BTech in Electronics and Communications Technology under Gauhati University

Duration – 4 Years Full Time
Course Structure and Detailed Curriculum.
2008

PREAMBLE

Gauhati University aims to achieve academic excellence by providing quality education to students and encourage them to reach the pinnacle of success. The University has a tradition that provides rigorous academic programmes with necessary skills to enable students to excel in their careers. The orientation of the newly proposed courses is towards a linkage to technology primarily to provide the upcoming generation all the skills required to seek dignified employment and obtain education that have universal recognition and acceptability. Gauhati University in its pursuit of excellence considers such courses to be of significance which in the long run will have far reaching impact in the overall development of the NE Region.

This booklet prepared by the Department of Electronics Science, Gauhati University contains the Course Structure, detailed Syllabus and details of Examination. The Programme Structure includes the courses (Core & Elective), arranged semester wise. The Programme is multi-disciplinary in nature and includes Basic Science subjects like Physics, Chemistry, Mathematics and Biology. It also includes Humanities and Management Components as deemed essential.

PROGRAMME OBJECTIVE

The main objective of the programme is to develop skilled professionals in varied areas of Electronics and Communications Technology. The students will be familiarized with basic topics in Science, Management and Humanities. The students will also receive inputs on the foundations of Electronics and Communications Technology and also have an exposure to the advancements in related areas. The highlight of the programme is to give wider coverage of Electronics education, developing understanding of the intriguing issues related to Electronics and Communications Engineering and related areas. The curriculum has an inbuilt system of industrial summer training which keeps students abreast of latest industrial applications. Last semester is mainly devoted to research oriented project which helps the student to develop independent scientific temper with ability to execute a time bound fact finding initiative. The objective is to provide quality education to the youth of not only Assam but of the entire North East. Such courses will also help in reducing the scarcity in quality manpower in technology related areas in this part of the country.

Justification

- The distribution of Engineering colleges and technical institutes in the North Eastern part of India in general and Assam in particular is thin compared to the rest of the country. All of them are unable to meet the increasing demands of qualified technical manpower. Students from this part of the country, therefore, are forced to migrate to other parts of the country and seek technical education, most often in private institutes. It leads to serious problems with regards to quality, validity of the degrees obtained, waste of resources etc. Time has come to initiate certain measures which will slow down the resultant slide in this respect.
- The introduction of a BTech programme in Electronics and Communication Technology under the proposed School of Technology, Gauhati University will be a measure, atleast, to initiate a systematic study of Electronics and related technology at the under graduate level and provide the students greater opportunity to get absorbed. It will help to produce properly trained manpower to meet the needs of the industry and related sectors.
- As demands for students with BTech degrees are ever increasing both in the private and the public sectors, Gauhati University finds it to be an opportune moment to initiate such courses with focus on current needs of the industry.

Course Structure: Programme contents are classified into four groups of courses as below:

(i)	Institute Common Courses (ICC)
(ii)	Departmental General Courses (DGC)
(iii)	Departmental Elective Courses (DEC)
(iv)	Institute Elective Courses (IEC)

L-Lecture, T-Tutorial, P-Practical, C-Credit

Course code:

First Two letters- Subject/ Department/ Discipline

1st digit- year, 2nd digit- semester, 3rd digit – course serial number

First year shall be common with 4-year BS Programme.

The course structure in L-T-P-C format is as below:

Semester	Code	Course Name	L	T	P	C
1	PH 111	Physical Science I (ICC)	3	0	2	5
	CH 111	Chemical Science I (ICC)	3	0	2	5
	MA 111	Mathematical Science I (ICC)	3	0	0	3
	BI 111	Biological Science I (ICC)	3	0	0	3
	CS 111	Computer Fundamentals & Programming –I (ICC)	3	0	2	5
	HS 111	English Language Skills	2	1	0	3
	Semester Total		**17**	**1**	**6**	**24**
2	PH 121	Physical Science II (ICC)	2	0	2	4
	CH 121	Chemical Science II (ICC)	2	0	2	4
	MA 121	Mathematical Science II (ICC)	2	1	0	3
	B1 121	Biological Science II (ICC)	2	0	1	3
	GE 121	Engineering Graphics (ICC)	0	0	1	1
	EL 121	Electrical Circuits (ICC)	2	0	1	3
	CS 121	Computer Fundamentals & Programming-II (ICC)	3	0	1	4
	Semester Total		**13**	**1**	**1**	**22**

Semester	Course Code	Course Name	L	T	P	C	Contact Hours
3	EL 211	Basic Electronics	3	0	1	4	5
	EL 212	Digital Systems	3	0	1	4	5
	EL 213	Material Science & IC Process Technology	2	0	0	2	2
	EL 214	Network Analysis and Synthesis	2	1	0	3	3
	EL 215	Signals & Systems	2	1	1	4	5
	CS 211	Data & File Structures	2	1	1	4	5
	GE 211	Workshop Practice	0	0	1	1	2
	HS 211	Environmental Science	2	0	0	2	2
Semester Total			**16**	**3**	**5**	**24**	**29**
4	EL 221	Electromagnetics	3	0	0	3	3
	EL 222	Instrumentation	3	0	0	3	3
	EL 223	Control System	2	0	1	3	3
	EL 224	Linear Active Circuits	3	0	2	5	7
	EL 225	Microprocessor	3	0	1	4	5
	EL 227	Communication System	3	0	1	4	5
	HS 221	Research Methodology	2	0	0	2	2
Semester Total			**19**	**0**	**5**	**24**	**28**
5	EL 311	Digital Communication	2	0	1	3	4
	EL 312	Microwave Devices	2	0	1	3	4
	EL 313	Digital Signal Processing	3	0	1	4	5
	EL 314	Optoelectronics	2	0	0	2	2
	EL 315	Mechatronics and Electronic System Design	3	0	0	3	3
	EL 316	Microprocessor-II	2	0	1	3	4
	CS 312	Operating System	3	0	1	4	5
	HS 31X	Humanities Elective	2	0	0	2	2
Semester Total			**19**	**0**	**5**	**24**	**29**
6	EL 321	TV Engineering	2	0	0	2	2
	EL 322	Power Electronics	2	0	0	2	2
	EL 323	Photonics	2	0	0	2	2
	EL 324	Microcontroller	3	0	1	4	5
	EL 325	Mobile Communication	3	0	1	4	5
	EL 327	Electrical Machines	2	0	0	2	2
	EL 328	LAB: Electronics Design	0	0	3	3	6
	MG 321	Financial and Cost Accounting	3	0	0	3	3
	Industrial Training		0	0	0	3	2 months
Semester Total			**17**	**0**	**5**	**25**	**27**

7	EL 411	DSP Processors	2	0	1	3	3
	EL 412	Digital Image Processing	3	0	1	4	5
	EL 413	Elective- VLSI Design	3	0	1	4	5
	EL 414	Optical Communication	2	1	0	3	3
	EL 415	Project Phase 1	0	3	3	6	9
	EL 416	Lab: Advanced Electronics Design	0	0	2	2	4
	HS 411	Humanities Elective-Foreign Language	2	0	0	2	2
Semester Total			**12**	**4**	**8**	**24**	**31**
8	EL 421	Project Phase 2	0	6	7	13	20
	EL 422	Elective: Embedded System	2	0	2	4	6
	EL 423	Entrepreneurship Development	2	0	0	2	2
	EL 424	Web Technology	2	1	0	3	3
	EL 425	Seminar and Term Paper	0	2	0	2	2
Semester Total			**6**	**9**	**9**	**24**	**33**

Eligibility:

- Minimum 50 % marks in Physics, Chemistry and mathematics at 10+2 level
- Qualifying position in the AIEEE or CEE, Assam

Selection Procedure: Selection will be on the basis of a selection test and a personal interview held among the students fulfilling the eligibility criteria.

Duration: Four Years (eight semesters) Full time

Examination

Though absolute marking should be the guiding principle of evaluation of performance of students, the performance measure should be reported in terms of grades as per the following classification:

Conversion of marks to Grades:

Actual marks secured by a group of candidates are converted into Relative Percentile (R) before conversion into Relative Letter Grades. The maximum actual marks (i.e. highest mark) (M) secured in a particular group is converted into 100% and other actual marks (A) secured by the students of the same group are converted to the relative percentile

R= Relative Percentile

M = Maximum (Highest) marks in the class.

A= Actual marks of a student who passed i.e. if the actual mark is not less than 30%.

b. Conversion Table: The letter grades and the corresponding grade points are as follows :

Range of	Letter	Grade
90-100	A	10
75-89	B	8
55-74	C	6
40-54	D	4
30-39	E	2
of A/ or R is	F	0

In addition, there shall be one transitional grades 'I'' used by the instructors. The teacher of a subject may award the grade 'I' to a student if the latter was compelled to absent him / her- self from the end semester examination on account of:

i. Illness or accident which disabled him from appearing at the examination.
ii. A calamity in the family at the time of the examination, which, in the opinion of the Institute, required the student to be away from the campus.

A student will be eligible for the award of grade 'I' only if his / her attendance at classes and performance in other components of assessment are complete and satisfactory.

Evaluation is based of the specific clauses mentioned in the programme-specific University Ordinance.

The following pages provide the **detailed syllabus**.

Semester One:

Course Code	Courses	L	T	P	C
PH 111	Physical Science I (ICC)	3	0	2	5
CH 112	Chemical Science I (ICC)	3	0	2	5
MA 113	Mathematical Science I (ICC)	3	0	0	3
BI 114	Biological Science I (ICC)	3	0	0	3
CS 115	Computer Fundamentals & Programming –I (ICC)	3	0	2	5
HS 116	English Language Proficiency (ICC)	2	1	0	3
Semester Total		**17**	**1**	**6**	**24**

PH 111	**Physical Science I (ICC)**	3	0	2	5

Course Objective:
Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering

Course Contents:

Module I:
Rotational motion - Torque and angular momentum, conservation of angular momentum, KE of rotation, Moment of Inertia - Theorem of parallel and perpendicular axes, determination of M.l. Of various geometrical bodies.
Elasticity: Stress & strain, Hook's law -three types of elasticity - Bulk modulus - modulus of rigidity- Young's modulus - relations connecting elastic constants - Poisson's ratio - Experiments detennination of Young's modulus & Poisson's ratio (for rubber). Searle's method for comparison of Young's modulus & coefficient of rigidity for a given material.

Module II:
Simple harmonic motion- equation and energy conservation, superposition of two SHMs, Lissajous figures, damped and forced oscillations- equations, amplitude and frequency response, LCR Circuit, resonance, sharpness of resonance, equation of motion for plane progressive waves, superposition of waves.

Module III:
Interference: Conditions of interference, division of wavefronts, Fresnel's biprism, division of amplitude, interference due to thin films, Newton's ring.
Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, transmission grating and its resolving power.
Polarization: Birefringence, Nicol prism, production and analysis of plane, circularly and elliptically polarized light, Half and quarter wave plates, optical rotation.

Module IV:
Electric potential due to a dipole, uniformly charged sphere, couple on a dipole in an electric field, divergence and curl of electric field, Gauss's divergence theorem, differential form of Laplace's and Poissions equation, Laplace's and Poissions equation in spherical polar co-ordinates, solution of boundary value problem using solution of Laplaces and Poission's equation (one or two dimensions).
Electric potential due to a dipole, uniformly charged sphere, couple on a dipole in an electric field, divergence and curl of electric field, Gauss's divergence theorem, differential form of Laplace's and Poissions equation, Laplace's and Poissions equation in spherical polar co-ordinates, solution of boundary value problem using solution of Laplaces and Poission's equation (one or two dimensions).

Suggested reading:

- Waves & oscillation, A. P. French
- Physics of waves, W. C. Elmore & M. A. Heald
- Introduction to Electrodynamics, D. J. Griffith
- Electrodynamics, Gupta, Kumar & Singh
- Optics, A. K. Ghatak
- Engineering Physics- Satya Prakash
- Engineering Physics- G. Vijaykuamri, Vikash Publishing
- Engineering Physics Practical- G. Vijaykuamri, Vikash Publishing

List of Experiments

1. Determination of acceleration due to gravity 'g' using bar pendulum.
2. Determination of Moment of Inertia.
3. Determination of Young's modulus by Searle's apparatus etc.
4. To study the Newton’s ring.
5. To study the Dispersive power of the material of prism
6. To determine the width of a narrow slit using diffraction phenomena.
7. To study the Polarimeter. To determine the value of specific charge (ratio of e/m) of an electron by Thomson method.
8. To determine the internal resistance of Leclanche cell with the help of Potentiometer.
9. To determine the resistance per unit length of a Carey Foster’s bridge wire and also to find out the specific resistance of a given wire.
10. To plot graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current, and hence estimate the radius of the coil.
11. To study the Platinum resistance thermometer.
12. To study the Coefficient of Linear expansion.

CH 111	Chemical Science I (ICC)	3	0	2	5

Course Objective:

Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. All engineering fields have unique bonds with chemistry whether it is Aerospace, Mechanical, Environmental and other fields the makeup of substances is always a key factor, which must be known. For electronics and computer science engineering, apart from the material, computer modeling and simulation knowledge can be inherited from the molecule designing. The upcoming field of technology like Nanotechnology and Biotechnology depends fully on the knowledge of basic chemistry. With this versatile need in view, course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I : Atomic Structure

Atomic structure;Hydrogen Like orbitals for Many Electron atoms, Electron spin evidence, Pauli Exclusion Principle, The building up principle and the structure of the Periodic Table. Introduction to periodic trends in atomic properties: ionisation energy, electronegativity, electron affinity, atomic and ionic radius.

Autlmu Principle and Electronic Configuration of Elements,Born' s Interpretation of Orbitals. Radial Distribution function Heisenberg's Uncertainty Principle. Orbitals and Orbit, Energies of orbitals and Screening.Ionization energiy, Rlectronegativity. Electron Affinity, Atomic Radius Ionic Configuration and Isoelectronic sequence.

Module II :Chemical Bonding

Chemical bonding and molecular structure/shape; Electron Pair Bond, Heitler Treatment of Hydrogen molecule, orbital overlap, Atomic Hybridization. Electron pair repulsion theory, Sigma and Pi bonded molecules Valence Shell electron Pair Repulsion theory. intermolecular forces; properties of solids; liquids, gases and solutions.

Module III :States of Matter

Overview of properties of the three principal states of matter; solids, liquids and gases. Microscopic view of structure and motion in the three states; radial distribution function. Density, mechanical properties, thermal and electrical conductivity, diffusion and viscosity, degrees of freedom and heat capacity, interaction with light. Introduction to intermolecular forces and potentials. Gas imperfection, Van der Waals equation, virial expansion. Relationship between potential energy curve (isotropic interaction) and the virial coefficients/internal energy.

Module IV :Chemical Behavior

Solutions, acid-base properties and pH Acid/base chemistry;Bronsted-Lowry Acids and Bases, Lewis Concept.Reactions of metals and Nonmetals with water, oxidation and reduction reactions,addition, Displacement and Combustion. Qualitative Description of Electronic transitions.

List of Experiments:

1. Determination of the solubility of a given substance at different temperature and to plot the solubility curve.
2. Determination of the water of crystallization of hydrated salt by ignition and weighing.

3. Detection ofN, S and Halogens from the binary mixture of compounds. Test of functional groups by analytical methods
4. Analysis of functional groups of organic compounds.
5. Preparation of a derivative of organic compound and determination of melting point.
6. To identify the constituents of a given mixture of cations/anions by paper chromatography
7. To determine the water of crystallization of green vitriol by titration with 0.1 N
8. KMn04 solution.
9. To determine the hardness of water by EDTA titration.
10. To determine specific rotation of an optically active substance by Polarimeter. me
11. To determine the concentration of an optically active substance by Polarimetric method.
12. To determine the specific reaction rate of hydrolysis of methyl acetate catalyzed by hydrogen ion at room temperature.

MA 111	**Mathematical Science I (ICC)**	3	0	0	3

Course Objective:
The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Contents:

BI 111	**Biological Science I (ICC)**	3	0	0	3

Course Objective:
The objective of the course is to provide students an understanding of the very basic molecules of life-DNA,RNA, proteins and how these molecules, when form further complex molecules like carbohydrates, vitamins and lipids , then functioning of body takes place. Since technology is advancing in every field, emphasis is also given on the understanding of application of some biotechnological concepts used in our daily life like biofuels, biofertilizers. An introduction to the origin of earth, the environment-air, water and land, origin of life on Earth, how life evolved from a single cell, some environmental problems and measures to be taken to combat them.

Course Contents:

Module I: Overview of plant diversity including bacteria, protests, fungi and plants, Classification, phylogeny and evolution

Module II: Overview of animal diversity, classification phylogeny and evolution. the endocrine, sensory, nervous, circular and respiratory systems

Module 3: Basic chemistry of biomolecules: Carbohydrates: Classifications and biological functions, Amino acids: Classification and properties, Proteins: Classification based on structure and functions, structural organization of proteins (primary, secondary, tertiary and quaternary structures), Lipids Structure, properties, classification and functions and Nucleic acids.

Module 4: Enzymes: Classification, mechanism of enzyme action, factors influencing enzyme activity, co-enzymes and co-factors, Introduction to Plant and Animal hormones.

Module 5: Scopes in microbiology, Concept of microbial diversity

Module 6: Microscopy: Fluorescence, Phase contrast, Electron Microscope

Module 7: Introduction to eubacteria, archaea and eukaryotic microorganisms, Microbial growth: hatch, continuous and synchronized cultures

Module 8: Microbial nutrition: phototrophs, chemotrophs, heterotrophs, Microbial Media: simple. differential and selective, Pure culture technique: Isolation, Preservation and maintenance of culture

Suggested Reading

I. Molecular Biology of cell- Bruce Alberts *el al.,* Garland Publications
2. Molecular Cell Biology - Daniel, Sceintific American Books.
3. Cell Biology - Jack D.Bruke, The William Twilkins Company.
4. Principles of Gene Manipulations - Old and Primrose, Black Well Scientific Publications.
5. Cell Biology - Ambrose and Dorouthy M Hasty, ELBS Publications.
6. Fundamentals of Cytology - Sharp, Mc Graw Hill Company
7. Cytology - Wilson and Marrision, Reinform Publications

8. Molecular Biology - Smith Faber and Faber Publications
9. Cell Biology and Molecular Biology - EDP Roberties and EMF Roberties, Sauder College.
10. Microbiology - Pelczar, Chan, Krieg, Tata McGraw **Hill** Publications.
11. Microbiology - Concepts and Application by Paul A.Ketchum, Wiley Publications
12. Fundaments of Microbiology- Frobisher, Sauders and toppan Publications.
13. Microbiology - Ronald M.Atlas
14. Introductory Biotechnology - R.B. Singh C.B.D. India (1990)
15. Industrial Microbiology - CasidaLE. Wiley Eastern Ltd.
16. Fundamentals of Bacteriology - Salley
17. Fontiers in Microbial technology - P.S.Bisen, CBS Publishers
18. General Microbiology-C.B.Powar, H.F. Daginawala, Himalayan Publishing House
19. Principles of Biochemistry- AlbertL. Lehninger CBS Publishers & Distributors
20. Biochemistry - Keshav Trehan Wiley Eastern Publications
21. Biochemistry- L.U. Satyanarayana, Books and Allied Pvt. Ltd.
22. Outlines of Biochemistry- Conn and Stump, Wiley Eastern Ltd., New Delhi.
23. Biochemistry-Voet and Voet, John Wiley and Sons.

CS 111	Computer Fundamentals & Programming (ICC)	3	0	2	5

Course Objective:
The objective of this course module is to acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Module I: Introduction
Introduction to computer, history, von-Neumann architecture, memory system (hierarchy, characteristics and types),H/W concepts(I/O Devices),S/W concepts(System S/W & Application S/W, utilities).Data Representation: Number systems, character representation codes, Binary ,octal, hexadecimal and their interconversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers, Memory storage unit.

Module II: Programming in C
History of C, Introduction of C, Basic structure of C program, Concept of variables, constants and data types in C, Operators and expressions: Introduction, arithmetic, relational, Logical, Assignment, Increment and decrement operator, Conditional, bitwise operators, Expressions, Precedence of Arithmetic operators, Operator precedence of Arithmetic Operators, Operator precedence and associativity. Managing Input and output Operation, formatting I/O.

Module III: Fundamental Features in C
C Statements, conditional executing using if, else, nesting of if, switch and break Concepts of loops, example of loops in C using for, while and do-while, continue and break. Storage types(automatic, register etc.), predefined processor, Command Line Argument.

Module IV: Arrays and Functions
One dimensional arrays and example of iterative programs using arrays, 2-D arrays Use in matrix computations. Concept of Sub-programming, functions Example of user defined functions. Function prototype, Return values and their types, calling function, function argument, function with variable number of argument, recursion.

Module V: Advanced features in C:
Pointers, relationship between arrays and pointers Argument passing using pointers, Array of pointers. Passing arrays as arguments. Strings and C string library. Structures and Unions. Defining C structures, Giving values to members, Array of structure, Nested structure, passing strings as arguments; File Handling.

Suggested Reading:
- Let us C-Kanitkar,BPB Publishers;
- Programming in C-Balaguswamy,TataMacgrawHill

List of Assignments: Write programmes using C to perform the following:

a. Find prime numbers upto N.
b. Find the greatest common divisor of a number
c. Find factorial of a number using & without using recursion.
d. Write a function to find the sum of series.
e. Find sum, average, minimum & maximum of an array of numbers.
f. For a given string write functions to
    i. Convert it to upper case.
    ii. Find the length
    iii. Reverse the string.
    iv. Write a main function and then give function calls.
g. Check whether a string is palindrome or not.
h. Generate the following pattern.

```
    *
   * *
  *   *   *
```

i. Find the sum of two matrices.
j. Find the sum of diagonal elements of a matrix.
k. Use bubble sort method to sort an array of numbers.

HS 111	English Language Proficiency (ICC)	2	1	0	3

Course Objectives

1. **To** enhance learners' confidence in using English in their academic, professional and social sphere of life
2. To enable the learners to express ideas logically and coherently through speech as well as writing
3. To enable the learners to read different kinds of texts for comprehension
4. To enable the learners to write formal and academic documents like applications, seminar papers, reports etc.
5. To enable the learners to take part in group discussions and practise seminar
   Skills

Course Content

The course content will be divided into six modules comprising Listening, Speaking, Reading, Writing, Vocabulary and Grammar.
Modules 1 & 2 (Listening & Speaking) will be part of Internal Assessment.

Distribution of marks per module

Module	Component	Marks	Assessment	No. of Contact hours
1	Listening	10	Internal, Oral	4
2	Speaking	10	Internal, Oral	4
	Sub Total	**20**		8
3	Readinq	25	External, Written	10
4	Writinq	25	External, Written	10
5	Vocabulary	10	External, Written	3
6	Grammar	20	External, Written	8
	Sub Total	**80**		**31**
	Grand Total	**100**		**39**

Listening: 10 Marks

Objectives

1. To enable the learners to identify the main points and sub-points in oral presentations (e.g., in seminars, class lectures, meetings).
2. To enable the learners to understand speakers' intent and attitude
3. To train the learners to take notes while listening to lectures, presentations or discussions.

Sl. No.	Teaching Point
1	Distinguishing between different functions of communication (con'd)
2	Distinguishing between main and sub-points
3	Listening and note taking
4	Listening for clues to speaker's attitude

Speaking: 10 Marks

Objectives

1. To enable the learners to perform various language functions such as requesting, agreeing & disagreeing, asking for & giving directions and so on
2. To enable them to respond appropriately in formal discussions
3. To enable them to respond appropriately in informal situations

Sl. No.	Teaching Point
1	
2	Practising the use of formal and informal expressions in conversations
3	Describing a process
4	Practising pronunciation in connected s speech

Reading: 25 Marks

Objectives

1. To train the learners to survey a text before reading it
2. To help them in locate the topic sentence in a paragraph
3. To enable them to d!stinguish between main and subordinate ideas in a text
4. To help them to infer ideas implied in a text

Sl. No.	Teaching point
1	Techniques of reading efficiently • Surveying a text
	• Understanding the functions of semantic markers
2	Distinguishing between various types of texts: narrative, descriptive, discursive or expositor
3	Distinguishing between main and subordinate ideas

Writing: 25 Marks

Objectives

1. To enable the learners to use appropriate vocabulary, structures and punctuation in developing different types of paragraphs
2. To help them to take notes from a lecture or passage
3. To train them to transfer graphical presentation of information into text and vice versa
4. To train the learners to edit drafts

Sl. No.	Teaching point
1	Composing and building paragraphs • Using correct punctuation markers • Writing an introduction, body and conclusion of a text • Editing for grammar and overall sense
2	Note taking (different types of notes-list notes, branching notes etc.)
3	Presenting textual information in graphical form and vice versa

Vocabulary: 10 Marks

Objectives

1. To help the learners to recognize words commonly misused
2. To help them know abbreviations of words and their use
3. To familiarize learners with words related to their field of study

Serial No.	Teaching point
1	Words easily confused
2	Common abbreviations
3	Guessing meaning from context
4	Terms used in formal and informal situations

4.

Grammar: 20 Marks

Objectives

1. To enable the learners to use phrases and idioms appropriately
2. To enable them to recognize common mistakes in sentence structure
3. To enable the learners to speak and write intelligible English

Serial No.	Teaching point : The Appropriate Use of
1	Verbs: Tensed and non-tensed, transitivity ,auxiliary and main etc.
2	Clauses • relative clauses • conditional clauses • adverb clauses
3	Identifying common errors (as in concord and subject-verb agreement in structures
4	Agreement: () subject- Verb, person- verb etc

Reference Books

1. *A Course in Listening and Speaking I* (2005) by V.P. Sasikumar, Kiranmai Dutt and G. Rajeevan. (Foundation Books) Cambridge University Press.
2. *A Course in Listening and Speaking /I* (2007) by V.P. Sasikumar, Kiranmai Dutt and G. Rajeevan. (Foundation Books) Cambridge University Press.
3. *Better English Pronunciation* (2000) by J.D. O'Connor Cambridge University Press low priced edition.
4. *Language in Use* (2002) by Adrian Doff and Christopher Jones. Cambridge University Press
5. *Cambridge Advanced English* (2001) by Leo Jones. Cambridge University Press
6. *Study Writing* (2006) by Liz Hamp-Lyons & Ben Heasly. Cambridge University Press
7. *English Vocabulary in Use* (1997) by Stuart Redman. Cambridge University Press

Second Semester

Course code	Courses	L	T	P	C
PH 121	Physical Science II (ICC)	2	0	2	4
CH 121	Chemical Science II (ICC)	2	0	2	4
MA 121	Mathematical Science II (ICC)	2	1	0	3
BI 121	Biological Science II (ICC)	2	0	1	3
GE 121	Engineering Graphics (ICC)	0	0	1	1
EL 121	Electrical Circuits (ICC)	2	0	1	3
CS121	Computer Fundamentals & Programming –II (ICC)	3	0	1	4
Semester Total		**14**	**1**	**9**	**24**

PH 121	Physical Science II (ICC)	2	0	2	4

Course Objective:
Aim of this course is to introduce the students to fundamentals of Physics, which form the basis of all applied science and engineering

Module I: Wave Mechanics
de-Broglie matter waves, wave nature of particles, experimental proof of wave nature of particle; Davision & Garmer experiment, phase and group velocity, Heisenberg uncertainty principle, wave function and its physics interpretation, Operators, expectation values. Time dependent & time independent Schrodinger wave equation for free & bound states, square well potential (rigid wall), Concept of step potential.

Module II: Atomic physics
Inertial & non-inertial frame, Special theory of relativity, Transformation of velocity, Variation of mass, length & time with velocity, Mass-Enrgy equivalence, Vector atom model, LS and j-j coupling, Zeeman effect & Paschen-Back effect

Module III: Solid State Physics
Sommerfield's free electron theory of metals, Fermi energy, Energy bands in solids, physics of semiconductors, doping, intrinsic and extrinsic semiconductors, Depletion layer, characteristics of PN junction, Forward and reverse biasing, Breakdown voltage, Superconductivity, Meissner effect, Introduction to Nanomaterials

Module IV: Nuclear physics
Constituents of a nucleus, mass, mass defect, packing fraction, binding energy, variation of binding energy per nucleon with mass number, nuclear fission and fusion reaction as the source of energy

Suggested Reading

- Nuclear Physics- Kaplan, Narosa Publishing
- Nuclear Physics-D.C.Tayal, Himalaya Publishing
- Nuclear Physics- R C Saxena, Pragati Prakashan
- Engineering Physics, Satya Prakash
- Engineering Physics- G. Vijaykuamri, Vikash Publishing
- College Physics-
- Solid State Physics- Dekkar, McMIllan India Limited
- Solid State Physics-Kittel, Willey Eastern Limited.
- Refresher Course in Physics Vol 1 and II- Arora, S.Chand & Company LTD
- Oscillations, Wave and Sound- Sharma & Saxena, S.Chand & Co LTD
- Properties of Matter- Mathur, S.Chand & Co LTD
- A Textbook of Quantum Mechanics- Mathews and Venkatesan, TMGH
- Principles of Quantum Mechanics- Dirac, Oxford University Press
- College Physics- Sharma & Sharma, Kalyani Publishers

CH 121	Chemical Science II (ICC)	2	0	2	4

Course Objective:
Four basic sciences, Physics, Chemistry, Mathematics and Biology are the building blocks in engineering and technology. Chemistry is essential to develop analytical capabilities of students, so that they can characterize, transform and use materials in engineering and apply knowledge in their field. The course has been designed in such a way so that the student should get an overview of the whole subject starting from the very basic bonding mechanism to the application of materials.

Course Contents:

Module I: Chemical Bonding-II
Molecular Orbital Model and Molecular Energy Level, Linear combination of atomic orbitals, Covalent bond formation. Description of homo nuclear and lIctcronuclear diatomic molecules Frontier Orbitals, De10calised bonding .Acidity and Basicity from concepts of HOMO and LUMO.'

Module II :Fundamentals of Thermodynamics
Thermodynamics, chemical equilibrium; Concepts of Heat and Work in chemical systems. First Law of thermodynamics, Measurement of Heat of Reaction, Bond energies, Gas laws; BoltzmalID Distribution, Concept of Enthalpy. Spontaneous Chemical reaction, Carnot's ideal- real Engine and Entropy, Second law of thermodynamics, Entropy and Probability. Third law of thermodynamics, Entropy of crystals. Free energy and Chemical Equilibrium.

Module III : Kinetics and Mechanism
Rate laws and rate constants. Methods of rate determination. Reaction mechanisms, elementary reaction, Rate limiting step, Steady state approximation. Theories of elementary reaction, Collision theory and transition state theory.

Module IV : Acids and bases - Definitions (Bf0nsted, Lewis), pKas, trends in strengths of acids, Proton-transfer equilibria (Bronsted); nature of chemical equilibrium: relationship of *K* to ~Q(and breakdown of ~Qinto *!:ill,* t3.S) in brief, *pKa* values and terminology; factors affecting *pKa* values in some detail ~ith a wide range of examples to illustrate the operation of electronic effects in organic structures. Lewis acids and bases.

Module V: **Basic organic Chemistry**
Introduction to nuclear, organic, inorganic, and polymer chemistry. Structure and bonding along with elementary reaction mechanisms. Includes extensive treatment of hydrocarbons, alkyl halides, alcohols, and ethers as well as an introduction to spectroscopy.

List of experiments:
1. Estimation of inorganic ions by from the mixture of Cu and Fe volumetric method and separate the ions ..
2. Estimation of inorganic ions from the mixture of Fe and Ca complexometric methods and separate the ions.
3. Estimation of inorganic ions by from the mixture of cr and S04 - 2 precipitation methods and separate the ions.
4. Determination of equivalent mass of an acid by direct titration method.
5. Determination of saponification equivalent of an ester
6. Determination of amount of glucose by titration with Fehling solution.

7. Estimation of Urea by Hypobromite method.
8. To determine the coefficient of viscosity of the given liquid by Ostwald Viscometer.
9. To determine the 'composition of a given mixture by viscosity method.
10. To determine the surface tension of a liquid by stalagmometer.
11. To determine the composition of a given mixture by surface tension method.
12. To determine the mutual solubility curve of phenol and water.
13. To determine the molecular mass of a volatile liquid by Victor Meyer's method.

MA 121	**Mathematical Science II (ICC)**	2	1	0	3

Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

BI 121	**Biological Science II (ICC)**	2	0	1	3

Course Objective:
Cell biology plays a central role to connect the different fields of biotechnology which is highly interdisciplinary. The objective of the present course is to understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques.

Course Contents:
Module I:
Nucleic Acids: Nucleic acid as the genetic material, structure and aggregation of DNA and RNA, DNA double h'elix, different conformations of double helix, DNA supercoiling, denaturation and renaturation of DNA, C-value paradox, Cot curve, chemical complexity.

Module II:
DNA replication, DNA damage and DNA repair, Homologous recombination, site specific recombination and transposons Transcription in Prokaryotes and Eukaryotes, Regulation of gene expression in Prokaryotes, Genetic code, Translation in Prokaryotes and Eukaryotes.

Module III:
History and scope of Immunology, Types of Immunity: acquired and innate; cell mediated and humoral immunity, Cells, tissues and organs of the immune system.

Module IV:
Antigen: antigenicity vs. immunogenicity, Immunoglobulin: structure. function and diversity; antigen-antibody reactions, Concept of ELISA

Module V:
Principles of pH meter, dialysis, Principles of different types of centrifugation, ultracentrifugation, General principles of chromatography, adsorption chromatography. column, affinity. TLC, partition, Ion exchange, gel filtration and penneation chromatography

Module VI:
Principles and application of gel electrophoresis, Spectroscopic techniques: principles and applications of spectroscopy, Radioisotope technique: nature of radioactivity, principles of radioisotopes, radioactive decay,

Module VII:
Mendel's laws of inheritance, Linkage and crossing over, Sex determination and sex linked inheritance, Mutation and mutagenesis

Module VIII: Population genetics: Hardy-Weinberg equilibrium, Evidences of evolution.

Suggested Reading:

1. Molecular Biotechnology, Principles and application of recombinant DNA, Glick, B.T and Pastermak J.J (1998) Washington D.C. ASM press. Howe.C. (1995)
2. Gene Cloning and Manipulations, Cambridge University Press, USA Lewin, B., Gene VI New York Oxford University Press.
3. Genetic Engineering, Rigby, P. W.J. (1987), Academic Press Inc. Florida, USA.
4. Molecular Cloning Volumes **I,** II, & III Sambrooket al (2000) Cold spring Harbor Laboratory Press, New York, USA
5. Fundamental immunology William, E. Paul (1989), 2nd Edition Raven Press, New York.
6. The Experimental Foundations of Modern Immunology William. R. Clark (1991) (4th Edition) John Wiley and Sons, New York.
7. Statistics in Biology, Vol. I- Bliss, C.lK. (1967) Mc Graw Hill, New York.
8. Campbell R.C.(1974) Statistics for Biologists, Cambridge Dniv. Press, Cambridge.
9. Biostatistics (3rd Edition)- Daniel (1999) Panima Publications Corporation.
12. Practical Statistics for Experimental Biologists- Swardlaw, A.C. (1985), John Wiley and sons, Inc, NY
13. Fundamentals of Biostatistics- Khan (1999)
14. Principles of Genetics - E.J.Gardener, M.J.Simmons and D.P.Snustad, John Wiley and Sons Publications.
15. Genetics- M.W. Strickberger, Prentice Hall ofIndia Pvt. Ltd., New- Delhi.
16. Fundamentals of Genetics- B.D. Singh
17. Principle of Genetics - Gardner
18. Principles of Genetics - E..T.Gardener, M.lSimmons and D.P.Snustad, John Wiley and Sons Publications.

GE 121	**Engineering Graphics (ICC)**	0	0	1	1

Course Objective:
This course will provide students concepts on the drawings of different curves like straight line, parabola, ellipse etc. After completion of this course, students will be able to draw different figures manually and will be capable of using various instruments involved in drawings.

Course Contents:

Module I: General
Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Scales, Sense of proportioning, Different types of projections, Orthographic Projection, B.I.S. Specifications.

Module II: Projections of Point and Lines
Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.

Module III: Planes other than the Reference Planes
Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., Projections of points and lines lying in the planes, conversion of oblique plane into auxiliary Plane and solution of related problems.

Module IV: Projections of Plane Figures
Different cases of plane figures (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection.

Module V: Projection of Solids
Simple cases when solid is placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.

Module VI: **Development of Surface**
Development of simple objects with and without sectioning. Isometric Projection

Suggested Reading:

- Engineering Drawing and Grpahics- T Jeyapoovan, Vikash Publishing House.
- Engineering Drawing, M.B. Shah & B.C. Rana, Pearson Education, 2007
- Engineering Drawing, PS Gill, Kataria Publication
- Engineering Drawing, ND Bhatt, Charotar publications
- Engineering Drawing, N Sidheshwar, Tata McGraw Hill
- Mechanical Drawing, CL Tanta, Dhanpat Rai

EL 121	Electrical Circuits (ICC)	3	0	2	5

Course Objective:
The objective of the course is to provide a brief knowledge of Electrical Engineering and includes some theorems related to electrical, some law's related to flow of current, voltages, basic knowledge of transformer, basic knowledge of electromagnetism, basic knowledge of electrical network.

Course Contents:
Module I: Basic Electrical Quantities
Basic Electrical definitions-Energy, Power, Charge, Current, Voltage, Electric Field Strength, Magnetic Flux Density, etc., Resistance, Inductance and Capacitance. Ideal Source, Independent Source and Controlled Source

Module II: Network Analysis Techniques & Theorems
Circuit Principles: Ohm's Law, Kirchoff's Current Law, Kirchoff's Voltage Law Network Reduction: Star–Delta Transformation, Source Transformation, Nodal Analysis, Loop analysis. Superposition theorem, Thevenin's Theorem, Norton's theorem and Reciprocity theorem.

Module III: Alternating Current Circuits
Peak, Average and RMS values for alternating currents, Power calculation- reactive power, active power, complex power, power factor, impedance, reactance, conductance; Resonance: series Resonance, parallel resonance, basic definition of Q factor & Band-width. Passive filters- low pass, high pass, band pass and band reject.

Module IV: Transformers
Magnetic circuits, self and mutual inductance; Basic Transformer Operation principle, Construction, Voltage relations, current relations, Linear circuit models, open circuit test, short circuit test, Transformer Efficiency.

Module V: Polyphase circuits
Advantages in favour of polyphase circuits, Generation of three phase
emf, phase sequence, connection of three-phase winding, line and phase quantities in star connected circuit, line and phase quantities in delta-connected system, power in three-phase systems with balanced load.

Module VI: Bridges
Basic principles of working of a potentiometer, Generalized Wheatstone bridge, Anderson bridge, Maxwell's bridge, Schering bridge, Wien bridge, simple problems.

List of experiments:

1. To verify voltage and current division rules.
2. To verify the Thevenin's theorem & determine the equivalent circuit.
3. To verify the Norton's theorem & determine the equivalent circuit
4. To verify the Maximum power transfer theorem & determine the matched condition.
5. To design 1^{st} order and 2^{nd} order passive low pass filter and determination of the cut-off frequencies.
6. To design 1^{st} order and 2^{nd} order passive high pass filter and determination of the cut-off frequencies.

7. To design a series tuned circuit using RLC components & to determine its Q-point & bandwidth.
8. To design a parallel tuned circuit using RLC components & to determine its Q-point & bandwidth.
9. To design a passive differentiator and integrator and to determine the respective time constants.
10. To measure self inductance of an inductor by Anderson bridge.
11. Investigation of an inductance in an a.c. circuit.
    a)To verify the current -voltage characteristics for an inductance in a.c.circuit & hence to measure the value of inductance.
    b)To measure the reactance of an inductance coil in L.R. circuit.
    c)To study the variation of reactance of the inductive coil with frequency of the a.c. source & hence to measure its inductance.
12. Investigation of a capacitance in an alternating current circuit:
    a)To verify that the current -voltage relationship for a capacitor in a.c. circuit is linear & hence to measure the value of the capacitance.
    b)To measure the loss factor of a capacitor from the reactance characteristics of a C.R. circuit.
    c)To study the variation of reactance of a capacitor with frequency of the alternating current source & hence to measure the capacitance
13. To find the thermo emf of the given thermocouple using potentiometer.
14. To find the resistance of a potentiometer wire.

Suggested Reading:

1. Network Analysis- G.K. Mittal, Khanna Publishers.
2. Network Theory and filters Design V.K. Aatre, Wily Eastern Ltd.
3. Engineering Circuit Analysis- W.H. Hayt and J.E. Kemmerly, McGraw Hill
4. Network Analysis- M.E. Van Valkenberg, Prentice Hall of India
5. Network Analysis- Ghosh, PHI
6. Linear Circuit Analysis- Liu, Oxford University Press;
7. Network Analysis- Stanlay, Pearson Education;
8. Fundamentals of Electrical Engineering- Del Toro, PHI
9. Electrical Engineering- B.L. Thareja
10. Electric Circuits- Rajeshswaran, Pearson Education;
11. Electronics Lab Primer- K. K. Sarma, Global Publishing;

CS121	**Computer Fundamentals & Programming-II (ICC)**	**3**	**0**	**1**	**4**

Semester Three

Course Code	Course Name	L	T	P	C	Contact Hours
EL 211	Basic Electronics	3	0	1	4	5
EL 212	Digital Systems	3	0	1	4	5
EL 213	Material Science & IC Process Technology	2	0	0	2	2
EL 214	Network Analysis and Synthesis	2	1	0	3	3
EL 215	Signals & Systems	2	1	1	4	5
CS 211	Data & File Structures	2	1	1	4	5
GE 211	Workshop Practice	0	0	1	1	2
HS 211	Environmental Science	2	0	0	2	2
Semester Total		16	3	5	24	29

EL 211	**Basic Electronics**	3	0	1	4

Course Objective: To provide the students

- Basic understanding of semiconductor devices and circuits
- Knowledge to develop skills for semiconductor based device design
- Exposure to the underlying phenomena that govern semiconductor behaviour and characteristics.

Module 1

Physics of p-n junction –unbiased and biased, Diode equation, V-I characteristics of p-n junction diodes, Q-point & load line of a diode; resistance of a diode, temperature effect; reverse breakdown- avalanche & zener phenomena; Zener diode, varactor diode, tunnel diode, Schottky diode. Junction capacitance-transition and diffusion capacitances, dependence on barrier width and carrier densities.

Module 2:

Diode as a circuit element, equivalent representation of a diode, diode as a rectifier, half wave & full wave rectifiers, peak inverse voltage, bridge rectifier, effect of filters, Zener diode as regulator, load & line regulation, regulated power supply, basic idea-clipper, clamper, voltage multiplier.

Module -3

(a) Physics of BJT, Detailed analysis of current flow in BJT, Base-width modulation, Breakdown voltages.
(b) BJT characteristics and equivalent circuit, h-parameters. Biasing- dc load line & bias point, Fixed current bias, collector to base bias, emitter current bias, Thermal stability, ac load line, switching and amplification properties. Biasing transistor switching circuits. Transistor specifications & performance: Transistor data sheet, power dissipation, heat sinking, Decibels and frequency response, Transistor circuit noise, Transistor switching times.

Module -4

(a) JFET, Detailed analysis of current flow, second order effects, MOSFET, Detailed analysis of current flow, SCR and Power handling devices.
(b)JFET Data sheet & Parameters, FET voltage amplification, FET equivalent circuit, FET Biasing: dc load line & Bias point, Fixed voltage bias circuit, self bias circuit, potential divider bias.

Module -5

Small signal amplifiers: CE amplifier design, CS FET amplifier design, capacitor coupled two stage CE amplifier, Direct coupling between stages. Large signal amplifier: Transformer coupled class A amplifier and its design, capacitor coupled power amplifier.

Module -6

Negative Feedback: Concept, Current series and shunt, voltage series and shunt, amplifier circuit design with negative feedback, effects of negative feedback.

Module -7

OPAMP : Basic OPAMP circuit, Integrated circuit OPAMP, Biasing of OPAMP, Non inverting & inverting circuit, OPAMP non-linear circuits, OPAMP circuit stability, frequency and phase response, frequency compensation, circuits Bandwidth, circuit Stability precautions. Wave shaping circuit, frequency to voltage and voltage to frequency converters, Active Filters, Inductance simulation, OPAMP Voltage comparator, precision rectifier circuit, Schmitt trigger circuit, oscillators.

List of experiments:

1 To determine the V-I characteristics of a semiconductor diode and to draw its load line.
2 Study the zener diode:
   a. a) To study reverse bias characteristics of a zener diode.
   b. b) To study the load & line regulation of a zener diode voltage regulator
3 To design a halfwave rectifier using diode. Use filtering.
4 To design a double diode fullwave rectifier. Use filtering.
5 To design a fullwave bridge rectifier. Use filtering.
6 To study the static characteristics of the BJT in C-E mode & to determine its h-parameters. Draw the load line
7 To design a single stage RC coupled amplifier using BJT in C-E mode & to determine its voltage gain. Obtain its frequency response plot. Find the bandwidth.
8 To design a complete zener /IC regulated power supply. It may be treated as a mini project.
9 To design and study double stage RC-coupled BJT amplifier.
10 To study op-amp as (i) Inverting amplifier (ii) Non-inverting amplifier (iii) Voltage follower, (iv) Summing amplifier and (v) Subtrator using IC741.
11 To measure the phase difference of a given signal using Lissajous figure.

Suggested reading:

1. Electronic Devices & circuits. - David A. Bell, PHI
2. Semiconductor Devices - Jasprit Singh, John Wiley
3. Transistor- - Dennis Le Croissette.
4. Electronic Devises & Circuits Theory - Boylestad & Nashalsky. Pearson Education
5. Electronic Device & Circuit - Millman-Halkias, Tata McGraw Hill.
6. Electronic Design: From Concept to Reality - - Roden,. Carpenter, Wiesrman (SPD).
7. Introduction to Electronic Circuit Design – - Spencer & Ghausi, Pearson Education
8. Electronics Lab Primer- K.K. Sarma, Global Publishing;

EL 212	**Digital Systems**	3	0	1	4

Course objective:

- To provide insights into design of devices using digital techniques.
- To provide students knowledge about binary sytems, logic families and applications based on binary system.

Module-1 Number system and logic gates: Binary, octal and hexadecimal numbers, representation of signed integers, binary arithmetic on signed and unsigned integers and detection of overflow and underflow, Weighted Binary Codes: BCD, 2421, Reflective and sequential codes, Non-weighted codes: Excess-3 Codes, Gray codes, Error detecting codes, Error correcting codes, Alphanumeric Codes: ASCII Code, EBCDIC Codes and Hollerith code. Boolean operators, Rules (postulates and basic theorems) of Boolean algebra, Dual and complement of a Boolean expression, Sum of products and product of sums forms. Canonical forms. Conversion between different forms, Conversion between Boolean expression and truth table;Logic gates, Implementing logic expressions with logic gates (logic circuits).

Module -2 Digital logic families: Designing of basic logic gates with diode and transistor ; elementary idea of DTL, TTL, RTL, ECL,12L logic family and characteristics ; 7400 series, understanding of the basic NAND gate (TTL)

Module -4 Digital Circuits- Combinational: Boolean expressions and their simplification by algebraic method. Karnaugh map method and Quine-Mc Cluskey method, Don't Care conditions. Multiplexer, demultiplexer, encoder, decoder, Half-adder, Full-adder, magnitude comparator, Parity Checkers: Basic concepts, Design of parity checkers, parity generation, Code converters, Binary –to- Gray and Gray-to-Binary Code converter; Concept of magnitude comparator;
Sequential circuit: Simple R-S flip-flop or Latch, Clocked R-S Flip-flop, D flip-flop. J-K flip-flop, T flip-flop, Master-Slave flip-flop, J-K Master-Slave flip-flop. Asynchronous pre set and clear, edge triggering and level triggering. Registers: Shift registers, parallel/serial in, parallel/serial out. Buffer Counter design: different types of counters like asynchronous and synchronous, UP and Down, ring, Johnson etc. counter design using state diagram, state table and state equation.

Module -5: Semiconductor Memory: Classification of memories, Main Memory and Secondary Memory, Sequential Access Memory, Static and Dynamic Memory, Volatile and Non-volatile Memory, Concept of ROM, PROM, EPROM, RAM, DRAM, SDRAM, PSRAM, Memory Decoding, Programmable Logic Devices (PLD), Programmable Logic Array (PLA)

Module -6: IC Timer 555: Basics of IC555 Timer, Monostable and Astable Multivibrator using IC555, Schmitt Trigger using IC555, Some other applications.

Suggested reading:

1. Digital logic and computer design, -M. Mano. PHI.
2. Modern Digital Electronics - R.P. Jain, TMGH
3. Digital Fundamentals - Jain and Floyd, Pearson Education
4. Digital Electronics - Malvino & Leach, Pearson Education
5. Digital Computer Electronics - Malvino, TMGH
6. Digital Design - Morris Mano, Pearson Education

7. Digital Circuits and Design -S. Salivahanan and S. Arivazhagan, Vikash Publishing House Pvt. Ltd.
8. Digital Techniques - Prof. P. H. Talukdar, N. L. Publications
9. Digital Design - Wakerly, PHI

Practical:
List of experiments:

1 To verify the logic gates (i) AND gate (ii) OR gate (iii) NAND gate (iv) NOT gate
   (a) Using diode or BJT and resistance.
   (b) Using ICs- 7400 (ii) 7402 (iii) 7408 (iv) 7432 (v) 7486 (vi) 7404
2 To design and RS-flip-flop and study its truth table.
3 To design and study half and full adder circuit using logic gates.
4 To design and study 4:1 Multiplexer circuit using logic gates.
5 Design of a D/A converter using ladder method. Study the DAC 0808.Record the output corresponding to a digital input.
6 Design of a JK-Flip-flop. Display the results using LEDs.
7 Design of a 4-bit counter using IC7470/ 7472 (JK-flipflop). Display the output using LEDs or 7-segment LED display. Repeat the above using IC 74161/74162/74163 (4-bit counter).
8 Design a 8:1 multiplexer using common gates. Study IC74151 (8:1 multiplexer) and verify the truth tables.

EL 213	**Material Science and IC Process Technology (ICC)**	2	0	0	2

Course Objective:
To develop insights of the student regarding properties, characteristics and governing principles of materials used for Electronic device design.
To provide the theoretical foundation to students regarding methods of thin film and IC fabrication

Module 1: Introduction:
Crystal binding, ionic, covalent, metallic & Vander wall bond, Unit cell, Bravis lattice; Crystal defects;
Classical free electron theory- Electrical and thermal properties of metals, Relaxation time & mean free path, Qualitative discussion of the Block function, Kronig-Penny model, E-K diagram, Reduced zone representation, Brillouin-zone, concept of effective mass & holes;
Brief idea of dielectric materials, spontaneous polarization, ferroelectric &. Piezoelectric materials;
Introduction to magnetic materials-origin of dipole moment, classification & properties of magnetic materials;

Module 2: Classification of solids:
conductors, insulator & semiconductors. Properties of conductors & Insulators, Resistivity of conductors & insulators, Temperature coefficient, Insulation resistance, non-linear resistance, incremental & differential resistance, materials for resistors;
Introduction to vacuum tubes-diode, triode, tetrode, & pentode (brief review, V-I characteristics, tube parameters & applications)

Module 3: Semiconductors:
Energy band theory of semiconductors, Intrinsic, Extrinsic, degenerate, non degenerate, elemental & compound semiconductors; luminescence-photoluminescence, cathodoluminescence & electroluminiscence; Drift & diffusion process, Einstein's relation, calculation of Fermi level of the semiconductors.. Introduction to III-V semiconductors. Hall effect; introduction to metal-insulator-semiconductor junction;

Module 4: Special Materials-
Electrical conduction in polymers, polymer materials (OLED), optical fiber materials, Ceramics materials, Solar cell materials, materials for VLSI. Superconducting materials

Module 5: Thin Film
Basic definitions- thin and thick films, properties of thin films, thin film deposition methods- PVD, CVD, Epitaxy theory of nucleation and growth in thin films; VPE, LPE, MOCVD, MBE techniques Growth of multilayer structure, defects; diffusion, method of control and measurement of film thickness, structure, optical, electrical and mechanical characterization of thin films metallic, semi conducting and insulating films; non crystalline films; various applications of thin films.

Module6: I.C. Processing

Introduction to I.C s – Definition, scale of integration, types-monolithic, hybrid, thick & thin films; capacitance & resistance formation in ICs , idea of fabrication (silicon planar technology). Fabrication of diode, BJT, FET & MOSFET in ICs; Bulk semiconductor growth: zone refining technique Czochralski growth, vertical and horizontal Bridgman technique. Wafer preparation, oxidation, diffusion, ion implantation, metallization, pattern definition, encapsulation, lithography: advanced processing technique, electron beam lithography, soft x-ray lithography various types of etching plasma etching.

Suggested Reading:

1. Physics of semiconductor devices- S.M Sze John Wiley
2. Semiconductor devices- J. Singh, Mcgrawhill
3. Semiconductor optoelectronics device- P. Bhattacharya, Pearson Education;
4. Solid State Electronic Devices- Banerjee, Streetman, Pearson Education;
5. An Introduction to Solid State Physics- Charles Kittel, Wiley Publishers.
6. Electronics in metals- J.M.Ziman.
7. Solid state Electronics- S.Wang.
8. Electrical properties of materials- L.Solymar and D Walsh
9. The Materials Science of Thin Films - M. Ohring, . Academic
10. Thin film fundamentals - A. Goswami, New Agency Institute Pub.
11. Preparation of thin films- J. George. M. Dekker Inc.
12. Microelectronics- Millman, Mcrawhill.
13. VLSI fabrication principles.- Gandhi. S.K. Wiley
14. VLSI technology Sze S.M- Mcgrawhill
15. Integrated Circuit and fabrication- Elliot, McGrawhill publication

EL 214	Network Analysis and Synthesis	2	1	0	3

Course objective:
To provide the student the exposure of advanced skills of network analysis and synthesis.

Module–1: Review of network theorems:
Superposition, Maximum power transfer, Thevenin's and Norton's theorem.

Module – 2: Transient response and Laplace tranformation of networks:
Step function response of linear R-L, R-C, and R-L-C network. Network analysis using Laplace transformation: Laplace Transformation and inverse Laplace tranformation, Application of Laplace transformation in R-L, R-C and R-L-C networks; Response to R-L, R-C and R-L-C networks to step & sinusoidal voltage, impedance and transfer function of a two port network. Phasor diagram, Driving point impedance and transfer impedance, magnitude and phase response curves in S-planes, Poles and Zeroes, Method of partial fractions.

Module –3: Fourier analysis:
Fourier analysis of a periodic signal, Fourier integral, Power and Energy relationship in Network by Fourier method.

Module –4: Network parameters of two port network:
Short circuit admittance, open circuit impedance, transmission and Hybrid parameters, T-section and Π section representation of a two port network, Symmetrical, Ladder and Lattice network.

Module – 5: Network Syntheses:
Positive real functions; Hurwitz Polynomials, Realizability condition of network, Foster 1^{st} and 2^{nd} form ofnetwork synthesis for one port network, Cauer 1^{st} and 2^{nd} form.

Module – 6: Network Filters:
Filter Approximation and Frequency Transformation; Passive Filters, High pass, Low pass, Band pass and band elimination filters, m-derived filters, Butterworth approximation; Chebychev and Bessel response.

Module -7: Graph theory
Graph of a network and its parts; Oriented graph; Tree; Co-tree; Loops; Tie-set; Cut-set matrix; Incidence matrices; Network equilibrium equations

Suggested Reading:

1. Network Analysis- G.K. Mittal, Khanna Publishers.
2. Network Theory and filters Design V.K. Aatre, Wily Eastern Ltd.
3. Engineering Circuit Analysis- W.H. Hayt and J.E. Kemmerly, McGraw Hill
4. Network Analysis- M.E. Van Valkenberg, Prentice Hall of India
5. Network Analysis- Ghosh, PHI
6. Linear Circuit Analysis- Liu, Oxford University Press;
7. Network Analysis- Stanlay, Pearson Education;

EL 215	**Signals & Systems (DGC)**	2	1	1	4

Course Objective

- To provide insights into signals and types, methods of processing and transformation.
- To expose students to types of discrete systems, types and application.

Module 1: Signal and System classification:
Signals- Periodic, aperiodic; even-odd; exponential, sinusoidal; unit impulse & unit step functions; System with & without memory; invariability & inverse system; causality, linearity, time invariance; Sampling of signals and discrete signals;

Module 2: Signal Representation:
Signal space and orthogonal bases; Fourier series representation of continuous-time and discrete-time signals; continuous-time; Fourier transform and its properties; Parseval's relation, time-bandwidth product; discrete-time Fourier transform and its properties; relations among various Fourier representations;

Module 3: Sampling:
Sampling theorem and its implications: spectra of sampled signals; reconstruction: ideal interpolator, zero-order hold, first-order hold; aliasing and its effects. Time-frequency analysis: time-frequency representation and the uncertainty principle, short-time Fourier transforms and wavelet transforms.

Module 4: Linear time invariant [LTI] system
Review of basic principles of Fourier Transform- Sampling of analog signal, Representation of discrete time signals in terms of impulses; convolution; convolution sum representation of LTI systems; properties of LTI systems-commutative, distributive, associative; LTI systems with & without memory, causality, linearity, stability of LTI systems; Unit impulse response of an LTI system; Interconnection of LTI systems; Correlation, cross correlation and autocorrelation

Module 5: Discrete Fourier Transform
Definition, properties; linear & non-linear phase; DFT-definition & properties; Discrete linear and periodic convolution; IDFT. Relation of DFT to other transformation; FFT-Decimation in time and frequency; Radix-2 and radix-4 algorithms; Spectrum analysis using FFT; Discrete power spectral density;

Module 6 : z-transform
Definition, properties; inverse z-transform; relation with other transforms; Convolution, correlation- cross correlation and autocorrelation;

Suggested Reading:

1. Signals & Systems- Oppenheim & Willsky, PHI.
2. Digital Signal Processing- Mitra,Tata McgrawHill
3. Digital Signal processing- Proakis, Pearson Education;
4. Digital Signal processing- Salivahanan, Vallavaraja, Gnanapriya, TMGH
5. Digital Signal Processing- Bandopadyaya, PHI
6. Signal, System and Transforms- Philip, Pearson Education

CS 211	Data & File Structures	2	1	1	4

Course Objective:

- To provide exposure to students to advanced concepts in programming.
- To develop the skills of the students in applying concepts of OOPs and data structure for application development.

Module 1: Introduction
Assembler, Compiler, Interpreter; Attributes of a C++ programme; Structure of a C++ programme; C+= declarations; Data types; Operators; Order of precedence of operators; I/O process; Pre-processor directives;

Module 2: Control Structures
Decision making statements; If-else; Nested if-else; Do-while; goto; break; continue; switch; for loop;

Module 3: Array, String and Pointers
Definition, types; examples of 2-D arrays; examples - matrix addition, transpose, trace etc; String- creation, insertion, concatenation etc; Definition of pointer, pointers and arrays, arrays of pointers;

Module 4: Functions
Definition- types, parameter passing; referencing; functions and arrays; using of pointers for parameter passing; Prototyping; recursion; file handling;

Module 5: Class and Object
Structures-definition; Classes-definition, member functions, characteristics of member functions; encapsulation; Declaration of objects, static objects, array of objects; constructors and destructors; operator overloading and type conversion;

Module 6: Inheritance
Definition; Access specifiers and simple inheritance, types of inheritance- single, multilevel, multiple, hierarchical, hybrid, multipath; abstract classes; Pointers and inheritance; Advantage of inheritance;

Module7: Data Structures
Definition and examples of data structure, stack, queue, link list; function and data structure; Sorting- selection, insertion, quick; Search- Linear, binary; Dynamic memory allocation;

Suggested Reading:

1. Programming in C++ - Kamthane, Pearson Education;
2. Programming in C++ - Balaguruswamy, TMGH;
3. Let us C++ - Kanitkar, BPB Publishers

GE 211	**Workshop Practice**	0	0	1	1

Course Objective

The objective of the course is to provide hands –on exposure and training on different practices required for handling Civil, Mechanical, Electrical and Electronic components which a prospective technology student can encounter. The course aims to develop an understanding of different workshop practices adopted in technology and engineering applications.

Module I: Civil Engineering practice

Practices in Plumbing: Preparation of sketches, pipeline to washbasin, washing machine, water heater, water cooler;

Wood work- Sawing & Planing, Half-lap joit, Tee Lap Joint, Dovetail Halving Joint, Mortise & Tandon Joint, Mitre Faced Bridle Joint;

Pipeline connections on the suction and delivery lines, joints in door panels & wooden furniture;

Module II: Mechanical Engineering practice

Practices in Welding- Square butt joint, Lap joint, tee fillet joint, single & double vee joint, Gas welding practice;

Practices in Machining- Turning, facing & chamfering, step turning & grooving, taper turning, knurling & drilling,

Practices in fitting- Square, Tee, Vee, Radius, Dovetail, Stepped Fitting;

Practices in metal work- Square tray, rectangular tray, dust pan, frustum of a cone-funnel;

Module III: Electrical Engineering practice

Best practices; tools commonly used; service meter wiring;

Wiring- Staircase, Tube light, lamp & fan; Calibration of ammeter & voltmeter; measurement of power using wattmeter;

Module IV: Electronics Engineering practice

Best practices; tools commonly used; Study of electronic components & equipments, familiarization with components like resistance, capacitors, inductors, diode, BJT, JFET; Assembly of components on a PCB, soldering, de-soldering, continuity check using multimeter;

Suggested Reading:

1. Engineering Practices Lab Manual- Jeyapoovam, Saravanapandian, Vikash Publishing;
2. Electronics Lab Primer- K.K. Sarma, Global Publishing;

HS 211	HS Elective: Environnemental Science	2	0	0	2

Course Objective:
Environment constitutes one of the most important ingredients because of the global problems. Thus, it is imperative to understand the Bioremeditation of different components of environment. The present course will make them competent academically to envisage the different problems.

Course Contents:
Module I: Introduction
Ecology and ecosystem.

Module II: Environmental pollution
Water, soil and air, noise and thermal pollution, their sources and effects.

Module III: Waste water (sewage and industrial effluents) treatments
anaerobic and aerobic treatment, conventional and advanced treatment technology, methanogenesis, methanogenic, acetogenic, and fermentative bacteria- technical process and conditions, emerging biotechnological processes in waste - water treatment.

Module IV: Solid waste management
Landfills, composting, earthworm treatment, recycling and processing of organic residues**.**

Module V: Biodegradation
Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants and microbial treatment of oil pollution

Module VI: Microbial leaching and mining
Microbial leaching and mining : Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.

Module VII: Wasteland
Wasteland : Uses and management, bioremediation and biorestoration of contaminated lands.

Module VIII: Environmental genetics
Environmental genetics: degradative plasmids, release of genetically engineered microbes in environment.

Module IX: Hazardous wastes
Hazardous wastes: source management and safety.

Suggested Reading:

- Environmental Biotechnology by PK Mohapatra
- Comprehensive Biotechnology (Vol. 1-4): M.Y.Young (Eds.), Pergamon Press, Oxford.
- Environmental Microbiology: W.D. Grant & P.E. Long, Blakie, Glassgow and London.
- Microbial Gene Technology : H. Polasa (ED.) South Asian Publishers, New Delhi.
- Biotreatment Systems, Vol. 22, D. L. Wise (Ed.), CRCPress, INC.
- Standard Methods for the Examination of Water and Waste Water (14 th Education) , 1985. American Public health Association.

Semester Four

Course Code	Courses	L	T	P	C
EL 221	Electromagnetics (DGC)	3	0	0	3
EL 222	Instrumentation (DGC)	3	0	0	3
EL 223	Control System (DGC)	2	0	1	3
EL 224	Linear Active Circuits (DGC)	3	0	2	5
EL 225	Microprocessor (DGC)	3	0	1	4
EL 227	Communication System (DGC)	3	0	1	4
HS 221	Research Methodology	2	0	0	2
Semester Total		**19**	**0**	**5**	**24**

EL 221	**Electromagnetics (DGC)**	3	0	0	3

Course Objective
To provide exposure to students to the principles governing Electromagnetics, working, radiating systems, waveguides, transmission lines and antenna and the respective applications.

Module 1: Fundamentals concepts-
Vector Analysis, Electrostatics in Vacuum & Dielectrics, Boundary Value Problems, Magnetostatic Field, Electromagnetic Field; Maxwell's equations and solutions;

Module 2 : Uniform plane waves: Uniform plane waves in time domain in free space, sinusoidal time-varying uniform plane waves in free space, wave equation and solution for material medium, uniform plane waves in Dielectrics and conductors, Poynting Vector, Power dissipation and energy storage,

Module 3: Transmission lines 1(TL1)(time domain analysis): TL equations and solutions, Determination of line parameters, line terminated by resistive load, bounce diagram,TL discontinuity, Reactive and nonlinear resistive elements.

Module 4: TL 2 (sinusoidal steady state analysis): short circuited line, Line terminated by arbitrary load, TL line matching; Quarter wave transformer matching, single stub matching, Double stub matching, the smith chart and applications, the lossy line.

Module 5: Metallic Waveguides and resonators: uniform plane wave propagation in an arbitrary distinction, TE and TM waves in a parallel-plate waveguide Rectangular waveguide and cavity Resonator, Losses in Waveguides and Resonators.

Suggested Reading:

1. Elements of Engineering Electromagnetics – N.N. Rao, Pearson Education
2. Field and Wave Electromagnetics – D.K. Cheng, Pearson Education
3. Electromagnetic Waves & Radiating systems – Jordan & Balmain, TMGH
4. Electromagnetic Field Theory and Transmission Lines-Raju, Pearson Education
5. Antenna and Wave Propagation- Raju, Pearson Education

EL 222	**Instrumentation (DGC)**	3	0	0	3

Course Objective:
To familiarize the student with the principles of instrumentation system, working of different instruments, methods of application and types.

Module 1: Instrumentation scheme & error:
Electronic instruments & their characteristics, a generalized instrumentation scheme, classification of instrumentation error & their statistical behaviour; Basic instrumentation circuits- Operational amplifier application, Instrumentation amplifier, Noise measurements and noise reduction techniques

Module 2: Measurements:
Measurement of current ,voltage & power at audio & radio frequencies; electrostatic rectifier & thermocouple type instruments; advantage of electronic voltmeters, vacuum tube voltmeters(diode type only); True RMS-Responding voltmeter, digital voltmeter, Q meter, power factor meter; DC ammeters; ohmmeter, multimeter-analog & digital

Module 3: Signal generators:
Basic circuits for generation of square wave & triangular wave. Block diagram of laboratory square-wave & pulse generator. Function generator (block diagram), sine wave generation by a sine shaper (qualitative idea);sweep generator

Module 4: Cathode Ray Oscilloscope:
Motion of charged particles in electric & magnetic fields in simultaneous electric & magnetic field (cross & parallel) Block diagram of CRO, CRT: construction principles of focusing & deflection of electron beam,CRT screens vertical deflection system, vertical amplifier, delay line, horizontal amplifier, synchronization; CRO probes, trigger circuits, application of CRO in measuring voltage, frequency, phase, different types of CRO- DSO; Frequency domain measurements-Distortion analyzer, Wave and spectrum analyzer spectrum analyzer;

Module 5: Transducers:
Definition, types-active & passive, analog & digital; active-thermocouple & piezoelectric transducers, passive- potentiometric devices, thermistors, LVDT; Basic idea-displacement & temperature transducer;

Module 6: Digital Instrumentation
Digital measurement techniques, Time and frequency measurements, Interface of instruments with computer, Virtual Instruments. Digital transducers; Sensors-conventional and bio-sensors;

Suggested reading:

1. Instrumentation, Measurement and Feedback- B.E. Jones, Tata McGraw Hill
2. Electronics Measurements and Instrumentation- B.E. Oliver and J.M. Cage, McGraw Hill
3. Electrical & Electronic Measurements- Sawhnay….,Dhanpat Rai Publications
4. Process Control- Johnson, Pearson Education

EL 223	**Control System (DGC)**	2	0	1	3

Course Objective:
To familiarize the students with control system- its working principles, methods of design and analysis, transform methods and application.

Module 1: Concepts of closed-loop and open-loop systems: Importance and Application of Control System; Conceptual Block diagram of a control system and types- open loop and closed loop, Continuous and discrete data systems, Feedback theory;

Module 2: Representation of feedback control system: Block diagram, signal flow graphs, Mason's gain formula; Transfer function concept- Time and frequency domain analysis of first and second order systems to step, ramp and other inputs; error analysis, Types of systems;

Module 3: Stability: Routh Hurwitz stability criteria, Root locus, Nyquist criteria, Relative and absolute stability; Polar and Bode Plot, Gain and phase margins;

Module 4: Discrete Control Systems & Control System Design: Z-transform,
Simulation diagram and flow graphs. Effects of proportional, integral and derivative control, Discrete Vs Continuous control systems.

Module 5: State Variable Analysis: Importance of state variable analysis; Definition of state, state space, state vector; SV representation of physical systems and electrical networks; Eigen value and eigen vector; Determination of transfer function using SVA; Resolvent Matrix and State transition matrix; Solution of homogeneous and non-homogeneous systems using SVA;

List of experiments:

Certain experiments maybe formulated and performed using Simulink in Matlab 6 or above.

Suggested reading:

1. Control Systems Engineering - I.G. Nagrath, M. Gopal; Wiley Eastern Ltd.
2. Automatic Control Systems- B.C. Kuo, Prentice-Hall of India.
3. Modern Control Engineering- K. Ogata, Prenticd-Hall of India.
4. Control System – S. Ghosh, Pearson Education
5. Control System Engineering- Bhattacharjya- Pearson Education;

EL 224	**Linear Active Circuits (DGC)**	3	0	2	5

Course Objective

To provide exposure and knowledge to the students enabling them to develop insights into working of active devises and their design.

Module 1:

Transistor biasing: Fixed bias, emitter bias, voltage divider bias, d.c collector feedback bias; load line, Q- point, stability considerations;

BJT modeling: two port representation of the BJT with z-,y-,h-parameters;

r_e & hybrid models of C-E, C-B,C-C(emitter follower) amplifiers;

C-E amplifier in the above four biasing configurations, calculation of voltage gain, current gain, power gain, input impedance and output impedance of respective configurations and types; Hybrid-pi model of C-E amplifier in voltage divider bias configuration, Effect of parasitic capacitances, frequency response in low-,mid- & high- frequency conditions (cut-off frequencies ,bandwidth),respective voltage gains, current gain, input & output impedances;

Module 2:

Unipolar devices: Basic idea of UJT-application as a relaxation oscillator;

Junction field effect transistor: JFET structure & working principle, characteristics, Structure of MOSFET- enhancement & depletion , p & n -channel MOSFET, common gate, common drain configuration, long & short channel effects. FET Biasing: Self bias, fixed bias , voltage divider bias, simple problems, small signal A.C. equivalent circuit of FET as amplifier, hybrid parameters, CS, CD amplifiers, high frequency response, equivalent circuit.

Module 3:

Amplifier:

Tuned amplifier: single & double tuned amplifiers, Analysis of voltage gain & selectivity, IF amplifiers.

Power amplifier: Class A, B, C & AB type, Direct coupled (d.c amplifier, Darlington pair), Transformer coupled amplifier, pushpull amplifier, class B pushpull circuits, complementary symmetry amplifier, distortion in amplifiers.

Feed back amplifiers: General theory of feed back, negative & positive feedback, advantages of negative feedback, types of negative feedback in transistor amplifier-current series, voltage series, current shunt, voltage shunt amplifiers; practical circuits;

Operational amplifier: Differential amplifier; Ideal op-amp characteristics, offset current, offset voltage, CMRR, Basic op-amp application, inverting & noninverting amplifiers, adder, subtractor, voltage to current , current to voltage converters, nonlinear circuits, integrator, differentiator, gyrator, VCO. comparator, Schmitt trigger ,instrumentation amplifier, precision rectifier, Multivibrator- astable, monostable; Active filter-types-low pass, high pass, band pass & band elimination.

Module 4:

Oscillator circuit-Positive feedback & oscillation, Barkhausen criterion; types-RC,LC & crystal oscillators; Wein bridge, phase shift, Hartley, Colpitts & Clapp oscillators as examples; frequency stability & Q-value.

List of experiments:

1. To design clipper and clamper circuits using diode.
2. To design a voltage doubler using diode.
3. Design a two stage BJT RC coupled C-E amplifier and measure its voltage gain. Convert the design into a two stage form to study the frequency response of the two stage C-E amplifier. Determine its cut-off points & bandwidth. Repeat the above in case of a CS- JFET amplifier.
4. Design of a Wein bridge oscillator using BJT/FET/IC.
5. Design an astable multivibrator using BJT.
6. Design of a phase shift oscillator using BJT/ FET/ IC.
7. Design of a first and second order filters as low pass blocks using IC741
8. Design of a first and second order filters as high pass blocks using IC741
9. Design of first and second order filters as band pass blocks using IC741
10. Design of first and second order filters as band elimination blocks using IC741

Suggested Reading:

1. Electronic devices & circuit theory- Boylestad & Nashalsky, Pearson Education
2. Electronic Device & Circuit - Millman-Halkias , Tata McGraw Hill.
3. Microelectronics- Millman….,TataMcgrawHill
4. Microelectronic Circuits - Sedra & Smith,Oxford press
5. Solid State Devices- Streetman,PHI.
6. Electronic Fundamentals & Applications – Ryder,PHI.
7. Electronic Principles – Malvino,TataMcGraw Hill
8. Electronics Lab Primer- K. K. Sarma, Global Publishing

EL 225	Microprocessor (DGC)	3	0	1	4

Course Objective:
To provide the student the exposure of the working of the microprocessor, architectural details, instructions, programming and applications.

Module 1: History & evolution of microprocessor; Introduction to CPU: Components of CPU, block diagram, buses-data, control & address; ALU, Control Unit; main memory & secondary memory; I/O devices; Memory addressing-memory mapped I/O & I/O mapped I/O; address decoding; Memory & I/O interfacing;

Module 2: Instruction cycle: fetch, decode & execute; zero, one, two & three address instructions; addressing modes(register direct, relative, indirect, immediate, indirect& implied);

Module 3: Introduction to 8085; block diagram, registers, use of register pairs, PSW, accumulator; addressing modes; Instruction set of 8085; Complete set in details; Instruction set: Data Transfer, Arithmetic, Logic, Branch and Machine Control instructions. Delay and counter; stack & its application; interrupt and its application; Assembly level language programming of 8085;

Module 4: Interfacing: Memory interfacing;I/O interfacing; interfacing small devices like keyboard,7- segment display,relay, event counter etc; idea of PPIs like 8251, 8255, 8257 & 8279 (block diagram & function only); serial communication standard(RS-232C);

Module 5: Example of 16-bit (introduction to 8086); Examples like 80286, 80386, 80486 and 80586; microcontroller (block diagram & application of 8051);

List of experiments

1. Move a block of memory starting at location XXXX to a location YYYY. Perform the block move in reverse order as well.
2. Find the sum, maximum & minimum of an array of 8-bit numbers.
3. Compute X+Y-Z+56 using 16-bit numbers.
4. Compute X*Y using 8-bit numbers.
5. For the 8-bit number X find the bits $b_3b_4b_5$ .Output should show $b_3b_4b_5$.
6. Find whether a given number is odd or even. Store the result in a memory location as 1 when even & 0 when odd.
7. Design a relay driven bell. Generate an external interrupt. The bell should ring N seconds after the interrupt.
8. Design a 2-digit 7-segment display driver circuit. Use it to display the contents of memory starting at a given location.
9. Interface a steeper motor to a microprocessor. Write programs to move it clockwise and counter clockwise.
   Interface a d.c. motor to a microprocessor .Rotate it clockwise and counter clockwise.

Suggested reading:

1. Introduction to Microprocessors - Gaokar,New age Publication
2. Fundamentals of Microprocessor - N.Ram.Dhanpat Rai
3. 8085 Microprocessor Programming and Interfacing -N. K. Srinath, PHI
4. Microprocessor Based Design - Slater, PHI
5. Microprocessors - Gilmore, MacGraw Hill Publication
6. Microcomputers and Microprocessors - Uffenbeck, PHI

EL 227	Communication System	3	0	1	4

Course Objective:
To provide the knowledge of basic principles of communication system, types, design details and applications

Module 1: Basic signal theory**:**
Fourier transform, Convolution theorem, statements of time & frequency domain convolution. Power spectral density, Energy spectral density. Parseval's theorem.

Module 2: Communication system:
Block diagram; Requirements of modulation. Superheterodyne receiver-AGC; .Types of modulation-AM, FM, PM

Module 3: Amplitude modulation,
Basic principle of DSB, SSB (phase discrimination method) and VSB systems, Modulators & demodulators. Modulators: ring modulator, balanced modulator & BJT modulator; Demodulator: diode detector, envelope detector & BJT detector;

Module 4: Angle modulation:
Phase modulation & frequency modulation, Sinusoidal FM, frequency spectrum for sinusoidal FM, Average power, Sinusoidal PM, Equivalence between FM& PM, elementary idea of direct(Armstrong) & indirect modulator(VCO method), elementary idea of demodulators(discriminator, limiter, PLL & ratio detector).

Module 5: Noise:
Different types of noise, Thermal, shot, flicker noise, Noise figure, Equivalent noise temperature; Noise in DSB, SSB, FM systems;

Module 6: Pulse Modulation:
Sampling theorem, Nyquist criteria; PAM- generation and recovery; PCM,- stages like sampling, quantization, encoding, regeneration; noise considerations; Multiplexing: Frequency division multiplexing (FDM) & Time division multiplexing (TDM),

List of experiments:
1 Design of an AM modulator using diode/ BJT/ FET.
2 Design of an AM demodulator using diode / BJT/ FET
3 Design of an FM modulator using diode/ BJT/ FET.
4 Design of an FM demodulator using diode / BJT/ FET
5 Study of Phase modulation / pulse modulation using trainer kits.
6 Generation of PCM using discrete components/ trainer kits/ software.

Suggested Reading:

1. Communication Systems- B.P. Lathi, Willey Eastern
2. Radio Engineering, Vol.II- G.K. Mittal, Khanna Publishers
3. Electronic Communications- Schoenbeck, PHI
4. Electronic Communications Systems- Kennedy, TMGH
5. Communication Systems- Simon Haykin, John Wiley ;
6. Electronic Communication- Roddy, Coolen, PHI
7. Monochrome & Colour television- Gulati,Wiley Eastern;
8. Communication System Engineering- Prokais, Pearson Education

HS 221	**HS Elective: Research Methodology**	2	0	0	2

Semester Five

Course Code	Courses	L	T	P	C
EL 311	Digital Communication (DGC)	2	0	1	3
EL 312	Microwave Devices (DGC)	2	0	1	3
EL 313	Digital Signal Processing (DGC)	3	0	1	4
EL 314	Optoelectronics (DGC)	2	0	0	2
EL 315	Mechatronics and Electronic System Design (DGC)	3	0	0	3
EL 316	Microprocessor-II	2	0	1	3
CS 312	Operating System (DGC)	3	0	1	4
HS 31X	HSS Elective	2	0	0	2
Semester Total		**19**	**0**	**5**	**24**

EL 311	Digital Communication (DGC)	2	0	1	3

Course Objective
The course provides basic foundation of different aspects of Digital Communication and its applications.

Module 1. Random Process:
Probability theory, random variable, statistical averages, transformation of random variables, random process, stationarity, mean, correlation and covariance, ergodicity, transmission of a random process through a linear filter, power spectral density, Gaussian process;

Module 2: Pulse modulation
Sampling theorem, pulse analog modulations (PAM), Shaping of the transmitted signals spectrum, Equalization, Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM), Quantization; PCM- Limitations of PCM; Companding; DM, DPCM- preliminary idea; coding speech at low bit rate, APCM; CODEC;

Module 3: Digital Modulation techniques
Amplitude shift keying (ASK), Frequency Shift Keying (FSK), phase shift keying (PSK), Dual Phase Shift Keying (DPSK) schemes, Coherent binary PSK/ FSK; Coherent quadri- PSK; Coherent minimum shift keying; differential PSK Comparison of digital modulation schemes, M-array signaling scheme; QAM; Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM).

Module 4: MODEM techniques:
Baseband transmission; modem principles & architecture;

Module 5: Spread Spectrum modulation
Definition; types-direct sequence & frequency hoping; pseudo-noise generation; Idealized model of a spread spectrum modulator; DS- & FH-spread spectrum modulation generation and detection; application; CDMA, GSM;

List of experiments.
1 Generation of ASK using kits/software/ ICs.
2 Generation of PSK using kits/software/ ICs.
3 Generation of FSK using kits/software/ ICs.
4 Generation of BPSK using kits/software/ ICs.
5 Study of FDM using kits/ software.
6 Study of TDM using kits/ software.
7 Study of GSM using kits/ software.
8 Study of CDMA using kits/ software.

Suggested reading

1. Communication Systems- Simon Haykin, Wiley Eastern
2. Digital & Data Communication- Miller, Jaico.
3. Digital Communication- Simon Haykin, Willey Eastern
4. Communication System Engineering- Proakis, Pearson Education;
5. Digital Communication- Sklar, Pearson Education

EL 312	Microwave Devices	2	0	1	3

Course Objective:
To help students understand the principles of microwave, generation methods and applications.

Module 1: Limitations of conventional tubes: Limitations of conventional vacuum tubes at VHF and UHF; Bandwidth limitation effects, Tube reactance effects and transit time effects; Remedies.

Module 2: Klystron amplifier: Introduction to Klystron amplifier, Velocity modulation and bunching of electrons; L-cavity Klystron amplifier; operation and analysis; power and efficiency; Multi-cavity Klystrons, Reflex Klystrons, operation and analysis: Electronic admittance; Electronic tuning; Power output and efficiency; Applications.

Module 3: Magnetron: Principle of Magnetron, Linear and cylindrical magnetron, Hull cutoff voltage and Hull cutoff frequency, Basic principle of inverted magnetron

Module 4: Avalanche diode, Gunn affects diode, RWH theory, modes of operation and use of Gunn diode as microwave generator, Travelling Wave Tubes (TWT);

List of experiments:
1 Wavelength and frequency measurements using microwave bench.
2 Study of the characteristics of the reflex klystron.
3 Measurement of VSWR of a given signal pattern.
4 Study of the characteristics of the Gunn diode.
5 Study of the magic Tee.
6 Study and measurement of antenna gain and radiation patterns.

Suggested Reading:

1. Microwave Devices and Circuits- Samuel Y. Liao, Prentice Hall of India,
2. Microwave Engineering-Passive Circuits- Peter A. Rizzi, Prentice Hall of India

EL 313	Digital Signal Processing	3	0	1	4

Course Objective
The course provides advanced topics of signals and systems and their processing and applications. The course also provides exposure to analysis methods and tools of processing signals for various applications by digital means.

Module 1: Review
FFT-decimation in time and frequency, z-transform, sampling, quantization, ADC and DAC; IIR and FIR systems;

Module 2: Information Theory
Definition- Uncertainty, Information and Entropy; Source coding, Mutual Information, Channel Capacity and Channel Coding Theory; Information Capacity Theorem; Rate Distortion Theory;

Module 3: Effects of finite word length in digital systems
Introduction; Representation of numbers- fixed point, floating point; Rounding and Truncation Errors; Quantization Effects in ADC and DAC processes; Noise power from a digital system; Coefficient quantization effects in direct form realization of IIR and FIR systems;

Module 4: Implementation of discrete systems
Structures for FIR systems- direct form, cascade form, frequency sampling and lattice structures; Structures for IIR systems- Direct form, Signal flow graphs and transpose forms, cascade forms, parallel forms, lattice and lattice-ladder structures; Round off effects in Digital filter structures;

Module 5: Design of Digital Filters
Representation of 1 st & 2 nd order recursive & non-recursive filters; Digital-filter realizations from analog forms using impulse invariance, bilinear transforms; Low-pass, High- pass Filters FIR Filter, Low pass, High pass IIR filters, Comb filters; Filter design by windowing method. Design of FIR- symmetric and anti-symmetric FIR filters, Linear pahse filters using windows and frequency sampling; FIR differentiators; Least square method- Pade approximation, FIR Least Squares Inverse (Wiener) Filter;

Module 6: Prediction
Innovations representation of a random process; Forward and Backward Prediction; Solution to normal equations- Levinson-Durbin Algorithm, Schur Algorithm; Properties of Linear Prediction Filters; AR and ARMA Lattice-Ladder structure; Wiener filters for prediction;

List of experiments:
Matlab bases assignments related to topics covered in the course. A minimum of ten such experiments should be conducted.

Suggested Reading

1. Digital Signal Processing- Proakis, Pearson Education
2. Digital Signal Processing- Mitra, TMGH
3. Digital Signal Processing- Salivahanan, Vallavraj, Gnanapriay, TMGH

EL 314	Optoelectronics	2	0	0	2

Course Objective:
The course intends to provide the basic foundations that govern Optoelectronics and its applications. The course also focuses on different aspects of optical properties of semiconductors.

Module I - Electronic properties of semi conductors
Effect of pressure and temperature on band gap, density of carriers in intrinsic and extrinsic semiconductors, consequence of heavy doping, conduction processes in semiconductors, electron-hole pair formation and recombination, PN junction, carrier recombination and diffusion, injection efficiency, heterojunction, internal quantum efficiency, double heterojunction, quantum well, quantum dot and superlattices;

Module 2 - Optical properties in semiconductors
Exciton absorption, donor-acceptor and impurity band absorption, long wavelength absorption, Franz-Keldysh and Stark effect, absorption in quantum wells and quantum-confined Stark effect, Kramer-Kronig relations, Stokes shift in optical transitions, luminescence from quantum wells;

Module 3 - Optoelectronic devices
LED, LED materials, device configuration and efficiency, light output from LED, LED structure, device performance characteristics, manufacturing process of LED and applications, laser diode, threshold current and power output, heterojunction lasers, distributed feedback lasers, cleaved-coupled-cavity laser, quantum well lasers, surface emitting and rare earth doped lasers, laser mounting and fibre coupling, mode locking of SC;

Module 4 – Photodetectors
Thermal detectors, photoconductors, junction photodiodes, avalanche photo diode, optical heterodyning and electro-optic measurements, fiber coupling, phototransistor, modulated barrier photo diode, Schottky barrier photo diode, MSM photo diode, detectors for long wavelength operation, micro cavity photo diode; Solar cells: I-V characteristics and spectral response, materials and design considerations of solar cells;

Module 5- Display devices
Photoluminescence, electroluminescence and cathodoluminescence displays, displays based on LED, plasma panel and LCD; Optoelectronic modulation and switching devices: analog and digital modulation, Franz-Keldysh and Stark effect modulator, quantum well electro-absorption modulators, electro- optic, acousto-optic and magneto-optic modulators, SEED

Suggested reading:

1. Optical Fiber Communications - Gerd Keiser, Mc.Graw hill International
2. Opto- Electronics, An Introduction- J. Wilson and J.F.B. Hawks, PHI
3. Fundamentals of Fiber optics in Telecommunication and Sensor system.- Bishnu Pal, New Age International (P) Ltd.
4. Optics (Fourth edition)- Eugene Hecht, Pearson Education.
5. Optical information processing- Mir Mojtaba Mirsalehi
6. Semiconductor Optoelectronic Devices - Pallab Bhattacharya, Pearson Education
7. Semiconductor Optoelectronics - Jasprit Singh, John Wiley

EL 315	Mechatronics and Electronic System Design	3	0	0	3

Course objective:
The course provides basic and advanced concepts on an up-coming subject like Mechatronics and intends to develop skills for certain computer based design of Electronic Devices.

A: Mechatronics
Module-I Introduction
Evolution of Mechatronics, An overview of Mechatronics, Scope of Mechatronics;

Module -2 Electronics for Mechanical System
Electrical components and Electronic Devices, Basics of Digital Technology, Transducers and Sensors, Signal conditioning theory, circuits and systems;

Module -3 Actuators and Mechanisms
Actuator types and application areas- Electromechanical actuators, Fluid power actuators and active material based actuators; Mechanism- Bearings, Belt, Chain, Pulleys, Gears, Rack and Pinion, Slider and Crank, Cams and Followers, Four-bar linkages.

Module -4 Microprocessors and Microcontrollers
Microprocessor Architecture, Terminology, Instruction Types, Addressing Modes, Intel's 8085 Microprocessor, Microcontrollers;

Module -5 Modeling:
Introduction, System, Modeling, Mechanical System, Electrical System, Fluid system, Thermal systems, Engg. System, Translation mechanical systems with springs, damper and mass, Rotational mechanical system with spring, damper and mass, modeling electric motor, modeling chamber filled with fluid;

Module -6 CNC Systems:
Principle of numerical control, types and features of CNC System, Constituent parts of CNC machines and assembly techniques, configuration, Interfacing, Monitoring and diagnostics

B: Electronics System Design.
Module 1. Linear Circuit formulation and solution: Techniques in time domain and frequency domain. Pole-zero analysis, design and amplifiers, filters and other electronic circuits using PSPICE software along with hand on practice with various types of analysis provided by dot commands in PSPICE.

Module 2. CIM: Definition, elements of CIM, its nature and role, CIM hardware and software, requirement of a computer to be used in a CIM system;

Module 3. Robotics: Definition, types of robots, performance capabilities, programming robots, Robot operation and application, Integration of industrial robots into CIM system, Expert system in CIM;

Module 4. FMS: FMS – definition and its subsystems, scope, different types and elements of FMS. Optimization of FMS;

Suggested reading:

A: Mechatronics

1. Mechatronics- W. Bolton, Addition –Wesley Longman Ltd.
2. Mechatronics- Denny K. Miu, Springer- Verlag,
3. Production Technology- HMT. Ltd, TMH, New Delhi- 1981.
4. Mechatronics-Principles, concepts and Application – TMH,

B: Electronics System Design.

1. PSIPCE using ORCAD - Rashid, PHI
2. CAD/ CAM/ CIM -R. Radhakrishnan, S. Subram
3.

EL 316	**Microprocessor-II**	2	0	1	3

CS 312	**Operating System**	3	0	1	4

Course Objective:

The course provides an insight into the different aspects of working of operating system, different tasks handled by operating systems, different roles played by them, types and examples.

Module 1: Introduction

Operating system-definition, types, different parts; trends- parallel computing, distributed computing; Open systems; Hardware, software, firmware;

Module 2: Process Scheduling

Definition of a process; process states, transitions, process control, suspend and process, interrupt processing, nucleus of an operating system; parallel processing; Mutual exclusion, Critical Section; Solution of mutual exclusion; Semaphores; Deadlock-occurrence, prevention, detection and recovery;

Module 3: Storage management

Storage organization, management strategies, hierarchy; virtual storage, paging, segmentation;

Module 4: File system and I/O management
File system (function of a file system)- data hierarchy, blocking and buffering, file organization, queued and basic access methods, backup and recovery; I/O management (functions of I/O management subsystem), Distributed computing- OSI view, OSI network management, MAP, TOP, GOSIP, TCP/IP; OS security- requirements, external security, operational security, surveillance, threat monitoring; Introduction to Cryptography;

Module 5: Case Study
UNIX- Shell, Kernel, File System, Process Management, Memory Management, I/O System, Distributed UNIX; Example of operating system-MS-DOS, Windows, OS/2, Apple Macintosh & Linux;

List of experiments
A list of assignments will be prepared by the teacher/ instructor concerned.

Suggested Reading:

1. Operating System- Deitel, Pearson Education
2. Operating System- Tanenbaum, PHI

HS 31X	**HSS Elective (IEC): Education I**	2	0	0	2

EDUCATIONAL MANAGEMENT

Course Objective:

1. To enable the students to understand the basic concepts of educational management, educational organization and administration.
2. To enable students understand the management process in education.

Component	Marks	Assessment	
Unit-1	20	External	& Written
Unlt-2	20	External	& Written
Unit-3	20	External	& Written
Unit-4	20	External	& Written
Unit-5	20	External	& Written

Module I:
Concept of Educational Management: Meaning nature and scope, Basic Principles of Educational Management.

Module -II
Types of Educational Management: Centralized, Decentralized, external and internal, autocratic and democratic, creative and laissez faire.

Module-III
Administration and Organization: Concept their differences and relationships.

Module-IV
Management process in Education: Planning organizing, directing and controlling.

Module V:
Management of Curriculum: Curriculum planning, curriculum construction, curriculum transaction and curriculum evaluation.

REFERENCES

1. Taba Hilda Curriculum development- Theory and Practice New York: Harcount Braice Javanorich.
2. Prasad LM Principle and Practice of Management, New Delhi, Sultanchand & Son
3. Thakur D. Educational and Manpoer Planning, New Delhi, Deep and Deep Publication.
4. B.C. Rai School Organisation and Management

Semester Six

Course Code	Courses	L	T	P	C
EL 321	TV Engineering (DGC)	2	0	0	2
EL 322	Power Electronics (DGC)	2	0	0	2
EL 323	Photonics (DGC)	2	0	0	2
EL 324	Microcontroller (DGC)	3	0	1	4
EL 325	Mobile Communication (DGC)	3	0	1	4
EL 327	Electrical Machines (DGC)	2	0	0	2
EL 328	Lab : Electronics Design (DGC)	0	0	3	3
MG-321	HS Elective: Financial & Cost Accounting	2	0	0	2
	Industrial Training	0	0	0	3
Semester Total		**16**	**0**	**5**	**24**

EL 321	TV Engineering (DGC)	2	0	0	2

Course Objective
The course is intended to provide the principles of TV- working, transmission and reception, different types of TV and a brief account of various dimensions of Informatics.

Module 1: Antennas: Hertzian dipole, Radiation resistance and Directivity, Linear Antennas, Antenna Arrays, Aperture Antennas, Yagi- antenna, Receiving properties, Antenna temperature, signal to noise ratio

Module 2
TV- Basic system, block diagram, basic working, modulation methods, transmission and reception; different types of scanning and scanning standards, Interlacing; camera tubes-iconoscope, synchronization-horizontal and vertical synchronization pulses; blanking- horizontal & vertical; bandwidth & channels;

Module 3
Monochrome TV- transmitter and receiver; picture elements, image orthicon & vidicon;

Module 4
Colour TV- generation of colour, .transmitter & receiver, picture tube- trinitron , CCD;

Module 5
HDTV- working, picture elements, transmission and reception; Plasma TV- working, picture elements, transmission and reception;

Module 5:
Informatics-Internet, Telephony, Fax and Telegraph – basic principles and applications; Internet TV;
Radar – Basic principles, range calculation, types and application, Antenna types used in radars; Applications of radars.

Suggested Reading:

1. Communication Systems- B.P. Lathi, Willey Eastern
2. Radio Engineering, Vol.II- G.K. Mittal, Khanna Publishers
3. Electronic Communications- Schoenbeck, PHI
4. Electronic Communications Systems- Kennedy, TMGH
5. Communication Systems- Simon Haykin, John Wiley ;
6. Electronic Communication- Roddy, Coolen, PHI
7. Monochrome & Colour television- Gulati,Wiley Eastern;
8. Communication System Engineering- Prokais, Pearson Education;

EL 322	Power Electronics	2	0	0	2

Course Objective:
To provide the know-how to students regarding power electron devices, working principles, types, modifications, design details and applications.

Module 1: Introduction to power electronics: Basic terminologies, definitions, comparison of conventional and power electronics, calculation of power, power factor, single/three phase, star and delta connections, power measurement techniques and equipment, heating effect, noise factors, shielding, protections, circuit breakers, ground leakage detection, MCBs ELCBs, etc. Single phasing preventors.

Module 2: Power electronics circuits: Controlled rectifiers and filters: Single phase half wave and full wave-Semi converter and full converter, Dual converter, Three phase half wave, semi and full wave converter, three phase dual converter, simple LC and cascaded LC filters, Power factor improvement. Inverters: Principle of operation, voltage driven inverters, current driven inverters; Choppers: Basic principles, Type A, B and C choppers Series and parallel turn-off choppers, Morgan choppers and Jones choppers. Triggering and protection circuit: Thyristor firing, circuit-using transistor, UJT, PUT etc. thyristor gate protection circuit, di/dt and dv/dt protection for thyristors;

Module 3: AC power supply systems: CVTs, Stabilizers, tap changers, UPS types (on-line and off line) etc; Introduction to SMPS.

Module 4: Special application DC power supplies: CVCC, voltage mode and current mode SMPS, Tracking and foldback systems, Low voltage, low current, high voltage and high current power supplies, SMPS for computers;

List of experiments:

1. Study of the V-I characteristics of the SCR.
2. To design a controlled rectifier using SCR.
3. Study of the VI characteristics of the DIAC.
4. Study of the V-I characteristics of the TRIAC.
5. Design of an arrangement for speed control of an electrical machine.
6. Design of an UPS system
7. Design of a SMPS

Suggested Reading:

1. Power Electronics – Rashid, PHI
2. Power Electronics- P.C. Sen, TMH Ltd.
3. Thyristor engineering- M.S. Berdi, Khanna publications.
4. Thyristors and their applications-N.Rammurthy

EL 323	Photonics (DGC)	2	0	0	2

Course Objective

The course provides the basic foundation of Photonics- basic principles, working of related devices and applications.

Module 1- Laser

Spontaneous and stimulated emissions, Einstein's A and B coefficients, absorption and gain of homogeneously broadened radiative transitions, gain coefficient and stimulated emission cross section for homogeneous and inhomogeneous broadening; Necessary and sufficient conditions for laser action (population inversion and saturation intensity), threshold requirements for laser with and without cavity, laser amplifiers, rate equations for three and four level systems, pumping mechanisms; Laser cavity modes: longitudinal and transverse modes in rectangular cavity, FP cavity modes, spectral and spatial hole burning, stability of laser resonator and stability diagram, unstable and ring resonators; Q-switching and mode locking, active and passive techniques, generation of giant pulses and pico second optical pulses, properties of laser beam and techniques to characterize laser beam; Generation of ultra fast optical pulses: pulse compression, femto-second optical pulses, characterization of femto second pulses;

Module 2- Laser Types and Applications

Classification of lasers, type of pumping, design aspects of resonator, stable and unstable resonators, tuning mechanism, He-Ne laser, CO_2 laser, Ar ion laser, dye laser, semi conductor laser, Nd-YAG laser, OPO Laser, FEL, pico and femto-second lasers, recombination laser, X-ray laser, DFB laser, surface emitting lasers; Industrial applications of lasers- absorption of radiation by metals, semiconductors and insulators, laser drilling, welding, cutting and surface cleaning, laser generated plasma and laser deposition of thin film, optical fibre splicing, generation of fibre grating;

Module 3- Holography

Holography and Speckle interferometry: hologram recording and recombination, thin and thick holograms, applications of holography in NDT and pattern recognition, principles of Speckle interferometry and its applications to NDT; Other applications of lasers: laser pollution monitoring, LIDAR, laser gyros, laser induced fusion, CD-ROM, laser cooling and trapping of atoms, magnetic and optical traps, optical molasses, lasers in computing, optical logic gates

Module 4- Non-linear Optics

Non linear polarization, second harmonic generation, phase matching condition, frequency mixing, self focusing;. Electro optic, acoustic optic and magnets optic effects;

Module 5- Photonic materials

Nano materials- Nanocrystals, quantum dots and quantum wells, nanocrystals of III-V compounds and indirect gap materials, energy states of quantum dots, photonics applications of quantum dots and quantum wells, photonic switches and modulators using quantum dots and quantum wells;

Organic materials for photonics, evaluation of second order and third order optical nonlinearities, organic materials for second and third order nonlinear optics, photorefractive polymers, polymers for light emitting sources, optical limiting, polymers for optical fiber; Sol-Gel materials- Photonics applications, method of preparations, electro optic, magneto optic and acousto optic materials, photonic devices based on EO, MO, AO effects, Fluoride glass based fibres and their applications;

Thin film optics based components- Design and production of thin films, anti

reflection and dichroic reflection coatings, DWDM filters, production and characterization of optical thin films, PLD, CVD, PVD, MBE, dip, spin and spray coatings;

Optical IC and wave guide structures- Coplanar waveguides, frequency doublers, mixers, MEMS, Photonic band gap structures, waveguides of elevated and buried structures, optical ICs- architecture and applications, CD read/write mechanism, materials and production;

Suggested Reading

1. Optical Fiber Communications - Gerd Keiser, Mc.Graw hill International
2. Opto- Electronics, An Introduction- J. Wilson and J.F.B. Hawks, PHI
3. Fundamentals of Fiber optics in Telecommunication and Sensor system.-Bishnu Pal, New Age International (P) Ltd.
4. Optics (Fourth edition)- Eugene Hecht, Pearson Education.
5. Optical information processing- Mir Mojtaba Mirsalehi
6. Semiconductor Optoelectronic Devices - Pallab Bhattacharya, Pearson Education
7. Semiconductor Optoelectronics - Jasprit Singh, John Wiley
8. Optical Properties of Semiconductor Quantum Dots - V Woggon
9. Nonlinear Optics of Organic Molecules and Polymers - H S Nalwa, S Miyata
10. Sol-Gel for Photonics - B J Thompson
11. Practical Design and Production of Optical Thin Films - Marcel & Dekker
12. Coplanar Waveguide Circuits, Components and Systems - R N Simons

EL 324	Microcontroller	3	0	1	4

Course Objective

The course provides a detailed study of the 8051 microcontroller, its instruction set, programming, interfacing with peripheral devices, I/O communication and applications.

Module 1: Introduction

Microcontroller-Definition, types, examples of popular microcontrollers, application, architecture, family members, resources, development trends, embedded processors, overview of 8051;

Module 2: 8051 Architecture

Inside the 8051, detailed pin pot diagram, registers, program counter, ROM space, internal and external memories, flags, PSW, data types, directives, counters, timers, synchronous and asynchronous serial USART interface, interrupts;

Module 3: Assembly level programming

Introduction, Assembly and running a program, Parts; Instruction set- data transfer, data and bit manipulation, arithmetic, logical, controlled flow (jump, loop, call), interrupt control flow, interrupt handling etc; Addressing modes; Programmable timers; Interrupt structure;

Module 4: Interfacing

Detailed study and interfacing of Serial PCI 8251, PPI 8255, Programmable DMAC 8257, Programmable Interrupt Controller 8259, ADC and DAC circuit interfacing, Keyboard-display controller 8279; Interfacing setup of switch, keypad, keyboard interface, LED, Array of LED, Alphanumeric devices, Printer devices, Programmable Instruments Interface using IEEE 488 (GPIB) Bus, Stepper motor, High power devices, analog input-output, industrial process control; Application to design simple digital filters;

Module 5: Programming Framework and Advanced Architectures

Programming in C and use of GNU tools- basics, CPU registers and Internal RAMs, Assemblers, Parameter passing, Control structures; Software building blocks; Real time operating system for system design; Microcontroller Application Development Tools; Case study of an exemplary IDE; Advanced Design- Introduction to 8096/ 80196 and one ARM 32-bit Design;

List of experiments

1 Addition of two numbers
2 Block move of an array of numbers in given order.
3 Block move of array of numbers in reverse order.
4 Addition of an array of numbers.
5 Application development.

Suggested Reading:

1. Microcontrollers- Rajkamal, Pearson Education;
2. 8051 Microcontroller- Mazidi, Pearson Education;
3. Microprocessor and Microcontroller- William Kleitz, Prentice Hall

EL 325	Mobile Communication	3	0	1	4

Course Objective

The course provides the basic foundation of mobile communication. The course covers aspects like working principles, types, modulation methods, channeling and applications.

Module 1: Introduction to Wireless Mobile Communications- History and evolution of mobile radio systems; Types of mobile wireless services / systems-Cellular, WLL, Paging, Satellite systems, Standards, Future trends in personal wireless systems

Module 2: Cellular Concept and System Design Fundamentals- Cellular concept and frequency reuse, Multiple Access Schemes, channel assignment and handoff, Interference and system capacity, Trunking and Erlang capacity calculations; cellular concept, spectral efficiency; design parameters at base station: antenna configurations, noise, power and field strength; design parameters at mobile unit: directional antennas and diversity schemes: frequency dependency; noise; antenna connections; field component diversity antennas; signaling and channel access: word-error-rate, channel assignment;

Module 3: Mobile Radio Propagation- Radio wave propagation issues in personal wireless systems, , Representation of a mobile radio signal; Propagation models, propagation path loss and fading- causes, types of fading and classification of channels; prediction of propagation loss: measurements, prediction over flat terrain, point-to-point prediction, microcell prediction model; calculation of fades- amplitude fades, random PM and random FM, selective fading, diversity schemes, combining techniques, bit error-rate and word-error-rate; Multipath fading and Base band impulse respond models, parameters of mobile multipath channels, Antenna systems in mobile radio;

Module 4: Modulation and Signal Processing- Analog and digital modulation techniques, Performance of various modulation techniques-Spectral efficiency, mobile radio interference: co-channel and adjacent-channel interference, intermodulation, intersymbol and simulcast interference; frequency plans: channelized schemes and frequency reuse, FDM, TDM, spread spectrum and frequency hopping, Error-rate, Power Amplification, Equalizing Rake receiver concepts, Diversity and space-time processing, Speech coding and channel coding

Module 5: System Examples and Design Issues- Multiple Access Techniques- frequency division multiple access, time division multiple access, code division multiple access, space division multiple access, operational systems, Wireless networking, design issues in personal wireless systems; Cellular CDMA: narrow band and wide band signal propagation, spread spectrum techniques, capacities of multiple access schemes; micro cell systems: conventional cellular system, micro cell system design, capacity analysis.

Suggested reading

1. Wireless digital communications- K.Feher, PHI,
2. Wireless Digital Communications Principles and Practice - T.S.Rappaport, Pearson Education
3. Mobile communications Engineering: Theory And Applications- W.C.Y.Lee McGraw Hill,
4. Mobile Communications- -Schiller, Pearson Education
5. Wireless Communications and Networks -Stallings, Pearson Education
6. Wireless Communication Systems -Wang and Poor, Pearson Education

EL 327	Electrical Machines	2	0	0	2

Course Objective

The course provides the basic foundations required for understanding the working of different electrical machines and their applications.

Module 1: D.C. Motors

Basic principles, circuit / block diagram, working, Calculation of the back e.m.f. and torque produced in a dc motor, control of torque and speed using bridge rectifiers, variation of torque, pole flux, armature voltage and power with speed, idea of copper and iron losses. Applications;

Module 2: Induction motors

Basic principles, circuit / block diagram, working; Idea of the rotating magnetic field, equivalent circuit for and induction motor. Derivation of torque and its functional dependence on the slip and the line frequency, Starting and breakdown torque, operation of an induction motor for low slips, Speed control using converter and inverter circuits (Block diagram);

Module 3: Single and multiphase phase motors

Basic principles, circuit / block diagram, working; Types; Equivalent circuit;

Module 4: Synchronous motors

Basic principles, circuit / block diagram, working; Need for synchronous speed, Dependence of the torque on the angle between rotor and resultant magnetic field pull-cut torque, non starting nature, control of speed (block diagram). Merits and demerits of three types of motors.

Module 5: Stepper motor

Stepper motor- Basic principles, circuit / block diagram, working; Types of stepper motor- detailed working of each of them; Applications;

Module 6: Transformer

Basic principles, circuit / block diagram, working; Equivalent circuit diagrams; Types like- core type, shell type, single phase and multiphase- detailed working of each of them; Ideal transformer; Efficiency and Power factor calculation; Applications;

Relay- Basic principles, Circuit / Block diagram, Working; Equivalent circuit diagram, Application;

Suggested Reading:

1. Electrical technology – B.L.Thareja, Khanna Publications
2. Fundamentals of Electrical technology- Del Toro, PHI

EL 328	Lab: Electronic Design	0	0	3	3

List of Experiments:

1. To Design and study Monostable multivibrator using IC555 Timer.
2. To Design and study Astable Multivibrator using IC555 Timer.
3. To Design and study Bistable multivibrator using IC 555 Timer.
4. To Design and study integrator and differentiator circuit using IC741.
5. To Design and study voltage comparator circuit using IC741.
6. To Design and study Schmitt trigger circuit using IC741.
7. To Design and study phase oscillator using IC741.
8. To Design and study 1^{st} order low pass filter using IC741.
9. To Design and study 1^{st} order high pass filter using IC741.
10. To Design and study 2^{nd} order low pass filter using IC741.
11. To Design and study 2^{nd} order high pass filter using IC741.

Suggested Reading:

- Electronics Lab Primer- K.K. Sarma, Global Publishing

MG-321	HS Elective: Financial & Cost Accounting	2	0	0	2

	Industrial Training (2- months duration)	0	0	0	3

Methodology

The students will go to various research institutes/R&D Labs of industries to learn various technological tools and procedures and their utility in commercial applications. The aim of this training is to train the students in the various industrial/ research aspects of commercialization of technological systems. The students will be supervised by the internal faculty during the tenure of training. The students shall submit a dissertation on the training undertaken which shall be evaluated by the concerned internal faculty. The Viva Voce shall then be conducted by an external Examiner

Examination Scheme:

Dissertation: 50%

Viva Voce: 50%

Total: 100

The training will carry 3 credits.

Semester Seven:

Course Code	Courses		L	T	P	C
EL 411	DSP Processors (DGC)		2	0	1	3
EL 412	Digital Image Processing (DGC)		3	0	1	4
EL 413	Departmental Elective Courses (DEC)	Communication Networks	3	0	1	4
		VLSI Design				
		Information Theory				
		Advanced Architectures				
EL 414	Optical Communication		2	1	0	3
EL 415	Project Phase 1		0	3	3	6
EL 416	Lab: Advanced Electronics Design		0	0	2	2
Hs 411	HS Elective: Foreign Language		2	0	0	2
Semester Total			**12**	**4**	**8**	**24**

EL 411	**DSP Processors**	2	0	1	3

Course Objective
The course provides a basic understanding on different aspects of DSP processor like architecture, instruction types, applications and programming.

Module 1: Introduction
Basic features, requirements, Computational characteristics of DSP algorithms and applications; Influence of Digital Signal processing in defining generic instruction-set architecture for DSPs.

Module 2: Design requirement of DSPs-
High throughput, low cost, low power, small code size, embedded applications. Techniques for enhancing computational throughput: parallelism and pipelining.

Module 3: Architecture
Data-path of DSPs- Multiple on-chip memories and buses, dedicated address generator units, specialized processing units (hardware multiplier, ALU, shifter) and on-chip peripherals for communication and control;
Control-unit of DSPs- pipelined instruction execution, specialized hardware for zero-overhead looping, interrupts;
Architecture of Texas Instruments fixed-point and floating-point DSPs: brief description of TMS320 C5x / C54x/ C3x DSPs; Programmer's model.
Architecture of Analog Devices fixed-point and floating-point DSPs: brief description of ADSP 218x / 2106x DSPs;
Programmer's model. Advanced DSPs: TI's TMS 320C6x, ADI's Tiger-SHARC, Lucent Technologies' DSP 16000 VLIW processors.

Module 4: Applications-
A few case studies of application of DSPs for signal processing, communication and multimedia.

Suggested Reading

1. Architectures for Digital Signal Processing- P. Pirsch, John Wiley
2. Digital Signal Processing in VLSI- R. J. Higgins, Prentice-Hall,
3. Texas Instruments TMSC5x, C54x and C6x Users Manuals.
4. Analog Devices ADSP 2100-family and 2106x-family Users Manuals.
5. VLSI Digital Signal Processing Systems- K. Parhi, John Wiley;
6. Digital Signal Processing for Multimedia Systems-K. Parhi and T. Nishitani: Marcel Dekker;
7. Digital Signal Processors- Kuo and Gan, Pearson Education;

EL 412	Digital Image Processing	3	0	1	4

Course Objective

The course provides an exposure to the different principles of image processing using digital means, applications and insights into Computer Vision and Machine Learning.

Module 1: Introduction

Steps in Digital Image Processing, Components of an Image Processing system, Applications. Human Eye and Image Formation; Sampling and Quantization, Basic Relationship among pixels- neighbour, connectivity, regions, boundaries, distance measures.

Module 2: Image Enhancement

Spatial Domain-Gray Level transformations, Histogram, Arithmetic/Logical Operations, Spatial filtering, Smoothing & Sharpening Spatial Filters; Frequency Domain- 2-D Fourier transform, Smoothing and Sharpening Frequency Domain Filtering; Convolution and Correlation Theorems;

Module 3: Image Restoration

Inverse filtering, Wiener filtering; Wavelets- Discrete and Continuous Wavelet Transform, Wavelet Transform in 2-D;

Module 4: Image Compression

Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression;

Module 5: Image Segmentation

Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations; Feature extraction; Classification; Object recognition;

Module 6: Colour Image Processing

Colour models, Different processing techniques; Colour image filtering;

Suggested Reading

1. Fundamentals of Digital Image processing- A. K. Jain, Pearson Education
2. Digital Image Processing- R. C. Gonzalez and R. E. Woods, Pearson Education
3. Digital Image Processing using MATLAB- R. C. Gonzalez , R. E. Woods and S. L. Eddins, Pearson Education
4. Digital Image Processing and Analysis- Chanda and Mazumdar, PHI
5. Digital Image Processing- Annadurai and Shanmugalakshmi, Pearson Education
6. Digital Image Processing- Castleman, Pearson Education
7. Digital Image Processing- Pratt, John Wiley

EL 413 A	**Departmental Elective: Robotics**	3	0	1	4

Course Objective
The course is an advanced treatment of different aspects of robotics like principles, working, design and applications.

Module 1: Introduction
Evolution of robotics, industrial robots; Cognitive and Biological aspects; Fields of application and future scope;

Module 2: Structural Design of Robot
Anatomy of robot; Manipulation, arm geometry, Degrees of freedom; drives and control (hardware) for motions. End effectors and grippers, pickups, etc. Matching robots to the working place and conditions; Interlock and sequence control, reliability, maintenance and safety of robotic systems;

Module 3: Robot Design
Direct and Inverse Kinematics, Path Planning and Motion Control, Robotic Manipulators, Sensors and Actuators; Low-Level Robot Control; Navigation Algorithms and Sensor-Based Navigation; Robot Vision and Other Sensors; Multi-Agent Robotics; Expert Systems

Module 4: Applications
Studies in manufacturing processes, e.g. casting, welding, painting, machine tools, machining, heat treatment and nuclear power stations, etc. Synthesis and evolution of geometrical configurations, robot economics, educating, programming and control of robots.

Suggested reading

1. Autonomous Robots- G. A. Bekey, MIT Press
2. Robotics and Control- Mittal, TMGH
3. Robotic Control- Fu, TMGH

EL 413 B	**Departmental Elective: Communication Networks**	3	0	1	4

Course Objective
The course gives an advanced treatment of different aspects of communication networks like layers of communication, protocols, modulation, multiplexing, applications and related aspects.

Module 1: Introduction
Computer Network: - Definition, necessity, basic types – LAN, MAN, WAN, Wireless networks, Inter networks; Network software: - Protocol definition, hierarchies, design issues, NETBIOS, interfaces and services; Connection- oriented and connectionless services. Reference Models: OSI Reference model, description of the seven layers TCP/ IP reference model, comparison of OSI & TCP/ IP reference models. Example Networks- Novell Network, ARPANET, Internet, Blue tooth- Pico net, SONET. Data Communication services – SMDS (Switched multi megabit data service), X.25 Networks, cellular service, mobile wireless, and frame relay, ISDN, ATM, Comparison of services.

Module 2: Physical Layer
Band limited signals, Shannon's Channel capacity theorem. Transmission Media: - Wired – magnetic, twisted pair, Base band coaxial, Optical Fiber; Wireless- Short wave radio, microwave, infrared & millimeter wave; Satellite communication; GSM, Transmission Impairments. Data Encoding – Digital Data – Digital Signals; Digital Data – Analog Signals; Analog Data – Digital Signals, Analog Data – Analog Signals. Transmission Models – Serial Parallel, Synchronous – Asynchronous, Full Duplex, Interfacing. Multiplexing – FDM, TDM, Statistical TDM, WDM, WANs – Circuit, Packet & Message Switching. LANs-Architecture, Configurations;

Module 3: Data link Layer
Data Link Control – Flow Control; Error Detection, Correction & Control; Framing. Data Link Protocols – Unrestricted Simple Protocols, Simplex stop-and-wait Protocol, Simplex Protocol for a Noisy channel. Sliding Window Protocols – One bit Sliding window protocol, protocol using go back n, Protocol Using selective repeat, Petri Net Models.Example of Data Link Protocol – HDLC – High Level Data Link Control, Data Link Layer in the Internet, Data Link Layer in ATM.

Module 4: Medium Access Sub layer
Channel Access Control – ALOHA, Carrier Sense Multiple Access Protocol, Collision Free Protocols, Limited Contention Protocols, WDMA Protocols, Wire Less LAN protocols, CDMA.IEEE Standard Protocols For LAN's & MAN's – 802.2 Logical Link Control, 802.3 CSMA/CD, 802.4 Token Bus, 802.5 Token Ring Protocols. Comparison between the above; 802.6 Distributed Queue Dual Bus.Bridges – Bridges from 802.x to 802.y; Transparent Bridges; Source routing bridges. High Speed LAN's – FDDI (Fiber Distributed Data Interface), Fast Ethernet, HIPPI (High Performance Parallel Interface), and Fiber channel. Satellite Networks – Polling, ALOHA, FDM, TDM, CDMA.

Module 5: Network Layer Services
Virtual Circuits & Data grams;Routing Algorithm – Kruskal's, Dijkstra's, Bellman-Ford's & Prim's; Routing methods: Session Routing, Adaptive & Non adaptive Routing, Hierarchical Routing, Routing for mobile host, Broadcast of multicast routing;Congestion Control Algorithm-Principles, policies, traffic shaping; Leaky Bucket Algorithm, Token Bucket Algorithm; Congestion Control in virtual circuit subnet; Congestion Control for multicasting; Internetworking: Concatenated virtual circuit, connectionless

internetworking, Tunneling; Firewalls;Network Layer in the Internet: IP Protocol, IP addresses, subnets, Internet Control Message Protocol, Address Resolution Protocol, Reverse Address Resolution Protocol; Internet Multicasting, Mobile IP, CIDR (Classless Inter-Domain Routing), IPv6.

Module 6: Telephone system-
Structure, PSTN topologies. Policies; Local loop; Trunk & Multiplexing; Switching; WLL (wire less in local loop);ISDN & ATM – Services, System architecture, Interface; Narrowband ISDN; Wide band ISDN;ATM networks; ATM switches

Module 7: Transport Layer
Services – Types, Quality, Primitives; Elements – Addressing, Establishment & release of connections, Flow Control & Buffering, Multiplexing, Crash Recovery; Protocols – Examples Service Primitives, Example Transport entity, TCP - Model, Protocol, Segment Header, Connection Management, Transmission Policy, Congestion Control, Timer Management, UDP, Wireless TCP & UDP, Protocols for Gigabit Networks

Module 8: Application Layer:
Network Security – Traditional Cryptography, Cryptography principles, Secret Key & Public Key Algorithm, Authentication Protocols, Digital Signatures; DNS – Domain Name System – DNS Name Space, Resource records, Name Servers.; SNMP – Simple Network Management Protocol – SMNP Model, ASN.1, Structure of Management Information (SMI), Management Information Base (MIB), SNMP protocol. E – Mail – Architecture & Services, User Agent, Message Format, Message Transfer, Privacy.

Module 9: World Wide Web
Architecture; Browsing; Client side; Server side; Locating information on the web; URL

Suggested Reading

1. Computer networks – Tanenbaum, Pearson Education
2. Data & Computer Communications – Stallings, Pearson Education
3. Digital & Data Communication – Miller, Jaico
4. Communication System – Simon Haykin, John Wiley
5. Digital Communication - Proakis, Mc Graw Hill, 4th Edition
6. Communication Engineering – Proakis, 2nd Edition, Pearson
7. Data Communication – Prakash C – Gupta, PHI.
8. Data Communication- Halsall, Pearson Education
9. Understanding Data Communication- Held, Pearson Education
10. Computer Networking- Kurose, Pearson Education
11. Introduction to Computer Networking- Mansfield, Pearson Education
12. Computer Networking with Internet Protocols- Stallings, Pearson Education
13. Data Communications and Networking- Forouzan, TMGH

EL 413 C	Departmental Elective: VLSI Design	3	0	1	4

Course Objective
The course provides an exposure to different methods of VLSI design and the principles behind such design.

Module1: Introduction
Evolution of integrated circuits, Advantages of integration, Basics of IC processing steps: Wafer preparation, Oxidation diffusion, Ion implantation, Dielectric & polysilicon film deposition, Metallization;

Module 2: Advanced Processing Techniques
Electron beam lithography, X-ray lithography, Relative ion etching, Plasma etching;. Process simulation: Introduction, Ion implantation, diffusion & Oxidation; VLSI process integration- CMOS & NMOS process integration, MOS memory IC technology, Bipolar IC technology; Advance techniques & packaging: of VLSI devices; Package type, Packaging design considerations;

Module 3: Digital IC Design
V-I Characteristics of MOS circuits, MOS switch and inverter, latch-up in CMOS inverter; sheet resistance and area capacitances of layers, wiring capacitances; CMOS inverter properties - robustness, dynamic performance, regenerative property, inverter delay times, switching power dissipation, MOSFET scaling - constant-voltage and constant-field scaling;
Dynamic CMOS design- steady-state behavior of dynamic gate circuits, noise considerations in dynamic design, charge sharing, cascading dynamic gates, domino logic, np-CMOS logic, problems in single-phase clocking, two-phase non-overlapping clocking scheme;
Subsystem design- design of arithmetic building blocks like adders - static, dynamic, Manchester carry-chain, look-ahead, linear and square-root carry-select, carry bypass and pipelined adders and multipliers - serial-parallel, Braun, Baugh-Wooley and systolic array multipliers, barrel and logarithmic shifters, area-time tradeoff, power consumption issues; designing semiconductor memory and array structures: memory core and memory peripheral circuitry.

Module 4: Yield & reliability in VLSI circuit
Mechanism of yield loss in VLSI reliability requirement for VLSI, Mathematics of failure distribution reliability & failure rates, Failure mechanism; VLSI simulation using P-SPICE & Model-simulation software;

Suggested reading

1. VLSI technology- S. M Sze, McGraw Hill.
2. VLSI fabrication principles- S.K Gandhi, John Wiley & sons.
3. Physics & Technology of semiconductor devices- A.S.Grove, Wiley, New York
4. Microelectronics- J. Millman & Gurbial , Tata McGraw Hill.
5. Digital Integrated Circuits- A Design Perspective- J.M. Rabaey, A. Chandrakasan & B. Nikolic, PHI;
6. Basic VLSI Design- D.A. Pucknell and K. Eshraghian, PHI;
7. Introduction to VLSI Design- E.D. Fabricius,McGraw Hill,
8. Principles of CMOS VLSI Design- Weste and Eshraghian, Pearson Education;

EL 413 D	**Departmental Elective: Information Theory**	3	0	1	4

Course objective

The course is an advanced treatment of different coding methods associated with information systems.

Module 1

Review of sampling theorem-Practical aspects of sampling-quantization of analog signals-Spectra of Quantization-wave from coding- PCM, ADPCM, Delta modulation- ADM-Bit rate and SNR-calculation-Mean and prediction coding; Base band shaping, binary Data formats, NRZ, RZ, Manchester formats- Baseband transmission-ISI- Effect of ISI, Synchronization-application. correlative coding Eye Pattern-Adaptive equalization for data transmission data reception matched filter, Optimum SNR. Introduction to Information Theory: Information and Sources Uniquely Decodable Codes; Instantaneous codes-. Construction of an Instantaneous code;. Kraft's Inequality. Coding Information Sources-: The Average length of a code;

Module 2

Encoding for special Sources; Shannon's Theorems. Shannon's theorem for the Binary Symmetric channel, Entropy and Source coding, Lossless coding techniques including Huffman codes, Arithmetic codes, Lempel-Ziv coding, Lossy coding techniques, Shannon coding theorem, Channel codes including Linear block codes, Cyclic codes, BCH codes Convolutional codes. Finding Binary Compact Codes, Huffman's code. r-ary compact Codes, Code Efficiency and Redundancy.

Module 3

Channels and Mutual Information: Information Channels, Trellis Coded Modulation; Probability relations in a channel; Apriori and Aposteriori Entropies, Generalization of Shannon's first theorem, Mutual Information. Properties of Mutual Information, Noiseless and Deterministic channels,

Module 4

Cascaded channels, Channel Capacity, Conditional Mutual Information; Reliable Messages through Unreliable channels: Error probability and Decision rules, the Fano bound, Hamming distance, Random Coding; Ensemble performance analysis of block and convolution codes; Introduction linear block codes-cyclic codes-Burst error detecting and correcting codes-Decoding algorithms of convolution codes-ARQ codes performance of codes.

Suggested reading

1. Information Theory and coding- N.Abrahamson, McGraw Hill Book Co., 1963.
2. Information theory and reliable communication- R.G.Gallagar, Wiley New York, 1968.
3. Principles of Practices of Information Theory-Richard.E.Balhut, Addison Wesley Pub.Co.,1987.

EL 413 E	**Departmental Elective: Advanced Architectures**	3	0	1	4

Course Objectives
The course provides a brief outline of architectural details, instruction set, advantage, programming and application of different advanced processor designs.

Module 1: Introduction:
Evolution of processor design; Cost/ performance issues in high performance processor design, performance metrics;

Module 2: Architectural abstractions- architecture, key features, the instruction set- principles and design; Arithmetic unit- arithmetic instructions and various implementations; Registers; Datapath and control unit- datapath requirements for different instruction classes; fixed-cycle vs. variable-cycle instruction implementation; Approach to control unit design - FSM control and microprogrammmed control; exceptions and exception handling; Performance enhancement techniques - pipelining and memory hierarchy: datapath pipelining; instruction-level pipelining; performance issues in pipelining; software pipelining. Space-time locality and cache memory; virtual memory, paging, TLB; case studies- 80286, 80386, 80486, 80586;

Module 3: Instruction Set and introduction to programming 80x86
Edit, assembly, link, test, debug; use of code, data, and stack segments

Module 4: I/O Interface
I/O performance measures; interfacing I/O to the memory, processor and OS; Interrupts and DMA; Data communication; Case studies (in brief): Intel x 86 families and the Pentium; RISC architectures like MIPS, SPARC, Power PC, PA-RISC.

Module 5: Introduction to DSP Architectures
Key issues in DSP architecture design; pipelining and parallelism in instruction set; On-chip memories and I/O peripherals. Case study- ADSP 21xx/ 21xxx family and TMS 320C5x family DSPs; Software and hardware development tools;

Suggested reading

1. The 80x86 Family- Uffenbeck, Pearson Education
2. The Pentium Processor- Antanokos, Pearson Education
3. The Intel Microprocessor- Brey, Pearson Education
4. Microprocessors and Interfacing- Hall, TMGH
5. Advanced Microprocessors and Peripherals-Ray, Bhurchandi, TMGH
6. Digital Signal Processors- Kuo, Gan, Pearson Education

EL 414	Optical Communication	2	1	0	3

Course Objective

The course provides an insight into different aspects of Optical Communication, working principles, transmission and reception, systems associated and applications.

Module I – Introduction

Evolution of fiber types, guiding properties of fibers, cross talk between fibers, coupled modes and mode mixing, dispersion properties of fibers, nonlinear properties of optical fibers, SRS, SBS, intensity dependent refractive index; Fiber design considerations: diameter, cladding, thickness, low and high bit rate systems, characterization of materials for fibers, fiber perform preparation, fiber drawing and control, roles of coating and jacketing;

Module 2 - Optical and mechanical characterization of fibres, optical cable design

Design objectives and cable structures, fibre splicing, fibre end preparation, single and array splices, measurement of splicing efficiency, optical fibre connectors, connector alignments, optical sources for communication, LED, injection lasers, modulation technique, direct and indirect methods, optical waveguide devices

Module 3 - Optical detectors

Photodiodes in repeaters, receiver design, digital and analog , transmission system design, system design choices, passive and low speed active optical components for fiber system, micro-optic components, lens-less components, all fiber components;

Module 4 - Optical fiber components

Modulation and demodulation, signal formats, direction detection receivers, coherent detection; Optical IC components for optical fiber components, electro optic devices for FO communication, optical switching, polarization control, inter office transmission system, trunking system, performance and architecture, under sea cable system, optical fibers in loop distribution system, photonic local network; Access network-network architecture, HFC, FTTC, optical access network architecture, deployment considerations, upgrading the transmission capacity, SDM, TDM, WDM, application areas, inter exchange, undersea, local exchange networks; Packaging and cabling of photonics components- photonic packet switching, OTDM, multiplexing and demultiplexing, optical logic gates, synchronization, broadcast OTDM network, OTDM testbeds;

Module 5 - Soliton communication-

Basic principle, metropolitan optical network, cable TV network, optical access network, photonics simulation tools, error control coding techniques, nonlinear optical effects in WDM transmission;

Suggested Reading:

1.Optical Fibre Telecommunication - S E Miller, A G Chynoweth
2.Optical Fibre Telecommunication II - S E Miller, I Kaninov
3.Optical Fibre Telecommunication IV B - I Kaninov, T Li
4. Deploying Optical Network Components - Gil Held

EL 415	**Project Phase 1**	0	3	3	6

Students individually or two at the most will carry out a detail study on a topic and implement a related system. The study must include literature survey, similar work done previously, proposed work, modifications to be included, applications etc. A report is to be prepared and submitted under the guidance of a supervisor. The report should contain design, implementation and experimental details. The topics involved in the work should be related to the courses undertaken by the student till this portion of progression under the programme and have contemporary relevance. It can involve research and development oriented works and be carried out with an eye on the needs of the industry. The work must be defended through a presentation in front of a panel constituted by selected experts.

EL 416	**Lab: Advanced Electronic Design**	0	0	2	2

List of Experiments

1. Two stage JFET amplifier.
2. Automatic gain control circuit using JFET as voltage controlled resistance.
3. Wein bridge oscillator with amplitude stabilization using JFET.
4. Regulated power supply with short circuit protection.
5. Regulated power supply with foldback current limiting and crowbar protection.
6. Frequency multiplier using Phase locked loop.
7. Differential amplifier using IC transistor array.
8. Stopwatch using TTL ICs.
9. Stopwatch using interrupt on microprocessor kit.
10. TTL IC tester using 8255 on microprocessor kit.
11. Real time clock using 8253 timer on microprocessor kit.
12. Analog signal input and output using A/D and D/A converters interfaced to microprocessor kit.
13. Light detectors and characteristics, Application of a LED/ Laser source to send data and recovery using photo detectors.
14. Switch mode power supply

HS 41X	**HSS : Foreign Language**	2	0	0	2

HS 471	**HSS : Project Management**	2	0	0	2

Course Objective:
The emphasis is to on imparting skills on how to develop a project management plan, identify key milestones and develop delivery plans. Implementation and co-ordination of the project plan with an emphasis on communication and project promotion and monitoring. Major challenge of identifying barriers to implementation and creating deliverable solutions.

Module I
Introduction – Conceiving a project, Strategic Management and Project Selection;

Module II
Project Training – Conflict and Negotiation Developing a project, Appraisal of project – financial, marketing appraisal, technology appraisal and HRD appraisal, Managing the project, Termination/Replacement of project, Project in Contemporary Organizations.

Module III: Project initiation
Project implementation – Scheduling, Resource Allocation, Monitoring and Information, Project Control;

Module IV
Project Termination – Project Auditing and Termination

Module V
Full understanding of project and business management theory in the context of a clinical trial.

Semester Eight

Course Code	Course		L	T	P	C
EL 421	Project Phase 2		0	6	7	13
EL 422	Departmental Elective Courses (DEC)	Nano Technology	2	0	2	4
		Neural Networks				
		Bluetooth				
		Embedded System				
		Bio Electronics				
		Speech Processing				
HS 423	Entrepreneurship Development (DGC)		2	0	0	2
EL 424	Web Technology		2	1	0	3
EL 425	Seminar & Term Paper (DGC)		0	2	0	2
Semester Total			**6**	**9**	**9**	**24**

EL 421	**Project Phase 2**	0	6	7	13

Students individually or two at the most will carry out a detail study on a topic and implement a related system. The study must include literature survey, similar work done previously, proposed work, modifications to be included, applications etc. A report is to be prepared and submitted under the guidance of a supervisor. The report should contain design, implementation and experimental details. The topics involved in the work should be related to the courses undertaken by the student till this portion of progression under the programme and have contemporary relevance. It can involve research and development oriented works and be carried out with an eye on the needs of the industry. The phase II involves the complete design of the work and the preparation of the report in continuation of the work carried out in the previous semester. The work must be defended through a presentation in front of a panel constituted by internal and external examiners.

GUIDELINES FOR PROJECT Work

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation. Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student. Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage. The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting
- from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout

The report should contain the following components:

1. **Title or Cover Page**. The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.
2. **Acknowledgements** (optional)-Acknowledgment to any advisory or financial assistance received in the course of work may be given.
3. **Abstract-** A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project
4. **Table of Contents**- Titles and subtitles are to correspond exactly with those in the text.
5. **Introduction**- Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided.

The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

6. **Present Work and Methods**- This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.
7. **Results and Discussion**- Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow. Note that in writing the various secions, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.
8. **Conclusion**- A conclusion should be the final section in which the outcome of the work is mentioned briefly.
9. **Future prospects**
10. **Appendices-** The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.
11. **References / Bibliography**

Stress should be given on latex based report generation.

ASSESSMENT OF THE PROJECT

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project. Project execution is concerned with assessing how much work has been put in.

Examination Scheme:

Dissertation and work: 50%

Presentation / Viva Voce: 50%

EL 422 A	**Departmental Elective: Nano Technology**	2	0	2	4

Course Objective:
The course provides an introduction to Nano-technology. It covers different aspects of nano-structures, formation, characterization and application.

Module 1: Introduction

Nanoscale, Definition of nanotechnology; Consequences of the nanoscale for technology and society. Beyond Moore's Law. Nano-scale 1D to 3D structures; Technologies for the Nanoscale; Nano-scale fabrications; Nanomanipulation,. Nanolithography

Module 2: Nanoscale Materials and Applications

Nanocomposites; Nano-scale Electronics; Safety issues with nanoscale powders; Quantum wells, wires, dots and nanoparticles; Nano-scale bio and medical applications; Applications in energy, informatics, medicine, etc.

Suggested reading

1. www.nanotechweb.org
2. www.nano.gov
3. www.nanotec.org.uk

EL 422 B	**Departmental Elective: Neural Networks**	2	0	2	4

Course Objective
The course provides the foundation of Artificial Neural network. It provides the basic principles and ANN and provides the exposure to Pattern Recognition and machine Learning.

Module 1: Introduction
Machine Perception, Pattern Classification Systems, Design Cycle, Learning and Adaptation; Bayesian Decision theory-Continuous & Discrete features, Minimum Error-Rate, Classification, Classifiers;

Module 2: Parameter Estimation
Maximum Likelihood Estimation, Bayesian Estimation, Hidden Markov Model;
Nonparametric Methods- Density Estimation, Parzen Windows, k-Nearest Neighbour Estimation; Introduction to fuzzy set & fuzzy classification; Linear Discriminant Functions;

Module 3: Neural Networks
Introduction, Biological Neurons, Artificial Neurons – various models, transfer functions; Learning methods, Stability and Convergence, Functional units for Pattern Recognition tasks; Single Layered Perceptron- LMS algorithm, Relation between perceptron and Bayes Classifier for a Gaussian Environment;

Module 4: Multilayered Perceptrons
Feed Forward and Feed Backward Networks, Back Propagation Algorithm, Feature Detection, Network pruning, Supervised learning as an Optimization problem, Convolution Networks, Radial Basis Function Networks; Introduction to SVM-application for a Pattern Recognition Task & Non Linear Regression;

Module 5: Self-Organizing Maps
Principles of Self-Organization, PCA, Two basic feature-Mapping Models, SOM Algorithm, Learning Vector Quantization; Introduction to neuro-hardware;

Module 6: Case study
Application of neural networks for data compression, character recognition, speech recognition etc;

Suggested reading

1. Pattern Classification- R. O. Duda, P. E. Hart and D. G. Stork, John Wiley;
2. Neural Networks- S. Haykin, 2nd Edition, Pearson Education;
3. Artificial Neural Networks- B. Yegnanarayana, PHI;
4. Neural Networks using Matlab 6.0- S. N. Sivanandam, S. Sumathi, S. N. Deepa, TMGH;
5. Computer Vision- D. A. Forsyth & J. Ponce, Pearson Education;

EL 422 C	Departmental Elective: Bluetooth	2	0	2	4

Course Objective:
The course provides the basic understanding of Bluetooth, architecture, protocols and application.

Module 1: Introduction
Overview and Objectives of Bluetooth technology, Piconets and Scatternets; Bluetooth version 1.0b, Bluetooth version 1.1; Applications; Advantage and disadvantage;

Module 2: Bluetooth Architecture and Protocol
Bluetooth profiles- Serial Port, Headset, Intercom, Fax; Bluetooth APIs; Protocol layers; Bluetooth Radio layer, Base band layer, Bluetooth addressing, Link Management Protocol, L2CAP, Host Controller Interface (HCI) , RFCOMM;

Module 3: Working with Bluetooth Devices
Configuring a Bluetooth-enabled mobile phone; Pairing with a headset; Pairing with other devices; Enabling and verifying Bluetooth security; Installing Bluetooth hardware; Installing Bluetooth driver software; Verifying interfaces and drivers; Bluetooth Configuration Tool; Testing the hardware; Configuring Bluetooth COM ports; Device discovery; Device properties; Service discovery;

Module 4: Bluetooth Security and Services
Bluetooth Security- Basics, Configuring Trust; Configuring Security Modes; Configuring Bonding;

Module 5: Bluetooth Services
Bluetooth services- Providing wireless access to a LAN, Creating a Bluetooth dial-up access point, Creating a Bluetooth Internet access point, Creating a Bluetooth Fax gateway, Security considerations; Accessing Internet services via a Bluetooth-enabled mobile phone; Accessing a corporate network via a Bluetooth-enabled mobile phone; Sending FAXes via Bluetooth; Troubleshooting resource access; Bluetooth products- Mobile phones, Pocket PCs and PDAs, Bluetooth adapters, PC adaptors: USB, PCMCIA, Bluetooth Access Points, Differentiating factors;

Suggested Reading

1. Data Communications and Networking- Forouzan, TMGH
2. Wireless Communications and Networks- Stallings, Pearson Education
3. Data Communications- Stalling, Pearson Education
4. Computer Networks- Tanenabaum, PHI

EL 422 D	**Departmental Elective: Embedded System**	2	0	2	4

Course Objective:
The course provides the basic understanding of Embedded System, types, programming and application.

Module 1: Introduction
Embedded system- definition, Types of processors used; Peculiarities and specialties; Requirement and Application;

Module 2: Processors and microcontrollers for embedded systems
Brief review of 8085, 8051, 8086, 80386, PIC processors and ARM based processor.

Module 3: Operating systems for embedded systems: -
Need for an operating system; Different types like single user and tasking, multi user, multi tasking, time sharing, batch processing, real time; Micro kernel vs monolithic; Major functions-Process management, Memory management, File system Management, I/O management and Network management.; Concept of process, threads, task switching, scheduling, critical sections, deadlock.

Module 4: Real time operating systems Issues
I/O programming- Synchronization, transfer rate and latency. Polled I/O issues. Interrupt driven I / O; ISR;. Response time- interrupt controller; Software interrupts and exceptions; Buffering of data and queuing of interrupt request; Concurrency control- Foreground / Background systems; Thread state and serialization, latency, prevention of interrupt overruns; Concurrent execution of threads, context switch, non-preemptive multitasking, preemptive multitasking; Critical sections:- disabling interrupts, disabling ask switch, spin lock, semaphore.

Module 5: Scheduling in embedded systems
Conventional scheduling, deadline driven scheduling, rate monotonic scheduling, deadlock, watchdog timer; Memory management in embedded systems- Static allocation, dynamic allocation;. Recursion and dynamic allocation; shared memory, re-entrant functions; Boot up and System initialization. 80x86 microprocessor with a C compiler (suited for RTOS) and uC / OS RTOS; Real time Embedded System applications as case study;

Suggested readings

1. Fundamentals of Embedded Software- Daniel W Lewis, Pearson Education
2. An Embedded Software Primer- David E. Simon, Pearson Education
3. Embedded Systems Design- Ramani Kalpathi and Ganesh Raja,
4. Design with PIC microcontroller- Peatman,, Pearson Education
5. Microcontrollers- Rajkamal,, Pearson Education

EL 422 E	Departmental Elective: Bio Electronics	2	0	2	4

Course Objective:
The course provides the basic understanding of Bio-Electronics, its importance, principles, devices, device modeling and application.

Module 1: Introduction
Nature of Biomedical signals; Bio Electronic potentials; Necessity of Bio Electronics; Components; Scope and Application; Basics of cell biology; Structure of the cell, the nervous system and the neuron; function of enzymes; nucleus and role of DNA and RNA, adhesion of cell to surfaces.

Module 2: Electrical Circuit treatment of biological environments
Behaviour of cells on semiconductor materials; Ionic conduction, the metal-electrolyte double layer, models of the cell membrane; Cell culture and biocompatibility testing; Mathematical modeling of the nervous system. Use of model neurons for associative computer memory; Bio-inspired systems;

Module 3: Electrical signal detection in biological systems
Silicon, glass and metal electrodes, amplifier design; Fundamentals of electron transfer and its application in bio electronic systems;.

Module 4: Bioelectronic device production
Microelectronic fabrication methods as adapted to Bioelectronics, hard and soft lithography, bio-compatibility of materials.

Module 5: Biosensors:
Importance, working, types; Miniaturization and Microsystems including sensing using optical techniques, field effect transistors, ion-selective and enzymatic sensitive electrodes, as well as impedance monitoring.

Module 6: Case study
Examples of industrial biosensors, e.g. for glucose monitoring and for DNA
Analysis and some others;

Suggested reading

1. Biosensors- E A Hall, Wiley;
2. Electrodes and Membranes- J Koryta Ions, Wiley ;
3. Bioelectronics- S Bone & B Zabba, Wiley;

EL 422 F	**Departmental Elective: Speech Processing**	2	0	2	4

Course Objective:
The course provides the basic understanding of Bio-Electronics, its importance, principles, devices, device modeling and application.

Module 1: Introduction
Definition, basic concepts, Types- voiced and unvoiced; Production of speech- Biological Model, Signal Processing Model; Application areas and trends; Steps of human-human communication; Speech reception and Comprehension by the listener; Digital model of speech perception;

Module 2: Speech Signal Processing
Spectral analysis- DTFT, STFT, DFT; Sinusoidal analysis; Cepstral Analysis; LP Analysis- LP and Inverse LP filters, LP-derived features;

Module 3: Speech Coding
Definition, Importance, Requirements, Speech coding trends, Classification- PCM, ADPCM, Transform domain coding, Sub band coding, Multi Pulse Linear Predictive Coding, Code Excitation Linear Prediction Coding;

Module 4: Speaker Recognition
Importance, Man-Machine interface, Automatic Speaker Recognition, Biometric speaker recognition, Speaker verification v/s Speaker Identification,. Text- dependence and independence, Closed set and opened set, Speaker recognition using pattern Recognition Methods, Feature Extraction, Pattern Classification Techniques- Vector Quantization, Dynamic Time Warping, Hidden Markov Model, Neural Networks; Pattern Comparison;

Module 5: Speech Enhancement
Definition, Requirements, Examples of degraded speech, Enhancement of single channel and multi channel speech; Time delay estimates;

Suggested Reading
1. Digital Processing of Speech- Rabiner and Schafer, Pearson Education;

EL 423	Entrepreneurship Development	2	0	0	2

Course Objective:

The Entrepreneurship program is designed to prepare students for an exciting career in today's competitive era. The course will equip students with the knowledge to cope up with the changing environment because of the advent of technology and other influences. The course will also develop required entrepreneurship skills in the students from a variety of disciplinary perspectives known to be important for independent and corporate entrepreneurs.

Module I

Principles and function of management, Planning and decision making, Line and staff relationship, management by objective

Module II

Formal and informal organization, Performance appraisal, Training and development

Module III

Entrepreneurship and entrepreneurial process, Business plan, Form of ownership suitable for business

Module IV

Entrepreneurial motivation and leadership, entrepreneurial competencies, entrepreneurial development programme

Suggested reading:

1. Essentials of Management, H. Koontz, H. Weihrich and C. O'Donnell, McGraw-Hill/Irwin
2. Entrepreneurship : New Venture Creation- David H Holt,

EL 424	Web Technology	2	1	0	3

Course Objective:
To provide the students the basic skills of using the Internet and developing applications for its effective utilization.

Module 1: Introduction to Computer Networks
Fundamentals of Computer Networks and the Internet, application layer protocols, transport layer protocols, network layer and routing, link layer and local area networks, security in computer networks. Introduction to World Wide Web (WWW), development of WWW, Graphical user Interface;

Module 2: Weaving the web
Introduction to Hyper Text Markup Language (HTML), Extensible Hypertext Markup Language (XHTML), and Extensible Markup Language (XML) to create web pages, Moving from HTML to XHTML, XHTML element structure, style sheets, using JavaScript to display to XML, introduction to XML DOCTYPES and their uses, XML in web publishing environment.

Module 3: Imaging Technologies for Web Publishing
Image file formats, creating low bandwidth graphics, using color, browser-safe colors, imaging transparency, creating graphical navigation tools, scanning techniques, creating small animations, image mapping, using scalable vector graphics (SVG), and graphical layout and alignment. Fundamentals of creating dynamic, interactive web pages: An introduction to Active Server Pages (ASP) technology, ASP syntax, and introduction to VBScript, the request, response, server, application, and session objects, working component, and connecting databases to ASP pages.

Module 4: Java in Web Publishing:
Preparing Java applets using the Abstract Windows Toolkit (AWT) framework, basic graphics features provided by Java Language.

Module 5: Web Services (WS)
Different implementation Techniques of WS, Dot-Net –Based WS Initiatives, Java-Based WS Initiative J2EE, Comparison of Dot-Net base and XML bas WS initiatives. The performance, efficiency, scalability, power, time-to-Market features, the portability etc., support of both the techniques for existing systems, The migration from previous platform of both the techniques.

Suggested Readings:

1. Web Design, The complete reference, - Thomas A. Powel, Tata McGraw Hill. Second Edition
2. The HTML 4.0 Source book- Ian Graham, John Wiley
3. The XML Specification Guide- Ian Graham and Liam Quin, John Wiley
4. The XHTML 1.0 Web Development Sourcebook- John Wiley and Sons.
5. Web Services Security- Mark O'Neill, et al. Tata McGraw Hill.

EL 425	Seminar & Term Paper	0	2	0	2

A. Seminar

Each student shall collect information on an allotted topic related to the subject, analyze it and formulate an approach to make a presentation. The students shall submit a report on the allotted topic which shall be evaluated by the concerned internal faculty. He/She then would present a seminar on the concerned topic.

Examination Scheme:

Report: 20

Presentation: 30

Total: 50

B. Term Paper

METHODOLOGY

A term (or research) paper is primarily a record of intelligent reading in several sources on a particular subject. The students will choose the topic at the beginning of the session in consultation with the faculty assigned. The progress of the paper will be monitored regularly by the faculty. At the end of the semester the detailed paper on the topic will be submitted to the faculty assigned. The evaluation will be done by Board of examiners comprising of the faculties.

GUIDELINES FOR TERM PAPER

The procedure for writing a term paper may consists of the following steps:

1. Choosing a subject
2. Finding sources of materials
3. Collecting the notes
4. Outlining the paper
5. Writing the first draft
6. Editing & preparing the final paper

1. Choosing a Subject

The subject chosen should not be too general.

2. Finding Sources of materials

a. The material sources should be not more than 10 years old unless the nature of the paper is such that it involves examining older writings from a historical point of view.
b. Begin by making a list of subject-headings under which you might expect the subject to be listed.
c. The sources could be books and magazines articles, news stories, periodicals, scientific journals etc.

3. Collecting the notes

Skim through sources, locating the useful material, then make good notes of it, including quotes and information for footnotes.

a. Get facts, not just opinions. Compare the facts with author's conclusion.
b. In research studies, notice the methods and procedures, results & conclusions.
c. Check cross references.

4. Outlining the paper

a. Review notes to find main sub-divisions of the subject.
b. Sort the collected material again under each main division to find sub-sections for outline so that it begins to look more coherent and takes on a definite structure. If it does not, try going back and sorting again for main divisions, to see if another general pattern is possible.

5. Writing the first draft

Write the paper around the outline, being sure that you indicate in the first part of the paper what its purpose is. You may follow the following:

- statement of purpose
- main body of the paper
- statement of summary and conclusion

Avoid short, bumpy sentences and long straggling sentences with more than one main ideas.

6. Editing & Preparing the final Paper

a. Before writing a term paper, you should ensure you have a question which you attempt to answer in your paper. This question should be kept in mind throughout the paper. Include only information/ details/ analyses of relevance to the question at hand. Sometimes, the relevance of a particular section may be clear to you but not to your readers. To avoid this, ensure you briefly explain the relevance of every section.
b. Read the paper to ensure that the language is not awkward, and that it "flows" properly.
c. Check for proper spelling, phrasing and sentence construction.
d. Check for proper form on footnotes, quotes, and punctuation.
e. Check to see that quotations serve one of the following purposes:
f. Show evidence of what an author has said.
g. Avoid misrepresentation through restatement.
h. Save unnecessary writing when ideas have been well expressed by the original author.
i. Check for proper form on tables and graphs. Be certain that any table or graph is self-explanatory.

7. Term papers should be composed of the following sections:

1) Title page
2) Table of contents
3) Introduction
4) Review
5) Discussion & Conclusion
6) References
7) Appendix

Generally, the introduction, discussion, conclusion and bibliography part should account for a third of the paper and the review part should be two thirds of the paper.

Discussion

The discussion section either follows the results or may alternatively be integrated in the results section. The section should consist of a discussion of the results of the study focusing on the question posed in the research paper.

Conclusion

The conclusion is often thought of as the easiest part of the paper but should by no means be disregarded. There are a number of key components which should not be omitted. These include:

a) summary of question posed
b) summary of findings
c) summary of main limitations of the study at hand
d) details of possibilities for related future research

References

From the very beginning of a research project, you should be careful to note all details of articles gathered.

The bibliography should contain ALL references included in the paper. References not included in the text in any form should NOT be included in the bibliography. The key to a good bibliography is consistency. Choose a particular convention and stick to this.

Appendix

The appendix should be used for data collected (e.g. questionnaires, transcripts, ...) and for tables and graphs not
included in the main text due to their subsidiary nature or to space constraints in the main text.

Assessment Scheme:

Continuous Evaluation: 40%

(Based on abstract writing, interim draft, general approach, research orientation, readings undertaken etc.)

Final Evaluation: 60%

(Based on the organization of the paper, objectives/ problem profile/ issue outlining, comprehensiveness of the research, flow of the idea/ ideas, relevance of material used/ presented, outcomes vs. objectives, presentation/ viva etc.)

Total marks- 50.