u>8.Microwave Amplifier Design</u></b>                  Basic consideration in the design of RF amplifier- Transistor S-parameter, Stability, matching network, noise figure; Matching network design using lumped elements and L-Section.                  Brief introduction to NBA, LNA.</p>	<b>4</b>
<b>4</b>	<p><b><u>9.Typical Microwave Test Bench &amp; measurement</u></b>                  VSWR meter, Tunable detector, Slotted line and Probe detector, Frequency meter, Network analyzer, Measurement of VSWR – low, medium and high, Measurement of power: low, medium and high, Frequency measurement.</p>	<b>4</b>

**Text Books:**

1. Microwave Engineering, 3Rd Ed David M. Pozar, Willey & Sons Inc.
2. Microwaves, K C Gupta, New Age Publishers.
3. Microwave Engineering, A Das & S Das, TMH.
4. Microwave Devices & Circuits, SY Liao , Pearson Education /PHI

**References Books:**

- (5) Microwave Engineering-Passive Circuits, PA Rizzi , Pearson Education.
- (6) Foundation of Microwave Engineering, 2ed edition, Robert E Collin, McGraw Hill, Inc.
- (7) Microwave Devices & Circuit Design , GP Srivastava & VL Gupta, PHI

**Optical Communication & N/W**

**EC703B**

**Contacts: 3L**

**Credits: 3**

Introduction to communication systems:

Principles, components; Different forms of communications in brief, advantages of optical fibre communication, spectral characteristics. [2]

Optical Fibre wave guide:

Structure, Single and Multimode operation; Attenuation, Material and wave guide dispersion. [2]

Optical Sources:

Light Emitting Diode; principle, structures, power and efficiency, coupling to fibres.  
 Laser diodes; principle, double heterostructure, gain and index guiding, distributed lasers.  
 Quantum Well Lasers; Modes and narrow linewidth lasers.  
 Modulation; Bandwidth for modulation, Optical transmitters: components. [5]

Optical Detectors:

Device types, optical detection principles, efficiency, responsivity, bandwidth. Preamplifiers; noise sources, signal to noise ratio. [2]

Point-to-point link and Wavelength Division Multiplexing:

Building blocks; Multiplexing; Intensity Modulation/Direct Detection system; Principle of Regeneration; WDM link, Optical amplifiers; EDFA, SOA, Raman amplifier, Fabry-Perot filters. Dispersion compensation and management, Link analysis and Bit-Error-Rate calculation. [11]

Optical Network:

LAN, MAN, WAN; Topologies: bus, star, ring; Ethernet; FDDI; Telecom networking:SDH/SONET. [4]

Different forms of access networks:

Telephony; ISDN; Cable TV; Broadcast and Switched Networks; HFC networks; FTTC and FTTH [4]

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networks; All optical networks.

Books:

1. Optical Networks – A practical perspective : Rajiv Ramaswami, K. N. Sivarajan, Galen H. Sasaki (Morgan-Kaufman)
2. Optical Fibre Communication : John M. Senior (Pearson)
3. Optical Fibre Communication : Gerd Kaiser (TMH)
4. Optical Communication Systems : John Gawar (PHI)

## Computer Networks

**EC703C**

**Contacts: 3L**

**Credits: 3**

### Module I

#### Overview of Data Communication and Networking: [4L]

Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

#### Physical Level: [6L]

Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

### Module II

#### Data link Layer: [5L]

Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC;

#### Medium Access sub layer: [5L]

Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief);

### Module III

#### Network layer: [8L]

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6;

#### Transport layer: [4L]

Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,

### Module IV

#### Application Layer [5L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

#### Modern topics: [5L]

ISDN services & ATM, DSL technology, Cable Modem: Architecture & Operation in brief  
Wireless LAN: IEEE 802.11, Introduction to blue-tooth.

#### Text Books:

1. B. A. Forouzan – “Data Communications and Networking (3rd Ed.)” – TMH
2. A. S. Tanenbaum – “Computer Networks (4th Ed.)” – Pearson Education/PHI
3. W. Stallings – “Data and Computer Communications (5th Ed.)” – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

#### Reference Books:

1. Kurose and Rose – “ Computer Networking -A top down approach featuring the internet” – Pearson Education
2. Leon, Garica, Widjaja – “Communication Networks” – TMH
3. Walrand – “Communication Networks” – TMH.
4. Comer – “Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)” – Pearson Education/PHI

## FPGA & Reconfigurable Computing

**EC703D**

**Contacts: 3L**

**Credits: 3**

### Module –I: Introduction to Reconfigurable Computing (RC)

History, State-of-the-Art and Future Trends, Computing requirements as Power, Area and VLSI scaling, Mapping of Algorithm-analysis and speed-up, RC architectures- Fine Grain and Coarse Grain, Hybrid and Embedded Architectures, Supercomputers.

5L

### Module-II: Reconfigurable Logic Devices:

FPGA and its internal architecture, computing elements, LUT, BRAM, interconnects, I/O Blocks, programming of FPGA and

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interfacing case study, ALU design, designing with embedded processors, introduction to Power PC and ARM processors.  
6L

### Module III: Hardware Description Language for RC:

Design cycle, algorithms, Hardware Description Language, VHDL, different design styles: data flow, structural and behavioral and practical logic circuit implementation example on FPGA, debugging, writing test bench, High level synthesis and Low level synthesis.

6L

### Module IV: RC Configuration:

Application segmentation and Resource partitioning, spatial and temporal configuration, systolic architectures and algorithms, Bit serial, on the fly, multiplexing vs. run-time reconfiguration

4L

### Module V: RC Implementation:

Virtual Hardware Components (VHC) design process, high level synthesis of VHC and optimization, VHC data-path and control unit design, simulation and verification of VHC, determination of reconfigurable scheme and associated loading mechanisms (temporal and spatial partitioning) for RC.

6L

### Module VI: RC applications:

RC for DSP, DSP application building blocks, RC for Image processing, Bioinformatics and Network Security

5L

### Text Books:

1. M. Gokhale and P. Graham; Reconfigurable Computing: Accelerating Computation with FPGAs, Springer, 2005
2. C. Maxfield ; The design Warrior's Guide to FPGAs: Devices, Tools and Flows, Newnes, 2004
3. C. Bobda, Introduction to Reconfigurable Computing : Architectures, Algorithm and Applications, Springer, 2005

### Reference Books:

1. W. Wolf , FPGA Based Systems Design, PHI, 2004
2. P. Lysagt and W. Rosenstiel, New Algorithms, Architectures and Applications for Reconfigurable Computing, Springer, 2005

## Radar Engineering

EC704A

Contacts: 3L

Credits: 3

### Module –I: Introduction to Radar

Historical background, radar terminology, radar band designations, Radar block diagram, radar equation: detection of signals in noise and signal-to-noise ratio, Probabilities of detection & False alarm, integration of radar pulses, radar cross section, distributed targets, Transmitted power, pulse-repetition frequency, antenna parameters & system losses, introduction to radar clutter.

6L

### Module – II: Radar Types

Pulse radars and CW radars, Advantages of coherent radar, Doppler radar and MTI: Doppler effect, delay-line cancellers, blind speeds, staggered PRFs, Digital filter bank, Moving Target Detector, limitations of MTI, tracking with radar, monopulse tracking, conical scan, limitation to tracking accuracy,

8L

### Module –III: Radar signals & clutter

Basic radar measurement, theoretical accuracy of radar measurements, Range and velocity ambiguities, the ambiguity diagram, pulse compression-principles, the matched filter, chirp waveforms, Waveform design: nonlinear FM, phase codes, waveform generation and compression

Descriptions of land & sea clutter, statistical models for surface clutter, detection of targets in clutter.

10L

### Module –IV: Devices and Radar Systems

Radar transmitter: Solid-state RF power source, Magnetron, other RF power sources, Radar receiver: Super heterodyne receiver, receiver noise figure, duplexers & diplexers, Receiver protectors, Applications: Electronic Warfare: ESM, ECM, ECCM; super resolution, IFM, types of jammers, Stealth and counter-stealth: stealth techniques for aircraft and other target types, low frequency and UWB radar ,System design examples

8L

### Text Books :

1. Introduction to Radar Systems-3/E , M. I. Skolnik, Tata McGrawhill

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2. Principles of Modern radar system , M. H. Carpentier, Artech House

## Reference Books:

1. Fundamentals of radar signal processing, M. I. Richards, McGraw-Hill
2. Handbook of radar measurement , Barton, David & Ward, H. R, Artech House
3. Radar Technology , Brookner, Eli, Artech House
4. Radar Handbook , ed. M. I. Skolnik, Mc-Graw Hill, 1990
5. Skolnik, M. I, "Fifty years of Radar", Proc. IEEE, vol. 73 (Feb. 1985), pp. 182-197

## **Embedded Systems**

**EC704B**

**Contacts: 3L**

**Credits: 3**

Introduction to Embedded System : Embedded system Vs General computing systems, History of Embedded systems, Purpose of Embedded systems, Microprocessor and Microcontroller, Hardware architecture of the real time systems.

[5]

Devices and Communication Buses: I/o types, serial and parallel communication devices, wireless communication devices, timer and counting devices, watchdog timer, real time clock, serial bus communication protocols, parallel communication network using ISA, PCI, PCT-X, Intranet embedded system network protocols, USB, Bluetooth.

[10]

Program Modelling Concepts ; Fundamental issues in Hardware software co-design, Unified Modelling Language(UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.

[5]

Real Time Operating Systems : Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS.

[8]

Examples of Embedded System : Mobile phones, RFID, WISENET, Robotics, Biomedical Applications, Brain machine interface etc.

Popular microcontrollers used in embedded systems, sensors, actuators. [6]

Programming concepts and embedded programming in C, C++, JAVA.

[4]

Ref:

1. Introduction to Embedded Systems : Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)
3. Embedded Systems : Rajkamal (TMH)
4. Embedded Systems : L. B. Das (Pearson)
5. Embedded System design : S. Heath (Elsevier)
6. Embedded microcontroller and processor design: G. Osborn (Pearson)

## **Biomedical Instrumentation**

**EC704C**

**Contacts: 3L**

**Credits: 3**

### Module -1 (Fundamentals)

1.1 Introduction to Physiological Systems –Organism, Cardiovascular, Respiratory, Renal, Hepatic, Gastrointestinal, Endocrinal, Nervous, Muscular, Cellular [2]

1.2 Biological Signals – Bioelectric events, Biomechanical Systems, Cellular & Membrane phenomenon. The Action Potential and Propagation through Nervous System. The Peripheral Nervous Systems and sensory mechanisms. Biomaterials.

[2]

1.3 Fundamentals of Electrophysiology –EKG, EEG, EMG, Evoked potentials. Quantification of Biological Signals[2]

### Module 2 (Measurement & Analysis )

2.1 Biological Sensors- Bio-electrodes, Biosensors and Transducers for Cardiology, Neurology, Pulmonary, Oxygen saturation & gaseous exchange, flow measurement, goniometry, Endoscopy, Impedance Plethysmography. [3]

2.2 Biological Amplifiers –Instrumentation Amplifiers for Electrophysiology ( ECG, EMG, EEG, EOG), Filters, Power Supplies.

[3]

2.3 Recording and Display systems, Digital Conversion for storage, Electrical Hazards in measurements, Isolation Circuits, calibration, alarms & Multi-channel re-constitution [2]

2.4 Hospital requirements – Multi-parameter bed-side monitors, Central Nursing Stations, Defibrillators, Ventilators, Catheters, Incubators. [2]

### Module - 3 (Life-Support & Treatment)

3.1 Cardiac Support: Implantable & programmable Pacemakers, External & Internal Defibrillators, Coronary Angiography.

[2]

3.2 Electro-physiotherapy : Shortwave & ultrasonic diathermy, Transcutaneous Nerve Stimulators in pain relief, Traction Systems,

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- Ultrasound in bone fracture regeneration, hypothermia & hyperthermia systems. [3]  
3.3 Lasers in treatment and surgery : Ophthalmic, Ablators, Endoscopic [2]  
3.4 Assists and Artificial limbs- Orthoses , passive and powered Prostheses [2]

## **Module-4 (Imaging)**

- 4.1 Fundamentals of X-Rays, Radiological Imaging, Digital Radiology, DSA. [3]  
4.2 Computer Tomography, Image Processing, solid state sensors, whole-body scans. [3]  
4.3 Gamma camera & radio- isotope imaging. [1]  
4.5 Ultrasonography- Transducers, Signal Conditioners, 2D & 3D scans, Doppler & Colour Doppler [3]  
4.6 Fundamentals of Magnetic Resonance Imaging and PET - scans [2]

## **Text Books:-**

- 2) R S Khandpur:- Handbook of Biomedical Instrumentation (Tata –Mcgraw Hill Education) [Partly Downloadable]
- 3) M E Valentiniuzzi:- Understanding the Human Machine- A Primer for Bioengineering [Freely Downloadable in PDF] (World Scientific Publishing Co. Pte. Ltd, Singapore)
- 4) L Cornwell, F.J. Weibell & E.A. Pfeiffer:- Biomedical Instrumentation and Measurements(Prentice Hall/ Medical)
- 5) J G Webster & J W. Clark:- Medical Instrumentation – Application & Design (Houghton Mifflin Pub)
- 6) J J Carr & JM Brown:- Introduction to Bio-medical Equipment Technology(Regents / Prentice Hall)
- 7) J Tompkins & J G Webster :-Design of Micro- controller based Medical Instrumentation (Prentice Hall Inc)

## **Reference Books:**

1. W.B. Blesser :- A systems approach to Biomedicine (McGraw Hill.,NY)
2. J H U Brown, J E Jacobs & L Stark:- Biomedical Engineering (Davis Co, Philadelphia, USA)
3. L A Geddes & L E Baker :- Principles of Applied Biomedical Instrumentation (John Wiley & sons, NY)
4. J H Milsum:- Biological Control Systems(Mc Graw Hill, NY)
5. R Plonsey:- Bioelectric Phenomena (McGraw-Hill Co, NY)

## **Artificial Intelligence**

**EC705A**

**Contacts: 3L**

**Credits: 3**

### **Introduction [2]**

Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

### **Intelligent Agents [2]**

Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

### **Problem Solving [2]**

Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

### **Search techniques [5]**

Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

### **Heuristic search strategies [5]**

Greedy best-first search, A\* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

### **Adversarial search [3]**

Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

### **Knowledge & reasoning [3]**

Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge



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representation.

## Using predicate logic [2]

Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

## Representing knowledge using rules [3]

Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

## Probabilistic reasoning [4]

Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

## Planning [2]

Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

## Natural Language processing [2]

Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

## Learning [2]

Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

## Expert Systems [2]

Representing and using domain knowledge, expert system shells, knowledge acquisition.

## Basic knowledge of programming language like Prolog & Lisp. [6]

### Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. Artificial Intelligence, Russel, Pearson

## Robotics

### EC705B

**Contacts: 3L**

**Credits: 3**

Robot Anatomy Arm Geometry-Direct & Inverse Kinematics Problem.Arm Dynamics,D Alembert Equations of Motion, Synthesis of elements with movalulity constraints,manipulations-trajectory planning, joint interpolated trajectories. [15L]

Control of Robot Manipulation-computed torque technique sequencing & adaptive control, resolved motion control Moluie Robots. [6L]

Robot sensing-Range & Proximity & Higher-Level vision, illumination techniques, Imaging Geometry, Segmentation Recognition & Interpretation. [8L]

Robot Programming Language Characteristics of Robot Level & Task Level languages.Robot intelligence-State Space search, Robot

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learning, Robot Task Planning, Knowledge Engineering.

[10L]

References:

1. K.S Fu R.C . CSG Lee-Robotics Control, Sensing, Vision & Intelligence, McGraw-Hill.
2. M.P. Groover, M. Weins, R.N. Nagel, N.C. Odrey –Industrial Robotics, McGraw Hill
3. Andrew C. Straugard-Robotics & AI, PHI
4. S. Sitharama Iyengar, Alberto Elfes-Autonomous Mobile Robots Control, Planning & Achitecture, IEEE Computer Society Press

## Database Management System

**EC705C**

**Contacts: 3L**

**Credits: 3**

### Introduction [4L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

### Entity-Relationship Model [6L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

### Relational Model [5L]

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

### SQL and Integrity Constraints [8L]

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

### Relational Database Design [9L]

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF

### Internals of RDBMS [7L]

Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking.

### File Organization & Index Structures [6L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .

Text Books:

8. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
9. Elmasri Ramez and Navathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing. Company.
10. Ramakrishnan: Database Management System , McGraw-Hill
11. Gray Jim and Reuter Address, “Transaction Processing : Concepts and Techniques”, Moragan Kauffman Publishers.
12. Jain: Advanced Database Management System CyberTech
13. Date C. J., “Introduction to Database Management”, Vol. I, II, III, Addison Wesley.
14. Ullman JD., “Principles of Database Systems”, Galgottia Publication.

Reference:

10. James Martin, “Principles of Database Management Systems”, 1985, Prentice Hall of India, New Delhi
11. “Fundamentals of Database Systems”, Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
12. “Database Management Systems”, Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

## Power Electronics

**EC705D**

**Contacts: 3L**

**Credits: 3**

Module	Topic	Hrs
Module I	<b>Advances in Power Electronics</b> Power Semiconductor Switches: Rectifier diodes, fast recovery diodes, Schottky barrier diode, Power	6

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	BJT, Power MOSFET, SCR, TRIAC, IGBT and GTO. Ratings, Static and Dynamic Characteristics, Trigger, driver and switching-aid circuits and cooling. SCR turn –on and turn - off methods, Triggering circuits, SCR Commutation circuits, SCR Series and Parallel operation, Snubber Circuit.	
Module II	Rectifiers Single phase and three phase controlled Rectifiers with inductive loads, RL load Effect of source inductance- performance parameters .Dual Converters.	6
Module III	Step up and Step down choppers Time ratio control and current limit control, Buck, Boost, Buck Boost and Cuk Converters, Concept of Resonant Switching.	4
Module IV	Single phase and three phase inverters – PWM techniques, Sinusoidal PWM, modified Sinusoidal PWM - multiple PWM Voltage and harmonic Control – Series resonant inverter-Current Sources Inverter.	6
Module V	AC Voltage Controllers, Single phase and three phase Cycloconverters – Power factor control and Matrix Converters.	4
Module VI	<b>DC and AC Drives</b> DC Motor Speed control Induction Motor Speed Control Synchronous Motor Speed Control	8

**Total Lecture Hours    34**

### Books:

- b) P.C. Sen, Power Electronics
- c) M.H. Rashid, Power Electronics, PHI/ Pearson Education
- d) C.W. Lander, Power Electronics, McGraw Hill
- e) B.K. Bose, Modern Power Electronics, JAICO
- f) Mohan, N Undeland, TM & Robbins, WP- Power Electronics, John Wiley & Sons

### Practical

#### Group Discussion

**HU781**

**Contacts: 3**

**Credits: 2**

#### To be incorporated

#### VLSI Design Lab

**EC792**

**Contacts: 3**

**Credits: 2**

Laboratory 1. Familiarity with Spice simulation tool ( 3 Hrs.)

Laboratory 2. Spice Simulation of Inverter , NAND , NOR Gates. ( 3 Hrs.)

Laboratory 3 Familiarity with EDA tools for VLSI design /FPGA based system design (6 Hrs.)

Laboratory 4. Layouts ,Transistors and tools,. ( 3 Hrs.)

Laboratory 5. Standars cell Design ( 3 Hrs.)

Laboratory 6. Design of CMOS XOR/XNOR Gates. (3 Hrs.)

Laboratory 7. Design of CMOS Full adder (3 Hrs.)

Laboratory 8. Design of CMOS Flip flops ( R-S ,D , J-K) ( 3 Hr.s)

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Laboratory 10. Design of 8 bit synchronous Counter (3 Hrs.)

Laboratory 11. Design of 8 bit bi-directional register with tri-stated input/output bus (3 Hrs.)

Laboratory 12. Design of a 12 bit CPU with few instructions and implementation and validation on FPGA (15 Hrs.)

1. M.J.S Smith , Application Specific Integrated circuits ,Pearson.
2. P.J Anderson ,The designer's guide to VHDL, Morgan Kaufman , 2<sup>nd</sup> edition ,2002.
3. W.Wolf , Modern VLSI Design: Systems on silicon , Pearson
4. G.Hatchel and F.Somenzi , logic Synthesis and verification Algorithms,Kluwer,1998

References:

1. <http://www-ee.eng.hawaii.edu/~msmith/ASIC/HTML/ASIC.htm#anchor935203>
2. J.Bhasker ,A VHDL Primer , BS Publications/Pearson Education.

## RF & Microwave Engg Lab

EC793A

Contacts: 3

Credits: 2

### Experiments

1. Determination of phase and group velocities in a waveguide carrying TE<sub>10</sub> Wave from Dispersion diagram [ $\omega$ - $\beta$  Plot].
2. Measurement of unknown impedance using shift in minima technique using a waveguide test bench/ Measurement of the susceptance of an inductive and or a capacitive window using shift in minima technique using a waveguide test bench
3. Study of the characteristics of a Reflex Klystron oscillator
4. Study of Gunn-oscillator Characteristics using X-band waveguide test bench.
5. Measurement of coupling factor, Directivity, Insertion loss and Isolation of a Directional coupler using X-band waveguide test bench set up.
6. Scattering matrix of a magic tee / E-plane tee / H-plane tee using waveguide test bench at X-band.
7. Experimental/Simulation Study of filter (LPF, HPF,BPF) response.
8. Measuring of dielectric constant of a material using waveguide test bench at X-band.

### Reference Books

1. ML Sisodia & GS Raghuvanshi Basic Microwave Techniques and Laboratory Manual; Wiley Eastern Limited 1987
2. EL Gintzton Microwave Measurements, McGraw-Hill Book Co.
3. M Sucher and J Fox, Handbook of Microwave Measurements, Vol I, Wiley-Interscience Inc.

## Optical Communication & N/W Lab

EC793B

Contacts: 3

Credits: 2

### Experiment with Optical fibre :

To calculate attenuation constant, bending loss and numerical aperture of optical fibre.

Experiments using LED module : Study of DC characteristics.

I-V characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.

P-I characteristics of LED (i) using optical fibre between LED and power meter and (ii) without using optical fibre.

Experiment with fibre Optic analog link :

Input-output characteristics using long optical fibre. Calculation of attenuation per unit length of optical fibre.

## Computer Networks lab

EC793C

Contacts: 3

Credits: 2

- 8) IPC (Message queue)
- 9) NIC Installation & Configuration (Windows/Linux)
- 10) Familiarization with
  - 11) Networking cables (CAT5, UTP)
  - 12) Connectors (RJ45, T-connector)

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- 13) Hubs, Switches
- 14) TCP/UDP Socket Programming
- 15) Multicast & Broadcast Sockets
13. Implementation of a Prototype Multithreaded Server
- 16) Implementation of
  - 17) Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
  - 18) Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
  - 19) Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

## FPGA & Reconfigurable Computing

**EC793D**

**Contacts: 3**

**Credits: 2**

1. Implementation of basic logic gates with VHDL on FPGA using different design styles.
2. Implementation of Multiplexers, Priority Encoder, decoder, counters etc. with VHDL on FPGA using different design styles.
3. Design and implementation of 16-bit ALU with VHDL on FPGA and verification by writing a test bench.
4.
  - a) Generation of Filter co-efficient of a LPF using Simulink FDA tool.
  - b) Generation of VHDL codes for the LPF by coupling the co-efficient in “a” with Xilinx.
  - c) Implementation of the LPF in FPGA using the code in “b”.
  - d) Testing of the LPF by using the hardware-in-the loop configuration.
5. Design and implementation of a real time user defined Traffic Light Controller using FSM method on an FPGA.
6. Interfacing of LCD display with FPGA and configuration for the scrolling display.

## Artificial Intelligence Lab

**EC795A**

**Contacts: 3**

**Credits: 2**

Programming Languages such as PROLOG & LISP

## Robotics Lab

**EC795B**

**Contacts: 3**

**Credits: 2**

1. Determination of link parameters of a multi-link robot using Denavit-Hartenberg scheme.
2. Inverse kinematic approach to determine required angular displacements for translation of link-end-points
3. Adaptive position control of a single/two-link robotic manipulator
4. Characterization of an ultrasonic transducer for range measurement applications
5. Segmentation of an image by histogram thresholding
6. Task-planning using pick-up and placement operations
7. Developing motion plan of a robot-cart using real-time A\* algorithm

## Database management System Lb

**EC795C**

**Contacts: 3**

**Credits: 2**

## Structured Query Language

1. **Creating Database**
  4. Creating a Database
  5. Creating a Table
  6. Specifying Relational Data Types
  7. Specifying Constraints
  8. Creating Indexes
2. **Table and Record Handling**
  10. INSERT statement

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11. Using SELECT and INSERT together
12. DELETE, UPDATE, TRUNCATE statements
13. DROP, ALTER statements

### 3. Retrieving Data from a Database

7. The SELECT statement
8. Using the WHERE clause
9. Using Logical Operators in the WHERE clause
10. Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING

#### Clause

11. Using Aggregate Functions
12. Combining Tables Using JOINS
13. Subqueries

### 4. Database Management

6. Creating Views
7. Creating Column Aliases
8. Creating Database Users
9. Using GRANT and REVOKE

#### Cursors in Oracle PL / SQL

#### Writing Oracle PL / SQL Stored Procedures

### Power Electronics Lb

EC795D

Contacts: 3

Credits: 2

#### List of Experiments:

1. Study of the characteristics of an SCR.
2. Study of the characteristics of a Triac
3. Study of different triggering circuits of an SCR
4. Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge.
5. Study of the operation of a single phase full controlled bridge converter with R and R-L load.
6. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters.
7. Study of performance of step down chopper with R and R-L load.
8. Study of performance of single phase controlled converter with and without source inductance (simulation)
9. Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (simulation).
10. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter.(simulation)
11. Study of performance of three phase controlled converter with R & R-L load. (simulation)
12. Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load.
13. Study of performance of three phase AC controller with R and R-L load (simulation)
14. Study of performance of a Dual converter. (simulation)
15. Study of performance of a Cycloconverter (simulation)

**Institute may develop experiments based on the theory taught in addition to experiments mentioned.**

#### Reference books:

1. Fundamental of Power Electronics with MATLAB, Randall Shaffer, Cengage Learning.
2. SPICE for Power electronics and electric power, M.H. Rashid & H.M. Rashid, Taylor & Francis.
3. Power Electronics: Principles and application, Jacob, Cengage Learning
4. Power Electronics, Daniel W. Hart, Tata McGraw Hill Edition.
5. Modeling & Simulation using MATLAB-SIMILINK, S. Jain, Wiley India
6. MATLAB & SIMULINK for Engineers, A.K. Tyagi, Oxford University Press.

### VIII Semester Theory

### Organisational Behaviour

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## HU801A

**Contacts: 2L**

**Credits: 2**

1. Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. [2]
2. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction. [2]
3. Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. [2]
4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory. [4]
5. Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. [2]
6. Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. [2]
7. Leadership: Definition, Importance, Theories of Leadership Styles. [2]
8. Organizational Politics: Definition, Factors contributing to Political Behaviour. [2]
9. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. [2]
10. Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture. [4]

### References:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15<sup>th</sup> Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12<sup>th</sup> Edn.
3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4<sup>th</sup> Edn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10<sup>th</sup> Edn.

## Smart Antenna

**EC801A**

**Contacts: 3L**

**Credits: 3**

### MODULE –I:

#### INTRODUCTION:

Antenna Basics, Phased array antenna, power pattern, beam steering, degree of freedom, adaptive antennas, smart antennas - key benefits of smart antenna technology, wide band smart antennas, Propagation Channels

**4L**

### MODULE –II:

#### SMART ANTENNAS FOR WIRELESS COMMUNICATIONS:

Spatial Processing for Wireless Systems, Key Benefits of Smart Antenna Technology, The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beam forming Networks, Switched Beam Systems, Adaptive Antenna Systems, Wideband Smart Antennas, Diversity Techniques, Multiple Input - Multiple Output (MIMO) Communications Systems, MIMO for frequency selective scenarios.

**10L**

### MODULE –III:

#### ADAPTIVE PROCESSING:

Sample matrix inversion algorithm, unconstrained LMS algorithm, normalized LMS algorithm, Constrained LMS algorithm, Perturbation algorithms, Neural network approach, Adaptive beam space processing, Implementation issues.

**8L**

### MODULE –IV:

#### DIRECTION OF ARRIVAL ESTIMATION (DOA) METHODS:

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Spectral estimation methods, linear prediction method, Maximum entropy method, Maximum likelihood method, Eigen structure methods, MUSIC algorithm – root music and cyclic music algorithm, the ESPRIT algorithm.

8L

**MODULE –V:**

## IMPLEMENTATION OF SMART ANTENNA SYSTEM:

DOA based beam former design using simulation and hardware. Adaptive beam forming implementation using Altera Stratix® series FPGA, QRD RLS Algorithm. CORDIC algorithm.

6L

## TEXT BOOKS:

1. Smart Antenna for Wireless Communication ,  
T.S.Rappaport and J.C.Liberti, Prentice Hall, 1999
2. Smart Antennas,  
L.C.Godra, CRC Press, 2004
3. Adaptive Filter Theory,  
S. Haykin. Prentice Hall, 1985
4. Introduction to Smart Antennas,  
C.A.Balanis, Morgan and Claypool, 2007

## Digital Image Processing

**EC801B**

**Contacts: 3L**

**Credits: 3**

**Objective:** The course provides grounding in digital filter and transforms techniques for image processing and feature extraction, and an overview of common heuristic algorithms for Image Processing. The different representations of digital images, the importance of adequate sampling frequencies and the appearance of artifacts. Also how the important features in an image may be related to significant abstractions from the raw image. Prerequisite: Digital Signal Processing, Signals and Systems.

### Module 1

Digital Image Processing Systems:

Introduction to structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, storage, Processing, Communication, Display Image Sampling and quantization, Basic relationships between pixels. [4]

### Module 2

Image Transforms (implementation):

Introduction to Fourier transform, DFT and 2-D DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform, Hadamard transform, Discrete cosine transform, Slant transform, Optimum transform: Karhunen – Loeve (Hotelling) transform. [7].

### Module 3

Image Enhancement in the Spatial and Frequency Domain:

Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters. Frequency domain filters: Homomorphic filtering. [6]

### Module 4

Image Data Compression:

Fundamentals, Redundancies: Coding, Interpixel Psycho-visual, fidelity criteria, Image compression models, Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone Still Image compression standards, Video compression standards. [6]

### Module 5

Morphological Image Processing:

Introduction, Dilation, Erosion, Opening, closing, Hit -or-miss transformation, Morphological algorithm operations on binary Images, Morphological algorithm operations on gray-scale Images. [6]

### Module 6

Image Segmentation, Representation and Description: Detection of discontinuities, Edge linking and Boundary detection, Thresholding Region based segmentation, Image Representation schemes, Boundary descriptors, and Regional descriptors. [7]

## Text Books:

1. R.C Gonzalez and R. Woods :-Digital Image Processing, (Indian reprint: Pearson publication, 2001)
2. Anil K. Jain :- Digital Image Processing (Prentice-Hall, India)

## Reference Books:

1. W. K. Pratt :- Digital Image Processing, - 2nd Edition, (John Wiley & Sons).
2. B. Chanda & D. Dutta Majumder, Digital Image Processing and Analysis, (Prentice-Hall, India)



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3. M. A. Sid-Ahmed :- Image Processing- Theory, Algorithms & Architecture, (McGraw-Hill).

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## Satellite Communication & Remote Sensing

**EC801C**

**Contacts: 3L**

**Credits: 3**

Historical background, Basic concepts, Frequency allocation for satellite services, orbital & spacecraft problems, comparison of networks and services, modulation techniques used for satellite communication.(2)

Orbits- Two body problem, orbital mechanics, geostationary orbit, change in longitude, orbital maneuvers, orbital transfer, orbital perturbations. (2)

Launch Vehicles- principles of Rocket propulsion, powered flight, Launch vehicles for communication satellite (1)

RF link- noise, the basic RF link, satellite links (up and down) , optimization RF link, intersatellite link, noise temperature, Antenna temperature, overall system temperature, propagation factors, rain attenuation model. Tropospheric and Ionospheric EFFECT. (5)

Multiple access- FDMA, TDMA, CDMA techniques, comparison of multiple access techniques, error correcting codes.(5)

Satellite subsystems and satellite link design- AOCS, TT&C , power system, spacecraft antenna, transponder, Friis transmission equation, G/T ratio of earth station. (6)

Remote Sensing:

1. Basic of remote sensing, Electromagnetic Radiation principles, Atmospheric window, Indian satellite sensing satellite system, Active, Passive, ground based and space based remote sensing. ( 3)

2. Spatial, spectral, Radiometric and temporal resolution, satellite sensors, detectors and scanning technique, FOV and error sources, Image analysis and Interpretation weather RADAR, LIDAR, acoustic sounding systems, TRMM, AURA-MLS, Megha Tropiques Altimeter , Scatterometer, Radiometer.(9)

3. Ground based and radio occultation techniques, spectral response of water, Sea surface temperature, wind speed, colour monitor, clouds and aerosol, water vapor, convective system, Trace gases.(7)

Ref.: 1. Remote Sensing and GIS - B. Bhatta (Oxford University Press)

Remote sensing of the Environment – J.R. Jensen (Pearson)

Global Navigation satellite systems - B. S. Rao (TMH)

Satellite communication – D. Roddy (TMH)

Remote Sensing - R.A. Schowengerdt )Academic Press)

## Neural Network & Applications

**EC802A**

**Contacts: 3L**

**Credits: 3**

### Module-1

Introduction to neural networks: Human brain and models of a neuron, artificial neurons and activation functions; Learning processes: Introduction to Supervised, Unsupervised and Reinforcement Learning, Memory-based learning, Hebbian learning, competitive learning, Boltzman learning, Adaptive Linear Neuron (Adaline); [8L]

### Module-2

Single-layer perceptrons: Unconstrained optimization, LMS algorithm, learning curves, perceptrons, convergence theorem, limitations of single-layer perceptrons; Multi-layer perceptrons: Back-propagation algorithm, XOR problem, feature detection, accelerated convergence of back-propagation algorithm, limitations; [8L]

### Module-3

Radial Basis function networks: Theorems on separability of patterns, interpolation problem, regularization theory and regularization networks, generalized RBF, approximation properties of RBF, Wavelet Neural Network, comparison of RBF and back-propagation; [6L]

### Module-4

Associative Memory Networks: Training Algorithm for Pattern Association-Hebb Rule, Bidirectional Associative Memory, Hopfield Networks- Continuous and Discrete, Hamming Network;

Self- Organizing maps: Feature mapping models, SOM algorithm, learning vector quantization, adaptive vector quantization; Stochastic machines: Statistical mechanics, Markov chains, Simulated annealing, Gibbs sampling, Boltzman machine, Sigmoid belief networks; [10L]

### Module-5

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Applications: Applications on Digital Image Processing and other related areas, Image Restoration based on Associative Memory, Data Visualization with self organizing feature MAP, Support Vector machines (SVM), SVM based learning. Introduction to MATLAB Programming. [4L]

## Text Books:

- 1) S. N. Sivanandam, S.N. Deepa: Principles of Soft Computing (Wiley India)
- 2) Satish Kumar: Neural Networks – A Classroom Approach (Mc Graw Hill Ed.)
- 3) Mohamad H. Hassoun: Fundamentals of Artificial Neural Networks (PHI)
- 4) James A. Freeman, David M. Skapura: Neural Networks (Pearson)
- 5) Simon Heykin : Neural Networks – A Comprehensive Foundation (PHI)
- 6) M. Ananda Rao, J. Srinibas: Neural Networks Algorithms and Applications (Narosa Publ. House)
- 7) S. Rajsekaran, G.A. Vijaylakshmi Pai: Neural Networks, Fuzzy Logic and Genetic Algorithm

## Reference Books:

- 1) Amit Konar: Artificial Intelligence and Soft Computing (CRC Press, Indian Edition Available)
- 2) Cloete, Zarunda: Knowledge based Neurocomputing (University Press)
- 3) Duda, Hart, Stork: Pattern Classification (Wiley)
- 4) J.S. Jang, C.T. Sun, E. Mizutani: Neuro-Fuzzy and Soft Computing (PHI)
- 5) Bart Kosko: Neural Network and Fuzzy Systems (PHI)
- 6) N. K. Bose, P. Liang : Neural Network Fundamentals with Graphs, Algorithms and Applications (TMG)
- 7) Dan W Patterson, PHI : Introduction to Artificial Intelligence and Expert Systems (PHI)

## **Material Science & Engineering**

**EC802B**

**Contacts: 3L**

**Credits: 3**

Structure of Solids : Atoms and their binding, Bonds, Crystal Systems, Bravais Lattice Miller Indices, Crystalline, Polycrystalline and Amorphous Materials; Metals, Semiconductors and Insulators, Lattice defects- Qualitative ideas of point, line, surface and volume defects. [5]

Dielectric Propertise : Dielectric Polarization and Mechanism- Internal or local field, Dielectric Loss, Temperature and Frequency dependence of dielectric constant, Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric Materials and its Applications. [4]

Magnetic Properties : Elementary ideas of classification of magnetic materials – Diamagnetism, Paramagnetism, Ferromagnetism, Ferrimagnetism, Magnetic Domains. [2]

Superconductors : Basic concepts of superconductivity, Transition temperature, Meissner effect High-T superconductors, Hard and Soft Materials, SQUID. [3]

Optical properties : Absorption, Emission, Luminescence, Electro-optic and Acousto-optic effects, Photorefractive effects. [3]

Materials for Optical Communication : LED and Laser Materials, Optical Fibre. [3]

Materials for Data Storage : Magnetic Cores, Tapes, Disks, Hard disk, Floppy disk, Magneto-optic devices, Bubble memories, Magnetoelectronic Materials, CD, DVD, CCD. [5]

Materials for Display Devices : CRT, LED, LCD, TFT, Plasma Display. [3]

Advanced Materials : Metallic Glasses, Nanomaterials, etc. [2]

## Books:

1. Electrical Engineering Materials – A. J. Dekker (PHI)
2. Material Science and Engineering–A First Course – V. Raghavan (PHI Learning Pvt. Ltd)
3. Principles of Electronic Materials and Devices – S. Kasap (McGraw-Hill)
4. An Introduction to Solid State Physics - Charles Kittel (John Wiley & sons)
5. An Introduction to Electronic Materials for Engineers – W. Kao, Z. Lee and N. Sannes (World Scientific)

## **Renewable Energy**

**EC802C**

**Contacts: 3L**

**Credits: 3**

Classification of Energy Sources (2)

Advantages of Non Conventional Energy Sources over Conventional Sources

Economics, Impact on Environment

Electricity Generation from Non Conventional Energy Sources:

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Solar Energy:	(12)
Solar radiation and its Characteristics, Solar Collector: flat Plate, focusing, Solar Energy use for water heating, Solar thermal power generation, Hybrid solar power	
Principle of energy conversion in solar cells, Photovoltaics, Different types of PV Cells, Mono-poly crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems.	
Wind Energy:	(7)
Wind as energy source, Design of Wind turbine, Selection of site of Wind farm, characteristics of different types of wind generators used with wind turbines	
Hydel Energy:	(2)
Electricity generation from micro hydel plants, location, auxiliaries and associated problems.	
Bio Energy:	(4)
Resources and conversion process: bio gas conversion, bio gas plant, bio mass gasifier. co generation	
Bio diesel;	(2)
Sources, usability and advantages over mineral product,	
Tidal Energy: Principle, selection of site, Economics and future prospect	(2)
Wave Energy: Principle , selection of site and future prospect	(2)
Geo thermal Energy: Principle , location , economics and prospect	(2)
Fuel Cells:	(5)
Principle of fuel cells, Different types of fuel cells, advantages and limitations	
Magneto hydrodynamics energy conversion:	(2)
Principle, Economics and environmental aspect of MHD generation	

## Audio & Speech Processing

EC802D

Contacts: 3L

Credits: 3

**Objective:** The course provides fundamentals in human speech and music analysis, modeling and processing using digital filters and Pattern Recognition techniques, and an overview of Hidden Markov Models for speech encoding. The different representations of digitized human speech, the importance of adequate voiced and unvoiced speech sounds grouped into phonemes, are used along with spectrograms for speech recognition, articulation and understanding. Also covered are - how the dominant features of speech may be analyzed to form significant abstractions for speaker identification and speaker-independent linguistic comprehension. Prerequisites: Audio Systems, Analog Filters, Digital Signal Processing.

### Module -1

Introduction : Production and transmission of acoustic signals : articulation of human speech. Acoustic-phonetic structure of Speech and Music : music synthesis and speech synthesis. A history of Voders & Vocoders and early speech recognition methods.

[4]

### Module -2

Acoustic-Phonetic classification : Phonemes, Auto-spectra. Review of Digital Signal Processing and FFT.

Short-term Spectral Analysis and STFT, the ARPA and DARPA projects, Pattern matching, introduction to Hidden Markov (HMM) Models. Adaptive segmentation of speech.

[6]

### Module -3

The stochastic parameters of human speech, Gaussian densities and statistical model training, voiced and unvoiced speech, voice-box modeling, resonance. Acoustic travelling waves. Psycho-acoustics, Physiological exploration of periodicity, audio-spectrograms and sonograms, pitch-perception models. [7]

### Module -4

Physiology of the ear and hearing mechanism, the Auditory System modeled as a Filter-bank, Gamma-tone and Roex filters, Spectrum and Complex Cepstrum analysis of speech as perceived by detectors, Automatic Speech Recognition (ASR), Linear Prediction analysis

[7]

### Module -5

Phonetic and phonemic alphabets, phonological models of ASR, Linear and Dynamic Time-warping, connected word recognition, Statistical sequence recognition and model training in speech pattern recognition, HMM training, Viterbi training, MLP architecture and training,

[8]

### Module -6

Speech Synthesis and coding, Formant synthesizers, Vocoders, Speech transformation, Speaker verification, Music synthesizers, speech-assisted applications in industry, defence and medicine.

[5]

### Text Books :

14. B.Gold & N.Morgan :- Speech & Audio Signal Processing -*Processing and Perception of Speech & Music* (Wiley Student edition)
15. L.R. Rabiner & B.H.Juang :- Fundamentals of Speech Recognition (Prentice-Hall Signal Processing series)
16. B.Plannerer : An Introduction to Speech Recognition [Freely downloadable e-Book]

# Syllabus for B.Tech(ECE) Second Year

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)



17. F.Mihelic & J.Zibert : Speech Recognition (InTech) [Freely downloadable e-Book]
18. I. Mcloughlin : Applied Speech and Audio Processing with MATLAB examples (Cambridge University Press)

## Reference Books :

- viii) G. Young :-The Application of Hidden Markov Models in Speech Recognition [freely downloadable e-Book]
- ix) M.Grimm & K.Kroschel :-Robust Speech Recognition & Understanding (Intech)[Freely downloadable]
- x) L. R.Rabiner & R.W.Schafer : Theory and Applications of Digital Speech Processing (Hewlett-Packard Labs/Pearson Pub)
- xi) C. Schmandt :- Voice Communication with Computers-Conversational Systems (Van Norstrand Reinhold Computers Series)
- xii) SOUND FORGE software package (SONY) for practice sessions [freely downloadable]

## Practical

### **Design Lab**

**Contacts: 6L**

**Credits: 4**

**Objective:** To impart the essential knowledge of electronic circuit design and fault analysis, to enhance hands on experience and to encourage innovativeness.

**Modus operandi:** The subject will be a sessional subject so that students can employ all their resources in order to excel.

Total 18 designs have been indicated in the syllabus classified in 4 groups. Each student has to complete at least 8 designs in a semester taking two from each group.

At the end of the semester, the student will be interviewed by a panel of examiners, constituted by the head of the department/institution.

**Guidelines:** Each design given in the syllabus indicates the basis. On this basis, the teacher will prepare an exact design problem with specified parameters and assign to the student.

Objective of the job in brief is also given in the syllabus. As such the teacher can further elaborate or specialize the problem creating enough room for the student to learn and innovate.

If same job is assigned to more than one student/group, it must be with different parameter values.

The students will find their own design solutions with minimum input from the teacher. Of course there can be more than one solution but the student should ultimately know their comparative merits/demerits.

The hardware assembly and testing has to be done only during assigned class hours under general supervision of a teacher. The student must always make a comparative study between the theoretical and measured performance parameters and analyze their causes.

At the end of each job, the student will prepare a report including detail technical specification of his design, circuit diagram, design calculations, theoretical & measured values, graphs, references etc.

**Scoring:** The total score of 100 will be in two parts, e.g. a) continuous evaluation-60 and b) semester end viva-40.

A full mark of 10 is allotted to each job. At the end of each job, the teacher will evaluate the performance on the basis of initiative, innovativeness, speed and insight. The sum of 6 such evaluations will make the total for continuous evaluation.

At end semester, each student will be interviewed to assess his expertise in various facets of electronic design, and a score out of 40 will be allotted.

# Syllabus for B.Tech(ECE) Second Year

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)



## A. DISCRETE ANALOG CIRCUITS.

1. Rectifiers.  
(To design a rectifier for a given average output dc voltage and a given load resistance, compare between the theoretical values of  $V_{dc}$ ,  $V_{rms}$ , RF, HD, output regulation, transformer utility factor etc. with the measured values, and thus comprehend the relevance/effect of these various parameters.)
2. DC power supplies regulation and protection circuits.  
(To learn designing a series transistor based output regulation circuit, an output current limiting circuit, fold back circuit needed for a given output parameters.)
3. Single stage audio frequency voltage amplifier with BJT for a given  $A_v$ ,  $Z_{in}$  and  $Z_{out}$  and maximum symmetrical out put swing.  
(To learn basic design principles, different methods of biasing, bias stability, selection of transistor from data manuals and effect of ac coupling on bandwidth.)
4. Single stage audio frequency emitter follower with JFET for a given  $A_v$ ,  $Z_{in}$  and  $Z_{out}$  and maximum symmetrical out put swing.  
(To learn the design principles and applications of an emitter follower.)
5. Complimentary symmetry power amplifier with pre amplifier, if necessary, for a given out put power to a given load with single ended power supply.  
(To learn the distinction of a power amplifier over and above a voltage or current amplifier, its design principles, issues like, efficiency, cross over distortion etc.)
6. RC phase shift Oscillator , Wien Bridge oscillator, Hartley and Colpitt oscillator  
  
( To learn the design of oscillators and measuring the frequency and amplitude of oscillations)

## B. OPAMP BASED ANALOG CIRCUITS

1. Inverting and non-inverting amplifier of given dc gain, input impedance and output impedance.  
(To learn the basic design, inter relation between the dc gain and input/output impedances, offset balance and the relation between feedback and GBW.)
2. Adder and subtractor.  
(To learn the basic design and function of a multi input adder/subtractor (with ac and dc inputs present simultaneously).)
3. Comparator/voltage level detector for a given upper threshold level and a given lower threshold level with facility of independent adjustment of hysteresis and center point.  
(To learn the design and the technique of independent adjustment of both hysteresis and center point.)
4. Active filters: LP, BP, HP, 1<sup>st</sup> order, 2<sup>nd</sup> order.  
(To learn the design of a filter and it's inherent phase shifting characteristics.)
5. 555 based monostable and astable of duty cycle below and above 50%.  
(To learn designing 555 based timer circuits.)

## DIGITAL LOGIC CIRCUITS

1. Design and implement a BCD to 7-segment decoder with basic and universal gates.  
(To understand clearly the method of writing a truth table, use of K-map, simplifying a logic function and optimum design with minimum number of ICs and inputs.)

# Syllabus for B.Tech(ECE) Second Year

Revised Syllabus of B.Tech ECE (for the students who were admitted in Academic Session 2010-2011)



2. Design and implement a 4-digit frequency counter with a clock generator.  
(To learn designing a digital circuit using available standard gate, FF, counter and display Ics.)
3. Designing logic circuits using multiplexers, demultiplexers and gates to implement logic functions.  
(To learn the use multiplexers and demultiplexers)
4. Design and implement a sequence detector.  
(To learn designing a sequential circuit, whose output is 1 or 0 when any input bit is preceded or succeeded by a predefined binary sequence. To define the input & output sequence from a given physical problem, to prepare a state diagram, derive a minimal state table, to find the simplified state equation, to implement the same & verify the result)
5. To design and implement a combination of a logic circuit and a RAM in order to generate a 4-bit data after simplifying a logic expression, to store the output data at a predefined location in the RAM, to retrieve the same and verify.  
(To comprehend the structure and operating principle of memory devices.)

## **D. Power Electronics**

1. Design a Single-phase full & shaft controlled converter.
2. Design of Microprocessor based Triggering socket.