Tribhuvan University

Institute of Engineering

CURRICULUM

BACHELOR'S DEGREE IN ELECTRONICS & COMMUNICATION ENGINEERING

Revised Print
2009

Contents

1. INTRODUCTION

The Institute of Engineering (IOE) is offering this course with the objective of producing high level technical manpower capable of undertaking works in the Electronics & Communication Engineering field. The details of the course are as follows:

1.1 Title of the Course

Bachelor of Engineering in **Electronics & Communication Engineering**.

1.2 Duration of the Course

The total duration of the course is 4 years. Each year consists of two parts **I** and **II**, each part having duration of 90 working days (15 weeks).

2. COURSE STRUCTURE

The course is divided into 8 parts. The first year courses include fundamental common subjects. The second and third year generally include specific courses of the related discipline. The final year include professional and application type courses.

The course structure attached in the later section of this book provides information about lecture, tutorial and practical hours per week, full marks and pass marks for internal assessment and final examination, and the duration of final examination of each subject.

3. COURSE CODE

Each subject is specified by a unique code consisting of two letters followed by three digit number for core courses and five digit numbers for elective courses. The first two letters denote the department which offers the subject (SH: Science and Humanities, AE: Agricultural Engineering, AR: Architecture, CE: Civil Engineering, CT: Computer Engineering, EE: Electrical Engineering, EX: Electronics and Communication Engineering, GE: Geomatics Engineering, IE: Industrial Engineering, ME: Mechanical Engineering). The first digit of the number denotes the year on which the subject is offered (4 for first year, 5 for second year, 6 for third year and 7 for fourth year respectively for Bachelor' level course). The remaining two digits 01 to 49 are used for the core subjects offered in odd parts and 51 to 99 are used for the core subjects offered in even parts. Two extra digits from 01 to 99 are used for the elective courses.

Core Courses:

AB	DEF

AB: Offering Department (SH, AE, AR, CE, CT, EE, EX, GE or ME)

D: Year (4 for first year, 5 for second year, and so on).

EF: 01- 49 for courses offered in odd parts and 51 to 99 for courses offered in even parts

Elective Courses:

AB	DEFGH

GH: 01 to 99 specific numbers to each elective course

For example, ME 751 is the code for the core course "Finite Element Method" which is offered in fourth year second part by Department of Mechanical Engineering.

4. INSTRUCTION METHODS

The method of teaching is lectured augmented by tutorials and/or practical, whichever is relevant. Tutorials are used to enlarge and develop the topic and concepts stated in the lecture. Practical classes in the form of laboratory works and design/drawing practices are used to verify the concepts and to develop necessary basic skills. Each course is specified with certain lecture, tutorial and practical hour(s) per week. The hours specified as 3/2 in practical means 3 laboratory hours in each two weeks.

The use of multimedia and interactive mode (presentations) is encouraged for conducting fourth year courses.

5. INTERNAL ASSESSMENT AND FINAL EXAMINATION

The students' achievement in each subject is evaluated by internal assessment and final examination.

5.1 Internal Assessment

20 % of the total marks is allocated for internal assessment for theory part of all subjects. Internal assessment mark should include class performance, timely submissions and correctness of assignments, class tests, quizzes, etc.

Evaluation of practical part of most of the subjects is done through continuous assessment. It includes lab performance, report submission, presentation, viva etc. However, for few courses final examinations are also conducted.

70 % attendance is mandatory to qualify for the final examination.

5.2 Final Examination

Final examinations of 3 hours for theoretical subjects with full mark of 80 and 1.5 hours for theoretical subjects with full mark of 40 are conducted as per academic calendar of IOE.

5.3 Pass Marks

Any student must obtain 40 % in both internal assessment and final examination of each subject to pass in the subject. Only students who have passed the internal assessment of a particular subject are allowed to appear in the final examination of that subject.

6. EVALUATION SYSTEM

Students who have passed all the components of all subjects in all parts are considered to have successfully completed the course. The overall achievement of each student is measured by a final aggregate percentage which is obtained by providing a weight to percentages scored by the students in each part as prescribed below:

First year (both I and II Parts):	20 %
Second year (both I and II Parts):	20 %
Third year (both I and II Parts):	30 %
Fourth years (both I and II Parts):	30 %

Depending upon the final weighted aggregate percentage scored by a student, a division is awarded as follows:

80 % and above:	Distinction
65 % or above and below 80 %:	First
50 % or above and below 65%:	Second
40 % or above and below 50%:	Pass

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Year : I

Part : I

Teaching Schedule							Examination Scheme							
							Theory			Practical				
								Final			Final			
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Duaration hours	Marks	Assesment Marks	Duaration hours	Marks	Total	Remark
1	SH 401	Engineering Mathematics I	3	2		5	20	3	80				100	
2	CT 401	Computer Programming	3		3	6	20	3	80	50			150	
3	ME 401	Engineering Drawing I	1		3	4				60	3	40	100	
4	SH 402	Engineering Physics	4	1	2	7	20	3	80	20	3	30	150	
5	CE 401	Applied Mechanics	3	2		5	20	3	80				100	
6	EE 401	Basic Electrical Engineering	3	1	1.5	5.5	20	3	80	25			125	
		Total	**17**	**6**	**9.5**	**32.5**	**100**	**15**	**400**	**155**	**6**	**70**	**725**	

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Year : I

Part : II

Teaching Schedule							Examination Scheme								
							Theory			Practical					
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Final Duaration hours	Final Marks	Assesment Marks	Final Duaration hours	Final Marks	Total	Remark
1	SH 451	Engineering Mathematics -II	3	2		5	20	3	80				100	
2	ME 451	Engineering Drawing II	1		3	4				60	3	40	100	
3	EX 451	Basic Electronics Engineering	3	1	1.5	5.5	20	3	80	25			125	
4	SH 453	Enginering Chemistry	3	1	3	7	20	3	80	20	3	30	150	
5	ME 453	Workshop Technology	1		3	4	10			40			50	
6	ME 452	Fundamental of Thermodynamics and Heat Transfer	3	1	1.5	5.5	20	3	80	25			125	
		Total	**14**	**5**	**12**	**31**	**90**	**12**	**320**	**170**	**6**	**70**	**650**	

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Year : II

Part : I

Teaching Schedule							Examination Scheme							
							Theory			Practical			Total	Remark
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Final Duaration hours	Final Marks	Assesment Marks	Final Duaration hours	Final Marks		
1	SH 501	Engineering Mathematics III	3	2		5	20	3	80				100	
2	CT 501	Object Oriented Programming	3		3	6	20	3	80	50			150	
3	EE 501	Electric Circuit Theory	3	1	1.5	5.5	20	3	80	25			125	
4	EE 502	Electrical Engineering Material	3	1		4	20	3	80				100	
5	EX 501	Electronic Devices & Circuits	3	1	1.5	5.5	20	3	80	25			125	
6	EX 502	Digital Logic	3		3	6	20	3	80	50			150	
7	EX 503	Electromagnetics	3	1	1.5	5.5	20	3	80	25			125	
		Total	**21**	**6**	**10.5**	**37.5**	**140**	**21**	**560**	**175**			**875**	

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Year : II

Part : II

S. N.	Course Code	Course Title	Teaching Schedule				Examination Scheme							Remark
							Theory			Practical				
							Assesment Marks	Final		Assesment Marks	Final		Total	
			L	T	P	Total		Duaration hours	Marks		Duaration hours	Marks		
1	EE 554	Electrical Machine	3	1	1.5	5.5	20	3	80	25			125	
2	SH 553	Numerical Method	3	1	3	7	20	3	80	50			150	
3	SH 551	Applied Mathematics	3	1		4	20	3	80				100	
4	EE 552	Instrumentation I	3	1	1.5	5.5	20	3	80	25			125	
5	EE 553	Power System	3	1		4	20	3	80				100	
6	EX 551	Microprocessor	3	1	3	7	20	3	80	50			150	
7	CT 551	Discrete Structure	3			3	20	3	80				100	
		Total	**21**	**6**	**9**	**36**	**140**	**21**	**560**	**150**			**850**	

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Year : III Part : I

Teaching Schedule							Examination Scheme							
							Theory			Practical				
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Final		Assesment Marks	Final		Total	Remark
								Duaration hours	Marks		Duaration hours	Marks		
1	SH 601	Communication English	3	1	2	6	20	3	80	25			125	
2	SH 602	Probability and Statistics	3	1		4	20	3	80				100	
3	EE 602	Control System	3	1	1.5	5.5	20	3	80	25			125	
4	EX 602	Instrumentation II	3	1	1.5	5.5	20	3	80	25			125	
5	EX 603	Computer Graphics	3	1	3	7	20	3	80	50			150	
6	EX 601	Advanced Electronics	3	1	1.5	5.5	20	3	80	25			125	
7	CT 603	Computer Organization & Architecture	3	1	1.5	5.5	20	3	80	25			125	
		Total	**21**	**7**	**11**	**39**	**140**	**21**	**560**	**175**			**875**	

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Year : III

Part : II

Teaching Schedule							Examination Scheme							
							Theory			Practical				
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Final Duaration hours	Final Marks	Assesment Marks	Final Duaration hours	Final Marks	Total	Remark
1	CE 655	Engineering Economics	3	1		4	20	3	80				100	
2	CT 655	Embedded System	3	1	1.5	5.5	20	3	80	25			125	
6	EX 651	Signal Analysis	3	1	1.5	5.5	20	3	80	25			125	
4	EX 652	Communication System I	3	1	1.5	5.5	20	3	80	25			125	
5	CT 657	Computer Network	3	1	3	7	20	3	80	50			150	
6	EX 653	Propagation and Antenna	3	1	1.5	5.5	20	3	80	25			125	
7	EX 654	Minor Project			4	4				50		25	75	
		Total	**18**	**6**	**13**	**37**	**120**	**18**	**480**	**200**		**25**	**825**	

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Year : IV

Part : I

Teaching Schedule							Examination Scheme						Total	Remark
							Theory			Practical				
								Final			Final			
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Duaration hours	Marks	Assesment Marks	Duaration hours	Marks		
1	CT 701	Project Management	3	1		4	20	3	80				100	
2	ME 708	Organization and Management	3	1		4	20	3	80				100	
3	EX 701	Energy Enviroment and Society	2			2	10	1.5	40				50	
4	EX 702	Communication System II	3	1	1.5	5.5	20	3	80	25			125	
5	EX 703	Telecommunication	3	1	1.5	5.5	20	3	80	25			125	
3	EX 704	Filter Design	3	1	1.5	5.5	20	3	80	25			125	
7	EX 7250..	Elective I	3	1	1.5	5.5	20	3	80	25			125	
8	EX 707	Project (Part A)			3	3				50			50	
		Total	**20**	**6**	**9**	**35**	**130**	**19.5**	**520**	**150**			**800**	

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Year : IV

Part : II

Teaching Schedule							Examination Scheme							
							Theory			Practical				
								Final			Final			
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Duaration hours	Marks	Assesment Marks	Duaration hours	Marks	Total	Remark
1	CE 752	Professional Practice	2			2	10	1.5	40				50	
2	EX 751	Wireless Communication	3	1		4	20	3	80				100	
3	EX 752	RF and Microwave Engineering	3	1	1.5	5.5	20		80	25			125	
3	EX 753	Digital Signal Processing	3	1	1.5	5.5	20	3	80	25			125	
4	EX 7650..	Elective II	3	1	1.5	5.5	20	3	80	25			125	
5	EX 7850..	Elective III	3	1	1.5	5.5	20	3	80	25			125	
6	EX 755	Project (Part B)			6	6				50		50	100	
		Total	**17**	**5**	**12**	**34**	**110**	**13.5**	**440**	**150**		**50**	**750**	

ENGINEERING MATHEMATICS I

SH 401

Lecture : 3
Tutorial : 2
Practical : 0

Year : I
Part : I

Course Objective:
To provide students a sound knowledge of calculus and analytic geometry to apply them in their relevant fields.

1. Derivatives and their Applications **(14 hours)**

1.1. Introduction
1.2. Higher order derivatives
1.3. Mean value theorem
  1.3.1. Rolle's Theorem
  1.3.2. Lagrange's mean value theorem
  1.3.3. Cauchy's mean value theorem
1.4. Power series of single valued function
  1.4.1. Taylor's series
  1.4.2. Maclaurin's series
1.5. Indeterminate forms; L'Hospital rule
1.6. Asymptotes to Cartesian and polar curves
1.7. Pedal equations to Cartesian and polar curves; curvature and radius of curvature

2. Integration and its Applications **(11 hours)**

2.1. Introduction
2.2. Definite integrals and their properties
2.3. Improper integrals
2.4. Differentiation under integral sign
2.5. Reduction formula; Beta Gama functions
2.6. Application of integrals for finding areas, arc length, surface and solid of revolution in the plane for Cartesian and polar curves

3. Plane Analytic Geometry **(8 hours)**

3.1. Transformation of coordinates: Translation and rotation
3.2. Ellipse and hyperbola; Standard forms, tangent, and normal
3.3. General equation of conics in Cartesian and polar forms

4. Ordinary Differential Equations and their Applications **(12 hours)**

4.1. First order and first degree differential equations
4.2. Homogenous differential equations
4.3. Linear differential equations
4.4. Equations reducible to linear differential equations; Bernoulli's equation

4.5. First order and higher degree differential equation; Clairaut's equation
4.6. Second order and first degree linear differential equations with constant coefficients.
4.7. Second order and first degree linear differential equations with variable coefficients; Cauchy's equations
4.8. Applications in engineering field

References:

1. Erwin Kreyszig, "Advance Engineering Mathematics" , John Wiley and Sons Inc
2. Thomas,Finney, "Calculus and Analytical Geometry" Addison- Wesley
3. M. B. Singh, B. C. Bajrachrya, "Differential Calculus", Sukunda Pustak Bhandar,Nepal
4. M. B. Singh, S. P. Shrestha, "Applied Mathematics", RTU, Department of Engineering Science and Humanities.
5. G.D. Pant, G. S. Shrestha, "Integral Calculus and Differential Equations", Sunila Prakashan, Nepal
6. M. R. Joshi, "Analytical Geometry", SukundaPustak Bhandar,Nepal
7. S. P. Shrestha, H. D. Chaudhary, P. R. Pokharel, "A Textbook of Engineering Mathematics - Vol I", Vidyarthi Pustak Bhandar.
8. Santosh Man Maskey, "Calculus", Ratna Pustak Bhandar, Nepal

COMPUTER PROGRAMMING

CT 401

Lecture : 3
Tutorial : 0
Practical : 3

Year : I
Part : I

Course Objective:
To familiarize the student with computer software and high level programming languages and to develop the programming skill using C language

1. Overview of Computer Software & Programming Languages **(3 hours)**

1.1. System software
1.2. Application software
1.3. General software features and recent trends
1.4. Generation of programming languages
1.5. Categorization of high level languages

2. Problem Solving Using Computer **(3 hours)**

2.1. Problem analysis
2.2. Algorithm development and Flowchart
2.3. Compilation and Execution
2.4. Debugging and Testing
2.5. Programming Documentation

3. Introduction to 'C' Programming **(4 hours)**

3.1. Character set, Keywords, and Data types
3.2. Preprocessor Directives
3.3. Constants and Variables
3.4. Operators and statements

4. Input and Output **(3 hours)**

4.1. Formatted input/output
4.2. Character input/output
4.3. Programs using input/output statements

5. Control Statements **(6 hours)**

5.1. Introduction
5.2. The goto, if, if ... ... else, switch statements
5.3. The while, do ... while, for statements

6. User-Defined Functions **(4 hours)**

6.1. Introduction
6.2. Function definition and return statement
6.3. Function Prototypes

6.4. Function invocation, call by value and call by reference, Recursive Functions

7. Arrays and Strings **(5 hours)**

7.1. Defining an Array
7.2. One-dimensional Arrays
7.3. Multi-dimensional Arrays
7.4. Strings and string manipulation
7.5. Passing Array and String to function

8. Structures **(4 hours)**

8.1. Introduction
8.2. Processing a Structure
8.3. Arrays of Structures
8.4. Arrays within Structures
8.5. Structures and Function

9. Pointers **(4 hours)**

9.1. Introduction
9.2. Pointer declaration
9.3. Pointer arithmetic
9.4. Pointer and Array
9.5. Passing Pointers to a Function
9.6. Pointers and Structures

10. Data Files **(5 hours)**

10.1. Defining opening and closing a file
10.2. Input/Output operations on Files
10.3. Error handling during input/output operations

11. Programming Languages: FORTRAN **(4 hours)**

11.1 Character set
11.2 Data types, Constants and variables
11.3 Arithmetic operations, Library Functions
11.4 Structure of Fortran program
11.5 Formatted and Unformatted Input/Output Statements
11.6 Control Structures: Goto, Logical IF, Arithmetic IF, Do loops
11.7 Arrays: one dimensional and two dimensional

Practical

- Minimum 6 sets of computer programs in C (from Unit 4 to Unit 10) and 2 sets in FORTRAN (from Unit 11) should be done individually. (30 marks out of 50 marks)
- Student (maximum 4 persons in a group) should submit a mini project at the end of course. (20 marks out of 50 marks)

References:

1. Kelly & Pohl, "A Book on C", Benjamin/Cumming
2. Brian W. Keringhan & Dennis M. Ritchie, "The 'C' Programming Language", PHI
3. Daya Sagar Baral, Diwakar Baral and Sharad Kumar Ghimire "The Secrets of C Programming Language", Bhundipuran Publication
4. Bryons S. Gotterfried, "Programming with C", TMH
5. Yashavant Kanetkar, "Let Us C", BPB
6. Alexis Leon, Mathews Leon, "Fundamentals of Information Technology", Leon Press and Vikas Publishing House

ENGINEERING DRAWING I

ME 401

Lectures : 1
Tutorial : 0
Practical : 3

Year : I
Part : I

Course Objective:
To develop basic projection concepts with reference to points, lines, planes and geometrical solids. Also to develop sketching and drafting skills to facilitate communication.

1. Instrumental Drawing, Technical Lettering Practices & Techniques (2 hours)

1.1. Equipment and materials
1.2. Description of drawing instruments, auxiliary equipment and drawing materials
1.3. Techniques of instrumental drawing
1.4. Pencil sharpening, securing paper, proper use of T- squares, triangles, scales dividers, compasses, erasing shields, French curves, inking pens
1.5. Lettering strokes, letter proportions, use of pencils and pens, uniformity and appearance of letters, freehand techniques, inclined and vertical letters and numerals, upper and lower cases, standard English lettering forms

2. Dimensioning (2 hours)

2.1. Fundamentals and techniques
2.2. Size and location dimensioning, SI conversions
2.3. Use of scales, measurement units, reducing and enlarging drawings
2.4. Placement of dimensions: aligned and unidirectional

3. Applied Geometry (6 hours)

3.1. Plane geometrical construction: Proportional division of lines, arc & line tangents
3.2. Methods for drawing standard curves such as ellipses, parabolas, hyperbolas, involutes, spirals, cycloids and helices (cylindrical and conical)
3.3. Techniques to reproduce a given drawing (by construction)

4. Basic Descriptive Geometry (14 hours)

4.1. Introduction to Orthographic projection, Principal Planes, Four Quadrants or Angles
4.2. Projection of points on first, second, third and fourth quadrants
4.3. Projection of Lines: Parallel to one of the principal plane, Inclined to one of the principal plane and parallel to other, Inclined to both principal planes

4.4. Projection Planes: Perpendicular to both principal planes, Parallel to one of the principal planes and Inclined to one of the principal planes, perpendicular to other and Inclined to both principal planes
4.5. True length of lines: horizontal, inclined and oblique lines
4.6. Rules for parallel and perpendicular lines
4.7. Point view or end view of a line
4.8. Shortest distance from a point to a line
4.9. Edge View and True shape of an oblique plane
4.10. Angle between two intersecting lines
4.11. Intersection of a line and a plane
4.12. Angle between a line and a plane
4.13. Dihedral angle between two planes
4.14. Shortest distance between two skew lines
4.15. Angle between two non- intersecting (skew) lines

5. Multi view (orthographic) projections **(18 hours)**

5.1. Orthographic Projections
  5.1.1. First and third angle projection
  5.1.2. Principal views: methods for obtaining orthographic views, Projection of lines, angles and plane surfaces, analysis in three views, projection of curved lines and surfaces, object orientation and selection of views for best representation, full and hidden lines
  5.1.3. Orthographic drawings: making an orthographic drawing, visualizing objects (pictorial view) from the given views
  5.1.4. Interpretation of adjacent areas, true-length lines , representation of holes, conventional practices
5.2. Sectional Views: Full, half, broken revolved, removed (detail) sections, phantom of hidden section, Auxiliary sectional views, specifying cutting planes for sections, conventions for hidden lines, holes, ribs, spokes
5.3. Auxiliary views: Basic concept and use, drawing methods and types, symmetrical and unilateral auxiliary views. Projection of curved lines and boundaries, line of intersection between two planes, true size of dihedral angles, true size and shape of plane surfaces

6. Developments and Intersections **(18 hours)**

6.1. Introduction and Projection of Solids
6.2. Developments: general concepts and practical considerations, development of a right or oblique prism, cylinder, pyramid, and cone, development of truncated pyramid and cone, Triangulation method for approximately developed surfaces, transition pieces for connecting different shapes, development of a sphere
6.3. Intersections: lines of intersection of geometric surfaces, piercing point of a line and a geometric solid, intersection lines of two planes, intersections of -prisms and pyramids, cylinder and an oblique plane.

Constructing a development using auxiliary views, intersection of - two cylinders, a cylinder & a cone

Practical:

1. Drawing Sheet Layout, Freehand Lettering, Sketching of parallel lines, circles, Dimensioning
2. Applied Geometry(Sketch and Instrumental Drawing)
3. Descriptive Geometry I: Projection of Point and Lines (4.1 to 4.3)(Sketch and Instrumental Drawing)
4. Descriptive Geometry II: Projection of Planes (4.4) (Sketch and Instrumental Drawing)
5. Descriptive Geometry III: Applications in Three dimensional Space (4.5 to 4.15) (Sketch and Instrumental Drawing)
6. Multiview Drawings (5.1) (Sketch and Instrumental Drawing)
7. Multiview, Sectional Drawings and Dimensioning I (5.2)(Sketch and Instrumental Drawing)
8. Multiview, Sectional Drawings and Dimensioning II (5.2) (Sketch and Instrumental Drawing)
9. Auxiliary View, Sectional Drawings and Dimensioning (5.3) (Sketch and Instrumental Drawing)
10. Projection of Regular Geometrical Solids (Sketch and Instrumental Drawing)
11. Development and Intersection I (6.1) (Sketch and Instrumental Drawing)
12. Development and Intersection II (6.2) (Sketch and Instrumental Drawing)
13. Development and Intersection III (6.3) (Sketch and Instrumental Drawing)

References:

1. M. C. Luintel, "Engineering Drawing (Vol.I)", Athrai Publication (P) Limited.
2. W. J. Luzadder, "Fundamentals of Engineering Drawing", Prentice Hall.
3. T. E. French, C. J. Vierck, and R. J. Foster, "Engineering Drawing and Graphic Technology", Mc Graw Hill Publshing Co.
4. A . Mitchell, H. C. Spencer and J. T. Dygdone, "Technical Drawing", F. E. Giescke, Macmillan Publshing Co.
5. N. D. Bhatt, "Elementary Engineering Drawing", Charotar Publshing House, India.
6. P. S. Gill, "A Text Book of Engineering Drawing", S. K. Kataria and Sons, India
7. R. K. Dhawan, "A Text Book of Engineering Drawing", S. Chand and Company Limited, India

ENGINEERING PHYSICS

SH 402

Lecture : 4
Tutorial : 1
Practical : 2

Year : I
Part : I

Course objectives:

To provide the concept and knowledge of physics with the emphasis of present day application.

1. Oscillation: **(7 hours)**

1.1 Mechanical Oscillation: Introduction
1.2 Free oscillation
1.3 Damped oscillation
1.4 forced mechanical oscillation
1.5 EM Oscillation: Free, damped and Forced electromagnetic oscillation

2. Wave motion **(2 hours)**

2.1 Waves and particles,
2.2 Progressive wave,
2.3 Energy, power and intensity of progressive wave

3. Acoustics **(3 hours)**

3.1 Reverberation,
3.2 Sabine' Law
3.3 ultrasound and its applications

4. Physical Optics **(12 hours)**

4.1 Interference,
- 4.1.1 Intensity in double slit interference,
- 4.1.2 Interference in thin films,
- 4.1.3 Newton's rings,
- 4.1.4 Hadinger fringes

4.2 Diffraction,
- 4.2.1 Fresnel and Fraunhoffer's diffraction,
- 4.2.2 Intensity due to a single slit;
- 4.2.3 Diffraction grating,
- 4.2.4 X-ray diffraction, x-ray for material test

4.3 Polarization,
- 4.3.1 Double refraction,
- 4.3.2 Nichol prism, wave plates,
- 4.3.3 Optical activity, specific rotation

5. Geometrical Optics **(3 hours)**

5.1 Lenses, combination of lenses,
5.2 Cardinal points,

5.3 Chromatic aberration

6. Laser and Fiber Optics **(4 hours)**

6.1 Laser production,
- 6.1.1 He-Ne laser,
- 6.1.2 Uses of laser

6.2 Fiber Optics,
- 6.2.1 Self focusing,
- 6.2.2 Applications of optical fiber

7. Electrostatics **(8 hours)**

7.1 Electric charge and force,
7.2 Electric field and potential,
7.3 Electrostatic potential energy,
7.4 Capacitors, capacitor with dielectric,
7.5 Charging and discharging of a capacitor

8. Electromagnetism **(11 hours)**

8.1 Direct current: Electric current,
- 8.1.1 Ohm's law, resistance and resistivity,
- 8.1.2 Semiconductor and superconductor

8.2 Magnetic fields:
- 8.2.1 Magnetic force and Torque,
- 8.2.2 Hall effect,
- 8.2.3 Cyclotron, synchrotron,
- 8.2.4 Biot-savart law,
- 8.2.5 Ampere's circuit law; magnetic fields straight conductors,
- 8.2.6 Faraday's laws, Induction and energy transformation, induced field,
- 8.2.7 LR circuit, induced magnetic field,
- 8.2.8 Displacement current

9. Electromagnetic waves **(5 hours)**

9.1 Maxwell's equations,
9.2 Wave equations, speed,
9.3 E and B fields,
9.4 Continuity equation,
9.5 Energy transfer

10. Photon and matter waves **(5 hours)**

10.1 Quantization of energy;
10.2 Electrons and matter waves;
10.3 Schrodinger wave equation;
10.4 Probability distribution;
10.5 One dimensional potential well;
10.6 Uncertainty principle;
10.7 Barrier tunneling

Practical:

1. To determine the acceleration due to gravity and radius of gyration of the bar about an axis passing through its center of gravity.
2. To determine the value of modulus of elasticity of the materials given and moment of inertia of a circular disc using torsion pendulum.
3. To determine the angle of prism and dispersive power of materials of the prism using spectrometer.
4. To determine the wavelength of sodium light by Newton's rings.
5. To determine the wavelength of He-Ne laser light and use it to measure the thickness of a thin wire by diffraction of light.
6. To study the variation of angle of rotation of plane of polarization using concentration of the cane sugar solution
7. To determine the specific rotation of the cane sugar solution using polarimeter.
8. To determine the low resistance of a given wire by Carey Foster bridge and to determine the resistance per unit length of the wire of the bridge.
9. To determine the capacitance of a given capacitor by charging and discharging through resistor.
10. To plot a graph between current and frequency in an LRC series circuit and find the resonant frequency and quality factor.
11. To determine dielectric constant of a given substance and study its variation with frequency by resonance method.
12. To determine the susceptibility of a solution of given materials by Quinkes method.
13. To study the electric field mapping.

References:

1. Halliday, Resnick, Walker, "Fundamentals of Physics", John Wiley & Sons. Inc.
2. Sapkota, Pokharel, Bhattarai, "Fundamentals of Engineering Physics", Benchmark Publication.
3. Brij Lal and Subrahmanyam, "A text book of Optics", S. Chand Publisher.
4. A. S. Basudeva, "Modern Engineering Physics", S. Chand Publisher.
5. R. K. Gaur and S. L. Gupta, "Engineering Physics", Dhanpat Publisher.
6. Brij Lal and Subrahmanyam, "Waves and Oscillation", S. Chand Publisher.

APPLIED MECHANICS

CE 401

Lecture : 3 **Year : I**
Tutorial : 2 **Part : I**
Practical : 0

Course Objective:

To provide concept and knowledge of engineering mechanics and help understand structural engineering stress analysis principles in later courses or to use basics of mechanics in their branch of engineering. Emphasis has been given to Statics.

1. Introduction **(2 hours)**

1.1 Definitions and scope of Applied Mechanics
1.2 Concept of Rigid and Deformed Bodies
1.3 Fundamental concepts and principles of mechanics: Newtonian Mechanics

2. Basic Concept in Statics and Static Equilibrium **(4 hours)**

2.1 Concept of Particles and Free Body Diagram
2.2 Physical meaning of Equilibrium and its essence in structural application
2.3 Equation of Equilibrium in Two Dimension

3. Forces Acting on Particle and Rigid Body **(6 hours)**

3.1 Different types of Forces: Point, Surface Traction and Body Forces -Translational Force and Rotational Force: Relevant Examples
3.2 Resolution and Composition of Forces: Relevant Examples
3.3 Principle of Transmissibility and Equivalent Forces: Relevant Examples
3.4 Moments and couples: Relevant Examples
3.5 Resolution of a Force into Forces and a Couple: Relevant Examples
3.6 Resultant of Force and Moment for a System of Force: Examples

4. Center of Gravity, Centroid and Moment of Inertia **(6 hours)**

4.1 Concepts and Calculation of Centre of Gravity and Centroid: Examples
4.2 Calculation of Second Moment of Area / Moment of Inertia and Radius of Gyration: And Relevant usages
4.3 Use of Parallel axis Theorem: Relevant Examples

5. Friction **(2 hours)**

5.1 Laws of Friction, Static and Dynamic Coefficient of Friction, Angle of

Friction: Engineering Examples of usage of friction

5.2 Calculations involving friction in structures: Example as High Tension Friction Grip bolts and its free body diagram

6. Analysis of Beams and Frames **(9 hours)**

6.1 Introduction to Structures: Discrete and Continuum

6.2 Concept of Load Estimating and Support Idealizations: Examples and Standard symbols

6.3 Use of beams/frames in engineering: Concept of rigid joints/distribute loads in beams/frames.

6.4 Concept of Statically/Kinematically Determinate and Indeterminate Beams and Frames: Relevant Examples

6.5 Calculation of Axial Force, Shear Force and Bending Moment for Determinate Beams and Frames

6.6 Axial Force, Shear Force and Bending Moment Diagrams and Examples for drawing it.

7. Analysis of Plane Trusses **(4 hours)**

7.1 Use of trusses in engineering: Concept of pin joints/joint loads in trusses.

7.2 Calculation of Member Forces of Truss by method of joints: Simple Examples

7.3 Calculation of Member Forces of Truss by method of sections: Simple Examples

8. Kinematics of Particles and Rigid Body **(7 hours)**

8.1 Rectilinear Kinematics: Continuous Motion

8.2 Position, Velocity and Acceleration of a Particle and Rigid Body

8.3 Determination of Motion of Particle and Rigid Body

8.4 Uniform Rectilinear Motion of Particles

8.5 Uniformly Accelerated Rectilinear Motion of Particles

8.6 Curvilinear Motion: Rectangular Components with Examples of Particles

9. Kinetics of Particles and Rigid Body: Force and Acceleration **(5 hours)**

9.1 Newton's Second Law of Motion and momentum

9.2 Equation of Motion and Dynamic Equilibrium: Relevant Examples

9.3 Angular Momentum and Rate of Change

9.4 Equation of Motion-Rectilinear and Curvilinear

9.5 Rectangular: Tangential and Normal Components and Polar Coordinates: Radial and Transverse Components

Tutorials:

There shall be related tutorials exercised in class and given as regular homework exercises. Tutorials can be as following for each specified chapters.

1. **Introduction** **(1 hour)**
   A. Theory; definition and concept type questions.
2. **Basic Concept in Statics and Static Equilibrium** **(2 hours)**
   A. Theory; definition and concept type questions.
3. **Concept of Force acting on structures** **(3 hours)**
   A. Practical examples; numerical examples and derivation types of questions.
   B. There can be tutorials for each sub-section.
4. **Center of Gravity, Centroid and Moment of Inertia** **(4 hours)**
   A. Concept type; numerical examples and practical examples type questions.
5. **Friction** **(2 hours)**
   A. Definition type; Practical example type and numerical type questions.
6. **Analysis of Beam and Frame** **(5 hours)**
   A. Concept type; definition type; numerical examples type with diagrams questions.
   B. There can be tutorials for each sub-section.
7. **Analysis of Plane Trusses** **(5 hours)**
   A. Concept type; definition type; numerical examples type questions.
   B. There can be tutorials for each sub-section.
8. **Kinematics of Particles and Rigid Body** **(4 hours)**
   A. Definition type; numerical examples type questions.
   B. There can be tutorials for each sub-section.
9. **Kinetics of Particles and Rigid Body: Force and Acceleration** **(4 hours)**
   A. Concept type; definition type; numerical examples type questions.
   B. There can be tutorials for each sub-section.

References:

1. F.P. Beer and E.R.Johnston, Jr. ,"Mechanics of Engineers- Statics and Dynamics", Mc Graw-Hill.
2. R.C. Hibbeler, Ashok Gupta, "Engineering Mechanics-Statics and Dynamics", New Delhi, Pearson.
3. I.C. Jong and B.G. Rogers, "Engineering Mechanics- Statics and Dynamics",

4. D.K. Anand and P.F. Cunnif, "Engineering Mechanics- Statics and Dynamics",
5. R.S. Khurmi, "A Text Book of Engineering Mechanics",
6. R.S.Khurmi, "Applied Mechanics and Strength of Materials",
7. I.B.Prasad, "A Text Book of Applied Mechanics",
8. Shame, I.H., "Engineering Mechanics-Statics and Dynamics", Prentice Hall of India, New Delhi.

BASIC ELECTRICAL ENGINEERING

EE 401

Lecture : 3 **Year : I**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objective:

To understand the fundamental concept of DC, AC & 3-phase electrical circuits.

1. General Electric System **(6 hours)**

1.1 Constituent parts of an electrical system (source, load, communication & control)
1.2 Current flow in a circuit
1.3 Electromotive force and potential difference
1.4 Electrical units
1.5 Ohm's law
1.6 Resistors, resistivity
1.7 Temperature rise & temperature coefficient of resistance
1.8 Voltage & current sources

2. DC circuits **(4 hours)**

2.1 Series circuits
2.2 Parallel networks
2.3 Krichhhof's laws
2.4 Power and energy

3. Network Theorems **(12 hours)**

3.1 Application of Krichhof's laws in network solution
  3.1.1 Nodal Analysis
  3.1.2 Mesh analysis
3.2 Star-delta & delta-star transformation
3.3 Superposition theorem
3.4 Thevninn's theorem
3.5 Nortan's theorem
3.6 Maximum power transfer theorem
3.7 Reciprocity theorem

4. Inductance & Capacitance in electric circuits **(4 hours)**

4.1 General concept of capacitance
  4.1.1 Charge & voltage
  4.1.2 Capacitors in series and parallel
4.2 General concept of inductance
  4.2.1 Inductive & non-inductive circuits
  4.2.2 Inductance in series & parallel

5. Alternating Quantities **(2 hours)**

5.1 AC systems
5.2 Wave form, terms & definitions
5.3 Average and rms values of current & voltage
5.4 Phasor representation

6. Single-phase AC Circuits **(6 hours)**

6.1 AC in resistive circuits
6.2 Current & voltage in an inductive circuits
6.3 Current and voltage in an capacitive circuits
6.4 Concept of complex impedance and admittance
6.5 AC series and parallel circuit
6.6 RL, RC and RLC circuit analysis & phasor representation

7. Power in AC Circuits **(5 hours)**

7.1 Power in resistive circuits
7.2 Power in inductive and capacitive circuits
7.3 Power in circuit with resistance and reactance
7.4 Active and reactive power
7.5 Power factor, its practical importance
7.6 Improvement of power factor
7.7 Measurement of power in a single-phase AC circuits

8. Three-Phase Circuit Analysis **(6 hours)**

8.1 Basic concept & advantage of Three-phase circuit
8.2 Phasor representation of star & delta connection
8.3 Phase and line quantities
8.4 Voltage & current computation in 3-phase balance & unbalance circuits
8.5 Real and reactive power computation
8.6 Measurements of power & power factor in 3-phase system

Practical:

1. Measurement of Voltage, current& power in DC circuit
   Verification of Ohm's Law
   Temperature effects in Resistance
2. Krichoff's Voltage & current Law
   Evaluate power from V & I
   Note loading effects of meter
3. Measurement amplitude, frequency and time with oscilloscope
   Calculate & verify average and rms value
   Examine phase relation in RL & RC circuit
4. Measurements of alternating quantities
   R, RL,RC circuits with AC excitation
   AC power, power factor, VARs, phasor diagrams

5. Three-phase AC circuits
   Measure currents and voltages in three-phase balanced AC circuits
   Prove Y-Δ transformation
   Exercise on phasor diagrams for three-phase circuits
6. Measurement of Voltage, current& power in a three-phase circuit
   Two-wattmeter method of power measurement in R, RL and RC three phase circuits
   Watts ratio curve

References:

1. J.R Cogdell, "Foundations of Electrical Engineering", Prentice Hall, Englewood Chiffs, New Jersy
2. I.M Smith," Haughes Electrical Technology", Addison-Wesley, ISR Rprint

ENGINEERING MATHEMATICS II

SH 451

Lecture : 3 **Year : I**
Tutorial : 2 **Part : II**
Practical : 0

Course Objective:
To develop the skill of solving differential equations and to provide knowledge of vector algebra and calculus. To make students familiar with calculus of several variables and infinite series.

1. Calculus of Two or More Variables **(6 hours)**
- 1.1. Introduction: limit and continuity
- 1.2. Partial derivatives
  - 1.2.1. Homogeneous function, Euler's theorem for the function of two and three variables
  - 1.2.2. Total derivatives
- 1.3. Extreme of functions of two and three variables; Lagrange's Multiplier

2. Multiple Integrals **(6 hours)**
- 2.1. Introduction
- 2.2. Double integrals in Cartesian and polar form; change of order of integration
- 2.3. Triple integrals in Cartesian, cylindrical and spherical coordinates;
- 2.4. Area and volume by double and triple integrals

3. Three Dimensional Solid Geometry **(11 hours)**
- 3.1. The straight line; Symmetric and general form
- 3.2. Coplanar lines
- 3.3. Shortest distance
- 3.4. Sphere
- 3.5. Plane Section of a sphere by planes
- 3.6. Tangent Planes and lines to the spheres
- 3.7. Right circular cone
- 3.8. Right circular cylinder

4. Solution of Differential Equations in Series and Special Functions (9 hours)
- 4.1. Solution of differential equation by power series method
- 4.2. Legendre's equation
- 4.3. Legendre polynomial function; Properties and applications.
- 4.4. Bessel's equation
- 4.5. Bessel's function of first and second kind. Properties and applications

5. Vector Algebra and Calculus **(8 hours)**
- 5.1. Introduction

5.2. Two and three dimensional vectors
5.3. Scalar products and vector products
5.4. Reciprocal System of vectors
5.5. Application of vectors: Lines and planes
5.6. Scalar and vector fields
5.7. Derivatives – Velocity and acceleration
5.8. Directional derivatives

6. Infinite Series **(5 hours)**

6.1. Introduction
6.2. Series with positives terms
6.3. convergence and divergence
6.4. Alternating series. Absolute convergence
6.5. Radius and interval of convergence

References:

1. Erwin Kreyszig, "Advanced Engineering Mathematics ", John Wiley and Sons Inc.
2. Thomas, Finney, "Calculus and Analytical Geometry", Addison- Wesley
3. M. B. Singh, B. C. Bajrachrya, "Differential Calculus", Sukunda Pustak Bhandar,Nepal
4. M. B. Singh, B. C. Bajrachrya, "A Text Book of Vectors", Sukunda Pustak Bhandar,Nepal
5. M. B. Singh, S. P. Shrestha, "Applied Engineering Mathematics", RTU, Department of Engineering Science and Humanities.
6. G.D. Pant, G. S. Shrestha, "Integral Calculus and Differential Equations", Sunila Prakashan,Nepal
7. Y. R. Sthapit, B. C. Bajrachrya, "A Text Book of Three Dimensional Geometry", Sukunda Pustak Bhandar,Nepal
8. Santosh Man Maskey, "Calculus", Ratna Pustak Bhandar, Nepal

ENGINEERING DRAWING II

ME 451

Lecture : 1
Tutorial : 0
Practical : 3

Year : I
Part : II

Course Objective:

To make familiar with the conventional practices of sectional views. To develop basic concept and skill of pictorial drawing and working drawings. Also to make familiar with standard symbols of different engineering fields.

1. Conventional Practices for Orthographic and Sectional Views (12 hours)

1.1 Conventional Practices in Orthographic views: Half Views and Partial Views, Treatment of Unimportant Intersections, Aligned Views, Treatment for Radially Arranged Features, Representation of Fillets and Rounds

1.2 Conventional Practices in Sectional views: Conventions for Ribs, Webs and Spokes in Sectional View, Broken Section, Removed Section, Revolved Section, Offset Section, Phantom Section and Auxiliary Sectional Views

1.3 Simplified Representations of Standard Machine Elements

2. Pictorial Drawings (20 hours)

2.1 Classifications: Advantages and Disadvantages

2.2 Axonometric Projection: Isometric Projection and Isometric Drawing
- 2.2.1 Procedure for making an isometric drawing
- 2.2.2 Isometric and Non-isometric Lines; Isometric and Non-isometric Surfaces
- 2.2.3 Angles in Isometric Drawing
- 2.2.4 Circles and Circular Arcs in Isometric Drawing
- 2.2.5 Irregular Curves in Isometric Drawing
- 2.2.6 Isometric sectional Views

2.3 Oblique Projection and Oblique Drawing
- 2.3.1 Procedure for making an Oblique drawing
- 2.3.2 Rules for Placing Objects in Oblique drawing
- 2.3.3 Angles, Circles and Circular Arcs in Oblique drawing

2.4 Perspective Projection
- 2.4.1 Terms used in Perspective Projection
- 2.4.2 Parallel and Angular Perspective
- 2.4.3 Selection of Station Point

3. Familiarization with Different Components and Conventions (8 hours)

3.1 Limit Dimensioning and Machining Symbols
- 3.1.1 Limit, Fit and Tolerances
- 3.1.2 Machining Symbols and Surface Finish

3.2 Threads, Bolts and Nuts
- 3.2.1 Thread Terms and Nomenclature, Forms of Screw Threads
- 3.2.2 Detailed and Simplified Representation of Internal and External Threads
- 3.2.3 Thread Dimensioning
- 3.2.4 Standard Bolts and Nuts: Hexagonal Head and Square Head
- 3.2.5 Conventional Symbols for Bolts and Nuts

3.3 Welding and Riveting
- 3.3.1 Types of Welded Joints and Types of Welds, Welding Symbols
- 3.3.2 Forms and Proportions for Rivet Heads, Rivet Symbols, Types of Riveted Joints: Lap Joint, Butt Joint

3.4 Familiarization with Graphical Symbols and Conventions in Different Engineering Fields
- 3.4.1 Standard Symbols for Civil, Structural and Agricultural Components
- 3.4.2 Standard Symbols for Electrical, Mechanical and Industrial Components
- 3.4.3 Standard Symbols for Electronics, Communication and Computer Components
- 3.4.4 Topographical Symbols

3.5 Standard Piping Symbols and Piping Drawing

4. Detail and Assembly Drawings **(20 hours)**

4.1 Introduction to Working Drawing
4.2 Components of Working Drawing: Drawing Layout, Bill of Materials, Drawing Numbers
4.3 Detail Drawing
4.4 Assembly Drawing
4.5 Practices of Detail and Assembly Drawing: V-block Clamp, Centering Cone, Couplings, Bearings, Antivibration Mounts, Stuffing Boxes, Screw Jacks, etc

Practical:

1. Conventional Practices for Orthographic and Sectional Views (Full and Half Section)
2. Conventional Practices for Orthographic and Sectional Views (Other Type Sections)
3. Isometric Drawing
4. Isometric Drawing (Consisting of Curved Surfaces and Sections)
5. Oblique Drawing
6. Perspective Projection
7. Familiarization with Graphical Symbols (Limit, Fit, Tolerances and Surface Roughness Symbols)

8. Familiarization with Graphical Symbols (Symbols for Different Engineering Fields)
9. Detail Drawing
10. Assembly Drawing I
11. Assembly Drawing II
12. Building Drawing

References:

1. W. J. Luzadder, " Fundamentals of Engineering Drawing", Prentice Hall.
2. T. E. French, C. J. Vierck, and R. J. Foster, "Engineering Drawing and Graphic Technology", Mc Graw Hill Publshing Co.
3. F. E. Giescke, A . Mitchell, H. C. Spencer and J. T. Dygdone, "Technical Drawing", Macmillan Publshing Co.
4. N. D. Bhatt, "Machine Drawing", Charotar Publshing House, India.
5. P. S. Gill, "Machine Drawing", S. K. Kataria and Sons, India.
6. R. K. Dhawan "Machine Drawing", S. Chand and Company Limited, India.

BASIC ELECTRONICS ENGINEERING

EX 451

Lecture : 3 **Year : I**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objective:
To understand the language of electronics, elements and their functionality. To understand analog and digital systems and their applications.

1. Basic Circuits Concepts **(4 hours)**

1.1 Passive components: Resistance, Inductance, Capacitance; series, parallel combinations; Kirchhoff's law: voltage, current; linearity
1.2 Signal sources: voltage and current sources; nonideal sources; representation under assumption of linearity; controlled sources: VCVS, CCVS, VCCS, CCCS; concept of gain, transconductance, transimpedance.
1.3 Superposition theorem; Thevenin's theorem; Norton's theorem
1.4 Introduction to filter

2. Diodes **(6 hours)**

2.1 Semiconductor diode characteristics
2.2 Modeling the semiconductor diode
2.3 Diode circuits: clipper; clamper circuits
2.4 Zener diode, LED, Photodiode, varacters diode, Tunnel diodes
2.5 DC power supply: rectifier-half wave, full wave (center tapped, bridge), Zener regulated power supply

3. Transistor **(8 hours)**

3.1 BJT configuration and biasing, small and large signal model
3.2 T and μ model
3.3 Concept of differential amplifier using BJT
3.4 BJT switch and logic circuits
3.5 Construction and working principle of MOSFET and CMOS
3.6 MOSFET as logic circuits

4. The Operational Amplifier and Oscillator **(7 hours)**

4.1 Basic model; virtual ground concept; inverting amplifier; non-inverting amplifier; integrator; differentiator, summing amplifier and their applications
4.2 Basic feedback theory; positive and negative feedback; concept of stability; oscillator
4.3 Waveform generator using op-amp for Square wave, Triangular wave Wien bridge oscillator for sinusoidal waveform

5. Communication System **(4 hours)**

5.1 Introduction
5.2 Wired and wireless communication system

5.3 EMW and propagation, antenna, broadcasting and communication
5.4 Internet / intranet
5.5 Optical fiber

6. Digital Electronics **(11 hours)**

6.1 Number systems, Binary arithmetic
6.2 Logic gates: OR, NOT, AND NOR, NAND, XOR, XNOR gate; Truth tables
6.3 Multiplexers; Demux, Encoder, Decoder
6.4 Logic function representation
6.5 Combinational circuits: SOP, POS form; K-map;
6.6 Latch, flip-flop: S-R flip-flop; JK master slave flip-flop; D-flip flop
6.7 Sequential circuits: Generic block diagram; shift registers; counters

7. Application of Electronic System **(5 hours)**

7.1 Instrumentation system: Transducer, strain gauge, DMM, Oscilloscope
7.2 Regulated power supply
7.3 Remote control, character display, clock, counter, measurements, date logging, audio video system

Practical:

1. Familiarization with passive components, function generator and oscilloscope
2. Diode characteristics, rectifiers, Zener diodes
3. Bipolar junction transistor characteristics and single stage amplifier
4. Voltage amplifiers using op-amp, Comparators, Schmitt
5. Wave generators using op-amp
6. Combinational and sequential circuits

References:

1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" PHI
2. Thomas L. Floyd, "Electronic Devices" Pearson Education, Inc., 2007
3. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press, 2006

ENGINEERING CHEMISTRY

SH 453

Lecture : 3 **Year : I**
Tutorial : 1 **Part : II**
Practical : 3

Course Objective:

To develop the basic concepts of Physical Chemistry, Inorganic Chemistry and Organic Chemistry relevant to problems in engineering.

1. Electro-chemistry and Buffer **(6 hours)**

1.1 Electro-chemical cells
1.2 Electrode Potential and Standard Electrode Potential
1.3 Measurement of Electrode Potential
1.4 Nernst equation
1.5 EMF of Cell
1.6 Application of Electrochemical and Electrolytic cells
1.7 Electrochemical Series and its Application
1.8 Buffer: its type and mechanism
1.9 Henderson's equation for pH of buffer and related problems
1.10 Corrosion and its type
1.11 Factors influencing corrosion
1.12 Prevention of corrosion

2. Catalyst **(4 hours)**

2.1 Introduction
2.2 Action of Catalyst (Catalytic Promoters and Catalytic Poisons)
2.3 Characteristics of Catalyst
2.4 Types of Catalyst
2.5 Theories of Catalysis
2.6 Industrial Applications of Catalysts

3. Environmental Chemistry **(5 hours)**

3.1 Air Pollution
3.2 Air Pollutants i) gases $SO_x, NO_x, CO, CO_2, O_3$ and hydrocarbons ii)particulates dust, smoke and fly ash
3.3 Effects of Air Pollutants on human beings and their possible remedies
3.4 Ozone depletion and its photochemistry
3.5 Water Pollution (Ref of surface water and pound water)
3.6 Water Pollutants (Ref of surface water) their adverse effect and remedies
3.7 Soil pollution
3.8 Pollutants of soil their adverse effects and possible remedies

4. Engineering Polymers **(6 hours)**

4.1 Inorganic polymers
4.2 General properties of inorganic polymers
4.3 Polyphosphazines
4.4 Sulpher Based Polymers
4.5 Chalcogenide Glasses
4.6 Silicones
4.7 Organic Polymers
4.8 Types of Organic Polymers
4.9 Preparation and application of
i) Polyurethane ii) Polystyrene iii) Polyvinylchloride iv) Teflon
v) Nylon 6,6 and vi) Bakelite vii) Epoxy Resin viii) Fiber Reinforced Polymer
4.10 Concept of bio-degradable, non-biodegradable and conducting polymers

5. 3-d Transition elements and their applications **(5 hours)**

5.1 Introduction
5.2 Electronic Configuration
5.3 Variable oxidation states
5.4 Complex formation tendency
5.5 Color formation
5.6 Magnetic properties
5.7 Alloy formation
5.8 Applications of 3-d transition elements

6. Coordination Complexes **(5 hours)**

6.1 Introduction
6.2 Terms used in Coordination Complexes
6.3 Werner's Theory Coordination Complexes
6.4 Sidgwick's model and Sidgwick's effective atomic number rule
6.5 Nomenclature of coordination compounds (Neutral type, simple cation and complex anion and complex cation and simple anion type)
6.6 Valence Bond Theory of Complexes
6.7 Application of valence bond theory in the formation of
i) Tetrahedral Complexes
ii) Square planar Complexes and iii) Octahedral Complexes
6.8 Limitations of Valence Bond Theory
6.9 Applications of Coordination Complexes

7. Explosives **(3 hours)**

7.1 Introduction
7.2 Types of explosives: Primary, Low and High explosives
7.3 Preparation and application of TNT, TNG, Nitrocellulose and Plastic explosives

8. Lubricants and Paints **(3 hours)**

8.1 Introduction
8.2 Function of Lubricants
8.3 Classification of Lubricants (Oils, Greases and Solid)
8.4 Paints
8.5 Types of Paint
8.6 Application of Paints

9. Stereochemistry **(4 hours)**

9.1 Introduction
9.2 Geometrical Isomerism (Cis Trans Isomerism) Z and E concept of Geometrical Isomerism
9.3 Optical Isomerism with reference to two asymmetrical carbon center molecules
9.4 Terms Optical activity, Enantiomers, Diastereomers, Meso structures, Racemic mixture and Resolution

10. Reaction Mechanism in Organic reactions **(4 hours)**

10.1 Substitution reaction
10.2 Types of substitution reaction SN^1 and SN^2
10.3 Elimination reaction
10.4 Types of elimination reaction El and E2
10.5 Factors governing SN^1, SN^2, El and E2 reaction mechanism path

References:

1. Jain and Jain, "Engineering Chemistry", Dhanpat Rai Publishing Co.
2. Shashi Chawala, "A Text Book of Engineering Chemistry", Dhanpat Rai Publishing Co.
3. J. D. Lee, "A New Concise Inorganic Chemistry", Wiley India Pvt. Limited.
4. Marron and Prutton, "Principles of Physical Chemistry", S. Macmillan and Co. Ltd.
5. Bahl and Tuli, "Essential of Physical Chemistry", S. Chand and Co. Ltd.
6. Satya Prakash and Tuli, "Advanced Inorganic Chemistry Vol 1 and 2", S. Chand and Co. Ltd
7. Morrison and Boyd, "Organic chemistry"
8. Moti Kaji Sthapit, "Selected Topics in Physical Chemistry", Taleju Prakashan, Kathmandu.
9. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw-Hill, New York.
10. R. K. Sharma, B. Panthi and Y. Gotame, "Textbook of Engineering Chemistry", Athrai Publication.

Practical:

1. Compare the alkalinity of different water samples by double indicator method 6 Periods

2. Determine the temporary and permanent hardness of water by EDTA Complexo-metric method 3 Periods
3. Determine residual and combined chlorine present in the chlorinated sample of water by Iodometric method 6 Periods
4. Prepare organic polymer nylon 6,6/ Bakelite in the laboratory 3 Periods
5. Determine the pH of different sample of buffer solution by universal indicator method 6 Periods
6. Prepare inorganic complex in the laboratory 3 Periods
7. Determine surface tension of the given detergent solution and compare its cleansing power with other detergent solutions 6 Periods
8. Construct an electrochemical cell in the laboratory and measure the electrode potential of it 3 Periods
9. Estimate the amount of iron present in the supplied sample of ferrous salt using standard potassium permanganate solution (redox titration) 6 Periods

FUNDAMENTALS OF THERMODYNAMICS AND HEAT TRANSFER

ME 452

Lectures : 3
Tutorial : 1
Practical : 3/2

Year : I
Part : II

Course Objective:

To develop basic concepts, laws of thermodynamics and heat transfer and their applications.

1. Introduction **(3 hours)**

1.1 Definition and Scope of Engineering Thermodynamics
1.2 Value of energy to society
1.3 Microscopic versus Macroscopic Viewpoint
1.4 Concepts and Definitions
  1.4.1 System, Surroundings, Boundary and Universe; Closed Systems, Open Systems, and Isolated Systems
  1.4.2 Thermodynamic Properties: Intensive, Extensive and Specific Properties
  1.4.3 Thermodynamic Equilibrium
  1.4.4 Thermodynamic State
  1.4.5 Thermodynamic Process, Cyclic Process, Quasi-equilibrium Process, Reversible and Irreversible Process
1.5 Common Properties: Pressure, Specific Volume, Temperature
1.6 Zeroth Law of Thermodynamics, Equality of Temperature

2. Energy and Energy Transfer **(3 hours)**

2.1 Energy and its Meaning
2.2 Stored Energy and Transient Energy; Total Energy
2.3 Energy Transfer
  2.3.1 Heat Transfer
  2.3.2 Work Transfer
2.4 Expressions for displacement work transfer
2.5 Power

3. Properties of Common Substances **(6 hours)**

3.1 Pure Substance and State Postulate
3.2 Ideal Gas and Ideal Gas Relations
3.3 Two Phase (Liquid and Vapor) Systems: Phase Change; Subcooled Liquid, Saturated Liquid, Wet Mixture, Critical Point, Quality, Moisture Content, Saturated Vapor and Superheated Vapor
3.4 Properties of Two Phase Mixtures

3.5 Other Thermodynamic Properties: Internal Energy, Enthalpy, and Specific Heats
3.6 Development of Property Data: Graphical Data Presentation and Tabular Data Presentation

4. First Law of Thermodynamics **(9 hours)**

4.1 First Law of Thermodynamics for Control Mass; First Law of Thermodynamics for Control Mass Undergoing Cyclic Process
4.2 First Law of Thermodynamics for Control Volume
4.3 Control Volume Analysis: Steady State Analysis and Unsteady State Analysis
4.4 Control Volume Application: Steady and Unsteady Work Applications and Steady and Unsteady Flow Applications
4.5 Other Statements of the First Law

5. Second Law of Thermodynamics **(9 hours)**

5.1 Necessity of Formulation of Second Law
5.2 Entropy and Second Law of Thermodynamics for an Isolated System
5.3 Reversible and Irreversible Processes
5.4 Entropy and Process Relation for an Ideal Gases and Incompressible Substances
5.5 Control Mass Formulation of Second Law
5.6 Control Volume Formulation of Second Law
5.7 Isentropic Process for an Ideal Gas and for an Incompressible Substances
5.8 Carnot Cycle, Heat Engine, Heat Pump and Refrigerator
5.9 Kelvin-Planck and Clausius Statements of the Second Law of Thermodynamics and their Equivalence

6. Thermodynamic Cycles **(9 hours)**

6.1 Classification of Cycles
6.2 Air Standard Brayton Cycle
6.3 Rankine Cycle
6.4 Internal Combustion Cycles
  6.4.1 Air standard Analysis
  6.4.2 Air Standard Otto Cycle
  6.4.3 Air Standard Diesel Cycle
6.5 Vapor Compression Refrigeration Cycle

7. Introduction to Heat Transfer **(6 hours)**

7.1 Basic Concepts and Modes of Heat Transfer
7.2 One dimensional steady state heat conduction through a plane wall
7.3 Radial steady state heat conduction through a hollow cylinder
7.4 Heat flow through composite structures
  7.4.1 Composite Plane Wall
  7.4.2 Multilayer tubes

7.5 Electrical Analogy for thermal resistance
7.6 Combined Heat Transfer and Overall Heat Transfer Coefficient for Plane Wall and Tube
7.7 Nature of Convection; Free and Forced Convection
7.8 Heat Radiation, Stefan's Law, Absorptivity, Reflectivity and Transmissivity; Black Body, White Body and Gray Body

Practical:

1. Temperature Measurements
2. Experiment related to first law
3. Heat Pump
4. Heat Conduction
5. Heat Radiation

References:

1. M. C. Luintel, "Fundamentals of Thermodynamics and Heat Transfer", Athrai Publication (P) Limited.
2. R. Gurung, A. Kunwar & T. R. Bajracharya, "Fundamentals of Engineering Thermodynamics and Heat Transfer", Asmita Books Publishers and Distributors (P) Limited.
3. J. R. Howell & R. O. Buckius, "Fundamentals of Engineering Thermodynamics", McGraw Hill Publishers
4. V. Wylen, Sonntag & Borgnakke, "Fundamentals of Thermodynamics", John Wiley & Sons, Inc.
5. M. J. Moran & H. N. Shapiro, "Fundamentals of Engineering Thermodynamics", John Wiley & Sons, Inc.
6. Y. A. Cengel & M.A. Boles, "Thermodynamics: An Engineering Approach", McGraw-Hill.
7. J. P. Holman, "Heat Transfer", McGraw-Hill
8. Y. A. Cengel, "Heat Transfer: A Practical Approach", McGraw-Hill.

WORKSHOP TECHNOLOGY

ME 453

Lecture : 1
Tutorial : 0
Practical : 3

Year : I
Part : II

Course Objective:

To impart knowledge and skill components in the field of basic workshop technology. To be familiar with different hand and machine tools required for manufacturing simple metal components and articles.

1. General Safety Considerations (2 hours)

1.1. Bench Tools
1.2. Machinist's Hammers
1.3. Screw Drivers
1.4. Punches
1.5. Chisels
1.6. Scrapers
1.7. Scribers
1.8. Files
1.9. Pliers and Cutters
1.10. Wrenches
1.11. Hacksaw
1.12. Bench Vise
1.13. Hand drill
1.14. Taps and Dies
1.15. Hand Shears
1.16. Rules, Tapes and Squares
1.17. Soldering Iron
1.18. Rivets

2. Hand Working Operations (1 hours)

2.1. Sawing
2.2. Filing
2.3. Threading
2.4. Scribing
2.5. Shearing
2.6. Soldering
2.7. Riveting

3. Measuring and Gauging (1 hours)

3.1. Introduction
3.2. Semi – Precision Tools – Calipers, depth Gauge, Feeler Gauge
3.3 Precision Tools – Micrometers, Vernier Calipers, Vernier Height Gauge,

Telescopic Gauge, Hole Gauge, Bevel Protractor, Dial Indicator, Gauge Blocks and Surface Plate

4. Drills and Drilling Processes **(1 hours)**

4.1 Introduction
4.2 Types of Drill Presses
4.3 Work Holding Devices and Accessories
4.4 Cutting Tools
4.5 Geometry of Drill Bits
4.6 Grinding of Drill Bits
4.7 Operations – Drilling, Counter - boring, Counter - sinking, Reaming, Honning, Lapping
4.8 Cutting Speeds
4.9 Drilling Safety

5. Machine Tools **(4 hours)**

5.1. General Safety Considerations
5.2. Engine Lathes
  5.2.1 Introduction
  5.2.2 Physical Construction
  5.2.3 Types of Lathe
  5.2.4 Lathe Operations – Facing, Turning, Threading
5.3 Shapers
  5.3.5 Introduction
  5.3.6 Types of Shapers
  5.3.7 Physical Construction
  5.3.8 General Applications
5.4 Milling Machines
  5.4.1 Introduction
  5.4.2 Types of Milling Machines
  5.4.3 Physical Construction
  5.4.4 Milling Cutters – Plain, Side, Angle, End, Form
  5.4.5 Milling Operations – Plain, Side, Angular, Gang, End, Form, Keyway
  5.4.6 Work Holding Devices
  5.4.7 Cutter Holding Devices
5.5 Grinding Machines
  5.5.1 Abrasives, Bonds, Grinding Wheels
  5.5.2 Rough Grinders – Portable Grinders, Bench Grinders, Swing Frame Grinders, Abrasive Belt Grinders
  5.5.3 Precision Grinders – Cylindrical Grinders, Surface Grinders

6. Material Properties **(1 hours)**

6.1. Tool materials – Low, medium and high carbon steels; Hot and cold rolled steels; Alloy steels; Carbide and Ceramic materials

6.2. Heat treating methods for steels – Annealing, Tempering, Normalizing, Hardening and Quenching
6.3. Non – ferrous metals – Brass, Bronze, Aluminum – Comparative Properties

7. Sheet Metal Works **(1 hours)**

7.1. Introduction
7.2. Sheet Metal Tools
7.3. Marking and Layout
7.4. Operations – Bending, Cutting, Rolling

8. Foundry Practice **(1 hours)**

8.1. Introduction
8.2. Pattern Making
8.3. Foundry Tools
8.4. Core Making
8.5. Melting Furnace – Cupola
8.6. Sand Casting Process

9. Forging Practice **(1 hours)**

9.1. Introduction
9.2. Forging Tools
9.3. Operations – Upsetting, Drawing, Cutting, Bending, Punching
9.4. Forging Presses and Hammers
9.5. Advantages and Limitations

10. Metal Joining **(2 hours)**

10.1 Safety Considerations
10.2 Introduction
10.3 Soldering
10.4 Brazing
10.5 Welding – Gas Welding, Arc Welding, Resistance Welding, Tungsten Inert Gas Welding (TIG), Metal Inert Gas Welding (MIG)

Practical:

1. Bench Tools and hand operations: Measuring, Marking, Layout, Cutting, Filling, Drilling, Tapping, Assembly
2. Bench Tools and hand operations: (Contd.)
3. Drilling machines
4. Measuring and Gauging Instruments
5. Engine lathe: Basic operations such as Plain turning, facing, cutting off, knurling.
6. Engine lathe: Taper turning, drilling and boring
7. Basic Shaper Operations
8. Milling Machines

9. Grinding Machines
10. Sheet Metal works
11. Foundry Practice
12. Forging Practice
13. Electric Arc Welding
14. Gas Welding

References:

1. Anderson and E. E. Tatro, "Shop Theory", JMcGraw – Hill.
2. O. D. Lascoe, C. A. Nelson and H. W. Porter, "Machine shop operations and setups", American Technical society.
3. "Machine shop Practice – Vol. I" , Industrial Press, New York.
4. "Machine shop Practice – Vol. I" , Industrial Press, New York.
5. Ryerson, " Technology of Machine Tools", Mc Graw Hill.
6. Oberg, Jones and Horton, "Machinery's Handbook", Industrial Press, New York.
7. S. K. Hajra Choudhury and A. K. Hajra Choudhury, "Elements of Workshop Technology - Vol. I (Manufacturing Processes)", Media Promoters and Publishers Pvt. Ltd. , Bombay, INDIA.
8. S. K. Hajra Choudhury, S. K. Bose and A. K. Hajra Choudhury , "Elements of Workshop Technology - Vol. II: (Machine Tools)" , Media Promoters and Publishers Pvt. Ltd. , Bombay, INDIA.
9. Prof. B. S. Raghuwanshi, "A Course in Workshop Technology - Vol. I" , Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA.
10. Prof. B. S. Raghuwanshi, "A Course in Workshop Technology - Vol. II" , Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA.
11. H. S. Bawa, "Workshop Technology - Vol. I", Tata Mc – Graw Hill publishing company Limited, New Delhi, INDIA,
12. H. S. Bawa, "Workshop Technology - Vol. II" , Tata Mc – Graw Hill publishing company Limited, New Delhi, INDIA,
13. R. S. Khurmi and J. K. Gupta, "A text book of Workshop Technology", S. Chand and Company Ltd, New Delhi. INDIA

ENGINEERING MATHEMATICS III

SH 501

Lecture : 3
Tutorial : 2
Practical : 0

Year : II
Part : I

Course Objective:
To round out the students' preparation for more sophisticated applications with an introduction to linear algebra, Fourier series, Laplace Transforms, integral transformation theorems and linear programming.

1. Determinants and Matrices (11 hours)

1.1. Determinant and its properties
1.2. Solution of system of linear equations
1.3. Algebra of matrices
1.4. Complex matrices
1.5. Rank of matrices
1.6. System of linear equations
1.7. Vector spaces
1.8. Linear transformations
1.9. Eigen value and Eigen vectors
1.10. The Cayley-Hamilton theorem and its uses
1.11. Diagonalization of matrices and its applications

2. Line, Surface and Volume Integrals (12 hours)

2.1. Line integrals
2.2. Evaluation of line integrals
2.3. Line integrals independent of path
2.4. Surfaces and surface integrals
2.5. Green's theorem in the plane and its applications
2.6. Stoke's theorem (without proof) and its applications
2.7. Volume integrals; Divergence theorem of Gauss (without proof) and its applications

3. Laplace Transform (8 hours)

3.1. Definitions and properties of Laplace Transform
3.2. Derivations of basic formulae of Laplace Transform
3.3. Inverse Laplace Transform: Definition and standard formulae of inverse Laplace Transform
3.4. Theorems on Laplace transform and its inverse
3.5. Convolution and related problems
3.6. Applications of Laplace Transform to ordinary differential equations

4. Fourier Series **(5 hours)**

4.1. Fourier Series
4.2. Periodic functions
4.3. Odd and even functions
4.4. Fourier series for arbitrary range
4.5. Half range Fourier series

5. Linear Programming **(9 hours)**

5.1. System of Linear Inequalities in two variables
5.2. Linear Programming in two dimensions: A Geometrical Approach
5.3. A Geometric introduction to the Simplex method
5.4. The Simplex method: Maximization with Problem constraints of the form "$\leq$"
5.5. The Dual: Maximization with Problem Constraints of the form "$\geq$"
5.6. Maximization and Minimization with mixed Constraints. The two-phase method
(An alternative to the Big M Method)

References:

1. S. K. Mishra, G. B. Joshi, V. Parajuli, "Advance Engineering Mathematics", Athrai Publication.
2. E. Kreszig, "Advance Engineering Mathematics", Willey, New York.
3. M.M Gutterman and Z.N.Nitecki, "Differential Equation, a First Course", Saunders, New York.

OBJECT ORIENTED PROGRAMMING

CT 501

Lecture : 3
Tutorial : 0
Practical : 3

Year : II
Part : I

Course Objective:

To familiarize students with the C++ programming language and use the language to develop object oriented programs

1. Introduction to Object Oriented Programming **(3 hours)**

- 1.1 Issues with Procedure Oriented Programming
- 1.2 Basic of Object Oriented Programming (OOP)
- 1.3 Procedure Oriented versus Object Oriented Programming
- 1.4 Concept of Object Oriented Programming
  - 1.4.1 Object
  - 1.4.2 Class
  - 1.4.3 Abstraction
  - 1.4.4 Encapsulation
  - 1.4.5 Inheritance
  - 1.4.6 Polymorphism
- 1.5 Example of Some Object Oriented Languages
- 1.6 Advantages and Disadvantages of OOP

2. Introduction to C++ **(2 hours)**

- 2.1 The Need of C++
- 2.2 Features of C++
- 2.3 C++ Versus C
- 2.4 History of C++

3. C++ Language Constructs **(6 hours)**

- 3.1 C++ Program Structure
- 3.2 Character Set and Tokens
  - 3.2.1 Keywords
  - 3.2.2 Identifiers
  - 3.2.3 Literals
  - 3.2.4 Operators and Punctuators
- 3.3 Variable Declaration and Expression
- 3.4 Statements
- 3.5 Data Type
- 3.6 Type Conversion and Promotion Rules
- 3.7 Preprocessor Directives
- 3.8 Namespace
- 3.9 User Defined Constant const
- 3.10 Input/Output Streams and Manipulators

3.11 Dynamic Memory Allocation with new and delete
3.12 Condition and Looping
3.13 Functions
  3.13.1 Function Syntax
  3.13.2 Function Overloading
  3.13.3 Inline Functions
  3.13.4 Default Argument
  3.13.5 Pass by Reference
  3.13.6 Return by Reference
3.14 Array, Pointer and String
3.15 Structure, Union and Enumeration

4. Objects and Classes **(6 hours)**

4.1 C++ Classes
4.2 Access Specifiers
4.3 Objects and the Member Access
4.4 Defining Member Function
4.5 Constructor
  4.5.1 Default Constructor
  4.5.2 Parameterized Constructor
  4.5.3 Copy Constructor
4.6 Destructors
4.7 Object as Function Arguments and Return Type
4.8 Array of Objects
4.9 Pointer to Objects and Member Access
4.10 Dynamic Memory Allocation for Objects and Object Array
4.11 this Pointer
4.12 static Data Member and static Function
4.13 Constant Member Functions and Constant Objects
4.14 Friend Function and Friend Classes

5. Operator Overloading **(5 hours)**

5.1 Overloadable Operators
5.2 Syntax of Operator Overloading
5.3 Rules of Operator Overloading
5.4 Unary Operator Overloading
5.5 Binary Operator Overloading
5.6 Operator Overloading with Member and Non Member Functions
5.7 Data Conversion: Basic – User Defined and User Defined – User Defined
5.8 Explicit Constructors

6. Inheritance **(5 hours)**

6.1 Base and Derived Class
6.2 protected Access Specifier
6.3 Derived Class Declaration
6.4 Member Function Overriding

6.5 Forms of Inheritance: single, multiple, multilevel, hierarchical, hybrid, multipath
6.6 Multipath Inheritance and Virtual Base Class
6.7 Constructor Invocation in Single and Multiple Inheritances
6.8 Destructor in Single and Multiple Inheritances

7. Polymorphism and Dynamic Binding **(4 hours)**

7.1 Need of Virtual Function
7.2 Pointer to Derived Class
7.3 Definition of Virtual Functions
7.4 Array of Pointers to Base Class
7.5 Pure Virtual functions and Abstract Class
7.6 Virtual Destructor
7.7 reinterpret_cast Operator
7.8 Run-Time Type Information
  7.8.1 dynamic_cast Operator
  7.8.2 typeid Operator

8. Stream Computation for Console and File Input /Output **(5 hours)**

8.1 Stream Class Hierarchy for Console Input /Output
8.2 Testing Stream Errors
8.3 Unformatted Input /Output
8.4 Formatted Input /Output with ios Member functions and Flags
8.5 Formatting with Manipulators
8.6 Stream Operator Overloading
8.7 File Input/output with Streams
8.8 File Stream Class Hierarchy
8.9 Opening and Closing files
8.10 Read/Write from File
8.11 File Access Pointers and their Manipulators
8.12 Sequential and Random Access to File
8.13 Testing Errors during File Operations

9. Templates **(5 hours)**

9.1 Function Template
9.2 Overloading Function Template
  9.2.1 Overloading with Functions
  9.2.2 Overloading with other Template
9.3 Class Template
  9.3.1 Function Definition of Class Template
  9.3.2 Non-Template Type Arguments
  9.3.3 Default Arguments with Class Template
9.4 Derived Class Template
9.5 Introduction to Standard Template Library
  9.5.1 Containers
  9.5.2 Algorithms
  9.5.3 Iterators

10. Exception Handling **(4 hours)**

10.1 Error Handling
10.2 Exception Handling Constructs (try, catch, throw)
10.3 Advantage over Conventional Error Handling
10.4 Multiple Exception Handling
10.5 Rethrowing Exception
10.6 Catching All Exceptions
10.7 Exception with Arguments
10.8 Exceptions Specification for Function
10.9 Handling Uncaught and Unexpected Exceptions

Practical:

There will be about 12 lab exercises covering the course. At the end of the course students must complete a programming project on object oriented programming with C++.

References :

1. Robert Lafore, "Object Oriented Programming in C++", Sams Publication
2. Daya Sagar Baral and Diwakar Baral, "The Secrets of Object Oriented Programming in C++", Bhundipuran Prakasan
3. Harvey M. Deitel and Paul J. Deitel, "C++ How to Program", Pearson Education Inc.
4. D. S. Malik, "C++ Programming", Thomson Course Technology
5. Herbert Schildt, "C++: The Complete Reference", Tata McGraw Hill

ELECTRIC CIRCUIT THEORY

EE 501

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : II
Part : I

Course Objectives:

To continue work in Basic Electrical Engineering including the use of the Laplace Transform to determine the time and frequency domain responses of electric circuits.

1. Network Analysis of AC circuit & dependent sources **(8 hours)**

- 1.1 Mesh Analysis
- 1.2 Nodal Analysis
- 1.3 Series & parallel resonance in RLC circuits
  - 1.3.1 Impedance and phase angle of series Resonant Circuit
  - 1.3.2 Voltage and current in series resonant circuit
  - 1.3.3 Band width of the RLC circuit.
  - 1.3.4 High-Q and Low-Q circuits

2. Initial Conditions: **(2 hours)**

- 2.1 Characteristics of various network elements
- 2.2 Initial value of derivatives
- 2.3 Procedure for evaluating initial conditions
- 2.4 Initial condition in the case of R-L-C network

3. Transient analysis in RLC circuit by direct solution **(10 hours)**

- 3.1 Introduction
- 3.2 First order differential equation
- 3.3 Higher order homogeneous and non-homogeneous differential equations
- 3.4 Particular integral by method of undetermined coefficients
- 3.5 Response of R-L circuit with
  - 3.5.1 DC excitation
  - 3.5.2 Exponential excitation
  - 3.5.3 Sinusoidal excitation
- 3.6 Response of R-C circuit with
  - 3.6.1 DC excitation
  - 3.6.2 Exponential excitation
  - 3.6.3 Sinusoidal excitation
- 3.7 Response of series R-L-C circuit with
  - 3.7.1 DC excitation
  - 3.7.2 Exponential excitation
  - 3.7.3 Sinusoidal excitation
- 3.8 Response of parallel R-L-C circuit with DC excitation

10. Exception Handling **(4 hours)**

10.1 Error Handling
10.2 Exception Handling Constructs (try, catch, throw)
10.3 Advantage over Conventional Error Handling
10.4 Multiple Exception Handling
10.5 Rethrowing Exception
10.6 Catching All Exceptions
10.7 Exception with Arguments
10.8 Exceptions Specification for Function
10.9 Handling Uncaught and Unexpected Exceptions

Practical:

There will be about 12 lab exercises covering the course. At the end of the course students must complete a programming project on object oriented programming with C++.

References :

1. Robert Lafore, "Object Oriented Programming in C++", Sams Publication
2. Daya Sagar Baral and Diwakar Baral, "The Secrets of Object Oriented Programming in C++", Bhundipuran Prakasan
3. Harvey M. Deitel and Paul J. Deitel, "C++ How to Program", Pearson Education Inc.
4. D. S. Malik, "C++ Programming", Thomson Course Technology
5. Herbert Schildt, "C++: The Complete Reference", Tata McGraw Hill

4. Transient analysis in RLC circuit by Laplace Transform (8 hours)

4.1 Introduction
4.2 The Laplace Transformation
4.3 Important properties of Laplace transformation
4.4 Use of Partial Fraction expansion in analysis using Laplace Transformations
4.5 Heaviside's partial fraction expansion theorem
4.6 Response of R-L circuit with
  4.6.1 DC excitation
  4.6.2 Exponential excitation
  4.6.3 Sinusoidal excitation
4.7 Response of R-C circuit with
  4.7.1 DC excitation
  4.7.2 Exponential excitation
  4.7.3 Sinusoidal excitation
4.8 Response of series R-L-C circuit with
  4.8.1 DC excitation
  4.8.2 Exponential excitation
  4.8.3 Sinusoidal excitation
4.9 Response of parallel R-L-C circuit with exponential excitation
4.10 Transfer functions Poles and Zeros of Networks

5. Frequency Response of Network (6 hours)

5.1 Introduction
5.2 Magnitude and phase response
5.3 Bode diagrams
5.4 Band width of Series & parallel Resonance circuits
5.5 Basic concept of filters, high pass, low pass, band pass and band stop filters

6. Fourier Series and transform (5 hours)

6.1 Basic concept of Fourier series and analysis
6.2 Evaluation of Fourier coefficients for periodic non-sinusoidal waveforms in electric networks
6.3 Introduction of Fourier transforms

7. Two-port Parameter of Networks (6 Hours)

7.1 Definition of two-port networks
7.2 Short circuit admittance parameters
7.3 Open circuits impedance parameters
7.4 Transmission Short circuit admittance parameters
7.5 Hybrid parameters
7.6 Relationship and transformations between sets of parameters
7.7 Application to filters
7.8 Applications to transmission lines
7.9 Interconnection of two-port network (Cascade, series, parallel)

Practical:

1. Resonance in RLC series circuit
   - measurement of resonant frequency
2. Transient Response in first Order System passive circuits
   - measure step and impulse response of RL and RC circuit using oscilloscope
   - relate time response to analytical transfer functions calculations
3. Transient Response in Second Order System passive circuits
   - measure step and impulse response of RLC series and parallel circuits using oscilloscope
   - relate time response to transfer functions and pole-zero configuration
4. Frequency Response of first order passive circuits
   - measure amplitude and phase response and plot bode diagrams for RL, RC and RLC circuits
   - relate Bode diagrams to transfer functions and pole zero configuration circuit
5. Frequency Response of second order passive circuits
   - measure amplitude and phase response and plot bode diagrams for RL, RC and RLC circuits
   - relate Bode diagrams to transfer functions and pole zero configuration circuit

References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall.
2. William H. Hyat. Jr. & Jack E. Kemmerly, "Engineering Circuits Analysis", McGraw Hill International Editions, Electrical Engineering Series.
3. Michel D. Cilletti, "Introduction to Circuit Analysis and Design", Holt, Hot Rinehart and Winston International Edition, New York.

ELECTRICAL ENGINEERING MATERIAL

EE 502

Lecture : 3
Tutorial : 1
Practical : 0

Year : II
Part : I

Course objectives:

To provide a basic understanding of the different materials used in electrical and electronics engineering.

1. Theory of Metals **(8 hours)**

1.1 Elementary quantum mechanical ideas: wave particle duality, wave function, schrodinger's equation, operator notation, expected value.
1.2 Infinite potential well: A confined electron.
1.3 Finite potential barrier: Tunneling phenomenon
1.4 Free electron theory of metals: electron in a linear solid, Fermi energy, Degenerate states, Number of states, Density of states, Population density.
1.5 Fermi-Dirac Distribution function
1.6 Thermionic emission: Richardson's equation, Schottky effect.
1.7 Contact potential: Fermi level at equilibrium.

2. Free electron theory of conduction in metal **(6 hours)**

2.1 Crystalline structure: Simple cubic structure, Body centered cubic, Face centered cubic.
2.2 Band theory of solids
2.3 Effective mass of electron
2.4 Thermal velocity of electron at equilibrium
2.5 Electron mobility, conductivity and resistivity

3. Dielectric materials **(6 hours)**

3.1 Matter polarization and relative permittivity: Relative permittivity, Dipole moment, Polarization vector, Local field, Clausius-Mossotti equation.
3.2 Types of Polarization: electronic polarization, ionic polarization, orientational polarization, Interfacial polarization.
3.3 Dielectric losses: frequency dependence.
3.4 Dielectric breakdown in solids
3.5 Ferro-electricity and Piezoelectricity

4. Magnetic materials **(6 hours)**

4.1 Magnetic material classification: Diamagnetism, Paramagnetism, Ferromagnetism, Anti-ferromagnetism, Ferrimagnetism.
4.2 Magnetic domains: Domain structure, domain wall motion, Hysteresis loop, Eddy current losses, demagnetization

4.3 Soft magnetic materials: Examples and uses
4.4 Hard magnetic materials: Examples and uses

5. Superconductivity **(5 hours)**

5.1 Zero Resistance and the Meissner effect
5.2 Type I and Type II superconductors
5.3 Critical current density

6. Semiconductors **(14 hours)**

6.1 Intrinsic semiconductors: Silicon crystal, energy band diagram, conduction in semiconductors, electrons and hole concentration.
6.2 Extrinsic semiconductors: n-type doping, p-type doping, compensation doping.
6.3 Introduction to GaAs semiconductor.
6.4 Temperature dependence of conductivity: Carrier concentration temperature dependence, drift mobility temperature and impurity dependence, conductivity temperature dependence, degenerate and non-degenerate semiconductors.
6.5 Diffusion on semiconductor: Einstein relationship
6.6 Direct and indirect generation and recombination
6.7 PN junction: Forward biased, reverse biased PN- junction.

References:

1. Bhadra Prasad Pokharel and Nava Raj Karki,"Electrical Engineering Materials",Sigma offset Press,Kamaladi, Kathmandu, Nepal.
2. R.C. Jaeger,"Introduction to Microelectronic Fabrication- Volume IV", Addison Wesley publishing Company,Inc.
3. Kasap.S.O, Principles of electrical engineering materials and devices, McGraw Hill, NewYork.
4. R.A.Colcaser and S.Diehl-Nagle,"Materials and Devices for Electrical Engineers and Physicists,McGraw-Hill, New York.

ELECTRONIC DEVICES AND CIRCUITS

EX 501

Lecture : 3 **Year : II**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To introduce the fundamentals of analysis of electronic circuits and to provide basic understanding of semiconductor devices and analog integrated circuits

1. Diodes **(5 hours)**

1.1 The Ideal Diode
1.2 Terminal Characteristics of Junction Diodes
1.3 Physical Operation of Diodes
1.4 Analysis of Diode Circuits
1.5 Small Signal Model and Its Application
1.6 Operation in the Reverse Breakdown Region - Zener Diodes

2. The Bipolar Junction Transistor **(10 hours)**

2.1 Operation of the npn transistor in the Active Mode
2.2 Graphical Representation of Transistor Characteristics
2.3 Analysis of Transistor Circuits at DC
2.4 Transistor as an Amplifier
2.5 Small Signal Equivalent Circuit Models
2.6 Graphical Load Line Analysis
2.7 Biasing BJT for Discrete-Circuit Design
2.8 Basic Single-Stage BJT Amplifier Configurations (C-B, C-E, C-C)
2.9 Transistor as a Switch – Cutoff and Saturation
2.10 A General Large-Signal Model for the BJT: The Ebers-Moll Model

3. Field-Effect Transistor **(9 hours)**

3.1 Structure and Physical Operation of Enhancement-Type MOSFET
3.2 Current-Voltage Characteristics of Enhancement-Type MOSFET
3.3 The Depletion-Type MOSFET
3.4 MOSFET Circuits at DC
3.5 MOSFET as an Amplifier
3.6 Biasing in MOS Amplifier Circuits
3.7 Junction Field-Effect Transistor

4. Output Stages and Power Amplifiers **(9 hours)**

4.1 Classification of Output Stages

4.2 Class A Output Stage
4.3 Class B Output Stage
4.4 Class AB Output Stage
4.5 Biasing the Class AB Stage
4.6 Power BJTs
4.7 Transformer-Coupled Push-Pull Stages
4.8 Tuned Amplifiers

5. Signal Generator and Waveform-Shaping Circuits **(6 hours)**

5.1 Basic Principles of Sinusoidal Oscillator
5.2 Op Amp-RC Oscillator Circuits
5.3 LC and Crystal Oscillators
5.4 Generation of Square and Triangular Waveforms Using Astable Multivibrators
5.5 Integrated Circuit Timers
5.6 Precision Rectifier Circuits

6. Power Supplies, Breakdown Diodes, and Voltage Regulators **(6 hours)**

6.1 Unregulated Power Supply
6.2 Bandgap Voltage Reference, a Constant Current Diodes
6.3 Transistor Series Regulators
6.4 Improving Regulator Performance
6.5 Current Limiting
6.6 Integrated Circuit Voltage Regulator

Practical:

1. Bipolar Junction Transistor Characteristics and Single Stage Amplifier
2. Field-Effect Transistor Characteristics and Single Stage Amplifier
3. Power Amplifiers
4. Relaxation Oscillator and Sinusoidal Oscillator
5. Series and Shunt Voltage Regulators

References:

1. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press,.
2. David A. Bell, " Electronics Device and Circuits ", PHI.
3. Robert Boylestad and Louis Nashelsky, " Electronic Device and Circuit Theory", PHI
4. Thomas L. Floyd, "Electronic Devices", Pearson Education Inc.

5. Mark N. Horenstein, "Microelectronic Circuits and Devices", PHI
6. Paul Horowitz and Winfield Fill, "The Art of Electornics", Cambridge Publication
7. Jacob Millman and Christos C. Halkias,andSatyabrataJit "Millman's Electronic Device and Circuits", Tata McGraw- Hill

DIGITAL LOGIC

EX 502

Lecture : 3
Tutorial : 0
Practical : 3

Year : II
Part : I

Course Objective:

To introduce basic principles of digital logic design, its implementation and applications

1. Introduction **(3 hours)**

1.1 Definitions for Digital Signals
1.2 Digital Waveforms
1.3 Digital Logic
1.4 Moving and Storing Digital Information
1.5 Digital Operations
1.6 Digital Computer
1.7 Digital Integrated Circuits
1.8 Digital IC Signal Levels
1.9 Clock wave form
1.10 Coding
  1.10.1 ASCII Code
  1.10.2 BCD
  1.10.3 The Excess – 3 Code
  1.10.4 The Gray Code

2. Digital Logic **(1 hours)**

2.1 The Basic Gates – NOT, OR, AND
2.2 Universal Logic Gates – NOR, NAND
2.3 AND-OR-INVERT Gates
2.4 Positive and Negative Logic
2.5 Introduction to HDL

3. Combinational Logic Circuits **(5 hours)**

3.1 Boolean Laws and Theorems
3.2 Sum-of-Products Method
3.3 Truth Table to Karnaugh Map
3.4 Pairs, Quads, and Octets
3.5 Karnaugh Simplifications
3.6 Don't Care Conditions
3.7 Product-of-Sums Method
3.8 Product-of-Sums Simplification
3.9 Hazards and Hazard Covers
3.10 HDL Implementation Models

4. Data Processing Circuits **(5 hours)**

4.1 Multiplexer
4.2 DeMultiplexer
4.3 Decoder
4.4 BCD-to-Decimal Decoders
4.5 Seven-Segment Decoders
4.6 Encoder
4.7 Exclusive-OR Gates
4.8 Parity Generators and Checkers
4.9 Magnitude Comparator
4.10 Read-Only Memory
4.11 Programmable Array Logic
4.12 Programmable Logic Arrays
4.13 Troubleshooting with a Logic Probe
4.14 HDL Implementation of Data Processing Circuits

5. Arithmetic Circuits **(5 hours)**

5.1 Binary Addition
5.2 Binary Subtraction
5.3 Unsigned Binary Numbers
5.4 Sign-Magnitude Numbers
5.5 2's Complement Representation
5.6 2's Complement Arithmetic
5.7 Arithmetic Building Blocks
5.8 The Adder-Subtracter
5.9 Fast Adder
5.10 Arithmetic Logic Unit
5.11 Binary Multiplication and Division
5.12 Arithmetic Circuits Using HDL

6. Flip Flops **(5 hours)**

6.1 RS Flip-Flops
6.2 Gated Flip-Flops
6.3 Edge-Triggered RS Flip-Flops
6.4 Egde Triggered D Flip-Flops
6.5 Egde Triggered J K Flip-Flops
6.6 Flip-Flop Timing
6.7 J K Mater- Slave Flip-Flops
6.8 Switch Contacts Bounds Circuits
6.9 Varius Representation of Flip-Flops
6.10 Analysis of Sequencial Circuits

7. Registers **(2 hours)**

7.1 Types of Registers
7.2 Serial In – Serial Out
7.3 Serial In – Parallel Out

7.4 Parallel In – Serial Out
7.5 Parallel In – Parallel Out
7.6 Applications of Shift Registers

8. Counters **(5 hours)**

8.1 Asynchronous Counters
8.2 Decoding Gates
8.3 Synchronous Counters
8.4 Changing the Counter Modulus
8.5 Decade Counters
8.6 Presettable Counters
8.7 Counter Design as a Synthesis Problem
8.8 A Digital Clock

9. Sequential Machines **(8 hours)**

9.1 Synchronous machines
- 9.1.1 Clock driven models and state diagrams
- 9.1.2 Transition tables, Redundant states
- 9.1.3 Binary assignment
- 9.1.4 Use of flip-flops in realizing the models

9.2 Asynchronous machines
- 9.2.1 Hazards in asynchronous system and use of redundant branch
- 9.2.2 Allowable transitions
- 9.2.3 Flow tables and merger diagrams
- 9.2.4 Excitation maps and realization of the models

10. Digital Integrate Circuits **(4 hours)**

10.1 Switching Circuits
10.2 7400 TTL
10.3 TTL parameters
10.4 TTL Overvew
10.5 Open Collecter Gates
10.6 Three-state TTL Devices
10.7 External Drive for TTL Loads
10.8 TTL Driving External Loads
10.9 74C00 CMOS
10.10 CMOS Characteristics
10.11 TTL- to –CMOS Interface
10.12 CMOS- to- TTL Interface

11. Applications **(2 hours)**

11.1 Multiplexing Displays
11.2 Frequency Counters
11.3 Time Measurement

Practical:

1. DeMorgan's law and it's familiarization with NAND and NOR gates
2. Encoder, Decoder, and Multiplexer
3. Familiarization with Binary Addition and Subtraction
4. Construction of true complement generator
5. Latches, RS, Master-Slave and T type flip flops
6. D and JK type flip flops
7. Ripple Counter, Synchronous counter
8. Familiarization with computer package for logic circuit design
9. Design digital circuits using hardware and software tools
10. Use of PLAs and PLDs

References:

1. Donald P. Leach, Albert Paul Malvino and GoutamSaha, " Digital Principles and Applications", Tata McGraw-Hill.
2. David J Comer, "Digital Logic And State Machine Design" Oxford University Press.
3. William I. Fletcher "An Engineering Approach to Digital Design" Prentice Hall of India, New Delhi.
4. William H. Gothmann, "Digital Electronics, An Introduction to Theory and Practice"

ELECTROMAGNETICS

EX 503

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : II
Part : I

Course Objectives:

To provide basic understanding of the fundamentals of Electromagnetics

1. Introduction **(3 hours)**

1.1 Co-ordinate system.
1.2 Scalar and vector fields.
1.3 Operations on scalar and vector fields.

2. Electric field **(12 hours)**

2.1 Coulomb's law.
2.2 Electric field intensity.
2.3 Electric flux density.
2.4 Gauss's law and applications.
2.5 Physical significance of divergence, Divergence theorem.
2.6 Electric potential, potential gradient.
2.7 Energy density in electrostatic field.
2.8 Electric properties of material medium.
2.9 Free and bound charges, polarization, relative permittivity, electric dipole.
2.10 Electric Boundary conditions.
2.11 Current, current density, conservation of charge, continuity equation, relaxation time.
2.12 Boundary value problems, Laplace and Poisson equations and their solutions, uniqueness theorem.
2.13 Graphical field plotting, numerical integration.

3. Magnetic field **(9 hours)**

3.1 Biot-Savart's law.
3.2 Magnetic field intensity.
3.3 Ampere's circuital law and its application.
3.4 Magnetic flux density.
3.5 Physical significance of curl, Stoke's theorem.
3.6 Scalar and magnetic vector potential.
3.7 Magnetic properties of material medium.
3.8 Magnetic force, magnetic torque, magnetic moment, magnetic dipole, magnetization.
3.9 Magnetic boundary condition.

4. Wave equation and wave propagation **(13 hours)**

4.1 Faraday's law, transformer emf, motional emf.
4.2 Displacement current.

4.3 Maxwell's equations in integral and point forms.
4.4 Wave propagation in lossless and lossy dielectric.
4.5 Plane waves in free space, lossless dielectric, good conductor.
4.6 Power and pointing vector.
4.7 Reflection of plane wave at normal incidence.

5. Transmission lines **(5 hours)**

5.1 Transmission line equations.
5.2 Input impedance, reflection coefficient, standing wave ratio.
5.3 Impadance matching, quarter wave transformer, single stub matching, double stub matching.

6. Wave guides **(2 hours)**

6.1 Rectangular wave guide.
6.2 Transverse electric mode, transverse magnetic mode.

7. Antennas **(1 hour)**

7.1 Introduction to antenna, antenna types and properties.

Practical:

1. Teledeltos (electro-conductive) paper mapping of electrostatic fields.
2. Determination of dielectric constant, display of a magnetic Hysteresis loop
3. Studies of wave propagation on a lumped parameter transmission line
4. Microwave sources, detectors, transmission lines
5. Standing wave patterns on transmission lines, reflections, power patterns on transmission lines, reflections, power measurement.
6. Magnetic field measurements in a static magnetic circuit, inductance, leakage flux.

References:

1. W. H. Hayt, "Engineering Electromagnetics", McGraw-Hill Book Company.
2. J. D. Kraus, "Electromagnetics", McGraw-Hill Book Company.
3. N. N. Rao, "Elements of Engineering Electromagnetics", Prentice Hall.
4. Devid K. Cheng, "Field and Wave Electromagnetics", Addison-Wesley.
5. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Press.

APPLIED MATHEMATICS

SH 551

Lecture : 3
Tutorial : 1
Practical : 0

Year : II
Part : II

Course Objective

This course focuses on several branches of applied mathematics. The students are exposed to complex variable theory and a study of the Fourier and Z-Transforms, topics of current importance in signal processing. The course concludes with studies of the wave and heat equations in Cartesian and polar coordinates.

1. Complex Analysis **(18 hours)**

- 1.1 Complex Analytic Functions
  - 1.1.1 Functions and sets in the complex plane
  - 1.1.2 Limits and Derivatives of complex functions
  - 1.1.3 Analytic functions. The Cauchy –Riemann equations
  - 1.1.4 Harmonic functions and it's conjugate
- 1.2 Conformal Mapping
  - 1.2.1 Mapping
  - 1.2.2 Some familiar functions as mappings
  - 1.2.3 Conformal mappings and special linear functional transformations
  - 1.2.4 Constructing conformal mappings between given domains
- 1.3 Integral in the Complex Plane
  - 1.3.1 Line integrals in the complex plane
  - 1.3.2 Basic Problems of the complex line integrals
  - 1.3.3 Cauchy's integral theorem
  - 1.3.4 Cauchy's integral formula
  - 1.3.5 Supplementary problems
- 1.4 Complex Power Series, Complex Taylor series and Lauren series
  - 1.4.1 Complex power series
  - 1.4.2 Functions represented by power series
  - 1.4.3 Taylor series, Taylor series of elementary functions
  - 1.4.4 Practical methods for obtaining power series, Laurent series
  - 1.4.5 Analyticity at infinity, zeros, singularities, residues, Cauchy's residue theorem
  - 1.4.6 Evaluation of real integrals

2. The Z-Transform **(9 hours)**

- 2.1 Introduction
- 2.2 Properties of Z-Transform
- 2.3 Z- transform of elementary functions
- 2.4 Linearity properties

2.5 First shifting theorem, second shifting theorem, Initial value theorem,
2.6 Final value theorem, Convolution theorem
2.7 Some standard Z- transform
2.8 Inverse Z-Transform
2.9 Method for finding Inverse Z-Transform
2.10 Application of Z-Transform to difference equations

3. Partial Differential Equations **(12 hours)**

3.1 Linear partial differential equation of second order, their classification and solution
3.2 Solution of one dimensional wave equation, one dimensional heat equation, two dimensional heat equation and Laplace equation (Cartesian and polar form) by variable separation method

4. Fourier Transform **(6 hours)**

4.1 Fourier integral theorem, Fourier sine and cosine integral; complex form of Fourier integral
4.2 Fourier transform, Fourier sine transform, Fourier cosine transform and their properties
4.3 Convolution, Parseval's identity for Fourier transforms
4.4 Relation between Fourier transform and Laplace transform

References:

1. S. K. Mishra, G. B. Joshi, S. Ghimire, V. Parajuli, " A text book of Applied Mathematics", Dibya Deurali Prakashan.
2. E. Kreyszig, "Advance Engineering Mathematics", Fifth Edition, Wiley, New York.
3. A. V. Oppenheim, "Discrete-Time Signal Processing", Prentice Hall.
4. K. Ogata, "Discrete-Time Control System", Prentice Hall, Englewood Cliffs, New Jersey, 1987.

NUMERICAL METHODS

SH 553

Lecture : 3
Tutorial : 1
Practical : 3

Year : II
Part : II

Course objective:

To introduce numerical methods used for the solution of engineering problems. The course emphasizes algorithm development and programming and application to realistic engineering problems.

1. Introduction, Approximation and errors of computation **(4 hours)**

- 1.1 Introduction, Importance of Numerical Methods
- 1.2 Approximation and Errors in computation
- 1.3 Taylor's series
- 1.4 Newton's Finite differences (forward , Backward, central difference, divided difference)
- 1.5 Difference operators, shift operators, differential operators
- 1.6 Uses and Importance of Computer programming in Numerical Methods.

2. Solutions of Nonlinear Equations **(5 hours)**

- 2.1 Bisection Method
- 2.2 Newton Raphson method (two equation solution)
- 2.3 Regula-Falsi Method , Secant method
- 2.4 Fixed point iteration method
- 2.5 Rate of convergence and comparisons of these Methods

3. Solution of system of linear algebraic equations **(8 hours)**

- 3.1 Gauss elimination method with pivoting strategies
- 3.2 Gauss-Jordan method
- 3.3 LU Factorization
- 3.4 Iterative methods (Jacobi method, Gauss-Seidel method)
- 3.5 Eigen value and Eigen vector using Power method

4. Interpolation **(8 hours)**

- 4.1 Newton's Interpolation (forward, backward)
- 4.2 Central difference interpolation: Stirling's Formula, Bessel's Formula
- 4.3 agrange interpolation
- 4.4 Least square method of fitting linear and nonlinear curve for discrete data and continuous function

4.5 Spline Interpolation (Cubic Spline)

5. Numerical Differentiation and Integration **(6 hours)**

5.1 Numerical Differentiation formulae
5.2 Maxima and minima
5.3 Newton-Cote general quadrature formula
5.4 Trapezoidal, Simpson's 1/3, 3/8 rule
5.5 Romberg integration
5.6 Gaussian integration (Gaussian – Legendre Formula 2 point and 3 point)

6. Solution of ordinary differential equations **(6 hours)**

6.1 Euler's and modified Euler's method
6.2 Runge Kutta methods for 1st and 2nd order ordinary differential equations
6.3 Solution of boundary value problem by finite difference method and shooting method.

7. Numerical solution of Partial differential Equation **(8 hours)**

7.1 Classification of partial differential equation(Elliptic, parabolic, and Hyperbolic)
7.2 Solution of Laplace equation (standard five point formula with iterative method)
7.3 Solution of Poisson equation (finite difference approximation)
7.4 Solution of Elliptic equation by Relaxation Method
7.5 Solution of one dimensional Heat equation by Schmidt method

Practical:

Algorithm and program development in C programming language of following:

1. Generate difference table.
2. At least two from Bisection method, Newton Raphson method, Secant method
3. At least one from Gauss elimination method or Gauss Jordan method. Finding largest Eigen value and corresponding vector by Power method.
4. Lagrange interpolation. Curve fitting by Least square method.
5. Differentiation by Newton's finite difference method. Integration using Simpson's 3/8 rule
6. Solution of 1st order differential equation using RK-4 method
7. Partial differential equation (Laplace equation)
8. Numerical solutions using Matlab.

References:

1. Dr. B.S.Grewal, "Numerical Methods in Engineering and Science ", Khanna Publication.
2. Robert J schilling, Sandra l harries, " Applied Numerical Methods for Engineers using MATLAB and C.", Thomson Brooks/cole.
3. Richard L. Burden, J.Douglas Faires, "Numerical Analysis", Thomson / Brooks/cole
4. John. H. Mathews, Kurtis Fink, "Numerical Methods Using MATLAB", Prentice Hall publication
5. JAAN KIUSALAAS , "Numerical Methods in Engineering with MATLAB" , Cambridge Publication

INSTRUMENTATION I

EE 552

Lecture : 3 **Year : II**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

To provide comprehensive treatment of methods and instrument for a wide range of measurement problems

1. Instrumentations Systems **(2 hours)**

1.1 Functions of components of instrumentation system introduction, signal processing , Signal transmission ,output indication
1.2 Need for electrical, electronics, pneumatic and hydraulic working media systems and conversion devices
1.3 Analog and digital systems

2. Theory of measurement **(10 hours)**

2.1 Static performance parameters - accuracy, precision, sensitivity, resolution and linearity
2.2 Dynamic performance parameters - response time, frequency response and bandwidth
2.3 Error in measurement
2.4 Statistical analysis of error in measurement
2.5 Measurement of voltage & current (moving coil & moving iron instruments)
2.6 Measurement of low, high & medium resistances
2.7 AC bridge & measurement of inductance and capacitance

3. Transducer **(8 hours)**

3.1 Introduction
3.2 Classification
3.3 Application
  3.3.1 Measurement of mechanical variables, displacement, strain. velocity. acceleration and vibration
  3.3.2 Measurement of process variables - temperature pressure, level, fluid flow, chemical constituents in gases or liquids, pH and humidity.
  3.3.3 Measurement of bio-physical variables blood pressure and myoelectric potentials

4. Electrical Signal Processing and transmission **(6 hours)**

4.1 Basic Op-amp characteristics
4.2 Instrumentation amplifier

4.3 Signal amplification, attenuation, integration, differentiation, network isolation, wave shaping
4.4 Effect of noise, analog filtering, digital filtering
4.5 Optical communication, fibre optics, electro-optic conversion devices

5. Analog - Digital and Digital - Analog Conversion **(6 hours)**

5.1 Analog signal and digital signal
5.2 Digital to analog convertors - weighted resistor type, R-2R ladder type, DAC Errors
5.3 Analog to digital convertors - successive approximation type, ramp type, dual ramp type, flash type, ADC errors

6. Digital Instrumentation **(5 hours)**

6.1 Sample data system, sample and hold circuit
6.2 Components of data acquisition system
6.3 Interfacing to the computer

7. Electrical equipment **(8 hours)**

7.1 Wattmeter
  7.1.1 Types
  7.1.2 Working principles
7.2 Energy meter
  7.2.1 Types
  7.2.2 Working principles
7.3 Frequency meter
  7.3.1 Types
  7.3.2 Working principles
7.4 Power factor meter
7.5 Instrument transformers

Practical:

1. Accuracy test in analog meters
2. Operational Amplifiers in Circuits
   - Use of Op amp as a summer, inverter, integrator and differentiator
3. Use resistive, inductive and capacitive transducers to measure displacement
   - Use strain gauge transducers to measure force
4. Study of Various transducers for measurement of Angular displacement, Angular Velocity, Pressure and Flow
   - Use optical, Hall effect and inductive transducer to measure angular displacement
   - Use tacho - generator to measure angular velocity
   - Use RTD transducers to measure pressure and flow
5. Digital to Analog Conversion
   - Perform static testing of D/A converter
6. Analog to Digital Conversion
   - Perform static testing of A/D converter

References:

1. D.M Considine "Process Instruments and Controls Handbook" McGraw Hill.
2. S. Wolf and R.F.M. Smith "Students Reference Manual for Electronics Instrumentation Laboratories", Prentice Hall.
3. E.O Deobelin "Measurement System, Application and Design" McGraw Hill.
4. A.K Sawhney "A Course in Electronic Measurement and Instrumentation " DhanpatRai and Sons.
5. C.S. Rangan, G.R Sharma and V.S.V. Mani, "Instrumentation Devices and Systems" Tata McGraw Hill publishing Company Limited New Delhi.
6. J.B. Gupta. "A Course in Electrical & Electronics Measurement & Instrumentation, Kataria& Sons.

POWER SYSTEM

EE 553

Lecture : 3
Tutorial : 1
Practical : 0

Year : II
Part : II

Course Objectives:

To deliver the principle and fundamental analysis techniques for generation, transmission and distribution components of a power system with basic protection system.

1. General Background (4 hours)

1.1 Power System Evolution
1.2 Generation, Transmission and Distribution Components
1.3 Major electrical components in power station; alternators, transformers, bus bars, voltage regulators, switch and isolators, metering and control panels
1.4 Voltage levels, AC vs DC Transmission
1.5 Single phase and three phase power delivery
1.6 Single line diagram representation of a power system

2. Mechanical consideration of Transmission (8 hours)

2.1 Overhead Lines
- 2.1.1 Line supports, spacing between conductors
- 2.1.2 Calculation of sag, equal and unequal supports, effect of ice and wind loadings
- 2.1.3 Application of G.P.S system

2.2 Underground cables
- 2.2.1 Classification, construction of cables, insulation resistance
- 2.2.2 Dielectric stress in single core/multi core cables
- 2.2.3 Cable faults and location of faults

3. Line parameter calculations (10 hours)

3.1 Inductance, resistance and capacitance of a line
3.2 Inductance of line due to internal & external flux linkages
3.3 Skin & proximity effect
3.4 Inductance of single phase two wire line, stranded & bundled conductor consideration, concept of G.M.R and G. M.D, inductance of 3 phase line; equilateral and unsymmetrical spacing
3.5 Transposition, inductance of double circuit 3 phase lines
3.6 Concept of G.M.R and G. M.D for capacitance calculations
3.7 Capacitance calculations of single phase two wire line, stranded & bundled conductor consideration, capacitance of 3 phase line; equilateral and unsymmetrical spacing, double circuit
3.8 Earth effect in capacitance of a line

4. Transmission line performance analysis **(8 hours)**

4.1 Classification of a lines based on short, medium and long lines
4.2 Representation of 'Tee' and 'Pi' of medium lines; calculation of ABCD parameters
4.3 Per unit system; advantage and applications
4.4 Voltage regulation & efficiency calculation of transmission lines
4.5 Transmission line as source and sink of reactive power
4.6 Real and reactive power flow through lines
4.7 Surge impedance loading
4.8 Reactive compensation of transmission lines

5. Interconnected power system **(5 hours)**

5.1 Real power/ frequency balance
5.2 Reactive power/ voltage balance
5.3 Computer application in Interconnected power system
5.4 Basic concept of Power system Load flow

6. Distribution System **(5 hours)**

6.1 Distribution system terminology
6.2 Distribution transformer & Load centers
6.3 Rural vs urban distribution
6.4 Radial, loop & network distribution
6.5 Voltage drop computation in a radial Dc & Ac distribution

7. Introduction to power system protection **(5 hours)**

7.1 Power system faults & protection principle
7.2 Fuse as a protection device
7.3 Relays; working and types
7.4 Circuit breaker; working and types
7.5 Basic protection schemes for generators, motors, transformers and transmission lines
7.6 Basic concept of power line carrier communication (PLCC)

References:

1 W.D. Stevension "Power System Analysis " Tata McGraw Hill Publications
2 S.N. Singh "Electric power Generation, Transmission & Distribution" Prentece Hall

ELECTRICAL MACHINES

EE 554

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : II
Part : II

Course Objective:

To impart knowledge on constructional details, operating principle and performance of Transformers, DC Machines, 1-phase and 3-phase Induction Machines, 3-phase Synchronous Machines and Fractional Kilowatt Motors.

1. Magnetic Circuits and Induction **(4 hours)**

1.1 Magnetic Circuits
1.2 Ohm's Law for Magnetic Circuits
1.3 Series and Parallel magnetic circuits
1.4 Core with air gap
1.5 B-H relationship (Magnetization Characteristics)
1.6 Hysteresis with DC and AC excitation
1.7 Hysteresis Loss and Eddy Current Loss
1.8 Faraday's Law of Electromagnetic Induction, Statically and Dynamically Induced EMF
1.9 Force on Current Carrying Conductor

2. Transformer **(8 hours)**

2.1 Constructional Details, recent trends
2.2 Working principle and EMF equation
2.3 Ideal Transformer
2.4 No load and load Operation
2.5 Operation of Transformer with load
2.6 Equivalent Circuits and Phasor Diagram
2.7 Tests: Polarity Test, Open Circuit test, Short Circuit test and Equivalent Circuit Parameters
2.8 Voltage Regulation
2.9 Losses in a transformer
2.10 Efficiency, condition for maximum efficiency and all day efficiency
2.11 Instrument Transformers: Potential Transformer (PT) and Current Transformer (CT)
2.12 Auto transformer: construction, working principle and Cu saving
2.13 Three phase Transformers

3. DC Generator **(6 hours)**

3.1 Constructional Details and Armature Winding
3.2 Working principle and Commutator Action
3.3 EMF equation

3.4 Method of excitation: separately and self excited, Types of DC Generator
3.5 Characteristics of series, shunt and compound generator
3.6 Losses in DC generators
3.7 Efficiency and Voltage Regulation

4. DC Motor **(6 hours)**

4.1 Working principle and Torque equation
4.2 Back EMF
4.3 Method of excitation, Types of DC motor
4.4 Performance Characteristics of D.C. motors
4.5 Starting of D.C. Motors: 3 point and 4 point starters
4.6 Speed control of D.C. motors: Field Control, Armature Control
4.7 Losses and Efficiency

5. Three Phase Induction Machines **(7 hours)**

5.1 Three Phase Induction Motor
  5.1.1 Constructional Details and Types
  5.1.2 Operating Principle, Rotating Magnetic Field, Synchronous Speed, Slip, Induced EMF, Rotor Current and its frequency, Torque Equation
  5.1.3 Torque-Slip characteristics
5.2 Three Phase Induction Generator
  5.2.1 Working Principle, voltage build up in an Induction Generator
  5.2.2 Power Stages

6. Three Phase Synchronous Machines **(6 hours)**

6.1 Three Phase Synchronous Generator
  6.1.1 Constructional Details, Armature Windings, Types of Rotor, Exciter
  6.1.2 Working Principle
  6.1.3 EMF equation, distribution factor, pitch factor
  6.1.4 Armature Reaction and its effects
  6.1.5 Alternator with load and its phasor diagram
6.2 Three Phase Synchronous Motor
  6.2.1 Principle of operation
  6.2.2 Starting methods
  6.2.3 No load and Load operation, Phasor Diagram
  6.2.4 Effect of Excitation and power factor control

7. Fractional Kilowatt Motors **(6 hours)**

7.1 Single phase Induction Motors: Construction and Characteristics
7.2 Double Field Revolving Theory
7.3 Split phase Induction Motor
  7.3.1 Capacitors start and run motor

7.3.2 Reluctance start motor
7.4 Alternating Current Series motor and Universal motor
7.5 Special Purpose Machines: Stepper motor, Schrage motor and Servo motor

Practical:

1. Magnetic Circuits
   - To draw B-H curve for two different sample of Iron Core
   - Compare their relative permeability
2. Two Winding Transformers
   - To perform turn ratio test
   - To perform open circuit (OC) and short circuit (SC) test to determine equivalent circuit parameter of a transformer and hence to determine the regulation and efficiency at full load
3. DC Generator
   - To draw open circuit characteristic (OCC) of a DC shunt generator
   - To draw load characteristic of shunt generator
4. DC Motor
   - Speed control of DC Shunt motor by (a) armature control method (b) field control method
   - To observe the effect of increasing load on DC shunt motor's speed, armature current, and field current.
5. 3-phase Machines
   - To draw torque-speed characteristics and to observe the effect of rotor resistance on torque-speed characteristics of a 3-phase Induction Motor
   - To study load characteristics of synchronous generator with (a) resistive load (b) inductive load and (c) capacitive load
6. Fractional Kilowatt Motors
   - To study the effect of a capacitor on the starting and running of a single-phase induction motor
   - Reversing the direction of rotation of a single phase capacitor induct

References:

1. I.J. Nagrath & D.P.Kothari," Electrical Machines", Tata McGraw Hill
2. S. K. Bhattacharya, "Electrical Machines", Tata McGraw Hill.
3. B. L. Theraja and A. K. Theraja, "Electrical Technology (Vol-II)", S. Chand.
4. Husain Ashfaq ," Electrical Machines", Dhanpat Rai & Sons
5. A.E. Fitzgerald, C.Kingsley Jr and Stephen D. Umans,"Electric Machinery", Tata McGraw Hill.
6. B.R. Gupta & Vandana Singhal, "Fundamentals of Electrical Machines, New Age International.

7. P. S. Bhimbra, "Electrical Machines", Khanna Publishers
8. Irving L.Kosow, "Electric Machine and Tranformers", Prentice Hall of India.
9. M.G. Say, "The Performance and Design of AC machines", Pit man & Sons.
10. Bhag S. Guru and Huseyin R. Hiziroglu, "Electric Machinery and Transformers" Oxford University Press.

MICROPROCESSORS

EX 551

Lecture : 3
Tutorial : 1
Practical : 3

Year : II
Part : II

Course Objective:

To familiarize students with architecture, programming, hardware and application of microprocessor

1. Introduction **(4 hours)**

1.1 Introduction and History of Microprocessors
1.2 Basic Block Diagram of a Computer
1.3 Organization of Microprocessor Based System
1.4 Bus Organization
1.5 Stored program Concept and Von Neumann Machine
1.6 Processing Cycle of a Stored Program Computer
1.7 Microinstructions and Hardwired/Microprogrammed Control Unit
1.8 Introduction to Register Transfer Language

2. Programming with 8085 Microprocessor **(10 hours)**

2.1 Internal Architecture and Features of 8085 microprocessor
2.2 Instruction Format and Data Format
2.3 Addressing Modes of 8085
2.4 Intel 8085 Instruction Set
2.5 Various Programs in 8085
  2.5.1 Simple Programs with Arithmetic and Logical Operations
  2.5.2 Conditions and Loops
  2.5.3 Array and Table Processing
  2.5.4 Decimal BCD Conversion
  2.5.5 Multiplication and Division

3. Programming with 8086 Microprocessor **(12 hours)**

3.1 Internal Architecture and Features of 8086 Microprocessor
  3.1.1 BIU and Components
  3.1.2 EU and Components
  3.1.3 EU and BIU Operations
  3.1.4 Segment and Offset Address
3.2 Addressing Modes of 8086

3.3 Assembly Language Programming
3.4 High Level versus Low Level Programming
3.5 Assembly Language Syntax
  3.5.1 Comments
  3.5.2 Reserved words
  3.5.3 Identifiers
  3.5.4 Statements
  3.5.5 Directives
  3.5.6 Operators
  3.5.7 Instructions
3.6 EXE and COM programs
3.7 Assembling, Linking and Executing
3.8 One Pass and Two Pass Assemblers
3.9 Keyboard and Video Services
3.10 Various Programs in 8086
  3.10.1 Simple Programs for Arithmetic, Logical, String Input/Output
  3.10.2 Conditions and Loops
  3.10.3 Array and String Processing
  3.10.4 Read and Display ASCII and Decimal Numbers
  3.10.5 Displaying Numbers in Binary and Hexadecimal Formats

4. Microprocessor System **(10 hours)**

4.1 Pin Configuration of 8085 and 8086 Microprocessors
4.2 Bus Structure
  4.2.1 Synchronous Bus
  4.2.2 Asynchronous Bus
  4.2.3 Read and Write Bus Timing of 8085 and 8086 Microprocessors
4.3 Memory Device Classification and Hierarchy
4.4 Interfacing I/O and Memory
  4.4.1 Address Decoding
  4.4.2 Unique and Non Unique Address Decoding
  4.4.3 I/O Mapped I/O and Memory Mapped I/O
  4.4.4 Serial and Parallel Interfaces
  4.4.5 I/O Address Decoding with NAND and Block Decoders (8085, 8086)
  4.4.6 Memory Address Decoding with NAND, Block and PROM Decoders (8085, 8086)
4.5 Parallel Interface
  4.5.1 Modes: Simple, Wait, Single Handshaking and Double Handshaking

4.5.2 Introduction to Programmable Peripheral Interface (PPI)

4.6 Serial Interface

4.6.1 Synchronous and Asynchronous Transmission

4.6.2 Serial Interface Standards: RS232, RS423, RS422, USB

4.6.3 Introduction to USART

4.7 Introduction to Direct Memory Access (DMA) and DMA Controllers

5. Interrupt Operations **(5 hours)**

5.1 Polling versus Interrupt

5.2 Interrupt Processing Sequence

5.3 Interrupt Service Routine

5.4 Interrupt Processing in 8085

5.4.1 Interrupt Pins and Priorities

5.4.2 Using Programmable Interrupt Controllers (PIC)

5.4.3 Interrupt Instructions

5.5 Interrupt Processing in 8086

5.5.1 Interrupt Pins

5.5.2 Interrupt Vector Table and its Organization

5.5.3 Software and Hardware Interrupts

5.5.4 Interrupt Priorities

6. Advanced Topics **(4 hours)**

6.1 Multiprocessing Systems

6.1.1 Real and Pseudo-Parallelism

6.1.2 Flynn's Classification

6.1.3 Instruction Level, Thread Level and Process Level Parallelism

6.1.4 Interprocess Communication, Resource Allocation and Deadlock

6.1.5 Features of Typical Operating System

6.2 Different Microprocessor Architectures

6.2.1 Register Based and Accumulator Based Architecture

6.2.2 RISC and CISC Architectures

6.2.3 Digital Signal Processors

Practical:

There will be aout 12 lab exercises to program 8085 and 8086 microprocessors.

References:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Application with 8085", Prentice Hall
2. Peter Abel, "IBM PC Assembly Language and Programming", Pearson Education Inc.
3. D. V. Hall, "Microprocessor and Interfacing, Programming and Hardware", Tata McGraw Hill
4. John Uffenbeck, "Microcomputers and Microprocessors, The 8080, 8085 and Z-80 Programming, Interfacing and Troubleshooting", Prentice Hall
5. Walter A. Triebel and Avtar Singh, "The 8088 and 8086 Microprocessors, Programming, Interfacing, Software, Hardware and Applications", Prentice Hall
6. William Stalling, "Computer Organization and Architecture", Prentice Hall

DISCRETE STRUCTURE

CT 551

Lecture : 3
Tutorial : 0
Practical : 0

Year : II
Part : II

Course Objectives:

To gain knowledge in discrete mathematics and finite state automata in an algorithmic approach and to gain fundamental and conceptual clarity in the area of Logic, Reasoning, Algorithms, Recurrence Relation, Graph Theory, and Theory of Automata

1. Logic, Induction and Reasoning (12 hours)

1.1 Proposition and Truth function
1.2 Propositional Logic
1.3 Expressing statements in Logic Propositional Logic
1.4 The predicate Logic
1.5 Validity
1.6 Informal Deduction in Predicate Logic
1.7 Rules of Inference and Proofs
1.8 Informal Proofs and Formal Proofs
1.9 Elementary Induction and Complete Induction
1.10 Methods of Tableaux
1.11 Consistency and Completeness of the System

2. Finite State Automata (10 hours)

2.1 Sequential Circuits and Finite state Machine
2.2 Finite State Automata
2.3 Language and Grammars
2.4 Non-deterministic Finite State Automata
2.5 Language and Automata
2.6 Regular Expression and its characteristics

3. Recurrence Relation (8 hours)

3.1 Recursive Definition of Sequences
3.2 Solution of Linear recurrence relations
3.3 Solution to Nonlinear Recurrence Relations
3.4 Application to Algorithm Analysis

4. Graph Theory (15 hours)

4.1 Undirected and Directed Graphs
4.2 Walk Paths, Circuits, Components
4.3 Connectedness Algorithm
4.4 Shortest Path Algorithm
4.5 Bipartite Graphs, Planar Graphs, Regular Graphs

4.6 Planarity Testing Algorithms
4.7 Eulerian Graph
4.8 Hamiltonian Graph
4.9 Tree as a Directed Graph
4.10 Binary Tree, Spanning Tree
4.11 Cutsets and Cutvertices
4.12 Network Flows, Maxflow and Mincut Theorem
4.13 Data Structures Representing Trees and Graphs in Computer
4.14 Network Application of Trees and Graphs
4.15 Concept of Graph Coloring

References:

1. Kenth Rosen, "Discrete Mathematical Structures with Applications to Computer Science", WCB/ McGraw Hill
2. G. Birkhoff, T.C. Bartee, "Modern Applied Algebra", CBS Publishers.
3. R. Johnsonbaugh, "Discrete Mathematics", Prentice Hall Inc.
4. G.Chartand, B.R.Oller Mann, "Applied and Algorithmic Graph Theory", McGraw Hill
5. Joe L. Mott, AbrahanKandel, and Theodore P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Prentice-Hall of India

COMMUNICATION ENGLISH

SH 601

Lecture : 3
Tutorial : 1
Practical : 2

Year : III
Part : I

Course Introduction

This course is designed for the students of engineering with the objective of developing all four skills of communication applicable in professional field.

Course Objectives

After completion of this course students will be able to:

a. comprehend reading materials both technical and semi-technical in nature
b. develop grammatical competence
c. write notice, agenda, minutes
d. write proposals
e. write reports
f. write research articles
g. listen and follow instruction, description and conversation in native speakers' accent
h. do discussion in group, deliver talk and present brief oral reports

Unit I: Reading **(15 hours)**

1. Intensive Reading **(8 hours)**

1.1 Comprehension
1.2 Note-taking
1.3 Summary writing
1.4 Contextual questions based on facts and imagination
1.5 Interpreting text

2. Extensive Reading **(5 hours)**

2.1 Title/Topic Speculation
2.2 Finding theme
2.3 Sketching character

3. Contextual Grammar **(2 hours)**

3.1 Sequence of tense
3.2 Voice
3.3 Subject-Verb agreement
3.4 Conditional Sentences
3.5 Preposition

Unit II: Introduction to technical writing process and meeting **(4 hours)**

1. Editing, MLA/APA **(2 hours)**

1.1 Composing and editing strategies
1.2 MLA and APA comparison

2. Writing notices with agenda and minutes **(2 hours)**

2.1 Introduction
2.2 Purpose
2.3 Process

Unit III: Writing Proposal **(6 hours)**

1. Introduction

1.1 Parts of the proposal
- 1.1.1 Title page
- 1.1.2 Abstract/Summary
- 1.1.3 Statement of Problem
- 1.1.4 Rationale
- 1.1.5 Objectives
- 1.1.6 Procedure/Methodology
- 1.1.7 Cost estimate or Budget
- 1.1.8 Time management/Schedule
- 1.1.9 Summary
- 1.1.10 Conclusion
- 1.1.11 Evaluation or follow-up
- 1.1.12 Works cited

Unit IV: Reports **(18hours)**

1. Informal Reports **(6 hours)**

1.1 Memo Report
- 1.1.1 Introduction
- 1.1.2 Parts

1.2 Letter Report
- 1.2.1 Introduction
- 1.2.2 Parts

2. Project/Field Report **(3 hours)**

- 2.2.1 Introduction
- 2.2.2 Parts

3. Formal report **(9 hours)**

3.1 Introduction
3.2 Types of Formal Reports
- 3.2.1 Progress Report
- 3.2.2 Feasibility Report
- 3.2.3 Empirical/ Research Report
- 3.2.4 Technical Report

3.3 Parts and Components of Formal Report
- 3.3.1 Preliminary section
  - 3.3.1.1 Cover page
  - 3.3.1.2 Letter of transmittal/Preface
  - 3.3.1.3 Title page
  - 3.3.1.4 Acknowledgements
  - 3.3.1.5 Table of Contents
  - 3.3.1.6 List of figures and tables
  - 3.3.1.7 Abstract/Executive summary
- 3.3.2 Main Section
  - 3.3.2.1 Introduction
  - 3.3.2.2 Discussion/Body
  - 3.3.2.3 Summary/Conclusion
  - 3.3.2.4 Recommendations
- 3.3.3 Documentation
  - 3.3.3.1 Notes (Contextual/foot notes)
  - 3.3.3.2 Bibliography
  - 3.3.3.3 Appendix

Unit V: Writing Research Articles **(2 hours)**

1.1. Introduction
1.2. Procedures

Language lab		30 hours
Unit I: Listening		12 hours
Activity I	General instruction on effective listening, factors influencing listening, and note-taking to ensure ttention. (Equipment Required: Laptop, multimedia, laser pointer, overhead projector, power point, DVD, video set, screen)	2 hours
Activity II	Listening to recorded authentic instruction followed by exercises. (Equipment Required: Cassette player or laptop)	2 hours
Activity III	Listening to recorded authentic description followed by exercises. (Equipment Required: Cassette player or laptop)	4 hours
Activity IV	Listening to recorded authentic conversation followed by exercises (Equipment Required: Cassette player or laptop)	4 hours
Unit II: Speaking		18 hours
Activity I	General instruction on effective speaking ensuring audience's attention, comprehension and efficient use of Audio-visual aids. (Equipment Required: Laptop, multimedia, laser pointer, DVD, video, overhead projector, power point, screen)	2 hours
Activity II	Making students express their individual views on the assigned topics (Equipment Required: Microphone, movie camera)	2 hours
Activity III	Getting students to participate in group discussion on the assigned topics	4 hours

Activity IV	Making students deliver talk either individually or in group on the assigned topics (Equipment Required: Overhead projector, microphone, power point, laser pointer multimedia, video camera, screen)	8 hours
Activity V	Getting students to present their brief oral reports individually on the topics of their choice. (Equipment Required: Overhead projector, microphone, power point, laser pointer multimedia, video camera, screen)	2 hours

Evaluation Scheme

Units	Testing Items	No. of Questions	Type of Questions	Marks Distribution		Total Marks	Remarks
I	Reading	3	For grammar = objective and for the rest = short	2 Short questions Interpretation of text Note + Summary Grammar	5+5 5 5+5 5	30	For short questions 2 to be done out of 3 from the seen passages, for interpretation an unseen paragraph of about 75 words to be given, for note + summary an unseen text of about 200to 250 to be given, for grammar 5 questions of fill up the gaps or transformation type to be given
II	Introduction to technical writing process and meeting	3	MLA/APA = objective, Editing and Meeting = short	MLA/APA = Editing = Meeting =	4 5 5	14	For APA/MLA 4 questions to be given to transform one from another or 4 questions asking to show citation according to APA/ MLA technique, For meeting minute alone or notice with agendas to be given
III	Proposal Writing	1	Long	10		10	A question asking to write a very brief proposal on any technical topic to be given
IV	Report writing	2	Informal report = short, Formal report = long	Informal report = Formal report =	6 10	16	A question asking to write very brief informal report on technical topic to be given, for formal report a question asking to write in detail on any three elements of a formal report on technical topic to be given
V	Research article	1	Long	10		10	A question asking to write a brief research article on technical topic to be given

Evaluation Scheme for Lab

Units	Testing items	No. of Questions	Type of questions	Marks Distribution	Remarks
I	Listening ▫ instruction ▫ description ▫ conversation	2	objective	5+5	listening tape to be played on any two out of instruction, description and conversation followed by 10multiple choice type or fill in the gaps type questions

II	Speaking ▫ group/round table discussion ▫ presenting brief oral report ▫ delivering talk	2	subjective	Round table discussion 5, talk or brief oral report =10	Different topics to be assigned in groups consisting of 8 members for group discussion and to be judged individually, individual presentation to be judged through either by talk on assigned topics or by brief oral reports based on their previous project, study and field visit.

Prescribed books

1. Adhikari, Usha, Yadav, Rajkumar, Yadav, Bijaya, ; " A Course book of Communicative English", Trinity Publication.
2. Adhikari, Usha, Yadav, Rajkumar, Shrestha, Rup Narayan ; "Technical Communication in English", Trinity Publication.

   (Note: 50 marks excluding reading to be covered on the basis of first book and reading part (i.e. 30 marks) to be covered on the basis of second book)

3. Khanal, Ramnath, "Need-based Language Teaching (Analysis in Relation to Teaching of English for Profession Oriented Learners)", Kathmandu: D, Khanal.
4. Konar, Nira, "Communication Skills for Professional", PHI Learning Private Limited, New Delhi.
5. Kumar, Ranjit, "Research Methodology", Pearson Education.
6. Laxminarayan, K.R, "English for Technical Communication", Chennai; Scitech publications (India) Pvt. Ltd.
7. Mishra, Sunita et. al. , "Communication Skills for Engineers", Pearson Education First Indian print.
8. Prasad, P. et. al , "The functional Aspects of Communication Skills", S.K. Kataria & sons.
9. Rutherfoord, Andrea J. Ph.D, "Basic Communication Skills for Technology", Pearson Education Asia.
10. Rizvi, M. Ashraf), "Effective Technical Communication", Tata Mc Graw Hill.
11. Reinking A James et. al, "Strategies for Successful Writing: A rhetoric, research guide, reader and handbook", Prentice Hall Upper Saddle River, New Jersey.
12. Sharma R.C. et al., "Business Correspondence and Report Writing: A Practical Approach to Business and Technical communication", Tata Mc Graw Hill.
13. Sharma, Sangeeta et. al, "Communication skills for Engineers and Scientists", PHI Learning Private Limited, New Delhi.
14. Taylor, Shirley et. al., "Model Business letters, E-mails & other Business documents", Pearson Education.

PROBABILITY AND STATISTICS

SH 602

Lecture : 3
Tutorial : 1
Practical : 0

Year : III
Part : I

Course Objective:

To provide the students with practical knowledge of the principles and concept of probability and statistics and their application in engineering field.

1. Descriptive statistics and Basic probability **(6 hours)**

1.1 Introduction to statistics and its importance in engineering
1.2 Describing data with graphs (bar, pie, line diagram, box plot)
1.3 Describing data with numerical measure(Measuring center, Measuring variability)
1.4 Basic probability, additive Law, Multiplicative law, Baye's theorem.

2. Discrete Probability Distributions **(6 hours)**

2.1 Discrete random variable
2.2 Binomial Probability distribution
2.3 Negative Binomial distribution
2.4 Poison distribution
2.5 Hyper geometric distribution

3. Continuous Probability Distributions **(6 hours)**

3.1 Continuous random variable and probability densities
3.2 Normal distribution
3.3 Gama distribution
3.4 Chi square distribution

4. Sampling Distribution **(5 hours)**

4.1 Population and sample
4.2 Central limit theorem
4.3 Sampling distribution of sample mean
4.4 Sampling distribution of sampling proportion

5. Inference Concerning Mean **(6 hours)**

5.1 Point estimation and interval estimation
5.2 Test of Hypothesis
5.3 Hypothesis test concerning One mean
5.4 Hypothesis test concerning two mean
5.5 One way ANOVA

6. Inference concerning Proportion **(6 hours)**

6.1 Estimation of Proportions
6.2 Hypothesis concerning one proportion
6.3 Hypothesis concerning two proportion
6.4 Chi square test of Independence

7. Correlation and Regression **(6 hours)**

7.1 Correlation
7.2 Least square method
7.3 An analysis of variance of Linear Regression model
7.4 Inference concerning Least square method
7.5 Multiple correlation and regression

8. Application of computer on statistical data computing **(4 hours)**

8.1 Application of computer in computing statistical problem. eq scientific calculator, EXCEL, SPSS , Matlab etc

References:

1. Richard A. Johnson, "Probability and Statistics for Engineers", Miller and Freund's publication.
2. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Brooks/Cole publishing Company, Monterey, California.
3. Richard I. Levin, David S Rubin, "Statistics For Management", Prentice Hall publication.
4. Mendenhall Beaver Beaver, "Introduction Probability and statistics", Thomson Brooks/Cole.

CONTROL SYSTEM
EE 602

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To present the basic concepts on analysis and design of control system and to apply these concepts to typical physical processes.

1. Control System Background **(2 hours)**

1.1 History of control system and its importance
1.2 Control system: Characteristics and Basic features
1.3 Types of control system and their comparison

2. Component Modeling **(6 hours)**

2.1 Differential equation and transfer function notations
2.2 Modeling of Mechanical Components: Mass, spring and damper
2.3 Modeling of Electrical components: Inductance, Capacitance, Resistance, DC and AC motor, Transducers and operational amplifiers
2.4 Electric circuit analogies (force-voltage analogy and force- current analogy)
2.5 Linearized approximations of non-linear characteristics

3. System Transfer Function and Responses **(6 hours)**

3.1 Combinations of components to physical systems
3.2 Block diagram algebra and system reduction
3.3 Signal flow graphs
3.4 Time response analysis:
  3.4.1 Types of test signals (Impulse, step, ramp, parabolic)
  3.4.2 Time response analysis of first order system
  3.4.3 Time response analysis of second order system
  3.4.4 Transient response characteristics
3.5 Effect of feedback on steady state gain, bandwidth, error magnitude and system dynamics

4. Stability **(4 hours)**

4.1 Introduction of stability and causes of instability
4.2 Characteristic equation, root location and stability
4.3 Setting loop gain using Routh-Hurwitz criterion
4.4 R-H stability criterion
4.5 Relative stability from complex plane axis shifting

5. Root Locus Technique **(7 hours)**

5.1 Introduction of root locus

5.2 Relationship between root loci and time response of systems
5.3 Rules for manual calculation and construction of root locus
5.4 Analysis and design using root locus concept
5.5 Stability analysis using R-H criteria

6. Frequency Response Techniques **(6 hours)**

6.1 Frequency domain characterization of the system
6.2 Relationship between real and complex frequency response
6.3 Bode Plots: Magnitude and phase
6.4 Effects of gain and time constant on Bode diagram
6.5 Stability from Bode diagram (gain margin and phase margin)
6.6 Polar Plot and Nyquist Plot
6.7 Stability analysis from Polar and Nyquist plot

7. Performance Specifications and Compensation Design **(10 hours)**

7.1 Time domain specification
  7.1.1 Rise time, Peak time, Delay time, settling time and maximum overshoot
  7.1.2 Static error co-efficient
7.2 Frequency domain specification
  7.2.1 Gain margin and phase margin
7.3 Application of Root locus and frequency response on control system design
7.4 Lead, Lag cascade compensation design by Root locus method.
7.5 Lead, Lag cascade compensation design by Bode plot method.
7.6 PID controllers

8. State Space Analysis **(4 hours)**

8.1 Definition of state -space
8.2 State space representation of electrical and mechanical system
8.3 Conversion from state space to a transfer function.
8.4 Conversion from transfer function to state space.
8.5 State-transition matrix.

Practical:

1. To study open loop and closed mode for d.c motor and familiarization with different components in D.C motor control module.
2. To determine gain and transfer function of different control system components.
3. To study effects of feedback on gain and time constant for closed loop speed control system and position control system.
4. To determine frequency response of first order and second order system and to get transfer function.
5. Simulation of closed loop speed control system and position control system and verification

References:

1. Ogata, K., "Modern Control Engineering", Prentice Hall
2. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill
3. Kuo, B.C., "Automatic Control System", Prentice Hall
4. Nagrath & Gopal, "Modern Control Engineering", New Ages International

ADVANCED ELECTRONICS

EX 601

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To provide knowledge on data conversion, amplifiers, instrumentation and power circuits

1. Operational Amplifier Circuits **(6 hours)**

1.1 Bias circuits suitable for IC Design
1.2 The Widlar current source
1.3 The differential amplifier
1.4 Active loads
1.5 Output stages

2. Operational Amplifier Characterization **(8 hours)**

2.1 Input offset voltage
2.2 Input bias and input offset currents
2.3 Output impedance
2.4 Differential and common-mode input impedance
2.5 DC gain, bandwidth, gain-bandwidth product
2.6 Common-mode and power supply rejection ratios
2.7 Higher frequency poles settling time
2.8 Slew rate
2.9 Noise in operational amplifier circuits

3. Digital-To-Analog and Analog-To-Digital Conversion **(8 hours)**

3.1 The R-2R ladder circuit
3.2 Unipolar and bipolar D/A converters
3.3 Count-up and Tracking A/D's based on D/A's
3.4 Successive approximation A/D converters
3.5 Integrating voltage-to-time conversion A/D converters, dual and quad slope types
3.6 Sigma delta A/D converters
3.7 Flash A/D converters

4. Instrumentation and Isolation Amplifiers **(4 hours)**

4.1. One and two operational amplifier instrumentation amplifiers
4.2. The three operational amplifier instrumentation amplifier
4.3. Consideration of non-ideal properties
4.4. Isolation amplifier principles and realization
4.5. Consideration of non-ideal properties

5. Operational Amplifier-Bipolar Transistor Logarithmic Amplifier (3 hours)

5.1 The basic logarithmic amplifier
5.2 Non-ideal effects
5.3 Stability consideration
5.4 Anti-logarithmic operations

6. Log-Antilog Circuit Application (5 hours)

6.1 Analog multiplier based on log-antilog principles
6.2 The multifunction converter circuit
6.3 Proportional to absolute temperature (PTAT) devices
6.4 RMS to dc conversion

7. Introduction to Power Electronics (7 hours)

7.1 Diodes, thyristors, triacs, IGBT
7.2 Controlled rectifier circuits
7.3 Inverters
7.4 Choppers
7.5 DC-to-DC conversion
7.6 AC-to-AC conversion

8. Switched Power Supplies (4 hours)

8.1 Voltage step-down regulators
8.2 Voltage step-up regulators
8.3 Step-up/step-down regulators
8.4 Filtering considerations
8.5 Control circuits, IC switched

Practical:

1. Characteristics of operational amplifier
2. 4 bit D to A converter
3. Differential amplifier, Instrumentation amplifier
4. Logarithmic amplifier
5. Study of switched voltage regulator
6. Study of Silicon-controlled-rectifier (SCR) and TRIAC circuit

Reference:

1. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press.
2. W. Stanely, "Operational Amplifiers with Linear Integrated Circuits", Charles E. Merrill Publishing Company, Toronto.
3. Jacob Millman and Christos C. Halkias, "Integrated Electronics", TATA McGRAW- Hill Edition.
4. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education.

5. Ramakant A. Gayakwad, "Operational Amplifiers with Linear Integrated Circuits", Prentice Hall, New Delhi.
6. Robert F. Coughlin and Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, New Delhi.
7. C.W. Lander, "Power Electronics", McGraw-Hill Book Company, New York.
8. J.G. Graeme, "Application of Operational Amplifiers: Third Generation Techniques", The Burr-Brown Electronics Series, McGraw-Hill, New York.
9. N. Mohan, T. M. Undeland and W. P, Robbins, "Power Electronics: Converters, Applications and Design", John Willey and Sons, New York.

INSTRUMENTATION II

EX 602

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : III
Part : I

Course Objective:

To introduce and apply the knowledge of microprocessor, A/D, D/A converter to design Instrumentation system and to provide the concept of interfacing with microprocessor based system and circuit design techniques

1. Microprocessor Based Instrumentation System **(4 hours)**

- 1.1 Basic Features of Microprocessor Based System
- 1.2 Open Loop and Closed Loop Microprocessor Based System
- 1.3 Benefits of Microprocessor Based System
- 1.4 Microcomputer on Instrumentation Design
- 1.5 Interfacing With Microprocessor
  - 1.5.1 PC Interfacing Techniques
  - 1.5.2 Review of Address Decoding
  - 1.5.3 Memory Interfacing
  - 1.5.4 Programmed I/O, Interrupt Driven I/O and Direct Memory Access (DMA)

2. Parallel Interfacing With Microprocessor Based System **(4 hours)**

- 2.1 Methods of Parallel Data Transfer : Simple Input and Output, Strobe I/O, Single Handshake I/O, & Double Handshake I/O
- 2.2 8255 as General Purpose Programmable I/O Device and its interfacing examples
- 2.3 Parallel Interfacing with ISA and PCI bus

3. Serial Interfacing With Microprocessor Based System **(6 hours)**

- 3.1 Advantages of Serial Data Transfer Over Parallel
- 3.2 Synchronous and Asynchronous Data Transfer
- 3.3 Errors in Serial Data Transfer
- 3.4 Simplex, Half Duplex and Full Duplex Data Communication
- 3.5 Parity and Baud Rates
- 3.6 Introduction Serial Standards RS232, RS423, RS422
- 3.7 Universal Serial Bus
  - 3.7.1 The Standards: - USB 1.1 and USB 2.0
  - 3.7.2 Signals, Throughput & Protocol
  - 3.7.3 Devices, Hosts And On-The-Go
  - 3.7.4 Interface Chips:- USB Device And USB Host

4. Interfacing A/D And D/A Converters **(4 hours)**

- 4.1 Introduction

4.2 General Terms Involved in A/D and D/A Converters
4.3 Examples of A/D and D/A Interfacing
4.4 Selection of A/D and D/A Converters Based on Design Requirements

5. Data Acquisition And Transmission **(5 hours)**

5.1 Analog and Digital Transmission
5.2 Transmission Schemes
  5.2.1 Fiber Optics
  5.2.2 Satellite
  5.2.3 Bluetooth Devices
5.3 Data Acquisition System
  5.3.1 Data Loggers
  5.3.2 Data Archiving and Storage

6. Grounding And Shielding **(3 hours)**

6.1 Outline for Grounding and Shielding
6.2 Noise, Noise Coupling Mechanism and Prevention
6.3 Single Point Grounding and Ground Loop
6.4 Filtering and Smoothing
6.5 Decoupling Capacitors and Ferrite Beads
6.6 Line Filters, Isolators and Transient Suppressors
6.7 Different Kinds of Shielding Mechanism
6.8 Protecting Against Electrostatic Discharge
6.9 General Rules For Design

7. Circuit Design **(3 hours)**

7.1 Converting Requirements into Design
7.2 Reliability and Fault Tolerance
7.3 High Speed Design
7.4 Bandwidth, Decoupling, Ground Bounce, Crosstalk, Impedance Matching, and Timing
7.5 Low Power Design
7.6 Reset and Power Failure Detection and interface Unit

8. Circuit Layout **(3 hours)**

8.1 Circuits Boards and PCBs
8.2 Component Placement
8.3 Routing Signal Tracks
Trace Density, Common Impedance, Distribution of Signals and Return, Transmission Line Concerns, Trace Impedance and Matching, and Avoiding Crosstalk.
8.4 Ground ,Returns and Shields
8.5 Cables and Connectors
8.6 Testing and Maintenance

9. Software For Instrumentation And Control Applications **(4 hours)**

9.1 Types of Software, Selection and Purchase
9.2 Software Models and Their Limitations
9.3 Software Reliability
9.4 Fault Tolerance
9.5 Software Bugs and Testing
9.6 Good Programming Practice
9.7 User Interface
9.8 Embedded and Real Time Software

10. Case Study **(9 hours)**

Examples chosen from local industrial situations with particular attention paid to the basic measurement requirements, accuracy, and specific hardware employed environmental conditions under which the instruments must operate, signal processing and transmission, output devices:

a) Instrumentation for a power station including all electrical and non-electrical parameters.
b) Instrumentation for a wire and cable manufacturing and bottling plant.
c) Instrumentation for a beverage manufacturing and bottling plant.
d) Instrumentation for a complete textile plant; for example, a cotton mill from raw cotton through to finished dyed fabric.
e) Instrumentation for a process; for example, an oil seed processing plant from raw seeds through to packaged edible oil product.
f) Instruments required for a biomedical application such as a medical clinic or hospital.
g) Other industries can be selected with the consent of the Subject teacher.

Practical:

The laboratory exercises deal interfacing techniques using microprocessor or microcontrollers. There will be about six lab sessions which should cover at least following:

1. Simple and Handshake data transfer using PPI.
2. Basic I/O device interfacing like keyboard, seven segments, motors etc
3. Analog to Digital interfacing
4. Digital to Analog interfacing
5. Design exercise (small group project)

Study in detail the instrumentation requirements of a particular proposed or existing industrial plant and design an instrumentation and data collection system for that particular industrial plant. The final report should present the instrumentation requirements in terms of engineering specifications, the hardware solution suggested, a listing of the particular devices chosen to satisfy the requirements, appropriate system flow diagrams, wiring diagrams, etc. to show how the system would be connected and operated.

References:

1. D. V. Hall, "Microprocessor and Interfacing, Programming and Hardware" Tata McGraw Hill
2. K.R. Fowler, "Electronic Instrument Design: Architecting for the Life Cycle", Oxford University Press
3. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Application with 8085", Prentice Hall
4. A.K. Ray & K.M. Bhurchandi, "Advanced Microprocessors And Peripherals", Tata McGraw Hill
5. E.O. Duebelin, "Measurement System Application And Design", Tata McGraw Hills
6. John Hyde, "USB Design By Example", Intel Press
7. PCI bus, USB, 8255,Bluetooth datasheets
8. D. M. Consodine, "Process Instruments and Controls Handbook", McGraw-Hill,New York.
9. S. Wolf and R. F. Smith, "Student Reference Manual for Electronic Instrumentation Laboratories", Prentice Hall, Englewood Cliffs, New Jersey.
10. S. E. Derenzo, "Interfacing: A Laboratory Approach Using the Microcomputer for Instrumentation, Data Analysis, and Control", Prentice Hall, Englewood Cliffs, New Jersey.

COMPUTER GRAPHICS

EX 603

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : III
Part : I

Course Objectives:

History of computer graphics, Applications of computer graphics, Hardware: Raster-Scan Displays, Vector Displays, Hard copy devices, Input Hardwares, Display Architectures, Applications in various fields like medicine, engineering, art, uses in virtual realism.

1. Introduction and application **(2 hours)**

History of computer graphics, Applications of computer graphics, Hardware: Raster-Scan Displays, Vector Displays, Hard copy devices, Input Hardwares, Display Architectures, Applications in various fields like medicine, engineering, art, uses in virtual realism.

2. Scan-Conversion **(6 hours)**

2.1 Scan-Converting A Point
2.2 Scan-Converting A Straight Line: DDA Line Algorithm, Bresenham's Line Algorithm
2.3 Scan-Converting a Circle and an Ellipse: Mid-Point Circle and Ellipse Algorithm

3. Two –Dimensional Transformations **(6 hours)**

3.1 Two –dimensional translation, rotation, scaling, reflection, shear transforms
3.2 Two-dimensional composite transformation
3.3 Two-dimensional viewing pipeline, world to screen viewing transformations and clipping (Cohen-Sutherland Line Clipping, Liang-Barsky Line Clipping)

4. Three-Dimensional Graphics **(6 hours)**

4.1 Three –dimensional translation, rotation, scaling, reflection, shear transforms
4.2 Three-dimensional composite transformation
4.3 Three-dimensional viewing pipeline, world to screen viewing transformation, projection concepts (orthographic, parallel, perspective projections)

5. Curve Modeling **(4 hours)**

Introduction to Parametric cubic Curves, Splines, Bezier curves

6. Surface modeling **(4 hours)**

Polygon surface, vertex table, edge table, polygon table, surface normal and spatial orientation of surfaces

7. Visible Surface Determination **(6 hours)**

7.1 Image Space and Object Space techniques
7.2 Back Face Detection, Z-Buffer, A-Buffer, Scan-Line method

8. Illumination and Surface Rendering methods **(8 hours)**

8.1 Algorithms to simulate ambient, diffuse and specular reflections
8.2 Constant , Gouraud and phong shading models

9. Introduction to Open GL **(3 hours)**

Introduction to OpenGl, callback functions, Color commands, drawing pixels, lines, and polygons using OpenGL, Viewing, Lighting.

Practical:

There shall be 5 to 6 lab exercise including following concepts:

1. DDA Line Algorithm
2. Bresenham's Line algorithm
3. Mid Point Circle Algorithm
4. Mid Point Ellipse Algorithm
5. Lab on 2-D Transformations
6. Basic Drawing Techniques in OpenGL

References

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C version"
2. Donald D. Hearn and M. Pauline Baker, "Computer Graphics with OpenGL"
3. Foley, Van Dam, Feiner, Hughes "Computer Graphics Principles and Practice"

COMPUTER ORGANIZATION AND ARCHITECTURE

CT 603

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : III
Part : I

Course objectives:

To provide the organization, architecture and designing concept of computer system including processor architecture, computer arithmetic, memory system, I/O organization and multiprocessors

1. Introduction **(3 hours)**

- 1.1 Computer organization and architecture
- 1.2 Structure and function
- 1.3 Designing for performance
- 1.4 Computer components
- 1.5 Computer Function
- 1.6 Interconnection structures
- 1.7 Bus interconnection
- 1.8 PCI

2. Central processing Unit **(10 hours)**

- 2.1 CPU Structure and Function
- 2.2 Arithmetic and logic Unit
- 2.3 Instruction formats
- 2.4 Addressing modes
- 2.5 Data transfer and manipulation
- 2.6 RISC and CISC
- 2.7 64-Bit Processor

3. Control Unit **(6 hours)**

- 3.1 Control Memory
- 3.2 Addressing sequencing
- 3.3 Computer configuration
- 3.4 Microinstruction Format
- 3.5 Symbolic Microinstructions
- 3.6 Symbolic Micro program
- 3.7 Control Unit Operation
- 3.8 Design of control unit

4. Pipeline and Vector processing **(5 hours)**

- 4.1 Pipelining
- 4.2 Parallel processing
- 4.3 Arithmetic Pipeline
- 4.4 Instruction Pipeline

4.5 RISC pipeline
4.6 Vector processing
4.7 Array processing

5. Computer Arithmetic **(8 hours)**

5.1 Addition algorithm
5.2 Subtraction algorithm
5.3 Multiplication algorithm
5.4 Division algorithms
5.5 Logical operation

6. Memory system **(5 hours)**

6.1 Microcomputer Memory
6.2 Characteristics of memory systems
6.3 The Memory Hierarchy
6.4 Internal and External memory
6.5 Cache memory principles
6.6 Elements of Cache design
  6.6.1 Cache size
  6.6.2 Mapping function
  6.6.3 Replacement algorithm
  6.6.4 Write policy
  6.6.5 Number of caches

7. Input-Output organization **(6 hours)**

7.1 Peripheral devices
7.2 I/O modules
7.3 Input-output interface
7.4 Modes of transfer
  7.4.1 Programmed I/O
  7.4.2 Interrupt-driven I/O
  7.4.3 Direct Memory access
7.5 I/O processor
7.6 Data Communication processor

8. Multiprocessors **(2 hours)**

8.1 Characteristics of multiprocessors
8.2 Interconnection Structures
8.3 Interprocessor Communication and synchronization

Practical:

1. Add of two unsigned Integer binary number
2. Multiplication of two unsigned Integer Binary numbers by Partial-Product Method
3. Subtraction of two unsigned integer binary number
4. Division using Restoring

5. Division using non- restoring methods
6. To simulate a direct mapping cache

References:

1. M. Morris Mano, "Computer System Architecture"
2. William Stalling, "Computer organization and architecture"
3. John P. Hayes, "Computer Architecture and Organization"
4. V.P. Heuring, H.F. Jordan, "Computer System design and architecture"
5. S. Shakya, "Lab Manual on Computer Architecture and design"

ENGINEERING ECONOMICS

CE 655

Lecture : 3
Tutorial : 1
Practical : 0

Year : III
Part : II

Course Objectives:

To provide concept and knowledge of economic studies that will be useful for the evaluation engineering projects and make decisions related to investment.

1. Introduction **(3 hours)**

- 1.1 Origin of Engineering Economy
- 1.2 Principles of Engineering Economy
- 1.3 Role of Engineers in Decision Making
- 1.4 Cash Flow Diagram

2. Interest and Time Value of Money **(6 hours)**

- 2.1 Introduction to Time Value of Money
- 2.2 Simple Interest
- 2.3 Compound Interest
  - 2.3.1 Nominal Interest Rate
  - 2.3.2 Effective Interest Rate
  - 2.3.3 Continuous Compounding
- 2.4 Economic Equivalence
- 2.5 Development of Interest Formulas
  - 2.5.1 The Five Types of Cash Flows
  - 2.5.2 Single Cash Flow Formulas
  - 2.5.3 Uneven Payment Series
  - 2.5.4 Equal Payment Series
  - 2.5.5 Linear Gradient Series.
  - 2.5.6 Geometric Gradient Series.

3. Basic Methodologies of Engineering Economic Analysis **(8 hours)**

- 3.1 Determining Minimum Attractive (Acceptable) Rate of Return (MARR).
- 3.2 Payback Period Method
- 3.3 Equivalent Worth Methods
  - 3.3.1 Present Worth Method
  - 3.3.2 Future Worth Method
  - 3.3.3 Annual Worth Method
- 3.4 Rate of Return Methods
  - 3.4.1 Internal Rate of Return Method.
  - 3.4.2 External/Modified Rate of Return Method
- 3.5 Public Sector Economic Analysis (Benefit Cost Ratio Method)
- 3.6 Introduction to Lifecycle Costing

3.7 Introduction to Financial and Economic Analysis

4. Comparative Analysis of Alternatives (6 hours)

4.1 Comparing Mutually Exclusive Alternatives having Same Useful Life by
- 4.1.1 Payback Period Method and Equivalent Worth Method
- 4.1.2 Rate of Return Methods and Benefit Cost Ratio Method

4.2 Comparing Mutually Exclusive Alternatives having Different Useful Lives by
- 4.2.1 Repeatability Assumption
- 4.2.2 Co-terminated Assumption
- 4.2.3 Capitalized Worth Method

4.3 Comparing Mutually Exclusive, Contingent and Independent Projects in Combination

5. Replacement Analysis (6 hours)

5.1 Fundamentals of Replacement Analysis
- 5.1.1 Basic Concepts and Terminology
- 5.1.2 Approaches for Comparing Defender and Challenger

5.2 Economic Service Life of Challenger and Defender

5.3 Replacement Analysis When Required Service Life is Long
- 5.3.1 Required Assumptions and Decision Framework
- 5.3.2 Replacement Analysis under the Infinite Planning Horizon
- 5.3.3 Replacement Analysis under the Finite Planning Horizon

6. Risk Analysis (6 hours)

6.1 Origin/Sources of Project Risks

6.2 Methods of Describing Project Risks
- 6.2.1 Sensitivity Analysis
- 6.2.2 Breakeven Analysis
- 6.2.3 Scenario Analysis

6.3 Probability Concept of Economic Analysis

6.4 Decision Tree and Sequential Investment Decisions

7. Depreciation and Corporate Income Taxes (6 hours)

7.1 Concept and Terminology of Depreciation

7.2 Basic Methods of Depreciation
- 7.2.1 Straight line method
- 7.2.2 Declining Balance Method
- 7.2.3 Sinking Fund Method
- 7.2.4 Sum of the Year Digit Method
- 7.2.5 Modified Accelerated Cost Recovery System (MACRS)

7.3 Introduction to Corporate Income Tax

7.4 After Tax Cash Flow Estimate

7.5 General Procedure for Making after Tax Economic Analysis

8. Inflation and its Impact on Project Cash Flows **(4 hours)**

8.1 Concept of Inflation
8.2 Measuring Inflation
8.3 Equivalence Calculation Under Inflation
8.4 Impact of Inflation on Economic Evaluation

Tutorial:

1. Assignments
2. Quizzes and Case study

References:

1. Chan S.Park,"Contemporary Engineering Economics", Prentice Hall, Inc.
2. E. Paul De Garmo, William G. Sullivan and James A. Bontadelli, "Engineering Economy", Mc Milan Publishing Company.
3. James L. Riggs, David D. Bedworth and Sabah U. Randhawa, "Engineering Economics", Tata McGraw Hill Education Private Limited.

EMBEDDED SYSTEM

CT 655

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : III
Part : II

Course Objective:
To introduce students to understand and familiarization on applied computing principles in emerging technologies and applications for embedded systems

1. Introduction to Embedded System **(3 Hours)**

1.1 Embedded Systems overview
1.2 Classification of Embedded Systems
1.3 Hardware and Software in a system
1.4 Purpose and Application of Embedded Systems

2. Hardware Design Issues **(4 Hours)**

2.1 Combination Logic
2.2 Sequential Logic
2.3 Custom Single-Purpose Processor Design
2.4 Optimizing Custom Single-Purpose Processors

3. Software Design Issues **(6 Hours)**

3.1 Basic Architecture
3.2 Operation
3.3 Programmer's View
3.4 Development Environment
3.5 Application-Specific Instruction-Set Processors
3.6 Selecting a Microprocessor
3.7 General-Purpose Processor Design

4. Memory **(5 Hours)**

4.1 Memory Write Ability and Storage Permanence
4.2 Types of Memory
4.3 Composing Memory
4.4 Memory Hierarchy and Cache

5. Interfacing **(6 Hours)**

5.1 Communication Basics
5.2 Microprocessor Interfacing: I/O Addressing, Interrupts, DMA
5.3 Arbitration
5.4 Multilevel Bus Architectures
5.5 Advanced Communication Principles

6. Real-Time Operating System (RTOS) **(8 Hours)**

6.1 Operating System Basics

6.2 Task, Process, and Threads
6.3 Multiprocessing and Multitasking
6.4 Task Scheduling
6.5 Task Synchronization
6.6 Device Drivers

7. Control System **(3 Hours)**

7.1 Open-loop and Close-Loop control System overview
7.2 Control System and PID Controllers
7.3 Software coding of a PID Controller
7.4 PID Tuning

8. IC Technology **(3 Hours)**

8.1 Full-Custom (VLSI) IC Technology
8.2 Semi-Custom (ASIC) IC Technology
8.3 Programming Logic Device (PLD) IC Technology

9. Microcontrollers in Embedded Systems **(3 Hours)**

9.1 Intel 8051 microcontroller family, its architecture and instruction sets
9.2 Programming in Assembly Language
9.3 A simple interfacing example with 7 segment display

10. VHDL **(4 Hours)**

10.1 VHDL overview
10.2 Finite state machine design with VHDL

Practical:

Student should be complete lab works and project work in practical classes.

Reference Books:

1. David E. Simon, "An Embedded Software Primer", Addison-Wesley
2. Muhammad Ali Mazidi, "8051 Microcontroller and Embedded Systems", Prentice Hall
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons
4. Douglas L. Perry, "VHDL Programming by example", McGraw Hill

COMPUTER NETWORKS

CT 657

Lecture : 3
Tutorial : 1
Practical : 3

Year : III
Part : II

Course Objective:

To understand the concepts of computer networking, functions of different layers and protocols, and know the idea of IPV6 and security

1. Introduction to Computer Network **(5 hours)**

1.1 Uses of Computer Network
1.2 Networking model client/server, p2p, active network
1.3 Protocols and Standards
1.4 OSI model and TCP/IP model
1.5 Comparison of OSI and TCP/IP model
1.6 Example network: The Internet, X.25, Frame Relay, Ethernet, VoIP, NGN and MPLS, xDSL.

2. Physical Layer **(5 hours)**

2.1 Network monitoring: delay, latency, throughput
2.2 Transmission media: Twisted pair, Coaxial, Fiber optic, Line-of-site, Satellite
2.3 Multiplexing, Circuit switching, Packet switching, VC Switching, Telecommunication switching system (Networking of Telephone exchanges)
2.4 ISDN: Architecture, Interface, and Signaling

3. Data Link Layer **(5 hours)**

3.1 Functions of Data link layer
3.2 Framing
3.3 Error Detection and Corrections,
3.4 Flow Control
3.5 Examples of Data Link Protocol, HDLC, PPP
3.6 The Medium Access Sub-layer
3.7 The channel allocation problem
3.8 Multiple Access Protocols
3.9 Ethernet,
3.10 Networks: FDDI, ALOHA, VLAN, CSMA/CD, IEEE 802.3, 802.4, 802.5, and 802.11.

4. Network Layer **(9 hours)**

4.1 Internetworking &devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway
4.2 Addressing: Internet address, classful address

4.3 Subnetting
4.4 Routing: techniques, static vs. dynamic routing , routing table for classful address
4.5 Routing Protocols: RIP, OSPF, BGP, Unicast and multicast routing protocols
4.6 Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP

5. Transport Layer **(5 hours)**

5.1 The transport service: Services provided to the upper layers
5.2 Transport protocols: UDP, TCP
5.3 Port and Socket
5.4 Connection establishment, Connection release
5.5 Flow control & buffering
5.6 Multiplexing & de-multiplexing
5.7 Congestion control algorithm: Token Bucket and Leaky Bucket

6. Application Layer **(5 hours)**

6.1 Web: HTTP & HTTPS
6.2 File Transfer: FTP, PuTTY, WinSCP
6.3 Electronic Mail: SMTP, POP3, IMAP
6.4 DNS
6.5 P2PApplications
6.6 Socket Programming
6.7 Application server concept: proxy caching, Web/Mail/DNS server optimization
6.8 Concept of traffic analyzer: MRTG, PRTG, SNMP, Packet tracer, Wireshark.

7. Introduction to IPV6 **(4 hours)**

7.1 IPv6- Advantages
7.2 Packet formats
7.3 Extension headers
7.4 Transition from IPv4 to IPv6: Dual stack, Tunneling, Header Translation
7.5 Multicasting

8. Network Security **(7 hours)**

8.1 Properties of secure communication
8.2 Principles of cryptography: Symmetric Key and Public Key
8.3 RSA Algorithm,
8.4 Digital Signatures
8.5 Securing e-mail (PGP)
8.6 Securing TCP connections (SSL)
8.7 Network layer security (IPsec, VPN)
8.8 Securing wireless LANs (WEP)
8.9 Firewalls: Application Gateway and Packet Filtering, and IDS

Practical:

1. Network wiring and LAN setup
2. Router Basic Configuration
3. Static and Dynamic Routing
4. Creating VLAN
5. Router access-list configuration
6. Basic Network setup on Linux
7. Setup of Web Server
8. DNS Server setup
9. Setup of DHCP Server
10. Virtualizations

References:

1. A.S. Tanenbaum, "Computer Networks", Prentice Hall India
2. W. Stallings, "Data and Computer Communication", Macmillan Press
3. Kurose Ross, "Computer Networking: A top down approach", Pearson Education
4. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers

SIGNAL ANALYSIS
EX 651

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : III
Part : II

Course Objectives:
To provide understanding of basic concepts in signals and systems.

1. Signal **(4 hours)**

Signal definition, continuous time signal, discrete time signal, basic signal types, energy signal, power signal, periodicity of continuous time signal, periodicity of discrete time signal, transformation of independent variable.

2. Fourier series **(9 hours)**

Continuous time Fourier series representation, properties of continuous time Fourier series (linearity, time shift, frequency shift, time reversal, time scaling, conjugation conjugate symmetry, multiplication, convolution), Parsevals relation. Discrete time Fourier series representation, Properties of discrete time Fourier series (linearity, time shift, frequency shift, time reversal, conjugation and conjugate symmetry, multiplication, convolution), parseval's relation.

3. Fourier transform **(12 hours)**

Continuous time Fourier transform representation, properties of continuous time Fourier transform (linearity, time shift, frequency shift, time reversal, time scaling, duality, conjugation and conjugate symmetry, multiplication, convolution), Parseval's relation, Fourier transform of square wave function, impulse function, unit step function, rectangular function, signum function, cosine function, periodic function etc, energy spectral density, power spectral density. Discrete time Fourier transform representation, properties of discrete time Fourier transform (linearity, time shift, frequency shift, time reversal, conjugation and conjugate symmetry, multiplication, convolution), Parseval's relation, Fourier transform of rectangular sequence, unit sample sequence, periodic sequence etc, discrete Fourier transform, properties of discrete Fourier transform.

4. Sampling **(2 hours)**

Ideal sampling, practical considerations in sampling, reconstruction of signal from its samples, aliasing.

5. Continuous time system **(9 hours)**

System definition, properties of system, Linear time invariant (LTI) system, convolution integral, properties of LTI system, frequency response of LTI system, bode plot, conditions for distortion less transmission, ideal low pass

filter, impulse response and step response of ideal low pass filter, impulse response and frequency response of first order system and second order system.

6. Discrete time system **(9 hours)**

System definition, properties of system, Linear time invariant (LTI) system, convolution sum, properties of LTI system, difference equation, transfer function, frequency response of LTI system, bode plot, conditions for distortion less transmission, impulse response and frequency response of first order system and second order system.

References

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid "Signals and Systems", Prentice Hall
2. B. P. Lathi, "Linear systems and signals", Oxford University Press.

COMUNICATION SYSTEM I

EX 652

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

To introduce the student to the principles and building blocks of analog communication systems.

1. Introduction **(4 hours)**

1.1 Analog and Digital communication sources, transmitters, transmission channels and receivers.
1.2 Noise, distortion and interference. Fundamental limitations due to noise, distortion and interference.
1.3 Types and reasons for modulation.

2. Representation of signals and systems in communication **(4 hours)**

2.1 Review of signals (types, mathematical representation and applications)
2.2 Linear/non-linear, time variant/invariant systems. Impulse response and transfer function of a system. Properties of LTI systems.
2.3 Low pass and band pass signals and systems, bandwidth of the system, distortionless transmission, the Hilbert transform and its properties.
2.4 Complex envelops rectangular (in-phase and quadrature components) and polar representation of band pass band limited signals.

3. Spectral Analysis **(4 hours)**

3.1 Review of Fourier series and transform, energy and power, Parseval's theorem
3.2 Energy Density Spectrum, periodogram, power spectral density function (psdf)
3.3 Power spectral density functions of harmonic signal and white noise
3.4 The autocorrelation (AC) function, relationship between psdf and AC function.

4. Amplitude Modulation **(12 hours)**

4.1 Time domain expressions, frequency domain representation, modulation index, signal bandwidth
4.2 AM for a single tone message, carrier and side-band components, powers in carrier and side-band components, bandwidth and power efficiency
4.3 Generation of DSB-FC AM

4.4 Double Side Band Suppressed Carrier AM (DSB-AM), time and frequency domain expressions, powers in side-bands, bandwidth and power efficiency
4.5 Generation of DSB-AM (balanced, ring modulators)
4.6 Single Side Band Modulation, time and frequency domain expressions, powers
4.7 Generation of SSB (SSB filters and indirect method)
4.8 Vestigial Side Bands (VSB), Independent Side Bands (ISB) and Quadrature Amplitude Modulations (QAM)

5. Demodulation of AM signals **(6 hours)**

5.1 Demodulation of DSB-FC, DSB-SC and SSB using synchronous detection
5.2 Square law and envelop detection of DSB-FC
5.3 Demodulation of SSB using carrier reinsertion , carrier recovery circuits
5.4 Phase Locked Loop (PLL), basic concept, definitions, equations and applications, demodulation of AM using PLL

6. Frequency Modulation (FM) and Phase Modulation (PM) **(12 hours)**

6.1 Basic definitions, time domain expressions for FM and PM
6.2 Time domain expression for single tone modulated FM signals, spectral representation, Bessel's functions
6.3 Bandwidth of FM , Carson's rule, narrow and wideband FM
6.4 Generation of FM (direct and Armstrong's methods)
6.5 Demodulation of FM and PM signals, synchronous (PLL) and non-synchronous (limiter-discriminator) demodulation
6.6 Stereo FM, spectral details, encoder and decoder
6.7 Pre-emphasis and de-emphasis networks
6.8 The superheterodyne radio receivers for AM and FM

7. Frequency Division Multiplexing (FDM) **(3 hours)**

7.1 Principle of frequency division multiplexing, FDM in telephony, hierarchy
7.2 Frequency Division Multiple Access (FDMA) systems- SCPC, DAMA, SPADE etc.
7.3 Filter and oscillator requirements in FDM.

Practical

1. Demonstration of power spectrum of various signals using LF spectrum analyzer
2. Generation of DSB-SC, DSB-FC and SSB signals
3. Demodulation of AM signals (synchronous and non-synchronous methods)
4. Generation of FM signals

5. Demodulation of FM signal (limiter-discriminator)
6. Operation of PLL, PLL as demodulator of AM and FM signals.

References:

1. S. Haykin, Analog and Digital communication systems
2. Leon Couch, Digital and analog communication systems
3. B.P.Lathi, Analog and Digital communication systems
4. J. Proakis, Analog and Digital communication systems
5. D. Sharma, Course manual "Communication Systems I".

PROPAGATION AND ANTENNA

EX 653

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

To provide the student with an understanding of antennas, EM wave propagation and optical fibre communications.

1. Radiation and Antenna Fundamentals **(5 hours)**

1.1 Retarded Potentials: EM wave generation with a conduction current, the short uniformcurrent dipole, the radiated electric and magnetic fields.

1.2 Radiation patterns and input impedance of the short uniform current dipole, the short Dipole and long dipole.

1.3 Antenna theorems: reciprocity, superposition, Thevenin, minimum power transfer, Compensation, equality of directional patterns, equivalence of receiving and Transmitting impedances.

2. Antenna Parameters and Arrays: **(5 hours)**

2.1 Basic antenna parameters

2.2 Pattern multiplication: Linear and two-dimensional antenna arrays, end fire and Broadside arrays.

3. Antennas classification: **(10 hours)**

3.1 Isotropic antenna

3.2 Omni directional antenna; Dipole

3.3 Directional antennas;

3.4 Travelling wave antennas – single wire, V and RhombusReflector antennas – large plane sheet, small plane sheet, linear, corner, parabolic,elliptical, hyperbolic and circular reflector.Aperture antenna - horn Array antennas – Yagi-Uda, Log PeriodicOther antennas – Monopole, Loop, Helical, Microstrip.

4. Propagation and Radio Frequency Spectrum **(7 hours)**

4.1 Ground or surface wave

4.2 Space wave; direct and ground reflected wave, duct propagation

4.3 Ionospheric or sky wave; critical frequency, MUF, Skip distance

4.4 Tropospheric wave

4.5 Radio frequency spectrum and its propagation characteristics

5. Propagation between Antennas: **(7 hours)**

5.1 Free space propagation: power density of the receiving antenna, path loss

5.2 Plane earth propagation: the ground reflection, effective antenna heights, the two ray
5.3 propagation model, path loss
5.4 Fresnel Zones and Knife edge diffraction

6. Optical fibres(Introductory) **(11 hours)**

6.1 Optical fibre communication system and its advantages and disadvantages overMetalled wire communication system
6.2 Types of optical fibre and its structural difference
6.3 Light propagation characteristics and Numerical Aperture (NA) in optical fibre
6.4 Losses
6.5 Light source and photo detector

Practical:

1. Two Experiments in properties of EM waves: refraction, diffraction, polarization
2. Two Experiments in radiation patters of various types of antennas
3. Two Experiments in measurements on optical fibre transmission systems

References:

1. J. D. Kraus, "Antenna" McGraw Hill
2. C. A. Balanis, " Antenna Theory Analysis and Design" John Wiley & Sons, Inc.
3. Collins, R. E., "Antenna and Radio Wave Propagation" McGraw Hill.
4. Gerd Kaiser "Optical Fibre Communications" McGraw Hill.
5. John Gowar" Optical Communication Systems" PHI Publications.

MINOR PROJECT

EX 654

Practical : 4
Tutorial : 0
Practical : 4

Year : III
Part : II

Objectives:

To carry out a small scale project to develop hands-on experience of working in a project. During the course, the student will also develop knowledge of application development platforms and tools (Java /C# dotnet / Visual C++/PHP or any platform of current trend). The students will learn working as a team and basic collaboration and project management skills. The student will also learn about formulating project documentations.

1. **Project ideas and proposal guidance** **(4 hours)**

2. **Application development** **(10 hours)**
   - 2.1 Visual programming (object oriented)
     - 2.1.1 Language basics
     - 2.1.2 Frameworks and APIs
   - 2.2 Programming basics and design patterns

3. **Project management, team work and collaboration** **(8 hours)**
   - 3.1 Project management techniques
   - 3.2 Collaborative development environment

4. **Project guidance** **(5 hours)**

5. **Project work** **(30 hours)**

6. **Project documentation guidance** **(3 hours)**

PROJECT MANAGEMENT

CT 701

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 0

Course objectives:

To make the students able to plan monitor and control project and project related activities

1. **Introduction** **(2 hours)**

   Definition of project and project management, Project objectives, classification of projects, project life cycle

2. **Project Management Body of Knowledge** **(4 hours)**

   Understanding of project environment, general management skill, effective and ineffective project managers, essential interpersonal and managerial skills, energized and initiator, communication, influencing, leadership, motivator, negotiation, problem solver, perspective nature, result oriented, global illiteracies, problem solving using problem trees.

3. **Portfolio and Project Management Institutes' (PMI) Framework** **(2 hours)**

   Portfolio, project management office, drivers of project success, inhibitors of project success

4. **Project Management** **(4 hours)**

   Advantages of project management, project management context as per PMI, Characteristics of project life cycles, representative project life cycles, IT Product Development Life Cycle, Product Life Cycle and Project Life Cycle, System Development methodologies, role and responsibilities of key project members

5. **Project and Organizational structure** **(2 hours)**

   System view of project management, functional organization, matrix organization, organizational structure influences on projects

6. **Project Management Process Groups** **(2 hours)**

   Project management processes, Overlaps of process groups in a phase, mapping of project management process groups to area of knowledge

7. **Project Integration Management** **(4 hours)**

   Develop project charters Develop preliminary project scope statement, Develop project management plan, Direct and manage project execution, monitor and control project work, Integrated change control, close project, project scope management, Create Work Break Down Structure, Scope

verification, Scope control.

8. Project Time Management **(4 hours)**

Activity definition, decomposition of activities, activity attributes, Activity sequencing, precedence relationship, network diagram, precedence diagram method, arrow diagramming method, Activity resources estimating, determining resource requirements, Schedule development and control, principles of scheduling, milestones, forward pass, backward pass, critical path method, critical chain technique, gantt chart, schedule control.

9. Project Cost Management **(4 hours)**

Cost and project, cost management, Cost estimating, types of cost estimates, estimating process and accuracy, enterprise environmental factors, organizational process assets, cost estimating tools, Cost budgeting, cost aggregation, deriving budget from activity cost, Cost control process, cost control methods, earned value management, EVM benefits, variance analysis.

10. Project quality management **(3 hours)**

Quality theories, Quality planning, project quality requirements, cost of quality, quality management plan, Quality assurance, quality audit, approach to a quality audit, Quality control process, control chart, pareto charts, testing of IT system, the test life cycle.

11. Project Communication Management **(3 hours)**

Importance of communication management, Communications planning process, communication requirement analysis, organizing and conducting effective meeting, Information distribution process, Performance reporting process, integrated reporting system

12. Project Risk Management **(4 hours)**

Understanding Risk, project risk, Risk management planning process, risk management plan, Risk identification, risk identification techniques, Qualitative risk analysis process, Quantitative risk analysis process, modeling techniques, Risk response planning, resolution of risk, strategies for negative risks or threats, strategies for positive risks or opportunities, Risk monitoring and control process.

13. Project Procurement Management **(3 hours)**

Procurement management process flow, Plan purchases and acquisition process, enterprise environmental factor, organizational process assets, Plan contracting process, standard forms, evaluation criteria, Request seller response process, Select seller process, Contract administration process, Contract closure process

14. Developing Custom Processes for IT projects **(3 hours)**

Developing it project management methodology, Moving forward with customized management processes, Certified associate in project management, Project management maturity, Promoting project Excellency through awards and assessment , Certification process flow, Code of ethics, Future trends.

15. Balanced scorecard and ICT project management **(1 hour)**

References:

1. M. C. Christensen and R.H. Thayer, "The Project Manager's Guide to Software Engineering's Best Practices", IEEE computer Society
2. Clifford F. Gray, Erik W. Larson, "Project Management: The Management Process", McGraw Hill
3. Nick Jenkins, "A Project Management Primer",
4. Trevor L Young, "A handbook of Project Management", Kogan Page India Private Ltd.
5. M. Gentle, "Balance Supply and Demand", Compuware
6. Kelkar, " IT project Management",

ORGANIZATION AND MANAGEMENT

ME 708

Lecture : 3
Tutorial : 2
Practical : 0

Year : IV
Part : I

Course Objective:
To give knowledge about organizational management and internal organization of companies required for managing an enterprise. Also to make familiar with personnel management, case study, management information system motivation and leadership for developing managerial skills.

1. Introduction **(20 hours)**

1.1 Organization (2 hours)
- 1.1.1 System approach applied to Organization
- 1.1.2 Necessity of Organization
- 1.1.3 Principles of Organization
- 1.1.4 Formal and Informal Organizations

1.2 Management (4 hours)
- 1.2.1 Functions of Management
- 1.2.2 Levels of Management
- 1.2.3 Managerial Skills
- 1.2.4 Importance of Management
- 1.2.5 Models of Management

1.3 Theory of Management (6 hours)
- 1.3.1 Scientific Management Approach
- 1.3.2 Administrative Management Approach
- 1.3.3 Behavioral Management Approach
- 1.3.4 Modern Management Theories

1.4 Forms of Ownership (2 hours)
- 1.4.1 Single Ownership – Advantages and limitations
- 1.4.2 Partnership – Types of Partners – Advantages and limitations
- 1.4.3 Joint Stock Company – Formation of Joint Stock Company – Advantages and limitations
- 1.4.4 Co – operative Societies – Types of Co – operatives – Advantages and limitations
- 1.4.5 Public Corporations – Advantages and limitations

1.5 Organizational Structure (2 hours)
- 1.5.1 Line Organization – Advantages and dis – advantages
- 1.5.2 Functional Organization – Advantages and dis – advantages
- 1.5.3 Line and Staff Organization – Advantages and dis – advantages
- 1.5.4 Committee Organization – Advantages and dis – advantages

1.6 Purchasing and Marketing Management (4 hours)
- 1.6.1 Purchasing – Introduction

1.6.2 Functions of Purchasing Department
1.6.3 Methods of Purchasing
1.6.4 Marketing – Introduction
1.6.5 Functions of Marketing
1.6.6 Advertising

2. Personal Management **(8 hours)**

2.1 Introduction
2.2 Functions of Personal Management
2.3 Development of Personal Policy
2.4 Manpower Planning
2.5 Recruitment and Selection of manpower – Scientific selection
2.6 Training and Development of manpower
2.7 Job Analysis, Job Evaluation and Merit Rating
2.8 Wages and Incentives

3. Motivation, Leadership and Entrepreneurship **(10 hours)**

3.1 Motivation (6 hours)
- 3.1.1 Human needs
- 3.1.2 Maslow's Hierarchy of needs
- 3.1.3 Motivation – Introduction
- 3.1.4 Types of Motivation
- 3.1.5 Attitude Motivation; Group Motivation; Executive Motivation
- 3.1.6 Techniques of Motivation
- 3.1.7 Motivation Theories
  - 3.1.7.1 McGregor's Theory X - Y
  - 3.1.7.2 Fear and Punishment Theory
  - 3.1.7.3 Alderfer's ERG Theory
  - 3.1.7.4 MacClelland's Theory of learned needs
  - 3.1.7.5 Herzberg's Hygiene Maintenance Theory
  - 3.1.7.6 Vroom's Expectancy/ Valency Theory

3.2 Leadership - Introduction (2hours)
- 3.2.1 Qualities of a good Leader
- 3.2.2 Leadership Style
- 3.2.3 Blakes and Mouton's Managerial Grid
- 3.2.4 Leadership Approach
- 3.2.5 Leadership Theories

3.3 Entrepreneurship – Introduction (2 hours)
- 3.3.1 Entrepreneurship Development
- 3.3.2 Entrepreneurial Characteristics
- 3.3.3 Need for Promotion of Entrepreneurship
- 3.3.4 Steps for establishing small scale unit

4. Case Studies **(2 hours)**

4.1 Introduction
4.2 Objectives of case study

4.3 Phases of case study
4.4 Steps of case study
4.5 Types of case studies

5. Management Information System **(5 hours)**

5.1 Data and Information
5.2 Need, function and Importance of MIS
5.3 Evolution of MIS
5.4 Organizational Structure and MIS
5.5 Computers and MIS
5.6 Classification of Information Systems
5.7 Information Support for functional areas of management
5.8 Organizing Information Systems

Note: Students have to submit a case study report after visiting an industrial organization outside or inside the Kathmandu valley.

Reference:

1. H. B. Maynard, "Industrial Engineering Handbook" , Editor – in – Chief, McGraw Hill.
2. E. S. Buffa and R. K. Sarin "Modern Production / Operations Management", 8th Edition, Wiley.
3. H. J. Arnold and D. C. Feldman "Organizational Behavior" , McGraw – Hill.
4. J. A. Senn, "Information Systems in Management " , Wadsworth Inc.
5. P. Hershey and K. H. Blanchard, "Management of Organizational Behavior – Utilizing Human Resources ", Prentice – Hall Inc.
6. M. Mahajan, "Industrial Engineering and production Management" ,Dhanpat Rai and Co. (P) Ltd. , Delhi.
7. S. Sadagopan, "Management Information System", Prentice Hall of India Pvt Ltd.
8. C. B. Mamoria "Personnel Management", Himalaya Publishing House..
9. O. P. Khanna, "Industrial Engineering and Management", Dhanpat Rai Publications (P) Ltd.
10. S. K. Joshi, "Organization and Management", IOE, Pulchowk Campus.

ENERGY, ENVIRONMENT AND SOCIETY

EX 701

Lecture : 2
Tutorial : 0
Practical : 0

Year : IV
Part : I

Course Objective:

To understand the various types of energy sources and their environmental impact.
To know the role of engineers for creating better and responsible society.

1. Technology and Development **(3 hours)**

1.1 Introduction to Technology
1.2 Appropriate Technology
1.3 Role of Appropriate Technology in Transformation of Society
1.4 Importance of Technology Transfer
1.5 Impact of technology on Society

2. Energy Basics **(4 hours)**

2.1 Importance of Energy in achieving Maslow's hierarchy of Needs, Human Development Index and Energy Consumption
2.2 Current Energy Trends, Demand and Supply of Energy in World and Nepal
2.3 Introduction to Global warming, Clean Development Mechanism, and Sustainability Issues
2.4 Conventional and Non-Conventional/Renewable Energy Sources
2.5 Conventional Energy Sources: Fossil fuel, Nuclear Energy

3. Renewable Energy Sources **(14 hours)**

3.1 Solar Energy
  3.1.1 Solar radiation
  3.1.2 Solar thermal energy
  3.1.3 Solar Cell (Photovoltaic Technology)
3.2 Hydropower
  3.2.1 Water sources and power
  3.2.2 Water turbines and hydroelectric plants
  3.2.3 Hydro Power Plant Classification (pico, micro, small, medium, large)
3.3 Wind Energy
  3.3.1 Availability of Wind Energy sources
  3.3.2 Wind turbines, wind parks and power control
3.4 Geothermal Energy
  3.4.1 Sources of Geothermal Energy
  3.4.2 Uses of Geothermal Energy
3.5 Bio-mass and Bio-energy
  3.5.1 Synthetic fuels from the biomass

3.5.2 Thermo-chemical, physio-chemical and bio-chemical conversion
3.5.3 Bio-fuel cells

3.6 Hydrogen Energy and Fuel Cell
3.6.1 Basics of electrochemistry
3.6.2 Polymer membrane electrolyte (PEM) fuel cells
3.6.3 Solid oxide fuel cells (SOFCs)
3.6.4 Hydrogen production and storage
3.6.5 Coal-fired plants and integrated gassifier fuel cell (IGFC) systems

4. Environmental Impact of Energy sources **(4 hours)**

4.1 Emission hazard
4.2 Battery hazard
4.3 Nuclear hazard

5. Energy Storage **(3 hours)**

5.1 Forms of energy storage
5.2 Hybrid vehicles
5.3 Smart grid systems
5.4 Batteries
5.5 Super-capacitors

6. Relevant International/national case studies **(2 hours)**

References:

1. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", Oxford University Press, latest edition
2. Aldo V. da Rosa, "Fundamentals of Renewable Energy Processes"

COMMUNICATION SYSTEMS II

EX 702

Lecture : 3 **Year : IV**
Tutorial : 0 **Part : I**
Practical : 3/2

Course Objectives:

To introduce the student to the principles and building blocks of digital communication systems and effects of noise on the performance of communication systems.

1. Introduction **(3 hours)**

1.1 Digital communication sources, transmitters, transmission channels and receivers.

1.2 Noise, distortion and interference. Fundamental limitations due to noise, distortion and interference

1.3 Source coding, coding efficiency, Shannon-Fano and Huffman codes, coding of continuous time signals (A/D conversion)

2. Sampling Theory **(4 hours)**

2.1 Nyquist-Kotelnikov sampling theorem for strictly band-limited continuous time signals, time domain and frequency domain analysis, spectrum of sampled signal, reconstruction of sampled signal

2.2 Ideal, flat-top and natural sampling processes, sampling of band-pass signals, sub-sampling theory

2.3 Practical considerations: non-ideal sampling pulses (aperture effect), non-ideal reconstruction filter and time-limitness of the signal to be sampled (aliasing effects)

3. Pulse Modulation Systems **(8 hours)**

3.1 Pulse Amplitude Modulation (PAM), generation, bandwidth requirements, spectrum, reconstruction methods, time division multiplexing

3.2 Pulse position and pulse width modulations, generation, bandwidth requirements

3.3 Pulse code modulation as the result of analog to digital conversion, uniform quantization.

3.4 Quantization noise, signal to quantization noise ratio in uniform quantization.

3.5 Non uniform quantization, improvement in average SQNR for signals with high crest factor, companding techniques (μ and A law companding)

3.6 Time Division Multiplexing with PCM, data rate and bandwidth of a PCM signal. The T1 and E1 TDM PCM telephone hierarchy

3.7 Differential PCM, encoder, decoder

3.8 Delta Modulation, encoder, decoder, noises in DM, SQNR. Comparison between PCM and DM

3.9 Parametric speech coding, vocoders

4. Baseband Data Communication Systems **(7 hours)**

4.1 Introduction to information theory, measure of information, entropy, symbol rates and data (bit) rates.

4.2 Shannon Hartley Channel capacity theorem. Implications of the theorem and theoretical limits.

4.3 Electrical representation of binary data (line codes), Unipolar NRZ, bipolar NRZ, unipolar RZ, bipolar RZ, Manchester (split phase), differential (binary RZ-alternate mark inversion) codes, properties, comparisons

4.4 Baseband data communication systems, Inter-symbol interference (ISI), pulse shaping (Nyquist, Raised- cosine) and bandwidth considerations

4.5 Correlative coding techniques, duobinary and modified duobinary encoders

4.6 M-ary signaling, comparison with binary signaling

4.7 The eye diagram.

5. Bandpass (modulated) data communication systems **(4 hours)**

5.1 Binary digital modulations, ASK, FSK, PSK, DPSK, QPSK, GMPSK, implementation, properties and comparisons

5.2 M-ary data communication systems, quadrature amplitude modulation systems, four phase PSK systems

5.3 Demodulation of binary digital modulated signals (coherent and non-coherent)

5.4 Modems and its applications.

6. Random signals and noise in communication systems **(7 hours)**

6.1 Random variables and processes, random signals, statistical and time averaged moments, interpretation of time averaged moments of a random process stationary process, ergodic process, psdf and AC function of a ergodic random process

6.2 White noise, thermal noise, band-limited white noise, the psdf and AC function of white noise

6.3 Passage of wide-sense stationary random signals through a LTI

6.4 Ideal low-pass and RC filtering of white noise, noise equivalent bandwidth of a filter

6.5 Optimum detection of a pulse in additive white noise, the matched filter. Realization of matched filters (time co-relaters). The matched filter for a rectangular pulse, ideal LPF and RC filters as matched filters

6.6 Performance limitation of baseband data communications due to noise, error probabilities in binary and M-ary baseband data communication.

7. Noise performance of band-pass (modulated) communication systems **(8 hours)**

7.1 Effect of noise in envelop and synchronous demodulation of DSB-FC AM, expression for gain parameter (ratio of output SNR to input SNR), threshold effect in non-linear demodulation of AM

7.2 Gain parameter for demodulations of DSB-SC and SSB using synchronous demodulators

7.3 Effect of noise (gain parameter) for non-coherent (limiter-discriminator-envelop detector) demodulation of FM, threshold effect in FM. Use of pre-emphasis and de-emphasis circuits in FM.

7.4 Comparison of AM (DSB-FC, DSB-SC, SSB) and FM (Narrow and wide bands) in terms power efficiency, channel bandwidth and complexity.

7.5 Noise performance of modulated digital systems. Error probabilities for ASK, FSK, PSK, DPSK with coherent and non-coherent demodulation.

7.6 Comparison of modulated digital systems in terms of bandwidth efficiency, power efficiency and complexity.

8. Error control coding techniques **(4 hours)**

8.1 Basic principles of error control coding, types, basic definitions (hamming weight, hamming distance, minimum weight), hamming distance and error control capabilities

8.2 Linear block codes (systematic and non-systematic), generation, capabilities, syndrome calculation

8.3 Binary cyclic codes (systematic and non-systematic), generation, capabilities, syndrome calculation.

8.4 Convolutional codes, implementation, code tree, trellis and decoding algorithms.

Practical:

1. Study of line codes
2. Study of PCM
3. Study of DPCM
4. Study of DM
5. Study of ASK, FSK and PSK
6. Study of eye diagram

References:

1. S. Haykin, "Analog and Digital communication systems", latest editions
2. Leon Couch, "Digital and analog communication systems", latest edition
3. B.P.Lathi, "Analog and Digital communication systems", latest edition
4. J. Proakis, "Analog and Digital communication systems", latest edition
5. D. Sharma, Course manual "Communication Systems II".

TELECOMMUNICATION

EX 703

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objectives:

To continue the study of modern communication systems, their characteristics and design.

1. Telecommunication Networks: **(4 hours)**

1.1 Evolution of telecommunications
1.2 Classification of switching system

2. Transmission Media: **(4 hours)**

2.1 Transmission media characteristics
2.2 Transmission lines
2.3 Hybrid Transformer and circuits
2.4 Signal and noise measurement

3. Signal Multiplexing: **(4 hours)**

3.1 Frequency division multiplex, Wavelength division multiplex
3.2 Space division multiplex
3.3 Time division multiplex; North American TDM system, The European E1

4. Digital Switching: **(8 hours)**

4.1 Digital Telephone Exchange
4.2 Space(S) Switch
4.3 Time(T) Switch
4.4 ST, TS, STS and TST switch
4.5 Comparison between TST and STS switch

5. Signaling System: **(4 hours)**

5.1 Classification of Signaling Systems: Channel Associated Signaling and Common Channel Signaling
5.2 ITU Common Channel Signaling System # 7 (SS7)

6. Telephone Traffic: **(9 hours)**

6.1 Network Traffic load and parameters
6.2 Loss System: Grade of service (GOS) and Blocking probability
6.3 Delay System: Queuing theory
6.4 Routing
6.5 Numbering Plans, Charging Plans

7. Telecommunication Regulation: **(2 hours)**

7.1. Purpose of ITU(International Telecommunications Union),
7.2. NTA(Nepal Telecommunications Authority)

8. Data Communication: **(10 hours)**

8.1 Switching Techniques in data Communication
8.2 IP Switching
8.3 Soft Switching
8.4 Routing and Flow control
8.5 ISDN
8.6 DSL

Practical: Six laboratory to illustrate course principles

References:

1. John C. Bellamy "Digital Telephony" John Wiley & Sons, Inc.
2. Roger L. Freeman "Telecommunication System Engg. " John Wiley & Sons, Inc.
3. A. S. Tanenbaum "Computer Networks" Prentice Hall.
4. Thiagarajan Vishwanathan, "Telecommunication Switching Systems and Networks",

FILTER DESIGN

EX 704

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objective:

To familiarize student with the concept of analog filter design: passive filters, RC active filters and switched-capacitor filters

1. Introduction **(4 hours)**

1.1 Filter and its importance in communication
1.2 Kinds of filters in terms of frequency response
1.3 Ideal response and response of practical filters
1.4 Normalization and denormalization in filter design
1.5 Impedance (magnitude) scaling and frequency scaling
1.6 History of filter design and available filter technologies

2. Approximation Methods **(8 hours)**

2.1 Approximation and its importance in filter design
2.2 Lowpass approximations methods
2.3 Butterworth response, Butterworth pole locations, Butterworth filter design from specifications
2.4 Chebyshev and inverse Chebyshev characteristics, network functions and pole zero locations
2.5 Characteristics of Cauer (elliptic) response
2.6 Bessel-Thomson approximation of constant delay
2.7 Delay Equalization

3. Frequency transformation **(2 hours)**

3.1 Frequency transformation and its importance in filter design
3.2 Lowpass to highpass transformation
3.3 Lowpass to bandpass transformation and
3.4 Lowpass to bandstop transformation

4. Properties and Synthesis of Passive Networks **(7 hours)**

4.1 One-port passive circuits
  4.1.1 Properties of passive circuits, positive real functions
  4.1.2 Properties of lossless circuits
  4.1.3 Synthesis of LC one-port circuits, Foster and Cauer circuits
  4.1.4 Properties and synthesis of RC one-port circuits
4.2 Two-port Passive Circuits
  4.2.1 Properties of passive two-port circuits, residue condition, transmission zeros

4.2.2 Synthesis of two-port LC and RC ladder circuits based on zero-shifting by partial pole removal

5. Design of Resistively-Terminated Lossless Filter **(4 hours)**

5.1 Properties of resistively-terminated lossless ladder circuits, transmission and reflection coefficients
5.2 Synthesis of LC ladder circuits to realize all-pole lowpass functions
5.3 Synthesis of LC ladder circuits to realize functions with finite transmission zeros

6. Active Filter **(7 hours)**

6.1 Fundamentals of Active Filter Circuits
- 6.1.1 Active filter and passive filter
- 6.1.2 Ideal and real operational amplifiers, gain-bandwidth product
- 6.1.3 Active building blocks: amplifiers, summers, integrators
- 6.1.4 First order passive sections and active sections using inverting and non-inverting op-amp configuration

6.2 Second order active sections (biquads)
- 6.2.1 Tow-Thomas biquad circuit, design of active filter using Tow-Thomas biquad
- 6.2.2 Sallen-Key biquad circuit and Multiple-feedback biquad (MFB) circuit
- 6.2.3 Gain reduction and gain enhancement
- 6.2.4 RC-CR transformation

7. Sensitivity **(3 hours)**

7.1 Sensitivity and importance of sensitivity analysis
7.2 Definition of single parameter sensitivity
7.3 Centre frequency and Q-factor sensitivity
7.4 Sensitivity properties of biquads
7.5 Sensitivity of passive circuits

8. Design of High-Order Active Filters **(6 hours)**

8.1 Cascade of biquads
- 8.1.1 Sequencing of filter blocks, center frequency, Q-factor and gain

8.2 Active simulation of passive filters
- 8.2.1 Ladder design with simulated inductors
- 8.2.2 Ladder design with frequency-dependent negative resistors (FDNR)
- 8.2.3 Leapfrog simulation of ladders

9. Switched-Capacitor Filters **(4 hours)**

9.1 The MOS switch and switched capacitor
9.2 Simulation of resistor by switched capacitor

9.3 Switched-capacitor circuits for analog operations: addition, subtraction, multiplication and integration
9.4 First-order and second-order switched-capacitor circuits

Practical:

The laboratory experiments consist computer simulation as well hardware realization for analysis and design of passive and active filters which include.

- Analysis and design of passive & active filter circuits using computer simulation
- Design of active filters using biquad circuits
- Design of higher order active filters using inductor simulation
- Design of higher order active filters using functional simulation

References:

1. Rolf Schaumann, Mac E. Van Valkenburg, " Design of Analog Filters"
2. Wai-Kai Chen, " Passive and Active Filters (Theory and Implementations)",
3. Kendal L Su, "Analog Filter",

PROJECT-I

EX 707

Lecture : 0
Tutorial : 0
Practical : 3

Year : IV
Part : I

Course Objectives:

The objective of this project work is to develop hands-on experience of working in a project. During the course, students have to design and complete a functional project which should require integration of various course concepts. Students will develop various skills related to project management like team work, resource management, documentation and time management.

1. Group formation (Not exceeding 4 persons per group)
2. Project concept development (software engineering concept must include for computer engineering and hardware / software elements include electronics & communication engineering)
3. Proposal preparation (proposal content: title, objective, scope of project, methodology, expected outcome, hardware/software element, list of equipment, and historical background and reviewed should be clearly reflected)
4. Project documentation (follow the project documentation guideline)

Evaluation Scheme:

Project (Part A): Internal Evaluation is done on the basis of Project Proposal, Regular activities, Progress Report and Presentation.

ELECTIVE I

ADVANCED JAVA PROGRAMMING

CT 725 01

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objective:

To provide programming knowledge for both single system software distribution and across networks/devices and to focus on the advanced topics that a Java programmer will need to know so that they will be in a position to do commercial Java development both for single services and also for distributed processes across multiple devices. To provide an in depth coverage of object serialization, Java Beans, XML, Servlets, JSP's, networking, remote objects (RMI), distributed computing, and Java database Connectivity.

1. Introduction **(2 hours)**

1.1 Overview
1.2 Java Programming Review

2. GUI Programming and Components **(4 hours)**

2.1 Swing Introduction
2.2 Frame Creation/Positioning
2.3 Working with Shape, Color, Text, Images
2.4 Basics of Event Handling
2.5 AWT Event Hierarchy
2.6 Low Level Event Types
2.7 User Interface Components
2.8 Layout Management
2.9 Text Input/Choice Components/Menu/Dialog Box

3. Applets and Application Deployment **(4 hours)**

3.1 Applet Basics
3.2 Applet HTML Tags & Attribute
3.3 Multimedia, URL Encapsulation
3.4 JAR files
3.5 Application Packaging
3.6 Storage of Application Preferences

4. Streams and File Handling **(4 hours)**

4.1 Streams
4.2 Text Input and Output
4.3 Working with Binary Data
4.4 Object Streams & Serialization
4.5 File Management, Buffer , Lock etc.

5. XML Programming **(3 hours)**

5.1 Introducing XML
5.2 Parsing an XML Documents
5.3 Validating XML Documents
5.4 XPath, SAX Parsers, XSL Transformations

6. Network Programming **(4 hours)**

6.1 Server Connection
6.2 Implementing Servers
6.3 Socket Timeouts / Interruptible Sockets
6.4 Sending E-mail
6.5 URL Connection Establishment
6.6 Posting Form Data

7. Database Programming **(6 hours)**

7.1 The design of JDBC and types
7.2 The Structured Query Language (SQL)
7.3 JDBC Configuration
7.4 Executing SQL Statements
7.5 Query execution
7.6 Scrollable and Updateable result sets
7.7 Row sets /Cached row sets
7.8 Metadata
7.9 Transactions
7.10 Enterprise Application and Connection management in Web
7.11 LDAP / LDAP Server configuration and accessing LDAP

8. Distributed Objects **(4 hours)**

8.1 Client – Server model
8.2 RMI Programming model
8.3 Parameters and return values in remote methods
8.4 Remote Object Activation
8.5 Web services and JAX-WS

9. Advanced Swing and advanced AWT **(5 hours)**

9.1 Swing: Lists, Tables, Trees, Text Components
9.2 Swing : Progress Indicators, Component Organizers, Split/tabbed Panes
9.3 AWT : Rendering, Shapes, Areas, Strokes, Coordinate Transformations
9.4 AWT : Clipping and Image manipulation, Printing, The Clipboard

10. Java Beans Components **(5 hours)**

10.1 Introducing Beans
10.2 Using Beans in Application Building
10.3 Packaging Beans in JAR files
10.4 Naming Patterns for Beans

10.5 Bean property types
10.6 JavaBeans Persistence

11. Miscellaneous **(4 hours)**

11.1 Security : Bytecode verification, User Authentication, Encryption, Digital Signature
11.2 Scripting : Scripting Engine, Script Binding, Script compilation
11.3 Other recent trends

Practicals:

There should be substantial program design and implementation assignments related to every chapter of the syllabus content.

References:

1. Car S. Horstmann, "Core Java Volume I and II – Advanced Features", Prentice Hall.
2. Y. Daniel Liang, "Introduction to Java Programming", Pearson/ Prentice Hall.
3. H. Deitel, P. Deitel, "Java How To Program" , Prentice Hall.

DATA MINING
CT 725 02

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objective:
To introduce the fundamental principles, algorithms and applications of intelligent data processing and analysis and to provide an in depth understanding of various concepts and popular techniques used in the field of data mining

1. Introduction **(2 hours)**
- 1.1 Data Mining Origin
- 1.2 Data Mining & Data Warehousing basics

2. Data Preprocessing **(6 hours)**
- 2.1 Data Types and Attributes
- 2.2 Data Pre-processing
- 2.3 OLAP & Multidimensional Data Analysis
- 2.4 Various Similarity Measures

3. Classification **(12 hours)**
- 3.1 Basics and Algorithms
- 3.2 Decision Tree Classifier
- 3.3 Rule Based Classifier
- 3.4 Nearest Neighbor Classifier
- 3.5 Bayesian Classifier
- 3.6 Artificial Neural Network Classifier
- 3.7 Issues : Overfitting, Validation, Model Comparison

4. Association Analysis **(10 hours)**
- 4.1 Basics and Algorithms
- 4.2 Frequent Itemset Pattern & *Apriori* Principle
- 4.3 FP-Growth, FP-Tree
- 4.4 Handling Categorical Attributes
- 4.5 Sequential, Subgraph, and Infrequent Patterns

5. Cluster Analysis **(9 hours)**
- 5.1 Basics and Algorithms
- 5.2 K-means Clustering
- 5.3 Hierarchical Clustering
- 5.4 DBSCAN Clustering
- 5.5 Issues : Evaluation, Scalability, Comparison

6. Anomaly / Fraud Detection **(3 hours)**

7. Advanced Applications **(3 hours)**

7.1 Mining Object and Multimedia
7.2 Web-mining
7.3 Time-series data mining

Practical:

Using either MATLAB or any other DataMining tools (such as WEKA), students should practice enough on real-world data intensive problems like IRIS or Wiki dataset.

References:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, *Introduction to Data Mining*, 2005, Addison-Wesley.
2. Jiawei Han and Micheline Kamber, *Data Mining: Concepts and Techniques*, 2nd Edition, 2006, Morgan Kaufmann.

EMBEDDED SYSTEMS DESIGN USING ARM TECHNOLOGY

CT 725 03

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objectives:

To provide fundamentals concepts and insights for understanding of the ARM based Processors architecture and programming embedded system based on ARM powered MCU for application in control, consumer, multimedia signal processing and mobile and wireless communications systems.

1. ARM Embedded Systems **(3 hours)**

1.1 Introduction to Embedded Systems
1.2 The RISC Design Philosophy
1.3 The ARM Design Philosophy
1.4 Embedded System Hardware
1.5 Embedded System Software

2. ARM Processor Fundamentals **(3 hours)**

2.1 The Acron RISC Machine
2.2 The ARM programmer's model
2.3 Current Program Status Register
2.4 Exceptions, Interrupts, and the Vector Table
2.5 ARM Processor Families

3. ARM Organization and Peripherals **(6 hours)**

3.1 3-stage pipeline ARM organization
3.2 5-stage pipeline ARM organization
3.3 ARM instruction execution
3.4 Peripherals: GPIO, UART, I2C, SPI, ADC/DAC, Timers, Displays, Interrupts and DMA.

4. Efficient C Programming for ARM **(3 hours)**

4.1 Data types, Expressions and Conditional statements
4.2 Loops, Functions and procedures
4.3 Use of memory
4.4 Pointer Aliasing
4.5 Bit-Field

5. ARM Assembly Language Programming **(3 hours)**

5.1 Data processing instructions
5.2 Data transfer instructions

5.3 Control flow instructions
5.4 Writing simple assembly language programs

6. ARM Instruction Set **(6 hours)**

6.1 Data Processing Instructions
6.2 Branch Instructions
6.3 Load-Store Instructions
6.4 Software Interrupt Instruction
6.5 Program Status Register Instructions
6.6 Loading Constants
6.7 Conditional Execution

7. Thumb Instruction Set **(3 hours)**

7.1 The Thumb bit in the CPSR
7.2 The Thumb programmer's model
7.3 Thumb branch instructions
7.4 Thumb software interrupt instruction
7.5 Thumb data processing instructions
7.6 Thumb single register data transfer instructions
7.7 Thumb multiple register data transfer instructions
7.8 Thumb breakpoint instruction
7.9 Thumb implementation
7.10 Thumb applications

8. Architectural Support for System Development **(6 hours)**

8.1 The ARM memory interface
8.2 The Advanced Microcontroller Bus Architecture (AMBA)
8.3 The ARM reference peripheral specification
8.4 Hardware system prototyping tools
8.5 The ARMulator
8.6 The JTAG boundary scan test architecture
8.7 The ARM debug architecture
8.8 Embedded Trace

9. Firmware and Embedded Operating Systems **(6 hours)**

9.1 Firmware and Bootloader
9.2 Fundamental components of embedded operating systems
9.3 Embedded Linux
9.4 Android Operating Systems

10. Signal Processing and Communication Application using ARM Cortex Processors **(6 hours)**

10.1 ARM Cortex-M4 Processors for Multimedia Signal Processing
10.2 Hardware and software development aspects for Cortex-M series applications

10.3 ARM Cortex-R processors for mobile and wireless communication
10.4 Hardware and software development aspects for Cortex-R series applications

Practicals:

1. Introduction to NXP LPC2148 MCU, Development Board and Development Tools
2. Programming in C & Assembly (KEIL and PROTEUS)
3. GPIO Programming (LED, LCD, Keypad, Buzzer)
4. Serial Protocols Programming (UART0, I2C0, SPI)
5. Timer Programming (Timer/Counter, PWM, WDT, RTC)
6. LPC2148 Interface for ADC/DAC

References:

1. Andrew N. Sloss, Dominic Symes, Chris Wright "ARM System Developer's Guide", Morgan Kaufmann.
2. Steve Furber, "ARM System-on-Chip Architecture," Second Edition, Addison Weley
3. Joseph Yiu, " The Definitive Guide to the ARM Cortex-M3," Newnes
4. William Hold, "ARM Assembly Language: Fundamentals and Techniques," CRC Press,
5. David Seal, "Free ARMv7-AR, ARMv7-M, ARMv6-M and ARMv5 Architecture Reference Manual Downloads," Addison-Wesley
6. Warwick A.Smith, "C Programming for Embedded Microcontrollers"

IMAGE PROCESSING AND PATTERN RECOGNITION

CT 725 04

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To be familiar with processing of images, pattern recognition and their applications.

1. Introduction to digital image processing **(4 hours)**

1.1 Digital image representation
1.2 Digital image processing: Problems and applications
1.3 Elements of visual perception
1.4 Sampling and quantization, relationships between pixels

2. Two-dimensional systems **(5 hours)**

2.1 Fourier transform and Fast Fourier Transform
2.2 Other image transforms and their properties: Cosine transform, Sine transform, Hadamard transform, Haar transform

3. Image enhancement and restoration **(8 hours)**

3.1 Point operations, contrast stretching, clipping and thresholding, digital negative, intensity level slicing, bit extraction
3.2 Histogram modeling: Equalization, Modification, Specification
3.3 Spatial operations: Averaging, directional smoothing, median, filtering, spatial low pass, high pass and band pass filtering, magnification by replication and interpolation

4. Image coding and compression **(4 hours)**

4.1 Pixel coding: run length, bit plane coding, Huffman coding
4.2 Predictive and inter-frame coding

5. Introduction to pattern recognition in images **(3 hours)**

6. Recognition and classification **(5 hours)**

6.1 Recognition and classification
6.2 Feature extraction
6.3 Models
6.4 Division of sample space

7. Grey level features edges and lines **(6 hours)**

7.1 Similarity and correlation
7.2 Template matching
7.3 Edge detection using templates
7.4 Edge detection using gradient models, model fitting

7.5 Line detection, problems with feature detectors

8. Segmentation **(3 hours)**

8.1 Segmentation by thresholding
8.2 Regions based Segmentation, edges, line and curve detection

9. Frequency approach and transform domain **(3 hours)**

10. Advanced Topics **(4 hours)**

10.1 Neural networks and their application to pattern recognition
10.2 Hopfield nets
10.3 Hamming nets, perceptron

Practical:

Laboratory exercises using image processing and pattern recognition packages.

References:

1. R. C. Gonzalez and P. Wintz, "Digital Image Processing", Second Edition, Addison-Wesley Publishing.
2. K. Castlemann. "Digital Image Processing", Prentice Hall of India Ltd.
3. A. K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India Pvt. Ltd..
4. Sing Tze Bow, M. Dekker, "Pattern Recognition and Image Processing",
5. M. James, "Pattern Recognition", BSP professional books.
6. P. Monique and M. Dekker, "Fundamentals of Pattern Recognition".

WEB TECHNOLOGIES AND APPLICATIONS

CT 725 05

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To introduce the key foundations of the Web, essential technologies and knowledge needed for web application development, and to highlight the recent developments on the dynamic area of the Web.

1. Introduction **(3 hours)**

1.1 History
1.2 Internet and the Web
1.3 Client/server computing paradigm

2. Web basics **(5 hours)**

2.1 Web documents and browsers
2.2 HTML, XHTML, forms, CSS
2.3 Crawling and information retrieval on the web

3. Server-side programming **(7 hours)**

3.1 Server-side scripting languages- PHP, JSP, Java servlets, ASP.NET etc.
3.2 Backend database programming
3.3 Multi-tier architecture

4. Client-side scripting **(4 hours)**

4.1 JavaScript basics
4.2 JavaScript DOM

5. Web applications **(6 hours)**

5.1 Content management systems
5.2 Web application frameworks
5.3 Online information systems and solutions

6. Web 2.0 **(6 hours)**

6.1 Introduction
6.2 Blogs, wikis, social networking and collective intelligence
6.3 Tagging - folksonomies
6.4 AJAX

7. Information representation and sharing – XML **(5 hours)**

7.1 XML documents, DTD
7.2 Stylesheets and transformation - XSLT
7.3 Information syndication - RSS

8. Web services **(4 hours)**

8.1 Service-oriented architecture
8.2 SOAP, WSDL, REST

9. The Semantic Web **(5 hours)**

9.1 Introduction
9.2 RDF and Ontologies
9.3 Linked Open Data
9.4 Applications and Web 3.0

Practical:

Regular lab sessions can be conducted related to web design, server-side programming, client-side scripting, working with application frameworks and tools, etc.

A number of practical assignments can be given for hands-on experience on web application development.

References:

1. Slides and handouts
2. Jeffrey C. Jackson, "Web technologies: a computer science perspective",
3. P. J. Deitel and H. M. Deitel, "Internet and World Wide Web: How to Program",.
4. G. McComb, "Web Programming Languages", John Wiley & Sons, Inc.
5. Marty Hall, "Core Web Programming", Prentice Hall PTR, Upper Saddle River, NJ 07458.

OPERATING SYSTEM

CT 725 06

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objective:

To be familiar with the different aspects of operating system and use the idea in designing operating system.

1. Introduction **(5 hours)**

1.1 Operating System and Function
1.2 Evolution of Operating System
1.3 Type of Operating System: Batch, Interactive, Multiprocessing, Time Sharing and Real Time System
1.4 Operating System Components
1.5 Operating System Structure: Monolithic, Layered, Micro-Kernel, Client-Server, Virtual Machine
1.6 Operating System Services
  1.6.1 System calls
  1.6.2 Shell commands
  1.6.3 Shell programming
1.7 Examples of O. S.: UNIX, Linux, MS-Windows, Handheld OS.

2. Process Management **(6 hours)**

2.1 Introduction to Process
  2.1.1 Process description
  2.1.2 Process states
  2.1.3 Process control
2.2 Threads
2.3 Processes and Threads
2.4 Scheduling
  2.4.1 Types of scheduling
  2.4.2 Scheduling in batch system
  2.4.3 Scheduling in Interactive System
  2.4.4 Scheduling in Real Time System
  2.4.5 Thread Scheduling
2.5 Multiprocessor Scheduling concept

3. Process Communication and Synchronization (5 hours)

3.1 Principles of Concurrency
3.2 Critical Region
3.3 Race Condition
3.4 Mutual Exclusion
3.5 Semaphores and Mutex
3.6 Message Passing
3.7 Monitors
3.8 Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem

4. Memory Management (6 hours)

4.1 Memory address, Swapping and Managing Free Memory Space
4.2 Resident Monitor
4.3 Multiprogramming with Fixed Partition
4.4 Multiprogramming With Variable Partition
4.5 Multiple Base Register
4.6 Virtual Memory Management
  4.6.1 Paging
  4.6.2 Segmentation
  4.6.3 Paged Segmentation
4.7 Demand Paging
4.8 Performance
4.9 Page Replacement Algorithms
4.10 Allocation of Frames
4.11 Thrashing

5. File Systems (6 hours)

5.1 File: Name, Structure, Types, Access, Attribute, Operations
5.2 Directory and File Paths
5.3 File System Implementation
  5.3.1 Selecting Block Size
  5.3.2 Impact of Block Size Selection
  5.3.3 Implementing File: Contiguous Allocation, Link List Allocation, Link List Allocation with Table, Inode
  5.3.4 Implementing Directory
5.4 Impact of Allocation Policy on Fragmentation
5.5 Mapping File Blocks on The Disk Platter
5.6 File System Performance
5.7 Example File Systems: CD ROM file system, MS-DOS file system, Unix File system

6. I/O Management & Disk Scheduling **(4 hours)**

- 6.1 Principles of I/O Hardware
- 6.2 Principles of I/O software
- 6.3 I/O software Layer
- 6.4 Disk
  - 6.4.1 Hardware
  - 6.4.2 Formatting
  - 6.4.3 Arm scheduling
  - 6.4.4 Error handling
  - 6.4.5 Stable Storage

7. Deadlock **(5 hours)**

- 7.1 Principles of deadlock
- 7.2 Deadlock Prevention
- 7.3 Deadlock Avoidance
- 7.4 Deadlock Detection
- 7.5 Recovery from deadlock
- 7.6 An Integrated Deadlock Strategies
- 7.7 Other Issues: Two phase locking, Communication Deadlock, Livelock, Starvation

8. Security **(4 hours)**

- 8.1 Security breaches
- 8.2 Types of Attacks
- 8.3 Security Policy and Access Control
- 8.4 Basics of Cryptography
- 8.5 Protection Mechanisms
- 8.6 Authentication
- 8.7 OS Design Considerations For Security
- 8.8 Access Control Lists And OS Support

9. System administration **(4 hours)**

- 9.1 Administration Tasks
- 9.2 User Account Management
- 9.3 Start And Shutdown Procedures
- 9.4 Setting up Operational Environment for a New User
- 9.5 AWK tool, Search, Sort tools, Shell scripts, Make tool

Practical:

1. Shell commands, shell programming: write simple functions, basic tests, loops, patterns, expansions, substitutions

2. Programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Programs using the I/O system calls of UNIX operating system
4. Implement the Producer – Consumer problem using semaphores.
5. Implement some memory management schemes

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", PHI.
2. Stalling William, "Operating Systems", Pearson Education
3. SilbcrschatzA.,Galvin P., Gagne G., "Operating System Concepts", John Wiley and Sons,
4. Milan Milenkovic, "Operating Systems Concepts and Design", TMGH
5. Das Sumitabha, "Unix Concepts and Applications", Tata McGraw Hill.
6. M. J. Bach, "The Design of The Unix Operating System", PHI.
7. Charles Crowley, "Operating Systems: A Design-oriented Approach", TMH.

RADAR TECHNOLOGY

EX 725 01

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objectives:

- To enable the student to become familiar with Radar technology
- To get an overview of Radar and the Radar equation
- To study about different types of radars and their operations
- To study about Radar transmitters, receivers, duplexers, displays and antennas
- To get a knowledge about the detection of Radar signals in noise

1. Introduction to Radar **(2 hours)**

1.1 Introduction
1.2 Radar block diagram and operation
1.3 Applications of Radar
1.4 Radar frequencies

2. The Radar equation **(8 hours)**

2.1 Simple form of Radar Equation
2.2 Prediction of range performance
2.3 Minimum detectable signal
2.4 Receiver noise
2.5 Signal to Noise ratio
2.6 Integration of Radar Pulses
2.7 Radar Cross Section of Targets (simple targets - sphere, cone-sphere)
2.8 Transmitter Power
2.9 Pulse repetition frequency and range ambiguities
2.10 System losses
2.11 Propagation effects

3. CW and Frequency Modulated Radar **(4 hours)**

3.1 The Doppler effect
3.2 CW Radar
3.3 FM-CW Radar
3.4 Multiple Frequency CW Radar

4. MTI andPulse Doppler Radar **(8 hours)**

4.1 Moving Target indicator Radar
4.2 Delay Line and Cancellers
4.3 Staggered Pulse Repetition Frequencies
4.4 Range Gated Doppler Filters,
4.5 Other MTI delay line,
4.6 Limitations of MTI performance,

4.7 Non-Coherent MTI
4.8 Pulse Doppler Radar
4.9 MTI from a moving platform
4.10 Limitations of MTI performance
4.11 MTI versus Pulse Doppler Radar

5. Tracking Radar **(6 hours)**

5.1 Tracking with Radar
5.2 Sequential Lobbing
5.3 Conical Scan
5.4 Monopulse Tracking Radar
5.5 Tracking in range
5.6 Acquisition
5.7 Comparison of Trackers

6. Radar Transmitters, Receivers, Duplexers, Displays and Antennas (10 hours)

6.1 Radar Transmitters
  6.1.1 Introduction
  6.1.2 Solid state transmitters
  6.1.3 Introduction to Radar Modulators
6.2 Radar Receivers
  6.2.1 Introduction
  6.2.2 Super Heterodyne Receiver
  6.2.3 Receiver Noise Figure
6.3 Duplexers
  6.3.1 Introduction
  6.3.2 Branch type and Balanced type
6.4 Displays
  6.4.1 Introduction and types
6.5 Antennas
6.6 Introduction
6.7 Parameters of Radar Antenna
6.8 Phased Array Antenna
  6.8.1 Basic Concepts
  6.8.2 Radiation Pattern
  6.8.3 Applications, Advantages and Limitations

7. Detection of Radar Signals in Noise **(5 hours)**

7.1 Introduction,
7.2 Matched Filter Receiver
  7.2.1 Response Characteristics and Derivation
7.3 Correlation Detection
  7.3.1 Correlation Function and Cross-correlation Receiver

8. Image Analysis and Applications **(2 hours)**

Practical:

1. Field trip to Airport for the introduction of Air Traffic Control (ATC) Radar.
2. Radar Cross Section Simulation and Analysis
3. Case Study

References:

1. Merrill I. Skolnik, "Introduction to Radar Systems", MacGraw Hill
2. Merrilll.Skolnik, "Radar Handbook", McGraw Hill Publishers
3. J. C. Toomay and Paul J. Hannen, "Radar Principles for the Non-Specialist", by J. C. Toomay, Paul Hannen, SciTech Publishing
4. David Knox Barton, A. I. Leonov, Sergey A. Leonov, I. A. Morozov and Paul C. Hamilton, "Radar Technology Encyclopedia", Artech House.
5. Dr. Eli Brookner (Editor), "Radar Technology", Artech House.
6. M. R. Richards, J. A. Scheer, W. A. Holm, Editors "Principles of Modern Radar, Basic Principles", SciTech Publishing.

SATELLITE COMMUNICATION

EX 725 02

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objectives:

- To enable the student to become familiar with satellites and satellite services
- To get an overview of satellite systems in relation to other terrestrial systems
- To study about satellite orbits, launching, link design, multiple access techniques, propagation effects and their impact on satellite-earth links
- To study about VSAT systems, Satellite TV, radio and GPS

1. Overview of satellite communication **(2 hours)**

1.1 Introduction
1.2 Frequency Allocations for Satellite Services
1.3 Intelsat
1.4 U.S.Domsats
1.5 Polar Orbiting Satellites

2. Orbital mechanics and launchers **(10 hours)**

2.1 Kepler's laws
2.2 Newton's law
2.3 Orbital parameters
2.4 Orbital Mechanics
2.5 Look Angle Determination
2.6 Orbital perturbations
2.7 Orbit Control system
2.8 Geo stationary orbit
2.9 Telemetry, tracking, Command and monitoring
2.10 Power systems
2.11 Communication subsystems
2.12 Transponders
2.13 Satellite Antennas
2.14 Equipment reliability and space qualification.

3. Satellite link design **(9 hours)**

3.1 Basic transmission Theory,
3.2 System noise temperature and G/T ratio,
3.3 Design of downlinks,
3.4 Satellite systems using small earth stations Uplink design,
3.5 Design for C/N:Combining C/N and C/I values in satellite links,
3.6 System design examples

4. Multiple access techniques for satellite links **(4 hours)**

4.1 Multiple access
4.2 Frequency Division Multiple Access
4.3 Time Division Multiple Access
4.4 On board processing
4.5 Demand access Multiple Access
4.6 Random access
4.7 Code division Multiple Access

5. Propagation effects and their impact on satellite-earth links **(3 hours)**

5.1 Quantifying attenuation and depolarization
5.2 Propagation effects that are not associated with hydrometers
5.3 Rain and ice effects
5.4 Prediction of rain attenuation
5.5 Prediction of XPD
5.6 Propagation impairment Countermeasures

6. VSAT systems **(4 hours)**

6.1 Network architectures
6.2 Access control protocol
6.3 Basic techniques
6.4 SAT earth station engineering
6.5 Calculation of link margins for VSAT star network
6.6 System design procedures

7. Low Earth Orbit and Non-Geostationary Satellite systems **(4 hours)**

7.1 Orbit considerations
7.2 Coverage and frequency considerations
7.3 Delay and throughput considerations
7.4 Operational NGSO constellation design
7.5 Introduction to Satellite mobile network
7.6 Meteorological Satellites System

8. Direct broadcast Satellite TV and radio **(4 hours)**

8.1 C-Band and Ku band home satellite TV
8.2 Digital DBS–TV
8.3 DBS–TV system design
8.4 DBS–TV link budget
8.5 Error control in digital DBS TV
8.6 DBS –TV link budget
8.7 Master control station and uplink
8.8 Establishment of DBS–TV antennas Satellite radio broadcasting

9. Satellite Navigation and Global Positioning System: **(5 hours)**

9.1 Radio and Satellite navigation
9.2 GPS position location principles

SATELLITE COMMUNICATION

EX 725 02

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

- To enable the student to become familiar with satellites and satellite services
- To get an overview of satellite systems in relation to other terrestrial systems
- To study about satellite orbits, launching, link design, multiple access techniques, propagation effects and their impact on satellite-earth links
- To study about VSAT systems, Satellite TV, radio and GPS

1. Overview of satellite communication **(2 hours)**

1.1 Introduction
1.2 Frequency Allocations for Satellite Services
1.3 Intelsat
1.4 U.S.Domsats
1.5 Polar Orbiting Satellites

2. Orbital mechanics and launchers **(10 hours)**

2.1 Kepler's laws
2.2 Newton's law
2.3 Orbital parameters
2.4 Orbital Mechanics
2.5 Look Angle Determination
2.6 Orbital perturbations
2.7 Orbit Control system
2.8 Geo stationary orbit
2.9 Telemetry, tracking, Command and monitoring
2.10 Power systems
2.11 Communication subsystems
2.12 Transponders
2.13 Satellite Antennas
2.14 Equipment reliability and space qualification.

3. Satellite link design **(9 hours)**

3.1 Basic transmission Theory,
3.2 System noise temperature and G/T ratio,
3.3 Design of downlinks,
3.4 Satellite systems using small earth stations Uplink design,
3.5 Design for C/N:Combining C/N and C/I values in satellite links,
3.6 System design examples

9.3 GPS receivers and Codes
9.4 Satellite signal acquisition
9.5 GPS navigation message
9.6 GPS signal levels
9.7 Timing accuracy
9.8 GPS receiver operation

Practical/ Field visits

Field visits to Satellite Stations.

References:

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications", John Willy & Sons (Asia) Pvt. Ltd.
2. Dennis Roddy, "Satellite Communications", McGraw-Hill Publication.
3. James Martyn, "Communication Satellite systems", Prentice Hall.
4. Wilbur L. Pritchard, Hendri G. Suyderhoud and Robert A. Nelson, "SatelliteCommunication Systems Engineering", Prentice Hall/Pearson.
5. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan.
6. Emanuel Fthenakis, "Manual of Satellite Communications", McGraw Hill Book Co.

BIOMEDICAL INSTRUMENTATION

EX 725 03

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objectives:

To provide specific engineering and instrumentation methods and principles to acquire basic knowledge of design, its application and maintenance of different biomedical instruments.

1. Fundamental of Medical Instrumentation: **(4 hours)**

- 1.1 Biomedical Engineering and Areas of Engineering Contribution
- 1.2 Biometrics and Design Consideration Factors for Medical Instruments
- 1.3 Man Instrument System and their Objectives
- 1.4 Components of Man Instrument System

2. Bioelectric Signals and Electrodes: **(4 hours)**

- 2.1 Body System and Bioelectric Phenomenon
- 2.2 Sources of Bioelectric Signals
- 2.3 Resting and Action Potentials
- 2.4 Electrode Theory and their Equivalent Circuits
- 2.5 Types of Biopotential Electrodes
- 2.6 Application of electrodes in medical instrumentation

3. Physiological Transducers: **(4 hours)**

- 3.1 Classification of Transducers
- 3.2 Performance Characteristics of Transducers
- 3.3 Active Transducers and their Application in Medical Instruments
- 3.4 Passive Transducers and their Types used in Medical Instruments

4. Bioelectric Signals Measurement and Recording System **(10 hours)**

- 4.1 Aspects of Bioelectric Signals
- 4.2 Electrocardiography (ECG)
  - 4.2.1 Normal Characteristics of Electrocardiogram
  - 4.2.2 ECG Lead Configuration and Recording Techniques
  - 4.2.3 Computer –Aided Electrocardiograph Analysis
- 4.3 Electroencephalography (EEG)
  - 4.3.1 Electroencephalogram and Evoked Potential
  - 4.3.2 EEG Pre amplifier Design
  - 4.3.3 EEG Electrode Configuration and Recording Techniques
  - 4.3.4 Practical Details of EEG

4.4 Electromyography (EMG)
- 4.4.1 Electromyography Recording Technique
- 4.4.2 Applications of EMG

5. Non- Invasive Diagnostic Instruments **(12 hours)**

5.1 Blood Flow Measurement
- 5.1.1 Magnetic Blood Flow meter
- 5.1.2 Ultrasonic Blood Flow meter
- 5.1.3 Blood Flow Measurement by Thermal Convection
- 5.1.4 Blood Flow Measurement by Radiographic Method

5.2 Diagnostic Medical Imaging System
- 5.2.1 Radiographic Imaging System
  - 5.2.1.1 Principle of generation of X-rays and its medical properties
  - 5.2.1.1 Functional X-ray Machine
  - 5.2.1.1 Biological Effects of X-rays
- 5.2.2 Ultrasonography Imaging System
- 5.2.3 Computer Tomography (CT-Scan) System
- 5.2.4 Magnetic Resonance Imaging System (MRI)
- 5.2.5 Nuclear Medicine Machine

6. Therapeutic Instruments **(4 hours)**

6.1 Function of Kidneys
6.2 Principle of Artificial Kidneys
6.3 Heamodialysis Machine
6.4 Types of Dialyzers
6.5 Lithotripsy and its principle
6.6 Lithotripter Machine
6.7 Defibrillator Machine

7. Biomedical Telemetry and Telemedicine **(3 hours)**

7.1 Wireless Telemetry
7.2 Single Channel Telemetry System
7.3 Multi channel Telemetry
7.4 Telemedicine Using Mobile Communication Equipments

8. Electrical Safety of Medical Equipment **(4 hours)**

8.1 Physiological Effects of Electricity
8.2 Leakage Currents and Methods of Accident Prevention
8.3 Micro shocks and Macro shocks Hazards
8.4 Electrical Safety Codes and Standards
8.5 Special Safety Measures for Electrical Susceptible Patients
8.6 Power Distribution and Protection System of the Hospital

Practicals:

1. Three practical exercises based on availability of the portable medical and clinical based equipments.
2. Field Visit to Medical Institution
3. Field Visit Report and Viva Voce.

References:

1. Leslie Cromwell, et Al, " Biomedical Instrumentation and Measurements", Prentice Hall, India
2. R S Khandpur, "A Hand Book of Biomedical Instrumentation", Tata McGraw Hill

AERONAUTICAL TELECOMMUNICATION

EX725 04

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : I

Course Objectives:

To give the basic understanding of aviation related ground based electronics equipment used for Communication, Navigation and Surveillance and their theory of operation.

1. Introduction to Aviation **(4 hours)**

History of Aviation, Aircraft, Airport, Airspace, Air Traffic Control and Air Traffic Management

2. Aeronautical Communication **(5 hours)**

Aviation Band , ICAO and ITU , VHF Air to Ground communication, HF Ground to Ground communication, Interference, Data link, AFTN/ATN/ AMHS

3. Aeronautical Navigation **(9 hours)**

3.1 Introduction
Introduction to Navigation, Piloting, Dead Reckoning, Radio Navigation, Ground Based Navigation System

3.2 Non Directional Radio Beacon (NDB)
NDB as a navigational aid, working principle, Uses of NBD, Advantages of NBD, Limitations of NDB , Sitting Requirements, Antenna System, Types of Antennas, Factors affecting NDB Antenna, Role of Top, loading, Transmitting equipment, Monitoring and Calibration.

3.3 VHF Omni Directional Radio Range (VOR)
VOR as a navigational aid, Frequency band, general principal of operation, basic VOR transmission techniques, rotation of cardioids, VOR errors, sitting requirements, Doppler VOR (DVOR), principal of operations of DVOR and its types, advantages of DVOR over conventional VOR, airborne VOR receiver, antenna system, conventional and Doppler VOR antenna, Transmitting techniques (i) conventional VOR (ii) Doppler VOR, monitoring and calibration.

4. Aeronautical Equipment **(9 hours)**

4.1 Distance Measuring Equipment (DME)
DME as a navigational aid, principal of operation, applications, Gaussian pulse, DME errors and echo suppression techniques, Airborne Interrogator, Sitting requirements, antenna system, monitoring and calibrations

4.2 Instrument Landing System (ILS)
ILS as a landing aid, co-location of DME with ILS, coverage of an ILS, Marker Beacons, siting requirements, general transmitting techniques, generation of DDM, localizer and glide slope equipment and antenna system.

5. Aeronautical Surveillance **(8 hours)**

History of Radar, Types of Airport Surveillance Radar, Theory of Primary and Secondary Surveillance Radar, Monopulse SSR and Mode-S, Radar Data Processing System, Introduction to Automatic Dependence Surveillance and Multi Lateration system.

6. Aeronautical Mobile Satellite System (AMSS) and Global NavigationSatellite system (GNSS) **(4 hours)**

International maritime satellite System (Inmarsat), International Telecommunication Satellite System (Intelsat), Global Positioning System (GPS), Global Orbiting Navigation Satellite System (GLONASS).

7. Basics of Aircraft Avionics Equipment **(6 hours)**

Aircraft HF, VHF and Satellite Communication equipment, Radio compass, Radio Magnetic Indicator (RMI), Horizontal Situation Indicator, Automatic Direction Finder, SSR Tansponder, Flight Data and Voice Recorders.

Practical

1. Field visits to Avionics Communication Stations and Centers.
2. Reports writing on various Surveillance/Navigation/Other Instruments which are specific to avionics communication

References

1. H.V Sudarsan, "Seamless Sky", Ashgate Publishing limited, England
2. Donald J. Clausing, "Aviator's Guide to Navigation"
3. J.S. Chitode, "Principles of communication"
4. Dale Stacey, "Aeronautical Radio Communication system and Networks"
5. International Civil Aviation Organization, Global Air Navigation Plan for
6. CNS/ATM systems (Doc9750)

ENGINEERING PROFESSIONAL PRACTICE

CE 752

Lecture : 2
Tutorial : 0
Practical : 0

Year : IV
Part : II

Course Objective:

To familiarize the students with their roles in the society, ethical and legal environment in which engineering is practiced, contract administration, regulatory environment and contemporary issues in Engineering.

1. History of Engineering Practices **(3 hours)**

1.1 Man and Society
1.2 Technology and Society
1.3 History of Engineering Practice in Eastern Society
1.4 History of Engineering Practice in Western society
1.5 Engineering Practices in Nepal

2. Profession and Ethics **(6 hours)**

2.1 Profession: Definition and Characteristics
2.2 Professional Institutions
2.3 Relation of an Engineer with Client, Contractor and Fellow Engineers
2.4 Ethics, Code of Ethics and Engineering Ethics
2.5 Moral Dilemma and Ethical Decision Making
2.6 Detailed Duties of an Engineer and Architect
2.7 Liability and Negligence

3. Professional Practices in Nepal **(3 hours)**

3.1 Public Sector practices
3.2 Private Sector Practices
3.3 General Job Descriptions of Fresh Graduates in both Public and Private Sector

4. Contract Management **(6 hours)**

4.1 Methods of work execution/contracting
4.2 Types of Contracts
4.3 Tendering Procedure
4.4 Contract agreement

5. Regulatory Environment **(5 hours)**

5.1 Nepal Engineering Council Act
5.2 Labor Law
5.3 Intellectual Property Right
5.4 Building Codes and Bylaws
5.5 Company Registration

6. Contemporary Issues in Engineering **(3 hours)**

6.1 Globalization and Cross Cultural Issues
6.2 Public Private Partnership
6.3 Safety, Risk and Benefit Analysis
6.4 Development and Environment
6.5 Conflict and Dispute Management

7. Case Studies based on Engineering Practices **(4 hours)**

References:

1. Carson Morrison and Philip Hughes "Professional engineering Practice – Ethical Aspects", McGraw-Hill Ryerson Ltd.' Toronto.
2. Dr Rajendra Adhikari, "Engineering Professional Practice – Nepalese and international Perspectives" Pashupati Publishing House, Kathmandu Nepal.
3. M. Govindarajan; S Natarajan and V.S. Senthikumar., " Engineering Ethics" – PHI Learning Pvt. Ltd. New Delhi.
4. Nepal Engineering Council Act
5. Contract Act
6. Labor Act
7. Company Act
8. Copyright Act
9. Public Procurement Act
10. Building By-Laws

WIRELESS COMMUNICATIONS

EX 751

Lecture : 3
Tutorial : 0
Practical : 0

Year : IV
Part : II

Course Objectives:

To introduce the student to the principles and building blocks of wireless communications.

1. Introduction **(2 hours)**

1.1 Evolution of wireless (mobile) communications, worldwide market, examples
1.2 Comparison of available wireless systems, trends
1.3 Trends in cellular radio (2G, 2.5G, 3G, beyond 3G) and personal wireless communication systems

2. Cellular mobile communication concept **(4 hours)**

2.1 Frequency re-use and channel assignment strategies
2.2 Handoff strategies, types, priorities, practical considerations
2.3 Interference and system capacity, co-channel and adjacent channel interference, power control measures
2.4 Grade of service, definition, standards
2.5 Coverage and capacity enhancement in cellular network, cell splitting, sectoring, repeaters, microcells

3. Radio wave propagation in mobile network environment **(12 hours)**

3.1 ReviewFree space propagation model, radiated power and electric field
3.2 ReviewPropagation mechanisms (large-scale path loss) - Reflection, ground reflection, diffraction and scattering
3.3 Practical link budget design using path loss models.
3.4 Outdoor propagation models (Longley-Rice, Okumura, Hata, Walfisch and Bertoni, microcell)
3.5 Indoor propagation models (partition losses, long-distance path loss, multiple breakpoint, attenuation factor)
3.6 Small scale fading and multipath (factors, Doppler shift), Impulse response model of multipath channel, multipath measurements, parameters of mobile multipath channel (time dispersion, coherence bandwidth, Doppler spread and coherence time)
3.7 Types of small-scale fading (flat, frequency selective, fast, slow), Rayleigh and Ricean fading distribution

4. Modulation-Demodulation methods in mobile communications **(4 hours)**

4.1 Review of amplitude (DSB, SSB, VSB) and angle (frequency, phase) modulations and demodulation techniques

4.2 Review of line coding, digital linear (BPSK, DPSK, QPSKs) and constant envelop (BFSK, MSK, GMSK) modulation and demodulation techniques
4.3 M-ary (MPSK, MFSK, QAM and OFDM) modulation and demodulation techniques
4.4 Spread spectrum modulation techniques, PN sequences, direct sequence and frequency hopped spread spectrums
4.5 Performance comparison of modulations techniques in various fading channels

5. Equalization and diversity techniques **(4 hours)**

5.1 Basics of equalization. Equalization in communications receivers, linear equalizers
5.2 Non-linear equalization, decision feedback and maximum likelihood sequence estimation equalizations
5.3 Adaptive equalization algorithms, zero forcing, least mean square, recursive least squares algorithms, fractionally spaced equalizers
5.4 Diversity methods, advantages of diversity, basic definitions
5.5 Space diversity, reception methods (selection, feedback, maximum ratio and equal gain diversity)
5.6 Polarization, frequency and time diversity
5.7 RAKE receivers and interleaving

6. Speech and channel coding fundamentals **(4 hours)**

6.1 Characteristics of speech signals, frequency domain coding of speech (sub-band and adaptive transform coding)
6.2 Vocoders (channel, formant, cepstrum and voice-excited), Linear predictive coders (multipulse, code and residual excited LPCs), Codec for GSM mobile standard
6.3 Review of block codes, Hamming, Hadamard, Golay, Cyclic, Bosh-Chaudhary- Hocquenghgem (BCH), Reed-Solomon (RS) codes
6.4 Convolutional codes, encoders, coding gain, decoding algorithms (Viterbi and others)
6.5 Trellis Code Modulation (TCM), Turbo codes

7. Multiple Access in Wireless communications **(9 hours)**

7.1 Frequency Division Multiple Access (FDMA), principles and applications
7.2 Time Division Multiple Access (TDMA), principles and applications
7.3 Spread Spectrum Multiple Access, Frequency Hopped Multiple Access, Code Division Multiple Access, hybrid spread spectrum multiple access techniques
7.4 Space Division Multiple Access
7.5 Standards for Wireless Local Area Networks

8. Wireless systems and standards **(6 hours)**

8.1 Evolution of wireless telephone systems: AMPS, PHS, DECT, CT2, IS-94, PACS, IS-95, IS-136, IS-54 etc.

8.2 Global system for Mobile (GSM): Services and features, system architecture, radio sub-system, channel types (traffic and control), frame structure, signal processing, example of a GSM call

8.3 CDMA standards: Frequency and channel specifications, Forward and Reverse CDMA channels

8.4 WiFi, WiMax, UMB, UMTS, CDMA-EVDO, LTE, and recent trends

8.5 Regulatory issues (spectrum allocation, spectrum pricing, licensing, tariff regulation and interconnection issues)

Practicals:

1. Case study and field visit
2. Visit to mobile service operator, network service provider, internet service provider.

References:

1. K. Feher, Wireless Digital Communications
2. T. Rappaport, Wireless Communications
3. J. Schiller, Mobile Communications
4. Leon Couch, Digital and analog communication systems
5. B.P.Lathi, Analog and Digital communication systems
6. J. Proakis, Digital communication systems
7. D. Sharma, Course manual "Communication Systems II".

RF AND MICROWAVE ENGINEERING

EX 752

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To understand the fundamentals of Radio Frequency (RF) and Microwave (M/W) theory and applications, design and analysis practices, and measurement techniques.

1. Introduction **(3 hours)**

1.1 Standard frequency bands
1.2 Behaviour of circuits at conventional and RF/microwave bands
1.3 Microwave applications

2. RF and M/W Transmission Lines **(6 hours)**

2.1 Types of transmission lines
2.2 Transmission line theory
2.3 Smith Chart analysis
2.4 Impedance transformations and matching analysis

3. RF an M/W Network Theory and Analysis **(4 hours)**

3.1 Scattering matrix and its properties
3.2 S-Parameter derivation and analysis

4. RF/Microwave Components and Devices **(8 hours)**

4.1 Coupling probes
4.2 Coupling loops
4.3 Waveguide
4.4 Termination, E-plane Tee, H-plane Tee, Magic Tee
4.5 Phase-Shifter
4.6 Attenuators
4.7 Directional coupler
4.8 Gunn diode
4.9 Microwave transistor
4.10 MASER
4.11 Resonator and circulators

5. Microwave Generators **(5 hours)**

5.1 Transit-time effect
5.2 Limitations of conventional tubes

5.3 Two-cavity and multi-cavity klystrons
5.4 Reflex klystron
5.5 TWT and magnetrons

6. RF Design Practices **(10 hours)**

6.1 RF Low pass filter
  6.1.1 Insertion loss
  6.1.2 Frequency scaling
  6.1.3 Microstrip implementation
6.2 RF Amplifier
  6.2.1 Amplifier theory
  6.2.2 Design and real world consideration
6.3 Oscillator and mixer
  6.3.1 Oscillator and super mixing theory
  6.3.2 Design and real world consideration

7. Microwave Antennas and Propagation **(3 hours)**

7.1 Antenna types
7.2 Propagation characteristics of microwave antennas
7.3 RF an M/W radiation, safety practices and standards

8. RF/Microwave Measurements **(6 hours)**

8.1 Power measurement
8.2 Calorimeter method
8.3 Bolometer bridge method
8.4 Thermocouples
8.5 Impedance measurement
8.6 RF frequency measurement and spectrum analysis
8.7 Measurement of unknown loads
8.8 Measurement of reflection coefficient
8.9 VSWR and Noise

Practicals:

1. Illustration of Smith Chart and load analysis
2. Introduction to RF and M/W signal and circuits, measuring techniques, instrumentations, and practices
3. Designing and analysis of simple strip-line and two-port circuits using network and spectrum analysers
4. Software-based (ADS-like) RF signal & circuit simulation practices

References:

1. Herbert J. Reich and et al., Van Nostard Reinhold, " Microwave Principles",
2. K.C. Gupta, "Microwave Electronics", Tata McGraw Hill.

3. A. K. Gautam, "Microwave Engineering" , S. K. Kataria & Sons.
4. D.C. Agrawal, "Microwave Techniques" , Tata McGraw Hill.
5. R. Chatterjee, "Elements of Microwave Engineering" ,Tata McGraw Hill.
6. Samuel Y. Liao, "Microwave Devices & Circuits", PHI.
7. David M. Pozar, "Microwave Engineering", John Wiley & Sons.
8. Newington "ARRL UHF/Microwave Experimenter's Manual", CT.
9. W. H. Hayt, "Engineering Electromagnetics" , McGraw-Hill Book Company.
10. A. Das, "Microwave Engineering", Tata McGraw Hill.
11. William Sinnema, "Electronic Transmission Technology: Lines, Waves, and Antennas", Prentice Hall.

DIGITAL SIGNAL PROCESSING

EX 753

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To introduce digital signal processing techniques and applications, and to design and implement IIR and FIR digital filter.

1. Introduction **(4 hours)**

1.1 Basic elements of Digital Signal Processing,
1.2 Need of Digital Signal Processing over Analog Signal Processing,
1.3 A/D and D/A conversion,
1.4 Sampling continuous signals and spectral properties of sampled signals

2. Discrete-time Signals and System **(6 hours)**

2.1 Elementary discrete-time signals,
2.2 Linearity, Shift invariance, Causality of discrete systems,
2.3 Recursive and Non-recursive discrete-time systems,
2.4 Convolution sum and impulse response,
2.5 Linear Time-invariant systems characterized by constant coefficient difference equations,
2.6 Stability of LTI systems, Implementation of LTI system.

3. Z-Transform **(6 hours)**

3.1 Definition of the z-transform,
3.2 One-side and two-side transforms, ROC, Left-side, Right-sided and two-sided sequences, Region of convergence, Relationship to causality,
3.3 Inverse z-transform-by long division, by partial fraction expansion,
3.4 Z-transform properties-delay advance, Convolution, Parseval's theorem,
3.5 Z-transform function H(z)-transient and steady state sinusoidal response, pole-zero relationship stability.

4. Discrete Fourier Transform **(7 hours)**

4.1 Definition and applications, Frequency domain sampling and for reconstruction, Forward and Reverse transforms, Relationship of the DFT to other transforms,
4.2 Properties of the Discrete Fourier Transform: Periodicity, Linearity and Symmetry Properties, Multiplication of two DFTs and Circular Convolution, Time reversal, Circular time shift and Multiplication of two sequences circular frequency shift, Circular correlation and Parseval's Theorem,

4.3 Efficient computation of the DFT: Algorithm, applications, Applications of FFT Algorithms.

5. Implementation of Discrete-time System **(8 hours)**

5.1 Structures for FIR and IIR, Direct Form, Cascaded and parallel form, Lattice for FIR,
5.2 Conversion between direct form and lattice and vice verse, Lattice and lattice-ladder for IIR,
5.3 Frequency response,
5.4 Digital filters, finite precision implementations of discrete filters,
5.5 Representation of Numbers; fixed point and floating binary point, Effect of Rounding and truncation; Limit cycle oscillations effect,
5.6 Quantization of filter coefficients and effects on location of poles, and zeros; pole perturbation, Overflow and underflow error, Scaling to prevent overflow and underflow.

6. IIR Filter Design **(5 hours)**

6.1 IIR Filter Design: IIR filter design by classical filter design using low pass approximations Butterworth, Chebychev, Inverse Chebyshev, Elliptic and Bessel-Thompson filters,
6.2 IIR filter design by Impulse-invariant method, Bilinear Transformation Method, Matched z-transform method,
6.3 IIR lowpass discrete filter design using bilinear transformation,
6.4 Spectral transformations, Highpass, Bandpass and Notch filters.

7. FIR Filter Design **(5 hours)**

7.1 FIR filter design by Fourier approximation,
7.2 Gibbs phenomena in FIR filter design, Design of Linear Phase FIR filters using window function, Applications of window functions to frequency response smoothing,
7.3 Window functions, Rectangular, Hamming, Blackman and Kaiser windows,
7.4 Design of linear phase FIR filter by the frequency sampling method,
7.5 FIR filter design using the Remez exchange algorithm,
7.6 Design of optimum equiripple linear-phase FIR filters.

8. Digital Filter Implementation **(4 hours)**

8.1. Implementations using special purpose DSP processors,
8.2. Bit-serial arithmetic, pipelined implementations,
8.3. Distributed arithmetic implementations.

Practical:

1. Study the behavior of a simple digital notch filter.
2. Response of a recursive digital.
3. Scaling, dynamic range and noise behavior of a recursive digital filter, observation of nonlinear finite precision effects.

4. Response of a non-recursive digital filter, Implementation in Impulse Invariant and Bilinear Transformation.
5. Band pass filters implemented using cascade second order sections and wave or ladder filters, Comparison of implementations.
6. Design of FIR filter using window method, Comparison of FIR filter for different windowing method.

References:

1. J.G. Proakis and D.G. Manolakis, "Digital Signal Processing", Prentice Hall of India.
2. A.V. Oppenheim, "Discrete-Time Signal Processing", Prentice Hall.
3. S.K. Mitra, "Digital Signal Processing, A Computer-based Approach", McGraw Hill.

PROJECT-II

EX755

Lecturer : 0
Tutorial : 0
Practical : 6

Year : IV
Part : II

Course Objectives:

The objective of this project work is to develop hands-on experience of working in a project. During the course, students have to design and complete a functional project which should require integration of various course concepts. Students will develop various skills related to project management like team work, resource management, documentation and time management.

1. Group formation (Not exceeding 4 persons per group)
2. Project concept development (software engineering concept must include for computer engineering and hardware / software elements include electronics & communication engineering)
3. Proposal preparation (proposal content: title, objective, scope of project, methodology, expected outcome, hardware/software element, list of equipment, and historical background and reviewed should be clearly reflected)
4. Project documentation (follow the project documentation guideline)

Evaluation Scheme:

Project (Part B): Internal and Final Evaluation is done on the basis of Regularity of the work, Completeness of project, Documentation, Progress Presentation and Final Presentation.

ELECTIVE II

AGILE SOFTWARE DEVELOPMENT

CT 765 02

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

- To deliver adaptable software iterations and releases based on Agile methodologies
- To minimize bugs and maximize productivity with Test-Driven Development and Unit Testing
- To Achieve quality design by adopting established coding principles
- To Provide an illustration on real life Agile Implementation through a case study in Extreme Programming
- To adopt best practices to successfully manage Agile projects

1. Review of Traditional Approaches **(4 hours)**

1.1 Overview of Waterfall Model
1.2 Overview of Spiral Model
1.3 Limitation of Traditional Approaches

2. Introduction to Agile Methodologies **(4 hours)**

2.1 Need of Agile Methodologies
2.2 Objectives of Agile Methodologies
2.3 Agile Implementations and Variants
2.4 Introduction to the Agile Manifesto

3. Planning an Agile Project **(6 hours)**

3.1 Establishing the Agile project
  3.1.1 Adopting the best practices of the Agile Manifesto
  3.1.2 Recognizing the structure of an Agile team
  3.1.3 Programmers
  3.1.4 Managers
  3.1.5 Customers
3.2 Developing a Foundation with User Stories
  3.2.1 Eliciting application requirements
  3.2.2 Writing user stories
3.3 Estimating and "The Planning Game"
  3.3.1 Defining an estimation unit
  3.3.2 Distinguishing between release and iteration

3.3.3 Prioritizing and selecting user stories with the customer
3.3.4 Projecting team velocity for releases and iterations

4. Agile Iterations **(5 hours)**

4.1 Breaking user stories into tasks
4.1.1 Recognizing a program's main purpose
4.1.2 Prioritizing tasks for a cohesive design
4.1.3 The Agile coding process
4.1.4 Write Test, Write Code, Refactor
4.1.5 Allocating time for a spike

5. Test Driven Development **(12 hours)**

5.1 Design process with automated testing
5.1.1 Introduction to Test Driven Development
5.1.2 Writing a User Acceptance Test
5.1.3 Compiling and Running tests
5.2 Integrating Unit Testing
5.2.1 Distinguishing between user tests and unit tests
5.2.2 Developing effective test suites
5.2.3 Achieving "green lights" through continuous testing
5.3 Optimizing test-driven development
5.3.1 Drafting a unit test that is simple, isolated and fast
5.3.2 Isolating classes for effective testing
5.3.3 Creating mock objects for testing
5.4 Refactoring
5.4.1 Code Duplication
5.4.2 Renaming fields and methods
5.4.3 Extracting methods and base classes
5.4.4 Programming by intention

6. Managing Agile Projects **(4 hours)**

6.1 Delivering the first release
6.2 Planning the next release
6.3 Adapting Agile to fit Development Methodology

7. Extreme Programming **(10 hours)**

7.1 Core Principles and Practices
7.2 Requirements and User Stories
7.3 Release Planning
7.4 Iteration Planning
7.5 Customer Tests
7.6 Small, Regular Releases

7.7 Pair Programming
7.8 Continuous Integration
7.9 Collective Code Ownership
7.10 Team Roles
7.11 Case Study

References

1. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices", Prentice Hall.
2. Andrew Hunt, David Thomas,"The Pragmatic Programmer: From Journeyman to Master", Addison-Wesley Professional.

NETWORKING WITH IPV6

CT 765 03

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objective:

To know the fundamental issues in network protocol design and implementation with the principles underlying TCP/IP protocol design; historical development of the Internet Protocol Version-6; IPv6 and QoS, IP network migrations and applications.

1. Internet and the Networking Protocols **(3 hours)**

- 1.1 Historical Development
- 1.2 OSI Model
- 1.3 Internet IP/UDP/TCP
- 1.4 IPv4 Addressing Review

2. Next Generation Internet Protocol **(14 hours)**

- 2.1 Internet Protocol Version 6 (IPv6)
  - 2.1.1 History of IPv6
  - 2.1.2 IPv6 Header Format
  - 2.1.3 Problems with IPv4
  - 2.1.4 Features of IPv6
  - 2.1.5 IPv6 Addressing format and Types
- 2.2 ICMPv6
  - 2.2.1 Features
  - 2.2.2 General Message Format
  - 2.2.3 ICMP Error & Informational Message types
  - 2.2.4 Neighbor Discovery
  - 2.2.5 Path MTU Discovery

3. Security and Quality of Service in IPv6 **(5 hours)**

- 3.1 Types of Threats
- 3.2 Security Techniques
- 3.3 IPSEC Framework
- 3.4 QoS in IPv6 Protocols

4. Routing with IPv6 **(6 hours)**

- 4.1 Routing in the Internet and CIDR

4.2 Multicasting
4.3 Unidirectional Link Routing
4.4 RIPng
4.5 OSPF for IPv6
4.6 PIM-SM & DVMRP for IPv6

5. IPv4/IPv6 Transition Mechanisms **(8 hours)**

5.1 Tunneling
5.1.1 Automatic Tunneling
5.1.2 Configured tunneling
5.2 Dual Stack
5.3 Translation
5.4 Migration Strategies for Telcos and ISPs.

6. IPv6 Deployment **(6 hours)**

6.1 Challenges and Risks
6.2 IPv6 Deployment Plan
6.3 IPv6 DNS (AAAA & A6 records)
6.4 IPv6 enabled Proxy, Web & Mail Servers

7. Advanced Applications **(3 hours)**

7.1 MPLS
7.2 NGN

Practical:

For practical, one PC to one student either in virtual environment or real environment will be provided. Students will be divided into group which consists of 3 students. The working environment and machine connectivity will look like the following:

Tools Needed: TCPDUMP & WIRESHARK

1. Enable IPv6 in Windows/Linux
2. IPv6 Header Analysis
3. IPv6 Packet analysis (neighbor/router solicitation/discovery)
4. Unicast Routing Implementation using Zebra-OSPF & OSPF phase analysis
5. Multicast Routing Implementation using XORP-PIM/SM & PIM/SM phase analysis
6. IPv6 DNS/WEB/Proxy implementation & test
7. Case Study

Reference:

1. Joseph Davice, "Understanding IPv6
2. Silvia Hagen, "IPv6 Essentials", O'reilly
3. S. A. Thomas, "IPng and the TCP/IP Protocols", Wiley.
4. O. Hersent, D. Gurle, J.-P. Petit, "IP Telephony", Addison-Wesley.

ADVANCED COMPUTER ARCHITECTURE

CT 765 04

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

To provide advanced knowledge of computer architecture including parallel architectures, instruction-level parallel architectures, superscalar architectures, thread and process-level parallel architecture.

1. Computational models **(5 hours)**

1.1 computational model,
1.2 the von Neumann Computational model,
1.3 Evolution and interpretation of the concept of computer architecture,
1.4 Interpretation of the concept of the computer architectures at different levels of abstraction,
1.5 Multilevel hierarchical framework

2. Parallel Processing **(8 hours)**

2.1 Process, Thread, Processes and threads in languages,
2.2 Concurrent and parallel execution and programming languages,
2.3 Types of available parallelism,
2.4 Levels of available functional parallelism,
2.5 Utilization of functional parallelism,
2.6 Classification of parallel architectures,
2.7 Relationships between languages and parallel architectures

3. Pipelined Processors **(8 hours)**

3.1 Principle of pipelining,
3.2 Structure of pipelines,
3.3 Performance measures,
3.4 Application scenarios of pipelines,
3.5 Layout of a pipeline, Dependence resolution,
3.6 Design space,
3.7 pipelined processing of loads and stores

4. Superscalar Processors **(8 hours)**

4.1 The emergence and widespread adaption of superscalar processors,
4.2 Specific tasks of superscalar processing,
4.3 Parallel decoding,
4.4 superscalar instruction issue,
4.5 Scope of shelving,
4.6 Layout of shelving buffers,
4.7 Operand fetch policies,

4.8 Instruction dispatch schemes ,
4.9 Scope of register renaming with example

5. Processing of control transfer Instructions (6 hours)

5.1 Types of branches, Performance measures of branch processing ,
5.2 Branch handling ,
5.3 Delayed branching,
5.4 Branch processing,
5.5 Multiday branching

6. Thread and process-level parallel architectures (10 hours)

6.1 MIMD architectures
6.2 Distributed memory MIMD architectures,
6.3 Fine-gain and Medium-gain systems,
6.4 Coarse-grain multicomputer,
6.5 Cache coherence
6.6 Uniform memory access(UMA) machines,
6.7 Cache-coherent non-uniform memory access(CC-NUMA) machines,
6.8 Cache only memory architecture(COMA)

References:

1. Deszo Sima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architectures: a design space approach",
2. John P. Hayes, "Computer Architecture and organization",
3. David A. Patterson, John L. Hennessy, "Computer Organization and Design",

INFORMATION SYSTEMS

CT 765 05

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

To introduce and apply the knowledge of computer based information systems. It also provides the concept to the student in designing and setting up complex information system.

1. Information system **(3 hours)**

1.1 Classification and evolution of IS
1.2 IS in functional area.
1.3 Information system architecture
1.4 Qualities of information systems
1.5 Managing Information System resources
1.6 Balanced Scorecard – case studies

2. Control, Audit and Security of Information system **(5 hours)**

2.1 Control of information system
2.2 Audit of information system
2.3 Security of information system
2.4 Consumer layered security strategy
2.5 Enterprise layered security strategy
2.6 Extended validation and SSL certificates
2.7 Remote access authentication
2.8 Content control and policy based encryption
2.9 Example of security in e-commerce transaction

3. Enterprise Management Systems **(4 hours)**

3.1 Enterprise management systems (EMS)
3.2 Enterprise Software: ERP/SCM/CRM
3.3 Information Management and Technology of Enterprise Software
3.4 Role of IS and IT in Enterprise Management
3.5 Enterprise engineering, Electronic organism, Loose integration vs. full integration, Process alignment, Frame work to manage integrated change, future trends.

4. Decision support and Intelligent systems **(7 hours)**

4.1 DSS, operations research models
4.2 Group decision support systems

4.3 Enterprise and executive decision support systems
4.4 Knowledge Management, Knowledge based Expert system
4.5 AI, Neural Networks, Virtual reality, Intelligent Agents
4.6 Data mining, Data ware Housing, OLAP, OLTP
4.7 Anomaly and fraud detection

5. Planning for IS **(3 hours)**

5.1 Strategic information system
5.2 Tactical information system
5.3 Operational information systems

6. Implementations of Information Systems **(7 hours)**

6.1 Change Management
6.2 Critical Success Factors
6.3 Next generation Balanced scorecard

7. Web based information system and navigation **(8 hours)**

7.1 The structure of the web
7.2 Link Analysis
7.3 Searching the web
7.4 Navigating the web
7.5 Web uses mining
7.6 Collaborative filtering
7.7 Recommender systems
7.8 Collective intelligence

8. Scalable and Emerging Information System techniques **(8 hours)**

8.1 Techniques for voluminous data
8.2 Cloud computing technologies and their types
8.3 MapReduce and Hadoop systems
8.4 Data management in the cloud
8.5 Information retrieval in the cloud
8.6 Link analysis in cloud setup
8.7 Case studies of voluminous data environment

Practicals:

The practical exercise shall include following three types of projects on designing of information system

1. E-commerce based information system for online transaction processing
2. web uses mining or collaborative filtering based processing system
3. scalable and emerging information system

References:

1. Leonard Jessup and Joseph Valacich , "Information Systems Today" , Prentice hall.
2. J.Kanter, "Managing With Information System", PHI.
3. M. Levene, "An Introduction to Search Engines and Web Navigation", Pearson Education,
4. Jimmy Lin and Chris Dyer, Morgan and Claypool, " Data-Intensive Text Processing with Map Reduce".
5. Jothy Rosenberg and Arthur Mateos , "The Cloud at Your Servic", Manning.

BIG DATA TECHNOLOGIES

CT 765 07

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

To introduce the current scenarios of big data and provide various facets of big data and to be familiar with the technologies playing key role in it and equips them with necessary knowledge to use them for solving various big data problems in different domains.

1. Introduction to Big Data **(7 hours)**

1.1 Big Data Overview
1.2 Background of Data Analytics
1.3 Role of Distributed System in Big Data
1.4 Role of Data Scientist
1.5 Current Trend in Big Data Analytics

2. Google File System **(7 hours])**

2.1 Architecture
2.2 Availability
2.3 Fault tolerance
2.4 Optimization for large scale data

3. Map-Reduce Framework **(10 hours)**

3.1 Basics of functional programming
3.2 Fundamentals of functional programming
3.3 Real world problems modeling in functional style
3.4 Map reduce fundamentals
3.5 Data flow (Architecture)
3.6 Real world problems
3.7 Scalability goal
3.8 Fault tolerance
3.9 Optimization and data locality
3.10 Parallel Efficiency of Map-Reduce

4. NoSQL **(6 hours)**

4.1 Structured and Unstructured Data
4.2 Taxonomy of NoSQL Implementation
4.3 Discussion of basic architecture of Hbase, Cassandra and MongoDb

5. Searching and Indexing Big Data **(7 hours)**

5.1 Full text Indexing and Searching
5.2 Indexing with Lucene
5.3 Distributed Searching with elasticsearch

6. Case Study: Hadoop **(8 hours)**

6.1 Introduction to Hadoop Environment
6.2 Data Flow
6.3 Hadoop I/O
6.4 Query languages for Hadoop
6.5 Hadoop and Amazon Cloud

Practical

Student will get opportunity to work in big data technologies using various dummy as well as real world problems that will cover all the aspects discussed in course. It will help them gain practical insights in knowing about problems faced and how to tackle them using knowledge of tools learned in course.

1. HDFS: Setup a hdfs in a single node to multi node cluster, perform basic file system operation on it using commands provided, monitor cluster performance
2. Map-Reduce: Write various MR programs dealing with different aspects of it as studied in course
3. Hbase: Setup of Hbase in single node and distributed mode, write program to write into hbase and query it
4. Elastic Search: Setup elastic search in single mode and distributed mode, Define template, Write data in it and finally query it
5. Final Assignment: A final assignment covering all aspect studied in order to demonstrate problem solving capability of students in big data scenario.

References

1. Jeffrey Dean, Sanjay Ghemawat, Map Reduce, "Simplified Data Processing on Large Clusters"
2. Sanjay Ghemawat, Howard Gobioff, and Shun-Tak Leung, "The Google File System"
3. http://wiki.apache.org/hadoop/

OPTICAL FIBER COMMUNICATION SYSTEM

EX 765 01

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objective:

To introduce the concept of optical fiber communication

1. Introduction to Optical Fiber Communication **(2 hours)**

1.1 Evolution of optical fiber communication
1.2 Optical fiber communication system
1.3 Advantage of optical fiber communication
1.4 Applications of optical fiber communication

2. Light Transmission in Optical Fiber **(2 hours)**

2.1 Introduction of optical fiber structure
2.2 Total internal reflection
2.3 Acceptance angle
2.4 Numerical aperture
2.5 Meridional and skew rays in optical wave guide

3. Electromagnetic Theory for Optical Propagation **(2 hours)**

3.1 Review of Maxwell's equation
3.2 The wave equation for slab waveguide
3.3 Wave equation for cylindrical waveguide

4. Mode Propagation in Optical Waveguide **(3 hours)**

4.1 Modes in a planar optical guide
4.2 Phase and group velocity
4.3 Evanescent field
4.4 Modes in cylindrical optical waveguide
4.5 Mode coupling

5. Optical Fibers **(5 hours)**

5.1 Introduction and types
5.2 Modes in multimode fibers: step index and graded index
5.3 Modes in step index and graded index single mode fiber
5.4 Cutoff wavelength, mode-field diameter and spot size
5.5 Transmission properties of optical fiber
5.6 Fiber attenuation
5.7 Fiber bend loss
5.8 Fiber dispersion

Practicals:

1. Familiarization with optical fiber laboratory, safety and precaution. Demonstration of the concept of light propagation in optical waveguide with the help of polymer rod and water spout
2. Determination of fiber numerical aperture and fiber attenuation
3. Plotting a power-current characteristic for LED
4. Determination of different optical fiber connector losses.
5. Determination of coupling efficiency/loss from source to fiber, fiber to fiber, and fiber to photodetector.
6. Digital optical transmission.

References:

1. John M. Senior, "Optical Fiber Communications – Principles and Practice", Prentice Hall.
2. William B. Jones. Jr. "Introduction to Optical Fiber Communication Systems", Holt, Rinheart and Winston, Inc.
3. Gerd Keiser, "Optical Fiber Communication", Second edition, McGraw Hill, Inc.
4. Roshan Raj Karmacharya, "Passive Optical Fiber LAN Design". M.Sc. Thesis, University of Calgary, Canada.

BROADCAST ENGINEERING

EX 765 03

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

- To make students familiar with the applications in different areas of broadcasting such as television, AM, FM, cable television, telecommunications, data communications, studio acoustics etc. through experiments and field researches
- To presenta complete perspective of basic equipments or devices used for transmission of signals such as filters and oscillators, radio frequency power amplifiers and mixers, basic circuits of modulation and demodulation, transmitters and studio equipments
- To study and understand the basic concepts of broadcasting and obtain the knowledge of designing a simple AM/FM transmitter

1. Audio Principles **(2 hours)**

1.1 Decibel scale and units
1.2 Balanced lines
1.3 Principles and types of microphones
1.4 Basic audio measurements and test gear
1.5 Sampling theory and its application to audio signals
1.6 Audio data rate reduction systems for recording and transport of audio signals including an overview of psychoacoustic techniques

2. Television Principles **(10 hours)**

2.1 Concepts of Scanning
2.2 Video waveform signal bandwidth
2.3 Low frequency response and DC restoration
2.4 Sampling theory and it's application to the digital studio standard
2.5 Effect of distortion and bit errors on picture
2.6 Generation of color component signals
2.7 International TV standards: Overview of different PAL standards, SECAM and NTSC, Problems of standards conversion

3. AM Transmitter **(9 hours)**

AM transmitter circuits and its modulation process

4. FM Transmitter **(4 hours)**

To know the basic FM transmitter circuits and its modulation process

5. AM Broadcasting **(3 hours)**

To know the actual set-up of devices/equipments used in AM broadcasting

6. **FM Broadcasting** **(4 hours)**

To know the actual set-up of devices/equipments used in FM broadcasting

7. **TV Broadcasting** **(4 hours)**

To know the actual set-up of devices/equipments used in TV broadcasting

8. **CATV Broadcasting** **(4 hours)**

To know the actual set-up of devices/equipments used in CATV broadcasting

9. **Satellite Navigation and Global Positioning System:** **(5 hours)**

9.1 Radio and Satellite navigation
9.2 GPS position location principles
9.3 GPS receivers and Codes
9.4 Satellite signal acquisition
9.5 GPS navigation message
9.6 GPS signal levels
9.7 Timing accuracy
9.8 GPS receiver operation

Practical:

1. Field visit to broadcasting stations
2. Field visit to VSAT stations.

References:

1. Roy Blake, "Comprehensive Electronic Communication", West Publishing Co.
2. B. Grob and Charles E. Herndon, "Basic Television and Video Systems", McGraw-Hill.

DATABASE MANAGEMENT SYSTEMS

EX 765 06

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To provide fundamental concept, theory and practices in design and implementation of Database Management System.

1. Introduction (3 hours)

1.1 Concepts and Applications
1.2 Objective and Evolution
1.3 Data Abstraction and Data Independence
1.4 Schema and Instances
1.5 Concepts of DDL, DML and DCL

2. Data Models (7 hours)

2.1 Logical, Physical and Conceptual
2.2 E-R Model
2.3 Entities and Entities sets
2.4 Relationship and Relationship sets
2.5 Strong and Weak Entity Sets
2.6 Attributes and Keys
2.7 E-R Diagram
2.8 Alternate Data Model (hierarchical, network, graph

3. Relational Languages and Relational Model (7 hours)

3.1 Introduction to SQL
3.2 Features of SQL
3.3 Queries and Sub-Queries
3.4 Set Operations
3.5 Relations (Joined, Derived)
3.6 Queries under DDL and DML Commands
3.7 Embedded SQL
3.8 Views
3.9 Relational Algebra
3.10 Database Modification
3.11 QBE and domain relational calculus

4. Database Constraints and Normalization (6 hours)

4.1 Integrity Constraints and Domain Constraints
4.2 Assertions and Triggering
4.3 Functional Dependencies

DATABASE MANAGEMENT SYSTEMS

EX 765 06

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To provide fundamental concept, theory and practices in design and implementation of Database Management System.

1. Introduction (3 hours)

1.1 Concepts and Applications
1.2 Objective and Evolution
1.3 Data Abstraction and Data Independence
1.4 Schema and Instances
1.5 Concepts of DDL, DML and DCL

2. Data Models (7 hours)

2.1 Logical, Physical and Conceptual
2.2 E-R Model
2.3 Entities and Entities sets
2.4 Relationship and Relationship sets
2.5 Strong and Weak Entity Sets
2.6 Attributes and Keys
2.7 E-R Diagram
2.8 Alternate Data Model (hierarchical, network, graph

3. Relational Languages and Relational Model (7 hours)

3.1 Introduction to SQL
3.2 Features of SQL
3.3 Queries and Sub-Queries
3.4 Set Operations
3.5 Relations (Joined, Derived)
3.6 Queries under DDL and DML Commands
3.7 Embedded SQL
3.8 Views
3.9 Relational Algebra
3.10 Database Modification
3.11 QBE and domain relational calculus

4. Database Constraints and Normalization (6 hours)

4.1 Integrity Constraints and Domain Constraints
4.2 Assertions and Triggering
4.3 Functional Dependencies

4.4 Multi-valued and Joined Dependencies
4.5 Different Normal Forms (1st, 2nd, 3rd, BCNF, DKNF)

5. Query Processing and Optimization **(4 hours)**

5.1 Query Cost Estimation
5.2 Query Operations
5.3 Evaluation of Expressions
5.4 Query Optimization
5.5 Query Decomposition
5.6 Performance Tuning

6. File Structure and Hashing **(4 hours)**

6.1 Records Organizations
6.2 Disks and Storage
6.3 Remote Backup System
6.4 Hashing Concepts, Static and Dynamic Hashing
6.5 Order Indices
6.6 B+ tree index

7. Transactions processing and Concurrency Control **(6 hours)**

7.1 ACID properties
7.2 Concurrent Executions
7.3 Serializability Concept
7.4 Lock based Protocols
7.5 Deadlock handling and Prevention

8. Crash Recovery **(4 hours)**

8.1 Failure Classification
8.2 Recovery and Atomicity
8.3 Log-based Recovery
8.4 Shadow paging
8.5 Advanced Recovery Techniques

9. Advanced database Concepts **(4 hours)**

9.1 Concept of Objet-Oriented and Distributed Database Model
9.2 Properties of Parallel and Distributed Databases
9.3 Concept of Data warehouse Database
9.4 Concept of Spatial Database

Practical:

1: Introduction and operations of MS-Access or MySQL or any suitable DBMS
2: Database Server Installation and Configuration (MS-SQLServer, Oracle)
3: DB Client Installation and Connection to DB Server. Introduction and practice with SELECT Command with the existing DB.
4, 5: Further Practice with DML Commands
6, 7: Practice with DDL Commands. (Create Database and Tables).

8: Practice of Procedure/Trigger and DB Administration & other DBs (MySQL, PG-SQL, DB2.)
9, 10, 11: Group Project Development.
12: Project Presentation and Viva

References

1. H. F. Korth and A. Silberschatz, " Database System Concepts", McGraw Hill.
2. A. K. Majumdar and P. Bhattacharaya, "Database Management Systems", Tata McGraw Hill, India.

ELECTIVE III

MULTIMEDIA SYSTEM

CT 785 03

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

To introduce the multimedia system: devices, systems and applications.

1. Introduction **(5 hours)**

1.1 Global structure of Multimedia
1.2 Medium
1.3 Multimedia system and properties

2. Sound / Audio System **(6 hours)**

2.1 Concepts of sound system
2.2 Music and speech
2.3 Speech Generation
2.4 Speech Analysis
2.5 Speech Transmission

3. Images and Graphics **(5 hours)**

3.1 Digital Image Representation
3.2 Image and graphics Format
3.3 Image Synthesis , analysis and Transmission

4. Video and Animation **(6 hours)**

4.1 Video signal representation
4.2 Computer Video Format
4.3 Computer- Based animation
4.4 Animation Language
4.5 Methods of controlling Animation
4.6 Display of Animation
4.7 Transmission of Animation

5. Data Compression **(8 hours)**

5.1 Storage Space
5.2 Coding Requirements
5.3 Source, Entropy and Hybrid Coding
5.4 Lossy Sequential DCT- based Mode
5.5 Expanded Lossy DCT-based Mode
5.6 JPEG and MPEG

6. User Interfaces **(5 hours)**

6.1 Basic Design Issues

6.2 Video and Audio at the User Interface
6.3 User- friendliness as the Primary Goal

7. Abstractions for programming **(5 hours)**

7.1 Abstractions Levels
7.2 Libraries
7.3 System Software
7.4 Toolkits
7.5 Higher Programming Languages
7.6 Object –oriented approaches

8. Multimedia Application **(5 hours)**

8.1. Media preparation and composition
8.2. Media integration and communication
8.3. Media Entertainment

References:

1. Ralf Steinmetz and KlaraNahrstedt, "Multimedia: Computing, Communications and Applications", Pearson Education Asia.
2. Fred Halsall, "Multimedia Communications, Applications, Networks, Protocols and Standards", Pearson Education Asia.
3. John F. Koegel Buford, "Multimedia Systems", Pearson Education Asia.

ENTERPRISE APPLICATION DESIGN AND DEVELOPMENT

CT 785 04

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

- To design and implementation of scalable enterprise applications.
- To introduce problem solving design patterns.
- To develop the service oriented solutions.
- To design and implement Rich Internet Applications

1. Introduction **(3 hours)**

1.1 Enterprise Applications trends and Challenges
1.2 Application Architecture
1.3 Multi-tier Architecture
1.4 MVC Architecture

2. Design Pattern **(6 hours)**

2.1 Introduction
2.2 Creational Pattern
2.3 Structural Pattern
2.4 Behavioral Patterns

3. Database Concepts **(4 hours)**

3.1 Database Design
3.2 Enterprise Database (Oracle/DB2/MSSQL)
3.3 Database Connectivity (JDBC/ODBC)
3.4 Connection Pool

4. Service-Oriented Architecture **(5 hours)**

4.1 SOA Concepts and principles
4.2 XML/SOAP
4.3 Web services

5. Platform for Enterprise Solutions: Java EE5: **(9 hours)**

5.1 Java EE Platform Overview
5.2 Web Core Technologies: Servlets and JSP

6. Enterprise Java Bean **(6 hours)**

6.1 Enterprise JavaBean architecture
6.2 Developing EJB3.0
6.3 Session and message-driven EJBs

7. Advanced Web Technology **(12 hours)**

7.1 Web2.0 Introduction and Concepts
7.2 Rich Internet Application Development
7.3 AJAX
7.4 AJAX Frameworks(Prototype Library, DWR Java Ajax Framework)

Reference

1. Kevin Mukhar, "Beginning Java EE 5", Apress.
2. Markl Grand, "Patterns in Java", John Wiley & Sons.
3. Dana Moore, Raymond Budd, Edward Benson," Professional Rich Internet Application", John Wiley & Sons.

GEOGRAPHICAL INFORMATION SYSTEM

CT 785 07

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objective:

To provide the knowledge about basics of GIS with spatial data modelling and database design, capturing the real world, spatial analysis and visualization

1. Introduction **(4 hours)**

1.1 Overview, History and concepts of GIS
1.2 Scope and application areas of GIS
1.3 Purpose and benefits of GIS
1.4 Functional components of GIS
1.5 Importance of GPS and remote sensing data in GIS

2. Spatial data modeling and database design **(10 hours)**

2.1 Introduction to geographic phenomena
2.2 Geographic fields and objects
2.3 Geographic boundaries
2.4 spatial relationships and topology
2.5 scale and resolution
2.6 vector, raster and digital terrain model
2.7 Spatial database design with the concepts of geodatabase.

3. Capturing the real world **(12 hours)**

3.1 Different methods of data capture
3.2 Map elements, map layers, map scales and representation
3.3 Coordinate system
3.4 Spatial referencing: ITRS, ITRF
3.5 Different classes of Map projections
3.6 Datum and Datum Transformation
3.7 GPS& Remote Sensing
3.8 Data preparation, conversion and integration
3.9 Quality aspects of spatial data

4. Spatial analysis and visualization **(10 hours)**

4.1 Functional Components of GIS
4.2 Analysis of spatial and attribute data
4.3 Vector and Raster overlay operators
4.4 Buffering
4.5 Concepts of Spatial Data Mining
4.6 Qualitative and Quantitative data visualization
4.7 Map outputs and its basic elements

5. Spatial data infrastructure **(5 hours)**

5.1 SDI concepts and its current trend
5.2 The concept of metadata and clearing house
5.3 Critical factors around SDIs

6. Open GIS **(4 hours)**

6.1 Introduction of open concept in GIS
6.2 Open source software for spatial data analysis
6.3 Overview of OpenStreetMap
6.4 Web Based GIS system

Practical

Lab: The lab should cover the chapters 3, 4, 5 and 6 by using the GIS tools like ArchView/ArchGIS
Lab 1&2: tutorial on ArchView/ArchGIS with real world map
Lab 3&4: Digitization and Map Layering practice
Lab 5&6: Linking to Databases, Data Analysis and Visualization
Lab 7&8: Building of your own GIS system.

Reference:

1. Rolf De By, Richard A. knippers, yuxian sun, " Principles of geographic information systems: An introductory textbook", international institute for Geo-information science and Earth observation, Netherlands
2. Andy Mitchell , "ESRI guide to GIS analysis", ESRI press, Red lands
3. GIS Cook BOOK

POWER ELECTRONICS

EE 785 07

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:

- To get an overview of different types of power semi-conductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basic topologies of Choppers.
- To learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods.
- To study simple applications

1. Power Semi-conductor Devices **(9 hours)**

1.1 Introduction
1.2 Power Diodes
1.3 Power BJT
1.4 Thyristor Characteristics
1.5 Two Transistor model of Thyristor
1.6 Series and Parallel operation of Thyristors
1.7 SCR, TRIAC, Power MOSFET, GTO, IGBT and SIT
  1.7.1 Device Structures and Characteristics
  1.7.2 Turn ON- Turn OFF methods and Circuits
  1.7.3 Protections, Ratings and applications
  1.7.4 Handling precautions and power dissipation

2. Controlled Rectifiers **(8 hours)**

2.1 Single Phase / Three Phase, Half wave / full wave, half controlled /fully controlled converters with R, RL and RLE loads
2.2 Continuous and discontinuous current operations
2.3 Evaluation of performance parameters
2.4 Effects of source inductance
2.5 Power factor improvement techniques
2.6 6-pulse and 12-pulse converters
2.7 Dual converters

3. Choppers **(11 hours)**

3.1 DC Choppers
  3.1.1 Introduction
  3.1.2 Principle of operation,
  3.1.3 Analysis with waveforms of Step-Down and Step-Up choppers
  3.1.4 Buck, boost and buck-boost Converter

3.2 AC Choppers:
- 3.2.1 Operation of 1-phase voltage regulator with R, RL loads
- 3.2.2 1-phase step up & step down cycloconverters

4. Inverters **(9 hours)**

- 4.1 Single phase and three phase (both 120° mode and 180°mode) inverters
- 4.2 PWM techniques: Sinusoidal PWM, modified sinusoidalPWM, multiple PWM
- 4.3 Introduction to space vector modulations
- 4.4 Voltage and harmonic control
- 4.5 Series resonant inverter
- 4.6 Current source inverter

5. Applications **(8 hours)**

- 5.1 Speed control of DC motor using rectifiers and choppers
- 5.2 Uninterruptible Power Supply (UPS)
- 5.3 Switched mode Power Supply (SMPS)
- 5.4 Battery Charger
- 5.5 Introduction to shunt and series compensators

Practical:

There should be experiments on

1. Basic characteristics of power transistors, diodes thyristors (SCRs)
2. Single phase, full wave and bridge rectifiers with resistive loads
3. Single phase SCR controller with UJT trigger
4. Three phase bridge rectifiers with diodes and with SCRs
5. Rectification for inductive loads
6. Various types of Choppers
7. Speed Control of DC Motor

References:

1. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education.
2. Philip T. Krein, "Elements of Power Electronics", Oxford University Press.
3. Jay P. Agarwal, "Power Electronic Systems – Theory and Design", Prentice Hall.
4. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics, Converters, Application and Design", John Wiley and Sons.
5. Cyril.W.Lander, "Power Electronics", McGraw – Hill.
6. M.D. Singh, K.B. Khanchandani, "Power Electronics", Tata McGraw – Hill.

REMOTE SENSING

CT 785 01

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objective:

To present an introduction to technological and scientific aspects of remote sensing (RS) of the Earth and its atmosphere

1. Introduction **(7 hours)**

1.1 General concepts of remote sensing
1.2 History and basics of remote sensing of the Earth and its atmosphere
1.3 Classifications

2. Physical Principles of Remote Sensing **(10 hours)**

2.1 Basic quantities
2.2 Electromagnetic principles
2.3 Emission/radiation theory
2.4 Radar backscattering theory

3. Remote Sensing Technology **(12 hours)**

3.1 Passive remote sensing
  3.1.1 Visible and infrared techniques
  3.1.2 Microwave radiometry
3.2 Active remote sensing
  3.2.1 Radar remote sensing
  3.2.2 Lider remote sensing
3.3 Basics of satellite remote sensing, and ground truths

4. Applications **(10 hours)**

4.1 Earth and its atmosphere
  4.1.1 Precipitation, winds, clouds and aerosols, temperature and trace gases
  4.1.2 Vegetation, forestry, ecology
  4.1.3 Urban and land use
  4.1.4 Water planet: meteorological, oceanographic and hydrologic RS
  4.1.5 Geological: Landforms, structure, topography, mine and resource exploration
  4.1.6 Geographic information system (GIS): GIS approach to decision making

4.2 Remote sensing into the 21st century: Outlook for the future RS

5. Remote Sensing Data **(6 hours)**

5.1 Processing and classification of remote sensing data
5.2 Data formats
5.3 Retrieval algorithms
5.4 Analysis and image interpretations

Practical:

1. Familiarization to remote sensing data available from department's capacity (via web and/or possible collaborations with national/international remote sensing agencies/institutions)
2. Data visualization/graphics
3. Data processing and pattern recognition
4. Computer simulations
5. Technical Writing

References:

1. Campbell, J.B., "Introduction to Remote Sensing," , The Guilford Press
2. Drury, S.A., "Image Interpretation in Geology", Chapman & Hall, 243 pp.
3. Drury, S.A., "Images of the Earth: A Guide to Remote Sensing", Oxford Press, 212 pp.
4. Kuehn, F. (Editor), "Introductory Remote Sensing Principles and Concepts", Routledge, 215 pp.
5. Lillesand, T.M. and Kiefer, R.W., "Remote Sensing and Image Interpretation", J. Wiley & Sons, 720 pp.
6. Sabins, Jr., F.F., "Remote Sensing: Principles and Interpretation", W.H. Freeman & Co., 496 pp.
7. Siegal, B.S. and Gillespie, A.R., "Remote Sensing in Geology", J. Wiley & Sons (especially Chapters 1 through 11)
8. Swain, P.H. and Davis, S.M., "Remote Sensing - the Quantitative Approach", McGraw-Hill Book Co.
9. Chen, H.S., "Space Remote Sensing Systems: An Introduction", Academic Press, Orlando
10. Jensen J. R., "Remote sensing of the environment: An Earth resource perspective" Academic Press, Orlando
11. Ulaby, F. T., R. K. Moore, and A. K. Fung, "Microwave Remote Sensing: Active and Passive", Artech House, Norwood, MA.
12. Periodicals devoted largely to remote sensing methods and applications:

13. IEEE Transactions on Geoscience and Remote Sensing.
14. IEEE Geoscience and Remote Sensing Letters
15. International Journal of Remote Sensing.
16. Photogrammetric Engineering and Remote Sensing.
17. Remote Sensing of the Environment
18. Canadian Journal of Remote Sensing
19. Journal of Remote Sensing Society of Japan

XML: FOUNDATIONS, TECHNIQUES AND APPLICATIONS

CT 785 05

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

Course objectives:

To provide knowledge of the Extensible Markup Language (XML), a standard for self-describing data, knowledge interchange, and information integration. Since representation, interchange and integration of information are fundamental to all information systems, there is a wide range of possible applications of XML.

1. XML Foundations **(10 hours)**

1.1 History and background
1.2 XML syntax
1.3 Document Type Definition (DTD)
1.4 XML Schema
1.5 XML Stylesheet Language Transformation (XSLT)
1.6 XML document design

2. XML Models **(4 hours)**

2.1 XML conceptual models
2.2 XML and logic

3. XML and Databases **(10 hours)**

3.1 XML as a database model
3.2 XML query languages – Xpath, XSLT, XQuery
3.3 XML native databases

4. XML and Semantics **(6 hours)**

4.1 RDF Resource Description Framework) syntax and semantics
4.2 RDF schema
4.3 Web Ontology Language (OWL)
4.4 The Semantic Web

5. Web Services **(8 hours)**

5.1 SOAP
5.2 WSDL
5.3 UDDI
5.4 Semantic Web Services

6. XML Applications **(7 hours)**

6.1 XBRL

6.2 Case studies of real XML applications

Practical:

A number of lab sessions can be conducted using XML Spy which is an XML editor and development environment.

References:

1. E.R. Harold, "XML Bible", IDG Books Worldwide.
2. S. Holzner and S. Holzner, "Real World XML", Peachpit Press.
3. S. Holzner, "Inside XML", New Riders Publishing.
4. S. Abiteboul, P. Buneman, and J. Gray, "Data on the Web: From Relations to Semistructured Data and XML", (Morgan Kaufmann Series in Data Management Systems, Morgan Kaufmann Publishers.
5. XML W3C Recommendation. http://www.w3.org/TR/2008/REC-xml-20081126/

ARTIFICIAL INTELLIGENCE

CT 785 06

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

- To provide basic knowledge of Artificial Intelligence
- To familiarize students with different search techniques
- To acquaint students with the fields related to AI and the applications of AI

1. Introduction **(4 hours)**

1.1 Definition of Artificial Intelligence
1.2 Importance of Artificial Intelligence
1.3 AI and related fields
1.4 Brief history of Artificial Intelligence
1.5 Applications of Artificial Intelligence
1.6 Definition and importance of Knowledge, and learning.

2. Problem solving **(4 hours)**

2.1 Defining problems as a state space search,
2.2 Problem formulation
2.3 Problem types, Well- defined problems, Constraint satisfaction problem,
2.4 Game playing, Production systems.

3. Search techniques **(5 hours)**

3.1 Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison,
3.2 Informed search techniques-hill climbing, best first search, greedy search, A* search Adversarial search techniques-minimax procedure, alpha beta procedure

4. Knowledge representation, inference and reasoning **(8 hours)**

4.1 Formal logic-connectives, truth tables, syntax, semantics, tautology, validity, well- formed-formula,
4.2 Propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses,
4.3 Rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system,

4.4 Statistical Reasoning-Probability and Bayes' theorem and causal networks, reasoning in belief network

5. Structured knowledge representation **(4 hrs)**

5.1 Representations and Mappings,
5.2 Approaches to Knowledge Representation,
5.3 Issues in Knowledge Representation,
5.4 Semantic nets, frames,
5.5 Conceptual dependencies and scripts

6. Machine learning **(6 hours)**

6.1 Concepts of learning,
6.2 Learning by analogy, Inductive learning, Explanation based learning
6.3 Neural networks,
6.4 Genetic algorithm
6.5 Fuzzy learning
6.6 Boltzmann Machines

7. Applications of AI **(14 hours)**

7.1 Neural networks
- 7.1.1 Network structure
- 7.1.2 Adaline network
- 7.1.3 Perceptron
- 7.1.4 Multilayer Perceptron, Back Propagation
- 7.1.5 Hopfield network
- 7.1.6 Kohonen network

7.2 Expert System
- 7.2.1 Architecture of an expert system
- 7.2.2 Knowledge acquisition, induction
- 7.2.3 Knowledge representation, Declarative knowledge, Procedural knowledge
- 7.2.4 Development of expert systems

7.3 Natural Language Processing and Machine Vision
- 7.3.1 Levels of analysis: Phonetic, Syntactic, Semantic, Pragmatic
- 7.3.2 Introduction to Machine Vision

Practical:

Practical exercises should be conducted in either LISP or PROLOG. Laboratory exercises must cover the fundamental search techniques, simple question answering, inference and reasoning.

References:

1. E. Rich and Knight, "Artificial Intelligence", McGraw Hill.
2. D. W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall.
3. P. H. Winston, "Artificial Intelligence", Addison Wesley.
4. Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson.

SPEECH PROCESSING

CT 785 08

Lecture : 3 **Year : IV**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objectives:

- To introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression
- To introduce the models for speech production
- To develop time and frequency domain techniques for estimating speech parameters
- To introduce a predictive technique for speech compression
- To understand speech recognition, synthesis and speaker identification.

1. Nature of speech signal **(8 hours)**

1.1 Speech production: Mechanism of speech production
1.2 Acoustic phonetics
1.3 Digitalmodels for speech signals
1.4 Representations of speech waveform
1.4.1 Sampling speechsignals
1.4.2 Basics of quantization
1.4.3 Delta modulation
1.4.4 Differential PCM

2. Time domain methods for speech processing **(8 hours)**

2.1 Time domain parameters of Speech signal
2.2 Methods for extracting the parameters
2.2.1 Short-time Energy
2.2.2 Average Magnitude
2.2.3 Short-time average Zero crossing Rate
2.3 Auditoryperception: psychoacoustics.
2.4 Silence Discrimination using ZCR and energy
2.5 Short Time Auto Correlation Function
2.6 Pitch period estimation using AutoCorrelation Function

3. Frequency domain method for speech processing **(10 hours)**

3.1 Short Time Fourier analysis
3.1.1 Fourier transform and linear filtering interpretations
3.1.2 Sampling rates
3.2 Spectrographic displays
3.3 Pitch and formant extraction
3.4 Analysis bySynthesis
3.5 Analysis synthesis systems

3.5.1 Phase Vocoder
3.5.2 Channel Vocoder
3.6 Homomorphic speech analysis
3.6.1 Cepstral analysis of Speech
3.6.2 Formant and PitchEstimation
3.6.3 Homomorphic Vocoders

4. Linear predictive analysis of speech **(10 hours)**

4.1 Basic Principles of linear predictive analysis
4.2 Auto correlation method
4.3 Covariance method
4.4 Solution of LPC equations
4.5 Cholesky method
4.6 Durbin's Recursive algorithm
4.7 Application of LPC parameters
4.7.1 Pitch detection using LPC parameters
4.7.2 Formant analysis
4.7.3 VELP
4.7.4 CELP

5. Application of speech & audio signal processing **(9 hours)**

5.1 Algorithms:
5.1.1 Dynamic time warping
5.1.2 K-means clustering and Vector quantization
5.1.3 Gaussian mixture modeling
5.1.4 Hidden Markov modeling
5.2 Automatic Speech Recognition
5.2.1 Feature Extraction for ASR
5.2.2 Deterministic sequence recognition
5.2.3 Statistical Sequence
5.2.4 Recognition
5.2.5 Language models
5.3 Speaker identification and verification
5.4 Voice response system
5.5 Speech synthesis
5.5.1 Basics of articulation
5.5.2 Synthesizer
5.5.3 Concatenative synthesis

Practical:

There should be a list of experiments based on the following topics

1. Spectral analysis
2. Time-Frequency analysis
3. Pitch extraction
4. Formant tracking

5. Speech enhancement
6. Audio coding
7. Speaker recognition

All these lab works may be performed in Matlab or similar softwares capable of processing speech signals. It can also be implemented in hardware if available.

References:

1. Thomas F. Quatieri, "Discrete-Time Speech Signal Processing", Prentice Hall /Pearson Education.
2. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", John Wiley and Sons Inc.
3. L.R.Rabiner and R.W.Schaffer, "Digital Processing of Speech signals", Prentice Hall
4. L.R. Rabiner and B. H. Juang, "Fundamentals of Speech Recognition", Prentice Hall.
5. J.R. Deller, J.H.L. Hansen and J.G. Proakis, "Discrete Time Processing of SpeechSignals", John Wiley, IEEE Press.
6. J.L Flanagan, "Speech Analysis Synthesis and Perception",Springer, Verlag.