INTRODUCTION

The Institute of Engineering, Pulchowk Campus, is offering this course with the objective of producing high level technical manpower capable of undertaking works in the Electronics Engineering field. The details of the course are as follows.

1. Title of the Course:

Bachelor of Engineering in **Electronics Engineering**.

2. Objective of the Course:

To train students in technical and analytical skills required to enable them to function and practice as professional Electronics engineer on all aspects of Electronics Engineering works.

3. Duration of the Course:

The total duration of the course is 4 years. Each year consists of two parts. A and B, each part having a duration of 90 working days (about 15 weeks).

4. Entry Requirements:

The minimum requirements for admission to the courses are:

(a) The candidate must have passed Intermediate of Science (Physical Group) examination of the Tribhuvan University or equivalent course recognized by the Tribhuvan University; and have scored at least 50% of the total marks in aggregate;

or

The candidate must have passed Diploma in Engineering of the Institute of Engineering Tribhuvan University or equivalent course with Physics, Chemistry, Mathematics and English as separate compulsory subjects, and have scored at least 50% of the total marks in aggregate:

and

(b) The candidate must pass the entrance admission tests conducted by the Campus and as prescribed by the Institute of Engineering.

5. Selection:

Students fulfilling the minimum eligible requirements will be selected for admission on the basis of merit.

6. Course Structure:

6.1 Contents:

The teaching of the course is divided into 8 parts (half yearly). The first two parts are of prerequisite nature.

6.2 Subject Codes:

Each subjects is coded with a unique member preceded and followed by certain letters. The code for all subjects offered in engineering disciplines begin with two letters 'EG', followed by three digit numbers denoting the subject offered in the particular half yearly part. The first digit denotes the year i.e. 4,5,6 and 7 for first, second, third and fourth year respectively of Bachelor's level course. The second digit from 0 to 4 is used for the first part of the year and 5 to 9 for the second part of the year. The third digit is used to identify the subject stream. The last letters denote the department which offers the subject (e.g. SH - Science and Humanities, CE - Civil Engineering, EE - Electrical Engineering, EX - Electronics Engineering, ME - Mechanical Engineering and AR - Architecture).

Example: EG 647 EE is the code for subject "Power System Analysis" which is offered in the engineering discipline in the third year part A of the Bachelor course and is conducted by the Electrical Engineering Department.

6.3 Instruction Methods:

The method of teaching is lecture augmented by tutorials and practical works. Tutorials are used to enlarge and develop the topic and concepts stated in the lecture. Practical classes in the form of laboratory works and drawing office practice are used to verify the concepts and to develop necessary technical and analytical skills.

Examination and Marking Schemes:

The students' achievement in each subject is evaluate by internal assessment during the course followed by a final examination at the end of each half yearly part. A weightage of 20% for the internal assessment and that of 80% for the half yearly examination are allocated for the theoretical component of a subject. The half yearly examination of all theory component are conducted through written tests. In case of practical components, the method of continuous assessment is adopted; in some cases, half yearly examinations are also conducted.

The students must obtain 40% in the internal assessment and 40% in the half yearly examination of each subject to pass in the subject. Student who have not obtained the prescribed pass marks in the internal assessment of a subject will not be allowed to sit in the half yearly examination of continue his/her studies in the third year. Similarly, a student must pass all the papers of the second year to continue his/her studies in the fourth year.

Students who have passed all the components of all subjects in all of the ten 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 weightage to each of half yearly aggregate percentages scored by the student as prescribed below.

First & Second Years	:	20% each
Third and Fourth	:	30% each

Depending upon the final aggregate percentage scored, a division is award as follows:

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

First Revision
November 1999

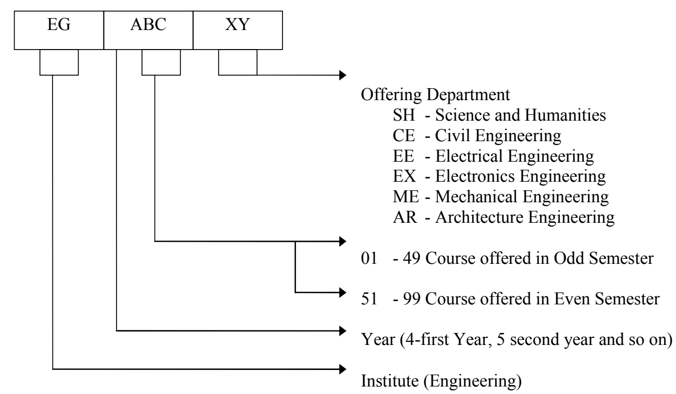
Note:
Division:

Pass Marks	:	40%
Pass	:	40% to <50%
Second Division	:	50% to <65%
First Division	:	65% to <80%
Distinction	:	> = 80%

Weightage:

I Year	:	20% of total marks in four years (Part A & B)
II Year	:	20% of total marks in four year (Part A & B)
III Year	:	30% of total marks in four year (Part A & B)
IV Year	:	30% of total marks in four year (Part A & B)

Course Coding:



B. E. DEGREE
IN
ELECTRONICS ENGINEERING

Year : I **Part : A**

S. N.	Course Code / Course Title	L	T	P	Total	Theory Assess-ment Marks	Theory Final Duration Hrs.	Theory Final Marks	Practical Assess-ment Marks *	Practical Final Duration Hrs.	Practical Final Marks	Total	Remarks
	Teaching Schedule					**Examination Scheme**							
1	EG 401 SH Mathematics I	3	2	-	5	20	3	80	-	-	-	100	* Continuous Assessment
2	EG 402 SH Physics	4	1	2	7	20	3	80	20	3	30	150	
3	EG 475 SH Computer Programming I	2	-	3	5	10	1.5	40	50	-	-	100	
4	EG 404 SH Communication I (English)	1	3	-	4	10	1.5	40	-	-	-	50	
5	EG 431 ME Engineering Drawing I	1	-	3	4	-	-	-	60	3	40	100	
6	EG 432 ME Workshop Technology	1	-	3	4	-	-	-	50	-	-	50	
7	EG 439 ME Applied Mechanics	3	1	-	4	20	3	80	-	-	-	100	
	Total =	**15**	**7**	**11**	**33**	**80**	**12**	**320**	**180**	**6**	**70**	**650**	

B. E. DEGREE
IN
ELECTRONICS ENGINEERING

Year : I **Part : B**

S. N.	Course Code / Course Title	L	T	P	Total	Theory Assess-ment Marks	Theory Final Duration Hrs.	Theory Final Marks	Practical Assess-ment Marks *	Practical Final Duration Hrs.	Practical Final Marks	Total	Remarks
	Teaching Schedule					**Examination Scheme**							
1	EG 403 SH Chemistry	3	1	2	6	20	3	80	10	3	15	125	* Continuous Assessment
2	EG 469 ME Thermodynamics and Heat Transfer	3	1	1.5	5.5	20	3	80	25	-	-	125	
1	EG 471 SH Mathematics II	3	2	-	5	20	3	80	-	-	-	100	
3	EG 476 EE Electrical Engineering Materials	3	1	-	4	20	3	80	-	-	-	100	
4	EG 477 EE Electrical Circuits I	3	1	3	7	20	3	80	50	-	-	150	
5	EG 481 ME Engineering Drawing II	1	-	3	4	-	-	-	60	3	40	100	
	Total =	**16**	**6**	**9.5**	**31.5**	**100**	**15**	**400**	**145**	**6**	**65**	**700**	

B. E. DEGREE
IN
ELECTRONICS ENGINEERING

Year : II **Part : A**

Teaching Schedule						Examination Scheme							
						Theory			Practical				
S. N.	Course Code Course Title	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks	Total	Remarks
1	EG 501 SH Mathematics III	3	2	-	5	20	3	80	-	-	-	100	* Continuous Assessment
2	EG 505 SH Computer Programming II	2	-	3	5	10	1.5	40	50	-	-	100	
3	EG 527 EE Electric Circuits II	3	1	1.5	5.5	20	3	80	25	-	-	125	
4	EG 532 EX Semiconductor Devices	3	1	1.5	5.5	20	3	80	25	-	-	125	
5	EG 533 EX Logic Circuits	3	-	3	6	20	3	80	50	-	-	150	
6	EG 539 CE Mechanics and Properties of Solids	3	1	1.5	5.5	20	3	80	25	-	-	125	
Total =		**17**	**5**	**10.5**	**32.5**	**110**	**16.5**	**440**	**175**	**-**	**-**	**725**	

B. E. DEGREE
IN
ELECTRONICS ENGINEERING

Year : II **Part : B**

Teaching Schedule						Examination Scheme							
						Theory			Practical				
S. N.	Course Code Course Title	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks	Total	Remarks
1	EG 561 SH Applied Mathematics	3	2	-	5	20	3	80	-	-	-	100	* Continuous Assessment
2	EG 572 EX Electronic Circuits I	3	1	1.5	5.5	20	3	80	25	-	-	125	
3	EG 573 EX Microprocessor	3	1	3	7	20	3	80	50	-	-	150	
4	EG 574 EX Electromagnetics	3	1	1.5	5.5	20	3	80	25	-	-	125	
5	EG 576 EE Instrumentation I	3	1	1.5	5.5	20	3	80	25	-	-	125	
6	EG 577 EE Electrical Machines I	3	1	1.5	5.5	20	3	80	25	-	-	125	
Total =		**18**	**7**	**9**	**34**	**120**	**18**	**480**	**150**	**-**	**-**	**750**	

B. E. DEGREE
IN
ELECTRONICS ENGINEERING

Year : III **Part : A**

Teaching Schedule							Examination Scheme						Total	Remarks
							Theory			Practical				
S. N.	Course Code Course Title	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks		Total	Remarks
1	EG 601 SH Numerical Methods	3	-	3	6	20	3	80	50	-	-		150	* Continuous Assessment
2	EG 604 SH Communication II (English)	1	3	-	4	10	1.5	40	-	-	-		50	
3	EG 632 EX Electronic Circuits II	3	1	1.5	5.5	20	3	80	25	-	-		125	
4	EG 634 EX Signal Analysis	2	-	1.5	3.5	20	3	80	-	-	-		125	
5	EG 647 EE Power System Analysis	4	1	-	5	20	3	80	-	-	-		100	
6	EG 648 EE Control System	3	1	1.5	5.5	20	3	80	25	-	-		125	
Total =		**16**	**6**	**7.5**	**29.5**	**110**	**16.5**	**440**	**100**	**-**	**-**		**650**	

B. E. DEGREE
IN
ELECTRONICS ENGINEERING

Year : III **Part : B**

Teaching Schedule							Examination Scheme						Total	Remarks
							Theory			Practical				
S. N.	Course Code Course Title	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks		Total	Remarks
1	EG 666 CE Engineering Economics	3	1	-	4	20	3	80	-	-	-		100	* Continuous Assessment
2	EG 671 SH Probability and Statistics	3	1	-	4	20	3	80	-	-	-		100	
3	EG 675 EX Filter Design	3	1	1.5	5.5	20	3	80	25	-	-		125	
4	EG 676 EX Communication Systems I	3	1	1.5	5.5	20	3	80	25	-	-		125	
5	EG 677 EX Digital Electronics	3	1	1.5	5.5	20	3	80	25	-	-		125	
6	EG 678 EX Computer Graphics	3	1	2	6	20	3	80	50	-	-		150	
Total =		**18**	**6**	**6.5**	**30.5**	**120**	**18**	**480**	**125**	**-**	**-**		**725**	

B. E. DEGREE
IN
ELECTRONICS ENGINEERING

Year : IV **Part : A**

Teaching Schedule							Examination Scheme							
							Theory			Practical				
S. N.	Course Code	Course Title	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks	Total	Remarks
1	EG 706 CE	Project Engineering	3	1	-	4	20	3	80	-	-	-	100	* Continuous Assessment
2	EG 709 ME	Organization and Management	3	2	-	5	20	3	80	-	-	-	100	
3	EG 728 EX	Computer Architecture	3	1	1.5	5.5	20	3	80	25	-	-	125	
4	EG 732 EX	Communication Systems II	3	1	1.5	5.5	20	3	80	25	-	-	125	
5	EG 733 EX	Propagation and Antennas	3	1	1.5	5.5	20	3	80	25	-	-	125	
6	EG 735 EX	Elective I	3	1	1.5	5.5	20	3	80	25	-	-	125	
		Total =	**18**	**7**	**6**	**31**	**120**	**18**	**480**	**100**	**-**	**-**	**700**	

B. E. DEGREE
IN
ELECTRONICS ENGINEERING

Year : IV **Part : B**

Teaching Schedule							Examination Scheme							
							Theory			Practical				
S. N.	Course Code	Course Title	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks	Total	Remarks
1	EG 766 CE	Engineering Prof. Practice	2	-	-	2	10	1.5	40	-	-	-	50	* Continuous Assessment
2	EG 767 CE	Technology, Environment & Society	2	-	-	2	10	1.5	40	-	-	-	50	
3	EG 771 EX	Instrumentation II	3	-	1.5	4.5	20	3	80	25	-	-	125	
4	EG 772 EX	Telecommunications	3	1	1.5	5.5	20	3	80	25	-	-	125	
5	EG 773 EX	Digital Signal Processing	3	-	3	6	20	3	80	50	-	-	150	
6	EG 777 EX	Project	-	-	6	6	-	-	-	100	viva	75	175	
7	EG 785 EX	Elective II	3	1	1.5	5.5	20	3	80	25	-	-	125	
		Total =	**16**	**2**	**13.5**	**31.5**	**100**	**15**	**400**	**225**	**-**	**75**	**800**	

MATHEMATICS I
EG401SH

Lecture: 3 Year: 1
Tutorial: 2 Part: A

COURSE OBJECTIVES: It is assumed that incoming students have a good grounding in algebra, some knowledge of trigonometry and analytic geometry and previous to calculus. By the end of the course, students will have seen the development of all of the elementary functions, ranging from polynomials to the inverse hyperbolic functions. In parallel, the calculus will be developed, making use of the increasing richness of the available functions. The student's skills in differentiation and integration will thus be progressively improved. Simple applications of the calculus will be explored from time to time. The course will conclude with brief discussion of conic sections and coordinate transformations.

1. Review. **(5 hours)**

1.1 Limit, Continuity.
1.2 Derivability of functions of a single variable. Derivative rules and formulas.
1.3 Integration rules and standard integrals.

2. **Derivative** **(9 hours)**

2.1 Higher order derivatives.
2.2 Maxima and Minima.
2.3 Mean value theorems.
2.4 Taylor and Maclaurin series.
2.5 Tangent and Normal.
2.6 Curvature.
2.7 Asymptotes.
2.8 Curve tracing.

3 Antiderivatives. **(12 hours)**

3.1 Definite integrals.
3.2 Fundamental theorem of integral calculus.
3.3 Improper integrals.
3.4 Reduction formulae for integrals, Beta and Gamma functions,

4 Applications of Integral **(8 hours)**

4.1 Areas
4.2. Lengths
4.3 Volumes.
4.4 Surfaces

5 Ordinary differential equations **(5 hours)**

5.1 Differential equations of first and second orders.
5.2 Linear equations with constant coefficients.

6. Analytic Geometry of two dimensions **(6 hours)**

6.1 Translation and rotation of axes.
6.2 Parabola.
6.3 Ellipse.
6.4 Hyperbola.
6.5 Central conics.

<u>Textbook</u>

1. E.W. Swokowski, "Calculus With Analytic Geometry", Second Alternate Edition, PWS-Kent Publishing Co., Boston.

PHYSICS
EG 402 SH

Lecture: 4 | Year: 1
Tutorial: 1 | Part: A
Practical: 2

Objectives: To provide the concept and knowledge of physics with the emphasis of present day applications. The background of physics corresponding to Proficiency Certificate Level is assumed.

1.0 Oscillations and Simple Harmonic motion (3 Hours)

1.1 Introduction to mean position and restoring force. Elastic restoring force. Hooks Law. Definition of SHM. Condition of SHM. Rarity of SHM'S. Equation of SHM.
1.2 Examples of SHM: spring-mass system, Physical pendulum and torsional pendulum.
1.3 Damped Oscillations. Equation of damped oscillator. Forced oscillation and resonance.

2.0 Wave in Elastic Media (6 Hours)

2.1 Introduction to the wave process. Types of waves (only introduction). Speed of transverse waves. Dependence of wave velocity from the properties of medium. Equation of wave process; Particle velocity and particle acceleration.
2.2 Energy power and intensity in wave motion. Standing waves and resonance.

3.0 Acoustics (7 Hours)

3.1 Sound waves. Propagation of sound wave in solids, liquids and gases (review). Pressure variation due to waves.
3.2 Energy considerations. Intensity, Intensity level and loudness. Decibel and phon. Introduction to the reflection, refraction, attenuation and diffraction of sound.
3.3 Auditorial acoustics. Reverberation of sound. Sabine's Law. Conditions for good auditorium and concert halls.
3.4 Doppler effect.
3.5 Ultrasound: Introduction and properties. Production of ultrasound by magnetostriction and piezoelectric methods. Uses of ultrasound in distance measurement, signaling. Non-destructive test of structures and materials.

4.0 Electrostatics (8 Hours)

4.1 Electric charge. Coulomb's law of electrostatic field. Lines of force. Calculation of electric field due to dipole, quadrupole, charged ring and linear charge.
4.2 Electric flux. Gauss' Law and its application to charges dielectric sphere.
4.3 Electric potential. Potential, field strength and potential gradient. Potential due to a point charge.
4.4 Potential due to dipole and quadrupole. Electrostatic potential energy.
4.5 Capacitors: Parallel plate capacitor, cylindrical capacitor, spherical capacitor.
4.6 Effect of dielectrics. Determination of relative dielectric Permitivity. Conductors and dielectrics in electric field. E and D fields. Energy stored in electric field. Energy density.
4.7 High intensity electrostatic fields. Uses of static electric fields in Xeroxing and precipitation. Hazard of strong electrostatic fields: lightning.

5.0 Direct current (3 Hours)

5.1 Current and current density. Current flow in solid, liquid and gases. Ohm's law. Resistance's in series and in parallel.
5.2 Kirchhoff's Laws.
5.3 Atomic view of resistivity. Current flow in semiconductors and metals. Temperature dependence of resistivity.
5.4 Energy loss in circuit. Joule's Law of heating effect. Long distance transmission lines.
5.5 Charging and discharging of a capacitor through a resistor. Time constant.

6.0 Magnetism and Magnetic fields. (7 Hours)

6.1 Source of Magnetic fields: Current and permanent magnets. Terrestrial magnetism. Lines of force. Flux of magnetic field and permeability.
6.2 Biot and Savart's law and its application to long straight wire and circular current loop. Amperes theorem and its application to long straight conductor, solenoid and toroid carrying current.
6.3 Magnetic scalar potential and potential gradient.
6.4 Force on moving charge on magnetic field. Hall effort. Force on conductor in magnetic field. Force per unit length between parallel conductors carrying current.
6.5 Faraday's law of electromagnetic induction. Flux linkage. Lenz's law. Self-induction. Calculation of the coefficient of self-induction for solenoid and toroid.
6.6 LR circuit. Energy stored in magnetic field. Energy density of magnetic field.
6.7 H, B and fields.

7.0 Electromagnetic Oscillations (7 Hours)

7.1 LC oscillations. Analogy to SHM.
7.2 Electromagnetic oscillations of LCR circuit. Forced oscillation of LCR circuit and resonance.

8.0 Electromagnetic waves (4 Hours)

8.1 Equation of continuity as the law of conservation of electric charge. Maxwell equations in integral and differential forms.
8.2 Displacement current and its significance.
8.3 Application of Maxwell equations: wave equations in free space and non-conducting medium.
8.4 Speed of electromagnetic waves. Energy of electromagnetic wave. Poynting vector.

9.0 Optics (15 Hours)

9.1 Introduction to light: Light as EM wave. Geometrical and wave optics. (Concepts only). Review of refraction through lenses. Combination of two lenses separated by distance. Cardinal points. Achromatic combination of two lenses separated by distance
9.2 Monochromatic aberration of lenses. Spherical aberration, astigmatism, coma, curvature of field and distortion. Causes and their minimization.
9.3 Fibre Optics: Introduction to optical fibres as medium for guiding a wave. The meaning of self focussing in optical fibres. Types of optical fibres according to the variation of refractive index within the optical fibres: single mode and multi mode. Uses of laser light in communication.
9.4 Lasers: principle of the generation of laser light. Basic differences of laser light from ordinary light: beam size, non-divergence, and high degree of monochromaticity and coherence. Uses of laser: industrial, medical and communication.
9.5 Interference. Introduction and mathematical theory. Coherent sources. Causes of non-coherence. Examples of the division of wavefront and amplitude. Interference in thin films and wedges. Fringes of equal inclination and fringes of equal thickness. Non-reflecting films. Newton's rings. Uses of interference in analysing the variation of thickness.
9.6 Diffraction: Introduction. Difference between Fresnel and Fraunhoffer diffraction. Difference between interference and diffraction pattern. Explanation of the variation of intensity due to single slit. Diffraction grating. Resolving power to diffraction gratings.
9.7 Polarisation: Visual explanation of polarization wave. Introduction to polarised and non-polarised light. Methods for obtaining polarised light. Malus' Law. Linearly, elliptically and circularly polarized light. Double refraction. Ordinary and extraordinary rays. Positive and negative crystals. Quarter and half-wave plates. Uses of polarised light in stress analysis. Optical activity. Specific rotation. Uses of optical activity in cahharimetry and detection of adulteration.

Text Books:

1 Haliday, Resnick and Walker, "**Fundamentals of Physics**", Fourth Edition, John Wiley and Sons 1988, 1993 and later editions.
2 A.S. Vasudeva, "**Modern Engineering Physics**", S-Chand & Co 1998, Delhi.

3 Robert Resnick and David Halliday, "**Physics: Part I and II**", 20^{th} Edition, Wiley Eastern Limited, 1985.

Reference Books:

1 Subramanyam and Brij Lal, "**Optic**s" S-Chand & Co 1994, 1995 Delhi.
2 A.S. Vasudeva, "**Concept of Modern Engineering Physics**", S-Chand & Co 1998, Delhi.

<u>Laboratory:</u>

1.0 Vibrating string.
2.0 Resonance tube
3.0 Geometrical optics.
4.0 Interference, difference and polarization.
5.0 Electrostatics.
6.0 Field mapping.

COMPUTER PROGRAMMING I
EG475SH

Lecture: 2 **Year**: 1
Practical:3 **Part**: A

Course Objective: To develop a working knowledge of computer methods, systems, and languages. Emphasis will be given on developing programming skills using FORTRAN.

1. Introduction to Computers **(4 hours)**

1.1 Historical development
- 1.1.1 Classes of computer (Analog & Digital)
- 1.1.2 Historical development of computers
- 1.1.3 Generation of electronics computers

1.2 Computer Systems and Organization
- 1.2.1 Computer Hardware (Block diagram of digital computer)
- 1.2.2 Computer Software
- 1.2.3 Programming languages
  - 1.2.3.1 Fortran
  - 1.2.3.2 Other programming languages like Pascal and 'C'
- 1.2.4 Text editor

2. Problem Solving Using Computer **(3 hours)**
- 2.1 Problem Analysis
- 2.2 Algorithm Development & Flowcharting
- 2.3 Data Flow Diagrams
- 2.4 Coding
- 2.5 Compilation and Execution
- 2.6 Debugging and Testing
- 2.7 Program Documentation

3. Introduction to Fortran **(3 hours)**
- 3.1 Classes of Data
  - 3.1.1 Constants
  - 3.1.2 Variables
- 3.2 Arithmetic Operations
- 3.3 Library Function
- 3.4 Structure of Fortran Program

4. Input and Output statement **(3 hours)**
- 4.1 Unformatted I/O
- 4.2 Formatted I/O
- 4.3 Sample Programs Using I/O statements
- 4.4 Logical and Character Variables

- 4.5 Double Precision and Complex Variables

5. Control Statements and Structure of Programs **(6 hours)**
- 5.1 Structured Programming
- 5.2 Control Statements
  - 5.2.1 IF Statements (Logical IF; IF .. THEN.. ELSE.. ENDIF, Arithmetic IF)
  - 5.2.2 DO loops
- 5.3 Series Computation
- 5.4 Recursive Computation

6. Arrays **(5 hours)**
- 6.1 Inputting and Outputting
- 6.2 Manipulation of Arrays
  - 6.2.1 Arithmetic Operations
  - 6.2.2 Sorting
  - 6.2.3 Vector /Matrix operations

7. Modular Programming and Subprograms **(3 hours)**
- 7.1 Concepts of Modular Programming
- 7.2 Function Subprogram
- 7.3 Subroutine Subprogram

8. Data File **(3 hours)**
- 8.1 Fundamental of Data file
- 8.2 Sequential and Direct Access file
- 8.3 Creation of Data file and writing into Data file
- 8.4 Read from Data file
- 8.5 Processing of Data file

- At the end of Course students are recommended to do a sample project using concepts drawn from the above topics.

  The objective of this project is to develop the skills of gathering knowledge drawn from entire course so that student can develop a simple project type experiments like preparing a mark-sheet of any student in a class, Preparing telephone bill, Preparing electricity bill and so forth.

***Laboratory**: 11 laboratory exercises with assignments growing in complexity from entering and running a small given program to the development of fairly complex subroutines and programs for engineering applications.*
Out of 4 remaining laboratory sessions, 2 laboratory sessions will be used for developments of simple project type experiment and 2 sessions for evaluation.

References:

1. *D. M. Etter, "Structured Fortran 77 for Engineers and Scientists", 3rd edition, Benjamin/Cummings, Redwood City, california, 1990.*
2. *R. N. Reddy and C. A. Ziegler, "Fortran 77 with Applications for Scientists and Engineers". West Publishing Company ,St. Paul, 1989.*
3. *D.D. Mccracken and W.I. salmon "computing for engineers and scientists with Fortran 77", 2nd Edition, Willey, New York, 1988.*
4. *Fortran 77 and Numerical Methods – C. Xavier*
5. *Programming with Fortran 77- Ram Kumar*

COMMUNICATION I
(English)
EG404SH

Lecture: 1 Year:1
Tutorial: 3 Part: A

Course Description:

This course is designed for the students of B.E. Level who have completed either Diploma Level in Engineering or I. Sc. It intends to develop and strengthen in them the basic communication skills in the English language with emphasis on reading, writing and speaking.

Course Objectives:

This course intends to develop:
- ability to use language laboratory facility for the practice of listening pronunciation and oral development.
- intensive reading skills in technical and non-technical reading materials.
- skills in writing memoranda, business letters, applications and proposals.

:

1. **Introduction to pronunciation** **(2 Hours)**
   1.1 Phonetic symbols: vowels, diphthongs and consonants.
   1.2 Stress: word and connected speech.
   1.3 Intonation
   1.4 Practice in listening and speaking :
   1.5 Effective listening and note taking.
   1.6 Telling personal experience and simple incidents.
   1.7 Delivering speech with notes and visual aids.

2. **Intensive reading:** **(9 Hours)**
   2.1 Comprehension
   2.2 Understanding: short questions answer
   2.3 Contextual grammar

3. **Writing:** **(2 Hours)**
   3.1 Memoranda
   3.2 Business letters
   3.3 Application letters
   3.4 Proposals

Evaluation Scheme:

A) Internal Assessment:

Proposal writing -	6 marks
Lab -	2 marks
Attendance -	2 marks
Total:	**10 marks**

B) Semester Exam:

Comprehension -	14 marks
Short questions answer and contextual grammar -	10 marks
Proposal writing or	
Business letter / Application -	8 marks
Memo -	4 marks
Stress / Intonation -	4 marks
Total	**40 marks**
Total (A + B)	**50 marks**

Reference Books:

1.0 Anne Eisenberg, "Effective Technical Communication", McGraw - Hill. 1982.
2.0 K.W. Hope and T.E. Pearsall, "Reporting Technical Information", 5th Edition Macmillan Publishing Company, New York, 1984.
3.0 G. M. Spankie - "English in use." 1975
4.0 John Swales - "Writing Scientific English" - 1971
5.0 JMcAllister Gmadama - "English for Electrical Engineers" -1976
6.0 Alan Mounfford - "English in Workshop Practice"
7.0 Eric H. Glending - " English in Mechanical Engineering" - 1974
8.0 Geoffrey Leech Jan Svartvik -"A Communicative Grammar of English"

ENGINEERING DRAWING I
EG 431 ME

Lecture : 1 — **Year : 1**
Tutorial : 3 — **Part : A**

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

1.0 Instrumental Drawing, Practices and Techniques (2 hours)

1.1 Equipment and Materials:
Description of drawing instruments, auxiliary equipment and drawing materials

1.2 Techniques of Instrument Drawing:
Pencil sharpening, securing paper, proper use of T-squares, triangles, scales, dividers, compasses, erasing shields, French curves, inking pens.

2.0 Freehand Technical Lettering (4 hours)

2.1 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.

3.0 Dimensioning (8 hours)

3.1 Fundamentals and Techniques:
Size and location dimensioning, SI conventions
Use of scales, measurement units, reducing and enlarging drawings

3.2 General Dimensioning Practices:
Placement of dimensions, aligned and unidirectional Recommended practice, some 50 items.

4.0 Applied Geometry (5 hours)

4.1 Plane Geometrical construction:
Bisecting and trisecting lines and angles, proportional division of lines, construction of angles, proportional division of lines, construction of angles, triangles, squares, polygons. Constructions using tangents and circular arcs. Methods for drawing standard curves such as ellipses, parabolas, hyperbolas, involutes, spirals, cycloids and helices (cylindrical and helical).

4.2 Solid Geometrical Construction:
Classification and pictorial representation of solid regular objects such as:

Prisms	: square, cubical, triangular and oblique
Cylinders	: right and oblique
Cones	: right and oblique
Pyramids	: square, triangular, oblique, truncated

Doubly-Curved and warped Surfaces: sphere, torus, oblate ellipsoid, conoid, serpentine, paraboloid, hyperboloid.

5.0 Basic Descriptive Geometry (8 hours)

5.1 Introduction:
Application of descriptive geometry principles to the solution of problems involving positioning of objects in three-dimensional space
5.2 The Projection of points, lines and plans in space
5.3 Parallel lines
5.4 True length of lines: horizontal, inclined and oblique lines
5.5 Perpendicular lines
5.6 Bearing of a line
5.7 Point view or end view of a line
5.8 Shortest distance from a point to a line
5.9 Principal lines of a plane
5.10 Edge view of a plane
5.11 True shape of an oblique plane
5.12 Intersection of a line and a plane
5.13 Angle between a line and a plane
5.14 Angle between two intersecting lines
5.15 Angle between two non-intersecting (skew) lines
5.16 Dihedral angle between two planes
5.17 Shortest distance between two skew lines

6.0 Theory of Projection Drawing (5 hours)

6.1 Perspective Projection drawing
6.2 Orthographic projection
6.3 Axonometric projection
6.4 Oblique projection
6.5 First and third angle projection
6.6 Systems and projection

7.0 Multiview Drawings (5 hours)

7.1 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
7.2 Orthographic Drawings:
Making an orthographic drawing
Visualizing objects from the given views
Interpretation of adjacent areas
True-length lines
Representation of holes
Conventional practices

8.0 Sectional Views (4 hours)

8.1 Full section view
8.2 Half section view
8.3 Broken section
8.4 Revolved section
8.5 Removed (detail) section
8.6 Phantom of hidden section
8.7 Auxiliary sectional views
8.8 Specifying cutting planes for sections
8.9 Conventions for hidden lines, holes, ribs, spokes

9.0 Auxiliary Views (5 hours)

9.1 Basic concept and use of auxiliary views
9.2 Drawing methods and types of auxiliary views
9.3 Symmetrical and unilateral auxiliary views
9.4 Projection of curved lines and boundaries
9.5 Line of intersection between two planes
9.6 True size of dihedral angles
9.7 True size and shape of plane surfaces

10.0 Freehand Sketching and Visualization (5 hours)

10.1 Sketching and design:
Value of sketching as part of design
10.2 Techniques of sketching:
Pencil hardness, squared paper, line densities
Techniques for horizontal, vertical and circular lines
10.3 Multiview sketches:
Choice of views, adding detail, dimensioning, title, notes
Proportioning and comparative sizing
10.4 Sketching pictorial views:
General pictorial sketching
Mechanical methods of sketching and proportioning
Isometric sketching
Oblique sketching
Perspective sketching
Conventional treatment of fillets, rounds and screw threads
Sketches of an exploded view to show assembly of components

11.0 Developments and Intersections (9 hours)

11.1 Developments:
General concepts and practical considerations
Development of a right or oblique prism, cylinder, pyramid, and cone
Development of a truncated pyramid and cone
Triangulation method for approximately developed surfaces
Transition pieces for connecting different shapes
Development of a sphere
11.2 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
Intersection of a cylinder and an oblique plane
Intersection of a sphere and an oblique plane
Constructing a development using auxiliary views
Intersection of two cylinders
Intersection of a cylinder and a cone

DRAWING LABORATORY: 3 hours/week, 13 weeks

1.0 Freehand Technical Lettering and use of Drawing Instruments
2.0 Freehand Technical Lettering and use of Drawing Instruments
3.0 Dimensioning
4.0 Geometrical and Projection Drawing
5.0 Descriptive Geometry
6.0 Descriptive Geometry (cont)
7.0 Projection and Multiview Drawings
8.0 Projection and Multiview Drawings
9.0 Sectional views
10.0 Auxiliary views
11.0 Freehand Sketching and Visualization
12.0 Developments and Intersections
13.0 Developments and Intersections (cont)

Textbooks and Reference Books:

1.0 W.J. Luzadder, "Fundamentals of Engineering Drawing", Prentice Hall, 8th Edition, 1981.
2.0 T.E. French, C.J. Vierck and R. J. Foster, "Engineering Drawing and Graphic Technology", McGraw-Hill, 1981.
3.0 F.E. Giesecke, A. Mitchell, H. C. Spencer and J. T. Dygdone, Macmillan, 8th Edition, 1986.

WORKSHOP TECHNOLOGY
EG 432 ME

Lecture : 1 **Year : 1**
Practical : 3 **Part : A**

COURSE OBJECTIVES: To provide instruction and practical workshop experience in basic machine shop metal-working operations.

1.0 Bench Tools and Basic Hand Operations: (8 hours)

1.1. Familiarization with tools and their use
1.2. Machinist's hammers
1.3. Types of screw drivers
1.4. Use and sharpening of punches, chisels, chippers and scrapers, scribers
1.5. Classification of files
1.6. Types of pliers and cutters
1.7. Types of wrenches: open end, box end, combination, adjustable, socket, offset, twelve point ratchet, strap wrench, pipe wrench, spanner wrenches, Allen wrenches
1.8. Hacksaws
1.9. Bench vises
1.10. Hand drills
1.11. Taps and dies
1.12. Hand shears
1.13. Rules, tapes and squares
1.14. Soldering and brazing equipment
1.15. Rivet types

2.0 Hand Working Operations: (8 hours)

2.1 Choice of blades and sawing techniques
2.2 Filling to obtain flat and parallel surfaces, square corners, roughing and finishing operations
2.3 Tapping holes and threading rods
2.4 Scribing layout patterns
2.5 Shearing and cutting sheet metal
2.6 Soldering
2.7 Safety
2.8 Riveting

3.0 Power Tools: (4 hours)

3.1 Power hacksaw
3.2 Horizontal cutoff band saw
3.3 Vertical band saw and cutting operations
3.4 Bench and hand-held grinders
3.5 Belt and disk sanders
3.6 Hand-held power drills

3.7 Safety aspects

4.0 Measuring and Gagging: (4 hours)

4.1 Semi-precision tools such as rules, scales, try squares, inside/outside clippers, depth gages, feeler gages

4.2 Precision tools such as micrometers, vernier calipers, vernier height gages, telescoping gages, hole gages, bevel protractors, dial indicators, gage blocks and surface plates

5.0 Drills and Drilling Processes: (4 hours)

5.1 Types of drill presses
5.2 Work holding attachments and accessories
5.3 Cutting tools
5.4 Geometry and grinding of drill bits
5.5 Drilling, countersinking, reaming, lapping
5.6 Cutting speeds
5.7 Safety

6.0 Machine Tools: (12 hours)

6.1 General safety considerations
6.2 Physical construction and types of engine lathes
6.3 Facing and straight turning operations
6.4 Threading
6.5 Tool selection and feed rates
6.5 Horizontal and vertical shapers
6.6 Applications of shapers
6.7 Types and construction of milling machines
6.8 Selection of milling machine cutters and accessories, operations
6.9 Grinding machines
6.10 Horizontal surface grinding
6.11 Plain cylindrical grinding

7.0 Material Properties: (8 hours)

7.1 Tool materials such as low, medium and high carbon steels, hot and cold rolled steels, alloy steels, carbide and ceramic materials

7.2 Heat treating methods for steels: hardening, tempering, annealing, normalizing, quenching

7.3 Non-ferrous materials such as brass, bronze, aluminium: comparative properties and machinability

8.0 Sheet Metal Work: (4 hours)

8.1 Tools
8.2 Marking and layout
8.3 Bending and rolling operations
8.4 Cutting operations

9.0 Metal Joining: (8 hours)

9.1 Safety considerations
9.2 Soldering methods and practices
9.3 Brazing methods and materials
9.4 Practice of torch brazing
9.5 Oxygen-acetylene welding methods and practices
9.6 Selection of welding rods
9.7 Arc welding methods and practices
9.8 Resistance welding
9.9 Electric arc welding

<u>Textbooks and Reference Books:</u>

1.0 J.Anderson and E.E. Tatro, “Shop Theory”, Mcgraw-Hill, 5th Edition, 1942.
2.0 O.D.Lascoe, C.A.Nelson andH.W.Porter, “Machine shop operations and setups”, American Technical society, 1973.
3.0 “Machine shop practice - volume I”, Industrial press, New York, 1971.
4.0 “Machine shop practice volume II”, Industrial press, New York, 1971.
5.0 K.Oswald, “Technology of Machine Tools”, McGraw Hill-Ryerson, 3rd Edition.
6.0 Oberg, Jones and Horton, “Machinery’s Handbook”, 23rd Edition, Industrial press, New York.

Workshop Practice: 3 hours per week for 12 weeks

1.0 Bench tools and hand operations: measuring, marking, layout, cutting, filling, drilling, tapping, assembly.
2.0 Bench tools and hand operations continued.
3.0 Power tools and drilling machines.
4.0 Measuring and gagging
5.0 Engine lathe: basic operations such as facing, cutoff, plain turning, knurling.
6.0 Lathe work continuation: taper turning, drilling and boring.
7.0 Basic shaper operations.
8.0 Milling machine and/or surface grinder.
9.0 Sheet metal working.
10.0 Soldering and brazing.
11.0 Gas welding.
12.0 Electric arc welding.

APPLIED MECHANICS
EG 439 CE

Lecture : 3 **Year : 1**
Tutorial : 1 **Part : A**

COURSE OBJECTIVES: To develop an understanding of mechanical equilibrium and of Newton's laws of motion by application to a wide range of problems of engineering interest.

1.0 General Principles of Statics (1 hour)
- 1.1 Concept of equilibrium of particles
- 1.2 Fundamental quantities of length, time and mass
- 1.3 SI system of units
- 1.4 Significant figures for calculations

2.0 Vectors (1 hour)
- 2.1 Force and position vectors
- 2.2 Vector operations: addition, subtraction, dot product, cross product, scalar and triple product, unit vectors.

3.0 Equilibrium of a particle (2 hours)
- 3.1 Condition of equilibrium
- 3.2 Free-body diagrams
- 3.3 Coplanar force systems; transmissibility, force resultant
- 3.4 Three-dimensional force systems

4.0 Force System Resultants (2 hours)
- 4.1 Cross products
- 4.2 Moment of a force - scalar and vector representation
- 4.3 Moment of a couple - scalar and vector representation
- 4.4 Reduction of systems of forces and moments to a single force and couple
- 4.5 Resultant force and moment for a system of forces

5.0 Equilibrium of a Rigid Body (3 hours)
- 5.1 Conditions for equilibrium
- 5.2 Equilibrium in two dimensions; equations, two and three force members
- 5.3 Equilibrium in three dimensions; equations, constraints for rigid bodies

6.0 Friction (2 hours)
- 6.1 Laws of friction, static and dynamic coefficients of friction, friction angle
- 6.2 Application to static problems

7.0 Planar Trusses, Frames and Mechanisms (3 hours)
- 7.1 Simple trusses
- 7.2 Types of frames; determinate and indeterminate

- 7.3 Degrees of freedom; structure or mechanism
- 7.4 Internal forces from equilibrium; examples for trusses, frames and mechanisms

8.0 Beams (3 hours)
- 8.1 Classification of beams, loads and supports
- 8.2 Determining internal shear force, axial force and bending moment at a section

9.0 Fluid Statics (2 hours)
- 9.1 Distribution of pressure on submerged surfaces
- 9.2 Centre of pressure and resultant force

10.0 Centre of Gravity and Centroid (2 hours)
- 10.1 Centres of gravity
- 10.2 Centroids of lines, areas and volumes
- 10.3 Second moment of and area

11.0 Moments of Inertia (2 hours)
- 11.1 Moments of inertia by integration
- 11.2 Parallel axis theorem
- 11.3 Moments of inertia of composite areas

12.0 Kinematics of a particle (3 hours)
- 12.1 Rectilinear and curvilinear motion
- 12.2 Uniformly accelerated motion
- 12.3 Projectile motion
- 12.4 Rectangular, normal and tangential components of acceleration

13.0 Kinetics of a Particle (3 hours)
- 13.1 Newton's laws and equations of motion
- 13.2 Applications using rectangular or normal and tangential components
- 13.3 Principle of work and energy
- 13.4 Work, power and efficiency
- 13.5 Linear impulse and momentum
- 13.6 Angular impulse and momentum

14.0 Planar Kinematics of a Rigid Body (4 hours)
- 14.1 Translation, rotation and general plane motion
- 14.2 Relative velocity and acceleration analysis
- 14.3 Applications: rigid bodies, simple mechanisms and linkages

15.0 Force Analysis for Rigid Bodies (4 hour)
- 15.1 Equations of motion
- 15.2 Need for moments of inertia
- 15.3 Translation, pure rotation and general plane motion
- 15.4 Constrained motion in a plane

16.0 Principle of Work and Energy for Rigid Bodies (3 hours)

16.1 Kinetic energy
16.2 Potential energy; gravitational forces and elastic elements
16.3 Conservative and non-conservative systems
16.4 Work by external forces; applied loads, frictional force

17.0 Linear and Angular Impulse and Momentum for Rigid Bodies (3 hours)

17.1 Conservative of linear and angular momentum
17.2 Impulse motion and accentric impact

<u>Textbook:</u>

1.0 F.P. Beer and E.R. Johnson, "Vector Mechanics for Engineers, Statics and Dynamics", Third Edition, McGraw-Hill
2.0 R.C. Hibbeler, "Engineering Mechanics, statics and Dynamics", Fifth Edition, MacMillan publishers, New York.
3.0 F.P. Beer and E.R. Johnson, "Mechanics of Materials", McGraw- Hill, 1981.

THERMODYNAMICS, HEAT AND MASS TRANSFER
EG 469 ME

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

Course objective: To provide the student with a basic understanding of thermodynamics, heat transfer and fluid flow.

1.0 Introductory Concepts: (2 hours)

1.1 The nature of thermodynamics
1.2 Concepts from mechanics and electromagnetics
1.3 Dimensional and unit systems
1.4 Energy and units

2.0 Energy and the First Law: (3 hours)

2.1 Systems and energy conservation
2.2 Energy transfer as work
2.3 Energy transfer as heat
2.4 Energy balance for a control mass, examples for no flow and steady flow systems

3.0 Properties and States of Substances: (4 hours)

3.1 Simple substances and equations of state
3.2 General nature of a compressible substance
3.3 Metastable states in phase transition
3.4 Physical properties data and engineering analysis
3.5 Other thermodynamic properties
3.6 The perfect gas
3.7 The simple magnetic substance

4.0 Energy Analysis: (2 hours)

4.1 General methodology
4.2 Examples of control mass energy analysis
4.3 Examples of control volume energy analysis

5.0 Entropy and Second Law: (3 hours)

5.1 The essential concept of entropy
5.2 Reversible and irreversible processes
5.3 Entropy as a function of state
5.4 Applications to energy conversion systems

6.0 Characteristics of Some Thermodynamic Systems: (3 hours)

6.1 The carnot cycle
6.2 Process models
6.3 Use of the Rankine cycle

6.4 Vapour refrigeration systems
6.5 Power systems

7.0 Introduction to Heat Transfer: (2 hours)
7.1 Basic concepts and models of heat transfer
7.2 The conduction rate equation and heat transfer coefficient
7.3 Conduction: insulation, R values, electric analogies; overall coefficient for plane walls, cylinders and fins; conduction shape factor; transient heat conduction
7.4 Free and forced convection: laminar and turbulent boundary layers; flat plates, tubes and fins; cross flow and application to heat exchangers
7.5 Radiation: radiation properties for black and gray bodies; applications; earth-atmosphere system; radiant heating systems
7.6 Heat transfer applications in electronics and electrical engineering: finned heat sinks for electronic applications, forced air cooling of electronic instrumentation, cooling of electric equipment such as transformers, motors, generators, power converters

8.0 Fluid Properties and Definitions: (2 hours)
8.1 Definition of a fluid
8.2 Viscosity
8.3 Density, specific gravity, specific volume
8.4 Bulk modulus
8.5 Surface tension

9.0 Fluid Statics: (3 hours)
9.1 Pressure variation in static fluids
9.2 Pressure measurement, units and scales
9.3 Forces on plane and curved submerged surfaces
9.4 Buoyant force
9.5 Stability of floating and submerged bodies

10.0 Fluid Flow Concepts and Basic Equations: (4 hours)
10.1 Types of flow and definitions
10.2 The continuity equation
10.3 Streamlines and the potential function
10.4 The Bernoulli energy equation
10.5 The momentum equation
10.6 Applications

11.0 Viscous Flow: (3 hours)
11.1 Turbulent and laminar flow, Reynold's number
11.2 Velocity distribution
11.3 Boundary layer concepts
11.4 Drag on immersed bodies
11.5 Resistance to flow in open and closed conduits

11.6 Pressure losses in pipe flow

12.0 Turbomachinery: (4 hours)
12.1 Geometrically similar (homologous) machines
12.2 Performance equations for pumps and turbines
12.3 Configurations and characteristics of turbomachines, axial and centrifugal pumps and blowers, impulse turbines (pelton), reaction turbines (Francis, Kaplan)
12.4 Cavitation

Laboratory: Selected fundamental laboratory experiments from the facilities for thermodynamics, heat transfer and fluid mechanics. In some cases, two laboratory exercises are to be completed in one three hour period.

1.0 Temperature and pressure measurement.
2.0 Compression and expansion of gases and heat equivalent of work.
3.0 Heat conduction and convection.
4.0 Refrigerator and/or heat pump.
5.0 Hydrostatics and properties of fluids, viscous flow in pipes.
6.0 One of: Air flow studies in axial and centrifugal fans Turbomachines: Kaplan, Pelton and Francis types.

Textbooks and References:

1.0 W.C. Reynolds, "*Engineering Thermodynamics*", McGraw-Hill, 2nd Edition, 1970.
2.0 V.M. Faires, "*Thermodynamics*", Macmillan.
3.0 M.N. ozisik, "*Heat Transfer - A Basic Approach*", McGraw-Hill, 1985.
4.0 de Witt, "*Fundamentals of Heat and Mass Transfer*", Wiley 1985.
5.0 Saberski, Acosta and Hauptmann, "*Fluid Mechanics*".
6.0 V.L. Streeter, Acosta and Hauptmann, "*Fluid Mechanics*", Latest Edition, McGraw Hill.

MATHEMATICS II
EG471SH

Lecture: 3 **Year:1**
Tutorial: 2 **Part: B**

COURSE OBJECTIVES: It is assumed that students have taken Mathematics I or an equivalent introduction to calculus as a prerequisite. Major topics to be covered are (a) two and three-dimensional vectors and some associated linear algebra (b) infinite series (c) first order differential equations.

1. **Plane curves and Polar coordinates.** **(4 hours)**

   1.1 Plane curves**.**
   1.2 Parametric equations.
   1.3 Polar coordinates.
   1.4 Integrals in Polar Coordinates.

2. **Calculus of Several Variables**. **(6 hours)**

   2.1 Calculus of two or more variables.
   2.2 Partial derivatives.
   2.3 Total differential coefficients.
   2.4 Extrema of functions of two or three variables.

3. **Multiple integrals.** **(4 hours)**

   3.1 Multiple integrals.
   3.2 Uses in areas.
   3.3 Volumes.
   3.4 Centroids.

4. **Analytic Geometry of 3-D** **(7 hours)**

   4.1 Analytic Geometry of three dimensions-planes.
   4.2 Straight lines.
   4.3 Standard equations of sphere.
   4.4 Cylinder and cone.

5. **Infinite series** **(9 hours)**

   5.1 Infinite series and sequences.
   5.2 Convergence
   5.3 Ratio, root, integral tests.

   5.4 Absolute convergence
   5.5 Power series.
   5.6 Radius of convergence.

6. **Vectors in two and three dimensions** **(5 hours)**

   6.1 Two and three dimensional Vectors.
   6.2 Scalar products.
   6.3 Vector products
   6.4 Linesand planes.

7. **Ordinary Linear differential equations** **(10 hours)**

   7.1 Homogeneous Linear differential equations of second order.
   7.2 General solution.
   7.3 Initial value problems.
   7.4 Non homogeneous equations.
   7.5 Solution in series, Legendre, Bessel equations.

Textbook:
1.0 E.W. Swokowski, "Calculus With Analytic Geometry", Second Alternate Edition, PWS-Kent Publishing Co., Boston.

Reference Books:
1.0 E. Kreyszig, "Advance Engineering Mathematics", Fifth Edition, Wiley, New York.

CHEMISTRY
EG403SH

Lecture: 3 | Year: 1
Tutorial: 1 | Part: B
Laboratory: 2

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

Group A (Physical Chemistry)

1.0 Atomic Structure **(5 hours)**
- 1.1 Limitations of Bohr's Theory
- 1.2 Sommerfeld's extension of Bhor model of atom (no derivation) Wave mechanical model of atom
- 1.3 De-Broglee's equation, matter waves and electromagnetic waves
- 1.4 Heisenberg's uncertainty principle, uncertainty principle and probability Concept.
- 1.5 Derivation of Schrodinger's equation (time Independent), significance of wave function, quantum numbers and orbital, radial and angular probability distribution graphs and shapes of s, p, d orbitals.
- 1.6 Pauli's exclusion principle, Hund's rule of maximum multiplicity aufbau principle, electronic configuration using s, p, d, f orbitals, stability of half filled and completely filled orbitals.

2.0 Ionic equilibrium **(4 hours)**
- 2.1 Strong and weak electrolytes
- 2.2 Ostwald's dilution law and its limitation
- 2.3 pH and pH scale
- 2.4 Common ion effect in ionic equilibria.
- 2.5 Buffer and pH of buffer

3.0 Flectro Chemistry **(4 hours)**
- 3.1 Electrolytic cells and Galvanic cells
- 3.2 Single electrode potentials and normal hydrogen electrode, elctro-chemical series
- 3.3 Nernst's equation and determination of electrode potential and cell potential under non-standard conditions
- 3.4 Corrosion of metals and its prevention.

4.0 Chemical energetics **(5 hours)**

- 4.1 Internal energy (E) and I law of thermodynamics.
- 4.2 Isothermal irreversible expansion of an ideal gas, isothermal reversible expansion of an ideal gas.
- 4.3 Experimental determination of E(using bomb Calorimeter)
- 4.4 Enthalpy (H) and experimental determination of H.
- 4.5 Enthalpy of Physical and Chemical changes
- 4.6 Hess's law of constant heat summation
- 4.7 Enthalpy change from bond energy
- 4.8 Molar heat Capacities, relation between Cp and Cv
- 4.9 Variation of heat of reaction with temperature (Kirchhoff's equations)
- 4.10 Calorific values of fuels and food.

Group B (Inorganic Chemistry)

5.0 Chemical Bonding **(4 hours)**
- 5.1 Valence bond theory
- 5.2 A brief treatment of the Covalent bond with valence bond theory.
- 5.3 Types of overlapping
- 5.4 Hybridization
- 5.5 Condition necessary for hybridization
- 5.6 Characteristic of hybrid orbitals
- 5.7 Types of hybridization - Sp, Sp^2, Sp^3, dsp^2, dsp^3 and d^2Sp^3

6.0 Co-ordination Complexes **(5 hours)**
- 6.1 Double Salt and complex Salt
- 6.2 Werner's Co-ordination theory
- 6.3 Nomenclature of Co-ordination Complexes.
- 6.4 Electronic interpretation in Co-ordination.
- 6.5 Bonding in Co-ordination compounds - only valence bond theory.
- 6.6 Applications of valence bond theory - Octahedral complexes, Tetrahedral complexes and Square planer complexes.
- 6.7 Application of Co-ordination complexes.

7.0 Transition elements - 3rd Series, with reference to **(5 hours)**
- 7.1 Electronic configuration.
- 7.2 Metallic character
- 7.3 Oxidation State
- 7.4 Colour formation
- 7.5 Magnetic properties
- 7.6 Tendency to form complexes.

8.0 Silicones - Properties and uses **(1 hour)**

Group C (Organic Chemistry)

9.0 Stereochemistry **(3 hours)**

9.1 Stereoisomerism
9.2 Geometrical isomerim
9.3 Optical Isomerisum

10.0 Four general types of organic reactions **(4 hours)**

10.1 Substitution reaction S_N^1 and S_N^2 reaction
10.2 Addition
10.3 Elimination E_1 and E_2 reactions
10.4 Rearrangement.

11.0 Organometallic compounds **(1 hours)**

Preparation of Grignard's reagent, properties and uses

12.0 Aromatic Compounds **(1 hours)**

Toluene- preparation, Properties and uses

13.0 Explosives **(2 hours)**

13.1 Simple idea about low and high explosives.
13.2 TNT, TNG and nitrocellulose preparation and uses

14.0 Plastics and Polymers **(3 hours)**

14.1 Polymers and Polymerization.
14.2 Types of Polymerization reaction.
14.3 Types of Polymers
14.4 Synthetic fibres Polystyrene, Teflon, nylon, terylene or dacron.

Text books and References.

Physical Chemistry:

Text:
1. Selected topics in physical chemistry.
-Motikaji Sthapit

References:
1. Principles of physical chemistry
-Marron & Prutton.
2. Essentials of physical chemistry.
-Bahl & Tuli

Inorganic chemistry:

Text:
1. Advanced Inorganic chemistry
- Satyaprakash, R. D. Modan., G.D. Tuli

References:
1. Concise Chemistry
-A.J. Lee
2. Inorganic chemistry
-R. C. Agrawal.

Organic chemistry:

Text:
1. Organic chemistry.
-Morrison and Boyd

References:
1. Organic chemistry
-B. S. Bahl
2. Mechanism in organic chemistry
-Peter Sykes.

Chemistry Laboratory
EG403SH

F M:25
Internal: 10
External: 15

1. To determine the alkalinity of water samples A&B.
2. To determine the hardness of water Complexometrically using EDTA.
3. To determine the amount of free chlorine in water by Standardization of hypo Solution.
4. To prepare the standard buffer solutions using acetic acid & sodium acetate and to measure the approximate pH of the given unknown solution by universal indicator method.
5. To prepare the standard buffer solutions using ammonia and ammonium chloride and to measure the approximate pH of the given unknown solution by using universal indicator.
6. To determine the relative and absolute viscosity of the given liquids by ostwald's Viscometer.
7. To find the surface tension of the liquids by stalagmometer and compare surface tension of the cleaning powder of detergents.
8. To measure the quantity of electricity required to deposit one mole of Copper.
9. To purify petroleum and crude alcohol by fractional distillation.

ELECTRICAL ENGINEERING MATERIALS
EG 476 EE

Lecture : 3 **Year : 1**
Tutorial : 1 **Part : B**

COURSE OBJECTIVES: To provide a basic understanding of the electric and magnetic properties of materials used in electrical and electronics engineering.

1.0 Theory of Metals: (6 hours)
- 1.1 Elementary quantum mechanical ideas
- 1.2 Free electron theory
- 1.3 Energy well model of a metal
- 1.4 Density of states function
- 1.5 The Fermi-Dirac distribution function
- 1.6 Thermionic emission
- 1.7 Work function
- 1.8 The Fermi level at equilibrium, contact potentials

2.0 Free Electron Theory of Conduction in Metals: (6 hours)
- 2.1 Thermal velocity of electrons at equilibrium
- 2.2 Lattice scattering, mean free time between collisions
- 2.3 Drift velocity of electrons in an electric field
- 2.4 Diffusion of electrons, diffusion coefficient, Einstein’s relationship between mobility and diffusion coefficients
- 2.5 Chemical and physical properties of common conducting materials such as Au, Ag, Cu, Al, Mn, Ni, etc.

3.0 Conduction in Liquids and Gases: (2 hours)
- 3.1 Ionic conduction in electrolytes
- 3.2 Electrical conduction in gases
- 3.3 Arc discharges, electric breakdown

4.0 Dielectric Materials: (6 hours)
- 4.1 Macroscopic effects
- 4.2 Polarization, dielectric constant
- 4.3 Dielectric losses, frequency and temperature effects
- 4.4 Dielectric breakdown
- 4.5 Ferroelectricity and piezoelectricity
- 4.6 Properties of common dielectrics such as glass, porcelain, polyethylene, pvc, nylon, bakelite, rubber, mica, transformer oils, etc.

5.0 Magnetic Materials: (8 hours)
- 5.1 Ferromagnetism, ferrimagnetism, paramagnetism
- 5.2 Domain structure

5.3 Hysterisis loop, eddy current losses
5.4 Soft magnetic materials
5.5 Fe-si alloys, Ni-Fe alloys
5.6 Ferrites for high frequency transformers
5.7 Square loop materials for magnetic memory, relaxation oscillators
5.8 Hard magnetic materials such as carbon steels, Alnico alloys and barium ferrites

6.0 Semiconducting Materials: (12 hours)

6.1 Band structure of Group IV materials, energy gap
6.2 Density of states function
6.3 Fermi-Dirac distribution function
6.4 Hole and electron densities in an intrinsic crystal
6.5 Effective densities of states, intrinsic concentration
6.6 Fermi level of energy at equilibrium
6.7 Group III and Group IV impurities, acceptors and donors, p and n-type materials
6.8 Energy band diagrams for uniformly-doped and graded p- and n-type materials
6.9 Generation and recombination of electrons and holes, concept of lifetime
6.10 Mobility and diffusion coefficients for electrons and holes in semi conductors
6.11 Transport and continuity equations for electrons and holes
6.12 Concept of diffusion length
6.13 Energy band diagram for a p-n junction, contact potentials
6.14 Metal-semiconductor contacts
6.15 Brief introduction to Crystallography/metallurgy (Phase diagram, transport phenomenon)

7.0 Semiconductor Materials Processing: (5 hours)

7.1 Crystal growing
7.2 Doping by solid state diffusion, ion implantation
7.3 Oxidation
7.4 Photolithography the planar process
7.6 Metallization contacts

<u>Textbooks:</u>

1.0 R.A. Colcaser and S.Diehl-Nagle, "Materials and Devices for Electrical Engineers and Physicists, McGraw-Hill, New York, 1985.
2.0 R.C. Jaeger, "Introduction to Microelectronic Fabrication- - Volume IV", Addison-Wesley publishing Company, Inc.,1988.

ELECTRIC CIRCUITS I
EG 477 EE

Lecture : 3 **Year : 1**
Tutorial : 1 **Part : B**
Practical : 3

COURSE OBJECTIVES: To introduce dc and ac circuit analysis.

1.0 Circuit Elements: (4 hours)

1.1 Mathematical description of the functional behaviour of resistors, capacitors and inductors in terms of current and voltage relationships
1.2 Basic physical structure of resistors, capacitors and inductors
1.3 Departures from ideal (pure R, L, or C) characteristics
1.4 Voltage and current sources, mathematical concepts and real physical devices as sources, batteries, photo cells, generators, etc.

2.0 Series and Parallel Circuits: (4 hours)

2.1 Resistive circuits with dc excitation
2.2 Resistors in parallel, resistors in series
2.3 Potential drop and potential rise
2.4 Circuits fed from voltage sources, from current sources
2.5 Output resistances of sources and effects on terminal characteristics
2.6 Power and energy considerations in dc circuits

3.0 Kirchhoff's Laws: (7 hours)

3.1 Kirchhoff's loop voltage and branch current laws for dc circuits
3.2 Loop and nodal formulations of circuit equations
3.3 Matrix methods of writing and solving simultaneous equations of networks

4.0 Network Analysis Theorem: (7 hours)

4.1 Maximum power transfer
4.2 Thevenin's equivalent circuit
4.3 Norton's equivalent circuit
4.4 Reciprocity

5.0 Single Phase AC Circuit Analysis: (10 hours)

5.1 Series, parallel and network circuits with ac excitation and resistances only
5.2 The concept of complex impedance and admittance
5.3 Sinusoidal excitation of inductive and capacitive reactances and complex impedances
5.4 Concept of time phase differences between various sinusoidal quantities
5.5 Sinusoidal waveform and phasor representation of ac quantities

6.0 Power and Energy in AC Circuits: (7 hours)

6.1 Effective values of sinusoidal and other waveforms of voltage and currents

6.2 Power and energy balances in ac excited circuits containing various combinations of resistors, capacitors and inductors
6.3 Instantaneous power, average real power, reactive power, power factor
6.4 Measurement of real and reactive power

7.0 Three Phase Circuit Analysis: (6 hours)
7.1 Ac circuits with several ac sources
7.2 The three phase excitation case
7.3 Phase relationships between line and phase quantities in three phase circuits
7.4 Real and reactive power in three phase circuits
7.5 Measurement of real and reactive power
7.6 Single phase representation of balanced three phase circuits
7.7 Power factor and power factor correction

Laboratory:

1.0 Introductory work
- principle of d'Arsonval movement
- use of voltmeter and ammeter
- multirange meters
- simple V and I measurement in lamp circuit; determine R = f(I) for incandescent light bulb

2.0 Kirchhoff's Voltage and Current Laws
- Use dc d' Arsenal meters to explore series, parallel and networked resistor combinations
- evaluate power from V and I
- note loading effects of meter

3.0 Measurement of Alternating Quantities Using Iron Vane Meters
- R, RL, RC circuits with ac excitation
- ac power, power factor, vars, phasor diagrams

4.0 The Oscilloscope (Dual Channel)
- examine signal generator output using oscilloscope
- examine phase relationships between signals in RL, RC circuits
- measure amplitude, frequency and time with the oscilloscope

5.0 The Dynamometer Wattmeter
- basic power measurement in dc circuits - meter loss compensation
- power, vars, power factor measurement in ac RL and RC circuits
- phasor diagrams

6.0 Measurements of Average and Effective Values
- use ac circuits with rectifier to generate non-sinusoidal wave. Measure average and rms values of currents and voltages using dc and ac meters

- examine waveforms (above) with oscilloscope and calculate average and rms values

7.0 Series and Parallel Resonant Circuits
- use audio signal generator and RLC resonant circuits to demonstrate resonance phenomena; use oscilloscope
- use a resonant circuit to extract a particular frequency signal from noise

8.0 Three-phase AC Circuits
- measure currents and voltages in three-phase balanced ac circuits
- prove wye-delta transformation
- exercise on phasor diagrams for three-phase circuits

9.0 Three-phase Power Measurement
- two wattmeter method of power measurement in R, RL, and RC three-phase circuits
- watts ratio curve

10.0 Electric Meters for Voltage and Current Measurement
- voltage measurements in high impedance circuits using moving coil and electronic voltmeters and oscilloscope
- electric power meters and their use

11.0 Bridge Circuits for Electrical Measurements
- potentiometers for voltage measurement
- dc and ac bridges for R, L, C measurements-Wien, Maxwell, Schering bridges

12.0 Electric Circuit Simulation Study
- introduce microcomputer simulation of circuits using SPICE (or other) software

Textbook :

1.0 J. R. Cogdell, "Foundations of Electrical Engineering", prentice Hall, Englewood Cliffs, New Jersey, 1990.
2.0 Paul W.Tuinenga, "SPICE - A Guide to Circuit simulation and Analysis using Pspice", prentice Hall, Englewood Cliffs, New Jersey, 1988.

ENGINEERING DRAWING II
EG 481 ME

Lecture : 1 **Year : 1**
Practical : 3 **Part : B**

COURSE OBJECTIVES: To continue ENGINEERING DRAWING I to the point of producing intelligible working drawings.

1.0 Pictorial Drawings: (12 hours)
1.1 Introduction
Characteristics, advantages and disadvantages
1.2 Axonometric Projection
Isometric
Diametric and trimetric drawing
1.3 Oblique projection
1.4 Perspective projection

2.0 Design and Production Drawings-Machine Drawings: (12 hours)
2.1 Introduction
Production of complete design and assembly drawings
2.2 Fundamental techniques
Size and location dimensioning
Placement of dimension lines and general procedures
Standard dimensioning practice (SI system)
2.3 Limit Dimensioning
Nominal and basic size, allowance, tolerance, limits of size, clearance fit, interference fit
Basic hole system and shaft systems
2.4 Threads and Standard Machine Assembly Elements
Screw threads: ISO standards, representation and dimensioning
Fasteners: Types and drawing representation
Key, collars, joints, springs bearings
2.5 Assembly Drawings
Drawing layout, bill of materials, drawing numbers

3.0 Welding and Riveting: (4 hours)
3.1 Representing Joints and Welds for Gas, Arc and Resistance Welding
Types: spot, seam, flash, fillet, back-back, surface and upset welds
3.2 Drawing symbols for welds
3.3 Rivets and riveted joints
Types and drawings representation

4.0 Piping Diagrams: (4 hours)
4.1 Piping, Tubing and Types of Joints
4.2 Specification of Threads, Fittings and Valves

4.3 Standard Piping Symbols
4.4 Piping Drawings and Symbolic Diagrams

5.0 Structural Drawings: (8 hours)
5.1 Steel Construction
Structural steel shapes
Bolted, welded and riveted connections
Detailing practices for structural steel
5.2 Wood Construction
Timber connections and bolted joints
Detailing practice
5.3 Concrete Construction
Slab and beam configurations
Steel reinforcement and prestressing
5.4 Masonry and Stone Construction

6.0 Electrical and Electronic Diagrams: (8 hours)
6.1 Standards
6.2 Types of Diagrams
Line diagrams, schematics and pictorials
6.3 Symbols for Components
6.4 Printed Circuits
6.5 Integrated Circuits

7.0 Topographical Drawings: (4 hours)
7.1 Topographical Maps
7.2 Cadastral Maps
7.3 Engineering Maps

8.0 Graphs, Charts and Nomograms: (4 hours)
8.1 Rectangular Coordinate Graphs
8.2 Charts
8.3 Nomograms

9.0 Reproduction and Duplicating of Engineering Drawings: (4 hours)
9.1 Blue Prints, Brown Prints and Blue-Line Prints
9.2 Ozalid Prints, Black and White (Diazo Prints)
9.3 Xerox Prints
9.4 Duplicate Tracings
9.5 Photocopies
9.6 Microfilming
9.7 Glass Cloth for Layouts

Texts and/or References:
1. "Fundamentals of Engineering Drawing", W.J. Luzadder, Prentice Hall, 8th Edition, 1981

2. "Engineering Drawing and Graphic Technology", T.E. French, C.J. Vierck and R.J. Foster, McGraw Hill, 1981
3. "Technical Drawing", F.E. Giesecke, A. Mitchell, H. C. Spencer and J. T. Dygdone, Macmillan, 8th Edition, 1986

LABORATORIES: 3 hr/week, 12 weeks

1. Isometric and Oblique Drawings
2. Oblique Drawing
3. Perspective Drawing
4. Machine Drawings; Sizing and dimensioning
5. Machine Drawings; Detail drawings, dimensioning and tolerancing
6. Machine Drawing; Assembly drawing
7. Threads and Fasteners
8. Welding, Jointing and Piping
9. Structural Drawing
10. Structural Drawing (cont.)
11. Electrical and Electronics Diagrams
12. Electrical and Electronics Diagrams (cont.)
13. Topographical and Engineering Maps
14. Graphs, Charts and Nomograms

1.5. Drawing Reproduction and Duplication

MATHEMATICS III
EG501SH

Lecture: 3 Year: 2
Tutorial: 2 Part: A

COURSE OBJECTIVES: The purpose of this course is to round out the student's preparation for more sophisticated applications with an introduction to linear algebra, a continuation of the study of ordinary differential equations and an introduction to vector calculus.

1. **Matrices and determinants** **(8 hours)**
   - 1.1 Matrix and determinants.
   - 1.2 Vector spaces
   - 1.3 Linear transformations
   - 1.4 System of linear equations, Gauss elimination.
   - 1.5 Rank, matrix inversion.
   - 1.6 Eigen values, eigen vectors.

2 **Fourier series** **(4 hours)**
   - 2.1 Fourier series,
   - 2.2 Periodic functions
   - 2.3 Odd and even functions.
   - 2.4 Fourier series for arbitrary range.
   - 2.5 Half range Fourier series.

3. **Laplace transforms** **(8 hours)**
   - 3.1 Laplace transforms.
   - 3.2 Standard L- transforms.
   - 3.3 Inverse laplace transforms.
   - 3.4 Applications.

4 **Vector Calculus** **(7 hours)**
   - 4.1 Vector Calculus.
   - 4.2 Differentiation and Integration of Vectors.
   - 4.3 Divergence.
   - 4.4 Gradient curl.

5 **Line, surface and volume integrals** **(18 hours)**
   - 5.1 Line integrals.
   - 5.2 Surface and volume integrals.
   - 5.3 Integral transformation theorems- Stoke's, Gauss and Green's theorems.

Textbook:
1.0 E. Kreszig, "Advanced Engineering Mathematics", Fifth Edition, Wiley, New York.
2.0 M. M. Guterman and Z.N. Nitecki, "Differential Equations, a First Course", 2nd Edition, Saunders, New York.

COMPUTER PROGRAMMING II
EG 505 SH

Lecture: 2 **Year: 2**
Practical: 3 **Part: A**

Course Objectives: To develop structured programming skills and to apply them to problems in electrical and electronics engineering.

1.0 Review of Algorithm Development: (2 hours)

1.1 Pseudocode and flowchart
1.2 Deterministic and non-deterministic techniques
1.3 Series methods, iterative techniques, recursive procedures, search techniques

2.0 The C Language: (14 hours)

2.1 Variables, constants, data types
2.2 Arithmetic expressions
2.3 Arrays
2.4 Functions
2.5 Structures
2.6 Strings
2.7 Pointers
2.8 Bit-oriented instructions
2.9 C pre-processors, C libraries
2.10 Errors and debugging
2.10.1 Syntax, run time errors and debugging
2.10.2 Overflow/underflow errors and debugging

2.11 User interface

3.0 Data Structures: (5 hours)

3.1 Queues
3.2 Stacks
3.3 Trees
3.4 Heaps

4.0 Structured Programming: (2 hours)

4.1 Review of structured programming principles
4.2 Constructs for structured programming – single entry/exit modules, conditionals – if –than-else, while, repeat
4.3 No goto statements, structured walkthrough

5.0 Programming Projects and Software Management: (4 hours)

5.1 Role of programming management in engineering.
5.2 Dynamic programming and use of constraints for solving engineering problems
5.3 Development time estimation
5.4 Structure charts and data flow diagrams
5.5 Bottom up or top down design
5.6 Testing – stub programs for testing, test at module boundaries, test boundary conditions
5.7 Documentation – data flow diagram, data dictionary, structure chart and program description sheets.

Laboratory:

Three or four substantial programming assignments in C, a major programming project in C

Reference Books:

a) Kelly and Pohl . "*A Book on C*", Benjamin/Cummings, 1984
b) E. Yourdan and LL, Constantine, "*Structured Design – Fundamentals of Discipline of Computer Program and System Design*", 2nd Edition, Yourdan press, New York, 1978.
c) C.A. Ziegler, "*Programming System Methodologies*", Prentice Hall, Englehood Cliffs, N.J., 1983.
d) J.K. Hughes and J.I. Michtom, "*A Structured Approach to Programming*", Prentice Hall, Englehood Cliffs, New Jersey, 1977

ELECTRIC CIRCUITS II
EG 527 EE

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

Course Objectives: To continue work in Electric Circuits I including the use of the Laplace Transform to determine the time and frequency domain responses of electric circuits.

1.0 Matrix Methods in Network Analysis: (4 Hours)

1.1 Mesh Analysis
1.2 Nodal analysis

2.0 Review of Classical Solution if Ordinary Differential Equations With Constant Coefficients: (5 hours)

2.1 First order differential equations, RL and RC circuits
2.2 General and particular solution
2.3 Initial conditions on L's and C's
2.4 Natural unforced response of LR and CR circuits from initial conditions, time constant
2.5 Complete transient and steady state response of first order system including initial conditions and applied forcing functions.

3.0 Complete Time Domain Response of Second and Higher Order System: (5 hours)

3.1 Initial conditions
3.2 Transient and steady state components of response including initial conditions
3.3 RLC resonance, damping factors, high and low Q circuits

4.0 Review of Laplace Transform: (4 hours)

4.1 Definitions and properties valuable for network analysis
4.2 Laplace transform of common forcing functions

4.2.1 Step and shifted step functions
4.2.2 Ramp and impulse functions
4.2.3 Sinusoidal functions

4.3 Real translation and complex translation theorem
4.4 Partial fraction expansion

5.0 Use of Laplace Transform Techniques for Solution of Ordinary Differential Equations with Constant Coefficients: (4 hours)

5.1 Transient and steady-state responses of networks to step, ramp, impulse and sinusoidal forcing functions with and without initial conditions on L's and C's

5.1.1 First order systems
5.1.2 Second and higher order systems

6.0 Transfer Functions, Poles and Zeros of Networks: (4 hours)

6.1 Concept of complex frequency
6.2 Transfer functions for two part networks
6.3 Poles and zeros of network functions
6.4 Relationship between pole/zero and system time response

7.0 Frequency Response of Networks: (4 Hours)

7.1 Magnitude and phase response
7.2 Bode diagrams
7.3 Band width, high-Q and low-Q circuits
7.4 Basic concept of filters, high-pass, band stop, low and band-pass filters

8.0 Fourier Series and transform: (5 hours)

8.1 Basic concept of Fourier series and analysis
8.2 Evaluation of Fourier coefficients for periodic non-sinusoidal waveforms in electric networks
8.3 Introduction of Fourier transforms

9.0 Two-port Parameters of Networks: (6 hours)

9.1 Definition of two-port networks
9.2 Short circuit admittance parameters
9.3 Open circuit impedance parameters
9.4 Transmission Short circuit admittance parameters
9.5 Hybrid parameters
9.6 Relationship and transformations between sets of parameters
9.7 Applications to filters
9.8 Applications to transmission lines

10.0 State Space Analysis: (4 hours)

10.1 Concept of state and state variables
10.2 State space representation of network equations

<u>Laboratory:</u>

1.0 Transient Response in first Order System Passive Circuits

- measure step and impulse of RC and RL circuits using oscilloscope
- relate time responses to analytical transfer function) calculations

2.0 Transform Response in Second Order System Passive Circuits

- measure step and impulse response of RLC series and parallel circuits using oscilloscope
- relate time responses to transfer functions and pole-zero configuration

3.0 Frequency Response of first and Second Order Passive Circuits

- measure amplitude and phase response and plot Bode diagrams for RL, RC and RLC circuits
- relate body diagrams to transfer functions and pole-zero configuration circuits.

4.0 Electric circuits Simulation Study

- Use SPICE program to simulate circuit and tests carried out in lab 1-3 and compare result from measurement with those from SPICE

5.0 Measurement of Harmonic Content of a Voltage

- Calculate Fourier coefficients for a square wave and variety this by harmonic measurements of a signal form a square wave generator using harmonic analyser.
- Repeat for a half wave rectified wave form using a diode and a resistor

<u>Reference Books:</u>

a) M.E. Van Valkenburg, "*Network Analysis*", third Edition, Prentice hall, 1995
b) William H. Hayt. Jr. & Jack E. Kemmerly, "*Engineering Circuits Analysis*", Forth edition, McGraw Hill International, Editions, Electrical Engineering Series, 1987.
c) Michel D. Cilletti, "*Introduction to Circuits Analysis and Design*", Holt, Hot Rinehart and Winston International Edition, New York, 1988.

SEMICONDUCTOR DEVICES
EG532EX

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

COURSE OBJECTIVES: To introduce the fundamentals of analysis of electronic circuits containing modern electronic components.

1.0 Linear Device Models: (6 hours)
- 1.1 Voltage-controlled voltage source model
- 1.2 Voltage-controlled current source model
- 1.3 Input and output resistance
- 1.4 Voltage and power gain calculations
- 1.5 Reverse transfer concept and the hybrid-pi circuit
- 1.6 Voltage gain calculations using the hybrid-pi circuit
- 1.7 y, z and h parameter calculations from the hybrid-pi circuit
- 1.8 Hybrid-pi circuit parameter calculations from the y, z and h parameters

2.0 Two-Terminal Nonlinear Devices: (6 hours)
- 2.1 Nonlinear circuit analysis
- 2.2 The load line
- 2.3 The perfect diode and circuit calculations
- 2.4 Semi conductor diode characteristics
- 2.5 Modeling the semi conductor diode and circuit calculations
- 2.6 Zener diode characteristics, modeling and circuit analysis

3.0 The Junction Field-Effect Transistor, a Three-Terminal Nonlinear Device: (6 hours)
- 3.1 JFET quadratic characteristics
- 3.2 Load line construction and biasing
- 3.3 Small-signal model around a dc operations point
- 3.4 JFET amplifier small-signal analysis

4.0 The Bipolar Transistor, a Three-Terminal Nonlinear Device: (8 hours)
- 4.1 The Ebers-Moll equations
- 4.2 Transistor configurations
- 4.3 Load line and biasing in the common-base configuration
- 4.4 Small-signal model around a dc operating point
- 4.5 Common-base amplifier small-signal analysis
- 4.6 Load line and biasing in the common-emitter configuration
- 4.7 Small-signal model around a dc operating point
- 4.8 Common-emitter amplifier small-signal analysis
- 4.9 Load-line and biasing in the common-collector configuration
- 4.10 Small-signal model around a dc operating point
- 4.11 Common-collector amplifier small-signal analysis

5.0 The Metal-oxide-semi conductor Transistor, a Three-Terminal Nonlinear Device: (6 hours)
- 5.1 The MOSFET quadratic characteristics
- 5.2 MOSFET load line and biasing
- 5.3 Small-signal model around a dc operating point
- 5.4 MOSFET amplifier small-signal analysis

6.0 Switching Circuits: (5 hours)
- 6.1 The bipolar transistor switch
- 6.2 Bipolar transistor logic circuits, examples of TTL circuits
- 6.3 The MOSFET switch
- 6.4 The NMOS family of logic circuits, some examples
- 6.5 The CMOS family of logic circuits, some examples

7.0 The Operational Amplifier: (6 hours)
- 7.1 The ideal operational amplifier
- 7.2 Feedback ideas
- 7.3 Inverting and non-inverting amplifiers
- 7.4 Summing amplifier
- 7.5 Integrator
- 7.6 Differentiator
- 7.7 Simple RC active filter
- 7.8 Combination of real diodes and the ideal operational amplifier in circuits such as the precision rectifier, the peak detector, the voltage clamp, etc.

Laboratory:
- 1.0 Introductory laboratory to familiarize students with equipment.
- 2.0 Diode characteristics, rectifiers, zener diodes.
- 3.0 Junction field-effect transistor characteristics and single stage amplifiers.
- 4.0 Bipolar transistor characteristics and single stage amplifiers.
- 5.0 some basic bipolar circuits for integrated circuit design: widlar current sources, current mirrors.
- 6.0 CMOS inverter characteristics, simple oscillator circuit.

Reference Book:

1.0 A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, 2nd Edition, Holt, Rinehart and Winston, Inc., New York, 1987.

2.0 J. R. Cogdell, “Foundations of Electrical Engineering”, Prentice Hall, Englewood Cliffs, New Jersey, 1990.

LOGIC CIRCUITS
EG 533 EX

Lecture: 3 **Year: 2**
Practical: 3 **Part: A**

Course Objectives: An introduction to logic design. The main goal is to develop methods of designing, constructing and building logic circuits.

1.0 Number System: (6 hours)
- 1.1 Decimal system and binary system
- 1.2 Base conversion methods
- 1.3 Complements of numbers
- 1.4 Basic arithmetic of binary numbers, use of 2' s complement
- 1.5 Signed and unsigned numbers
- 1.6 Fractions conversion
- 1.7 Octal, hexadecimal and binary coded decimal (BCD)
- 1.8 Gray code, alphanumeric code
- 1.9 Error codes

2.0 Digital Design Fundamentals: (11 hours)
- 2.1 Logic gates, symbols, truth tables
- 2.2 Realization of logic gates using diodes, using NAND / NOR gates
- 2.3 Boolean algebra, DeMorgan's law
- 2.4 The Karnaugh map, don't care conditions
- 2.5 Minimization theorems and reduction of K-map
- 2.6 Product- of-sum and sum-of -product realization of K-map
- 2.7 Functional test vectors

3.0 Digital System Building Blocks: (11 hours)
- 3.1 Combinational Digital System
  - 3.1.1 Half adder, full adder, n-bit adder
  - 3.1.2 Encoder, decoder, multiplexer, demultiplexer
  - 3.1.3 ROM, PLA
  - 3.1.4 Practical aspects – fan-in, fan-out, propagation delay
- 3.2 Sequential Digital System
  - 3.2.1 Difference between combinational and sequential circuit
  - 3.2.2 The concept of memory, flip-flop as 1-bit register
  - 3.2.3 Clock, Rising edge, falling edge and level triggering
  - 3.2.4 Setup time, hold time, clock skew
  - 3.2.5 S-R, J-K, Master-slave, T, and D type flip-flops, latches
  - 3.2.6 Shift registers
    - 3.2.6.1 Serial to parallel converter
    - 3.2.6.2 Serial in serial out register
    - 3.2.6.3 Parallel to serial converter
    - 3.2.6.4 Parallel in parallel out register
    - 3.2.6.5 Right shift, Left-shift register
    - 3.2.6.6 Digital delay line
    - 3.2.6.7 Sequence generator
    - 3.2.6.8 Shift register ring and twisted ring counter
  - 3.2.7 Ripple counter, synchronous counter, applications

4.0 Sequential Machines: (10 hours)
- 4.1 Synchronous machines
  - 4.1.1 Clock driven models and state diagrams
  - 4.1.2 Transition tables, Redundant states
  - 4.1.3 Binary assignment
  - 4.1.4 Use of flip-flops in realizing the models
- 4.2 Asynchronous machines
  - 4.2.1 Hazards in asynchronous systems and use of redundant branch
  - 4.2.2 Allowable transitions
  - 4.2.3 Flow tables and merger diagrams
  - 4.2.4 Excitation maps and realization of the model

5.0 Digital Design Examples: (7 hours)
- 5.1 Design study: Character Generators
  - 5.1.1 Dot matrix of a character
  - 5.1.2 Printed characters
  - 5.1.3 CRT single-character waveform
  - 5.1.4 Display of one character
  - 5.1.5 Display of a line of characters
- 5.2 Design work: Serial adder
  - 5.2.1 Block diagram and design issues
  - 5.2.2 Concept of tri-state logic and bus
  - 5.2.3 The registers with a common bus
  - 5.2.4 The summing unit

Laboratory : The laboratory exercises in this course consist of both CAD and hardware construction. The hardware experiments involve the use of logic patch boards for construction of gates array and memory based circuits.

1.0 Safe Laboratory procedures
2.0 AND, OR, and INVERTER gates
3.0 DeMorgan's law and familiarization with NAND and NOR gates.
4.0 Familiarization with binary addition and subtraction.
5.0 Construction of true complement generator
6.0 Encoder, decoder, and multiplexer.
7.0 Latches, RS, Master-slave and T type flip flops.
8.0 D and J-K type flip flops.
9.0 Shift registers
10.0 Ripple Counter, Synchronous counter
11.0 Familiarization with computer package for logic circuit design.
12.0 Design digital circuits using CAD.

References:

1.0 M. M. Mano, "*Digital Logic and Computer Design*". Prentice Hall, Englewood Cliffs, N. J. 07632, 1979.
2.0 William I. Fletcher, "*An Engineering Approach to Digital Design*". Prentice Hall of India, New Delhi 110 001, 1990.
3.0 Millman-Halkias, "*Integrated Electronics*". McGraw-Hill, 1986.
4.0 D. L. Dietmeyer, "*Logic Design of Digital systems*". Allyn and Bacon, Inc., Massachusetts 02194, 1982.
5.0 A. F. Malvino, "*Digital Electronics & Computer*" McGraw Hill

MECHANICS AND PROPERTIES OF SOLIDS
EG539CE

Lecture : 3	**Year : 2**
Tutorial : 1	**Part : A**
Practical : 1.5	

COURSE OBJECTIVES: To present the basic principle of analysis of stress, stain and deformation of solids and structures.

1.0 Introduction **(2 hours)**
- 1.1 Types of loads - static, dynamic, dead, live, wind, seismic
- 1.2 Types of supports and their symbolic representations
- 1.3 Types and numbers of beam reactions at supports
- 1.4 Statically determinate and indeterminate structures

2.0 Axial Forces, Shearing Forces and Bending Moments **(6 hours)**
- 2.1 Definitions and sign conventions
- 2.2 Plotting shearing force and bending moment diagrams
- 2.2 Plotting shearing force and bending moment diagrams
- 2.3 The concept of superposition of shearing forces and bending moments due to various combination of loads
- 2.4 Maximum shearing force and bending moment and their position
- 2.5 Calculation of bending moments from shearing force diagrams

3.0 Centroid of Plane Elements **(3 hours)**
- 3.1 General formulae for determination of centre of gravity
- 3.2 Determination of axes of symmetry
- 3.3 Determination of centre of gravity of built-up plane figures
- 3.4 Determination of centre of gravity of built-up standard steel sections

4.0 Moment of Inertia **(3 hours)**
- 4.1 Units of moment of inertia
- 4.2 Polar moment of inertia
- 4.3 Determination of moment of inertia of standard and built-up sections
- 4.4 Definition and determination of radius of gyration

5.0 Stresses and trains **(3 hours)**
- 5.1 Definition of stresses and strains
- 5.2 Relationship between stresses and strains
- 5.3 Elastic and elastoplastic behaviour under various stress loads

6.0 Types and Characteristics of Stresses **(3 hours)**
- 6.1 Ultimate stresses
- 6.2 Allowable stresses and factors of safety
- 6.3 Stress concentrations

6.4 Elastic constraints

7.0 Stress and Strain Analysis (4 hours)
- 7.1 Hooke's law, modulus of elasticity, Poisson's ratio and modulus of elasticity
- 7.2 Principal stresses and their relationship to normal and shear stress
- 7.3 Mohr's circle for stress and strain
- 7.4 Stresses due to change in temperature

8.0 Thin-Walled Vessels (3 hours)
- 8.1 Definition and characteristics of thin-walled vessels
- 8.2 Types of stresses in thin-walled vessels
- 8.3 Calculation of stresses in thin-walled vessels

9.0 Torsion (4 hours)
- 9.1 Definition
- 9.2 Calculation of torsional moments in elements
- 9.3 Calculation of torsional stresses
- 9.4 Elastic and plastic torsion

10.0 Theory of Flexure (4 hours)
- 10.1 Analysis of beams of symmetric cross-sections
- 10.2 Coplanar and pure bending
- 10.3 Radius of curvature, flexural stiffness and section modules
- 10.4 Elastic and plastic bending
- 10.5 Beam deflections
- 10.6 Analysis of composite beams

11.0 Mechanical Properties of Metals (10 hours)
- 11.1 Atomic structure and crystallography of metals
- 11.2 Strength, elasticity and hardness
- 11.3 Heat treatment
- 11.4 Fatigue and fracture
- 11.5 Thermal conductivity
- 11.6 Metals and alloys commonly used in electrical equipment

<u>Laboratory:</u>
- 1.0 Films - behavior of structural material, tensile and compressive forces on structures, loads on structures
- 2.0 Material properties in uniaxial tension: direct tension test and simple bending test
- 3.0 Torsion test to determine modulus of rigidity
- 4.0 Principle strains and stresses, stress/strain concentration, Poisson's Ratio
- 5.0 Column behaviour and buckling

<u>Textbook:</u>

Beer and Johnson, "Mechanics of Materials", McGraw-Hill, 1981.

APPLIED MATHEMATICS
EG561SH

Lecture: 3 Year: 2
Tutorial: 2 Part: B

Course objectives: This course focuses on several branches of applied mathematics. The student is 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 diffusion equations in cartesian, cylindrical and polar coordinates.

1. **Complex Variables (10 hours)**
   - 1.1 Function of Complex Variables.
   - 1.2 Taylor series.
   - 1.3 Laurent series.
   - 1.4 Singularities, Zeros and poles.
   - 1.5 Complex integration
   - 1.6 Residues.

2 **Z-Transforms (8 hours)**
- 2.6 Linear, time invariant systems, response to the unit spike
- 2.7 Delay, advance, convolution
- 2.8 Definition of the Z-transform
- 2.9 Relation of convolution to the product of transform
- 2.10 Region of convergence, relationship to causality
- 2.11 Inverse of the Z-transform by long division and by partial fraction expansion
- 2.12 Parseval's theorem

3 **The Fourier integral (8 hours)**
- 3.1 The Fourier integral
- 3.2 The inverse Fourier integral formula.
- 3.3 Frequency and phase spectra.
- 3.4 The delta function.

4 **Partial differential equations (10 hours)**
- 4.1 Basic concepts.
- 4.2 Wave equation.
- 4.3 Diffusion equation.
- 4.4 The Laplace equation in 2 and 3 dimensions.
- 4.5 Polar coordinates.
- 4.6 Cylindrical coordinates.
- 4.7 Spherical coordinates.
- 4.8 Bessels and Legendre equations.

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

5.1 The simplex method.
5.2 The canonical forms of solutions.
5.3 Optimal values.

Textbook:

1.0 E. Kreyszig, "Advanced Engineering Mathematics", Fifth Edition, Wiley, New York.

Reference for Z-Transform:

1.0 A.V. Oppenheim, "Discrete-Time Signal Processing", Prentice Hall, 1990.
2.0 K. Ogota, "Discrete-Time Control Systems", Prentice Hall, Englewood Cliffs, New Jersey,

ELECTRONIC CIRCUITS I
EG572EX

Lecture : 3 | **Year : 2**
Tutorial : 1 | **Part : B**
Practical : 3/2

COURSE OBJECTIVES: To build on the material presented in SEMI CONDUCTOR DEVICES to include the fundamentals of analog integrated circuit (IC) operation. Particular attention will be directed toward understanding operational amplifier operation over the full useful frequency range. Regulated power supplies, power amplifiers and relaxation and sinusoidal oscillators will be discussed.

1.0 Integrated Circuit Technology and Device Models: (10 hours)
1.1 The planar process for integrated circuit fabrication
1.2 Review of dc and ac diode models
1.3 Review of dc and ac JFET models
1.4 Review of dc and ac bipolar transistor models
1.5 Review of dc and ac MOS transistor models

2.0 Operational Amplifier Circuits: (8 hours)
2.1 Bias circuits suitable for IC design
2.2 The widlar currant source
2.3 The differential amplifier
2.4 Active loads
2.5 Output stages

3.0 Operational Amplifier Characterization: (6 hours)
3.1 Input offset voltage
3.2 Input bias and input offset currents
3.3 Output impedance
3.4 Differential and common-mode input impedances
3.5 DC gain, bandwidth, gain-bandwidth product
3.6 Common-mode and power supply rejection ratios
3.7 Higher frequency poles, settling time
3.8 Slew rate
3.9 Noise in operational amplifier circuits

4.0 Power Supplies and Voltage Regulators: (6 hours)
4.1 Half-wave and full-wave rectifiers
4.2 Capacitive filtering
4.3 Zener diodes, bandgap voltage references, constant current diodes
4.4 Zener diode voltage regulators
4.5 Series transistor-zener diode voltage regulators
4.6 Series transistor-zener diode-constant current diode voltage regulators

4.7 Voltage regulators with feedback
4.8 IC voltage regulations

5.0 Untuned and Tuned Power Amplifiers: (7 hours)
5.1 Amplifier classification
5.2 Direct-coupled push-pull stages
5.3 Transformer-coupled push-pull stages
5.4 Tuned power amplifiers
5.5 Power dissipation considerations

6.0 Oscillator Circuits: (8 hours)
6.1 CMOS inverter relaxation oscillator
6.2 Operation amplifier based relaxation oscillators
6.3 Voltage-to-frequency converters
6.4 Sinusoidal oscillators
6.5 Conditions for oscillators
6.6 Amplitude and frequency stabilization
6.7 Swept frequency oscillators
6.8 Frequency synthesizers
6.9 Function generators

Laboratory:
1.0 Study of a discrete component operational amplifier realization.
2.0 Commercial operational amplifier characterization.
3.0 Regulated power supplies
4.0 Power amplifiers
5.0 Relaxation oscillators
6.0 Sinusoidal oscillators

Reference Books:
1.0 W. Stanely "operational Amplifiers with Linear Integrated circuits", Charles E. Merrill publishing company, Toronto,1984.
2.0 J. G. Graeme, "Application of operational Amplifiers: Third Generation Techniques" The burr-Brown Electronic series", McGraw-Hill, New York, 1973.
3.0 P. E. Allen and D. R. Holberg, "CMOS Analog Circuit Design", Holt, Rinehart and Winston, Inc., New York, 1987.
4.0 A. S. Sedra and K. C. Smith, "Microelectronic Circuits", 2nd Edition, Holt, Rinehart and Winston, Inc., New York,

MICROPROCESSORS
EG573EX

Lecture : 3 **Year : 2**
Tutorial : 1 **Part : B**
Practical : 3

COURSE OBJECTIVES: To introduce the operation, programming, and application of microprocessors.

1.0 Introduction to Computer Architecture: (4 hours)
1.1 Automated calculator and stored program computer, Von Neuman, Harvard and modified Harvard architectures, principle elements - CPU, memory, control and input/output units
1.2 Simple stored program computer architecture, basic registers
1.3 Introduction to register transfer language (RTL) instruction description

2.0 Computer Instructions: (11 hours)
2.1 Introduction to memory reference, inherent, sequence modifying and input/output instructions
2.2 RTL descriptions of assembly level instructions
2.3 RTL description of load accumulator and store accumulator instructions
2.4 RTL description of inherent instructions, clear accumulator, increment and decrement
2.5 RTL descriptions of sequence modifying instructions - unconditional branch instructions, unconditional branch and jump instructions
2.6 RTL descriptions of sequence modifying instructions - conditional branch instructions, branch on accumulator zero, branch on accumulator not zero, signed and not signed arithmetic
2.7 Addressing modes - immediate, absolute, relative, indexed and indirect

3.0 Assembly Language Programming: (10 hours)
3.1 Assembler syntax - labels, instructions (opcodes, mnemonics and operands), directives and comments
3.2 Assembler operation - sample assembly language program and code generation, one pass and two pass assembly
3.3 Macro assemblers, linking assembler directives - .text, .data

4.0 Microcomputer Systems: (8 hours)
4.1 Microcomputer devices - bus structure, synchronous and asynchronous data bus, address bus, read and write operations and timing
4.2 Memory devices - static and dynamic random access memory (RAM), read only memory (ROM), ultraviolet electrically programmable memory (UVEPROM), electrically erasable programmable memory (EEPROM)
4.3 Input/output devices - parallel and serial interfaces, unique and non-unique address decoding

4.4 Synchronizing the computer with peripherals, simple and wait for data transfer wait interfaces
4.5 Serial asynchronous interfaces - ASCII codes, baud rate start bit, stop bit, parity bit, RS-232, RS-432 standards

5.0 Interrupt Operations: (6 hours)
5.1 Interrupt behaviour: complete instruction, save state of processor, optionally mask further interrupts and set program counter to interrupt service routine address
5.2 Interrupt service routine requirements - perform input/output, clear source of interrupt and return from interrupt
5.3 Interrupt priority - maskable and non-maskable interrupts, software interrupts, traps and exceptions
5.4 Vectored, chained and polled interrupt structures
5.5 Peripheral devices using interrupts - parallel and serial interfaces
5.6 Multiprocessing systems - communication between processes, semaphores, resource allocation and deadlock

6.0 Additional Topics: (6 hours)
6.1 Stacks, push and pull instructions
6.2 Static and dynamic variable allocation
6.3 Accumulator and register based computer architectures, reduced instruction set computer (RISC) and compressed instruction set computer (CISC) architectures, digital signal processing (DSP) processors.

Laboratory:
1.0 Introduction to a microprocessor system - machine language monitor, simple hardware interface (switch, LED and flip/flop) address and data bus operation for program execution and memory read and write.
2.0 Assembly language programming - use of assembler, character input/output, arithmetic operations, base conversion, conditional branching, static variable allocation using labels assembler directives
3.0 Parallel interface programming - wait interfaces, input and output, development of test programs dynamic variable allocation on system stack
4.0 Serial asynchronous interface programming - wait interfaces, buffered input data, circular buffer
5.0 Interrupt programming - multiple processes running with varied priority, peripheral data rate determined by an external clock, demonstration of deadlock

References:
1.0 Z.G Vranesic and S.G.Zaky, "Microcomputer structures", saunders College publishing, a division of Holt, Rinehart and Winston, 1989.

ELECTROMAGNETICS
EG574EX

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

COURSE OBJECTIVES: To impart a good working knowledge of the fundamental laws of static and dynamic electric and magnetic fields and to provide exposure to generation, transmission and measurement techniques involving electromagnetic fields and waves.

1.0 Introduction: (2 hours)
1.1 Coordinate systems
1.2 Scalar and vector fields
1.3 Operations on scalar and vector fields

2.0 Electrostatic Fields in Free Space: (2 hours)
2.1 Coulomb's law
2.2 Electric intensity
2.3 Electric flux density
2.4 Field lines
2.5 Graphical portrayal of fields

3.0 Gauss's Law in Integral Form and Applications: (2 hours)
3.1 Conductors, insulators, semiconductors
3.2 Boundary conditions at a conductor surface

4.0 Concept of Divergence: (2 hours)
4.1 Transition from macroscopic to microscopic description
4.2 Divergence theorem
4.3 Gauss's law in point form and applications

5.0 Electric Energy and Potential: (2 hours)
5.1 Gradient of a scalar point function
5.2 Electric intensity as the negative gradient of a scalar potential
5.3 Conservative fields
5.4 Electric energy density
5.5 Applications

6.0 Electrostatic Fields in Material Media: (2 hours)
6.1 Polarization
6.2 Free and bound charge densities
6.3 Relative permittivity
6.4 Capacitance calculations
6.5 Boundary conditions at the interface between two media

6.6 Applications

7.0 Boundary Value Problems in Electrostatics: (4 hours)
- 7.1 Laplace's and Poisson's equations
- 7.2 The uniqueness theorem
- 7.3 One-dimensional boundary value problems
- 7.4 Two-dimensional boundary value problems
- 7.5 Separation of variables
- 7.6 Cut-and-try method
- 7.7 Relaxation methods, numerical integration
- 7.8 Graphical field plotting
- 7.9 Capacitance calculations

8.0 Current and Current Density: (1 hour)
- 8.1 Conservation of charge
- 8.2 Continuity equation
- 8.3 Relaxation time constant
- 8.4 Applications

9.0 Time-Invariant Magnetic Fields: (3 hours)
- 9.1 Biot-Savart's law
- 9.2 Magnetic intensity and magnetic induction
- 9.3 Ampere's law in integral form
- 9.4 Applications

10.0 Concept of Curl: (3 hours)
- 10.1 Curl components as circulations per unit area
- 10.2 Stokes' theorem
- 10.3 Ampere's law in point form
- 10.4 Scalar and vector magnetic potentials
- 10.5 Boundary value problems and applications

11.0 Magnetic Forces and Torque: (1 hours)
- 11.1 Magnetic fields in material media
- 11.2 Relative permeability
- 11.3 Boundary conditions
- 11.4 Magnetic circuits

12.0 Quasi-Static Fields: (2 hours)
- 12.1 Faraday's law of electromagnetic induction
- 12.2 Applications

13.0 Electrodynamic Fields: (2 hours)
- 13.1 Inadequacy of Ampere's law derived for direct currents
- 13.2 Conflict with the continuity equation
- 13.3 Maxwell's postulate of displacement current

- 13.4 Maxwell's equations in integral and point forms
- 13.5 Examples

14.0 Wave Equations: (3 hours)
- 14.1 Uniform plane waves in dissipative media
- 14.2 Polarization
- 14.3 Wave impedance
- 14.4 Skin effect
- 14.5 A. C. resistance
- 14.6 Poynting vector
- 14.7 Reflection and refraction at the interface between two media
- 14.8 Reflection coefficient
- 14.9 Standing wave ratio
- 14.10 Impedance matching
- 14.11 Quarter wave transformer

15.0 Retarded Potentials: (2 hours)
- 15.1 Radiation from a dipole antenna
- 15.2 Wave guides

16.0 Transmission Lines: (8 hours)
- 16.1 Coaxial, single conductor/earth, two conductor lines
- 16.2 Field and lumped circuit equivalents
- 16.3 Characteristic impedance
- 16.4 Travelling and standing waves, reflection, termination impedance matching
- 16.5 Short and long lines
- 16.6 ABCD or h parameters, Y and Z parameters
- 16.7 Power and signal transmission capability of lines

Laboratory:
- 1.0 Teledeltos (electro-conductive) paper mapping of electrostatic fields
- 2.0 Determination of dielectric constant, display of a magnetic Hysterisis loop
- 3.0 Studies of wave propagation on a lumped parameter transmission line
- 4.0 Microwave sources, detectors, transmission lines
- 5.0 Standing wave patterns on transmission lines, reflections, power patterns on transmission lines, reflections, power measurement
- 6.0 Magnetic field measurements in a static magnetic circuit, inductance, leakage flux

References:

- 1.0 W.H. Hayt, "Engineering Electromagnetic", McGraw-Hill Book Company, New York.
- 2.0 J. D. Kraus and K.R. Carver, "Electromagnetics", prentice Hall Inc., New York.
- 3.0 N. Rao, "Elements of Engineering Electromagnetics"

INSTRUMENTATION I
EG 576 EE

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

Course Objectives: Comprehensive treatment of methods and instruments for a wide range of measurement problems.

1.0 Instrumentation Systems: (2 hours)

1.1 Functions of components of instrumentation system transduction, 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

2.0 Theory of measurements: (3 hours)

2.1 Static performance parameters: accuracy, precision, sensitivity, resolution, and linearity
2.2 Dynamic performance parameter: response time, frequency response and bandwidth
2.3 Error in measurement
2.4 Statistical analysis of errors in measurement

3.0 Transducers: (16 hours)

3.1 Measurement of electrical variables: voltage, current, resistance, frequency, inductance and capacitance
3.2 Measurement of mechanical variables: displacement, strain, velocity, acceleration, and vibration
3.3 Measurement of process variables: temperature, pressure, level, fluid flow, chemical constituents in gases or liquids, pH and humidity
3.4 Measurement of bio-physical variables: blood pressure and myoelectric potentials

4.0 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 and wave shaping
4.4 Effects of noise, analog filtering, digital filtering

5.0 Non-Electrical Signal Transmission: (3 hours)

5.1 Pneumatics, electro-pneumatic conversion devices, pneumatic transmission
5.2 Fibre optics, Electro-optic conversion devices, optical communications

6.0 Analog-Digital and Digital-Analog Conversion: (16 hours)

6.1 Analog signals and digital signals
6.2 Digital to analog converters: Weighted resistor type, R-2R ladder type, DAC Errors
6.3 Analog to digital converters: Successive approximation type, Dual ramp type, Flash type, ADC errors

7.0 Digital Instrumentation: (5 hours)

7.1 Sampled data system
7.2 Components of data acquisition system
7.3 Sample and hold circuits
7.4 Interfacing to the computers

8.0 Output Devices: (4 hours)

8.1 Indicators, meters
8.2 Strip chart recorders
8.3 magnetic tape recorders
8.4 4 X-Y plotters

Laboratory:

1.0 Operational Amplifiers in Circuit
- Use of Op-amp as a summer, inverter, integrator and differentiator

2.0 Study of Transducers for Measurement of Linear Displacement and Strain
- Use resistive, inductive and capacitive transducers to measure displacement.
- Use strain gauge transducers to measure force.

3.0 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 tachogenerator to measure angular velocity
- use RTD transducers to measure pressure and flow

4.0 Digital to Analog Conversion
- perform static testing of D/A converter

5.0 Analog to Digital Conversion
- perform static testing of A/D converter

6.0 Data Recording Devices
- study the performance characteristics of strip chart recorder

References:

1. D. M. Consodine, "*Process Instruments and Controls Handbook*", third edition, McGraw Hill, 1985
2. S. Wolf and R.F. M,. Smith, "*Students Reference Manual for Electronic Instrumentation Laboratories*". Prentice Hall, 1990.
3. E. O. Deobelin "*Measurement System: Application and Design*". McGraw Hill, 1990
4. A. K. Sawhney. "*A Course in Electronic Measurements and Instrumentation*", Dhanpat Rai and Sons. 1988
5. C. S. Rangan, G. R. Sarma and V.S.V. Mani, *"Instrumentation: Devices and Systems*", Tata McGraw Hill Publishing Company Limited, New Delhi, 1992

ELECTRICAL MACHINES I
EG 577 EE

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

Course Objectives: To introduce and apply electric magnetic circuit concepts to electromechanical energy conversion to explain and predict the performance of basic devices such as transformer, electromagnets and rotating electric machines.

1.0 Magnetic Circuit Concepts: (5 hours)

1.1 Ohm's law for magnetic circuits
1.2 Magnetic potential sources, electric current, permanent magnetic materials
1.3 Ferromagnetic materials, magnetic saturation, non-linearity, Hysterisis
1.4 Series and parallel magnetic circuits
1.5 Effect of air gaps
1.6 DC and AC excitation, Hysterisis and eddy currents, energy loss, laminations, sintered core
1.7 Self and mutual inductances
1.8 Force due to magnetic effects, electromagnets.

2.0 Transformer: (8 hours)

2.1 Magnetic circuits of transformer, transformer steels
2.2 Ideal transformers
2.3 Mutual inductance and coupled model of transformers
2.4 Air core Vs iron core transformers
2.5 Two winding transformers
2.6 Equivalent circuit of power transformers
2.7 Evaluation of Equivalent circuit parameters from open circuit and short circuit tests
2.8 Excitation consideration: core losses, current harmonics
2.9 Equivalent circuit calculation: voltage regulation and efficiency
2.10 Polarity of windings
2.11 Series and parallel connection of windings
2.12 Audio transformers Vs power transformers
2.13 Auto transformers
2.14 Instrumentation transformers – PTs, CTs
2.15 Three phase transformer connection
2.16 V-V and open delta connection
2.17 T-T connections
2.18 Scott 3 phase to 2 phase connections.

3.0 Principles of Electromechanical Energy Conversion: (2 hours)

3.1 Energy storage and retrieval from magnetic fields
3.2 Lenz's law, Faraday's laws, Fleming's rule
3.3 Force and torque due to magnetic fields, principle of virtual work, the co-energy function
3.4 Interaction between electric, magnetic and mechanical systems

4.0 General Aspects of Modeling and Steady State Performance of DC machines: (4 hours)

4.1 DC machine constructional features
4.2 Magnetic circuit, air gap flux patterns
4.3 Mechanical rectification by commutator action
4.4 Torque Production and voltage generation
4.5 Armature windings, lap and wave windings
4.6 Field excitation: shunt, series and compound fields
4.7 Armature reaction
4.8 Commutation, interpoles.
4.9 Reversible energy flow between electrical and mechanical systems with a dc machine

5.0 DC Motors: (4 hours)

5.1 Torque/speed characteristics of shunt field, series field and compound field motors.
5.2 Effects of armature reaction on motor operation
5.3 Commutation problems, pole face compensating windings
5.4 Speed regulation and control in dc motors
5.5 Effect of field excitation and armature applied voltage on steady state performance of dc motors
5.6 Reversal of rotation of dc motors
5.7 Motor starting problems, limiting armature current inrush.

6.0 DC Generators: (4 hours)

6.1 Voltage/speed/load characteristics of dc generators
6.2 Shunt, series and compound field machines
6.3 Separate and self-excited machines, voltage build-up in self excited generators
6.4 Voltage regulation of generators

7.0 Control of DC Machines in the steadies-state: (3 hours)

7.1 Automatic voltage regulation of dc generators
7.2 Manual and automatic starting and speed control of motors, armature voltage and shunt field control.

8.0 Induction machines: (8 hours)

8.1 Construction and type
8.2 Rotating magnetic field and action of induction motor
8.3 Torque-slip characteristic
8.4 Losses and efficiency
8.5 Induction motor starter
8.6 Induction generator

9.0 Synchronous machines: (8 hours)

9.1 Basic structure of synchronous machines, salient pole and cylindrical rotor structure
9.2 Synchronous generators

9.2.1 Operating principle and emf equation
9.2.2 Speed and frequency relationship.
9.2.3 Synchronous generator on load, armature reaction, voltage regulation
9.2.4 Synchronization, generator connected to large system, infinite bus concept.

9.3 Synchronous motor

9.3.1 Operating principle
9.3.2 Starting methods
9.3.3 Effect of excitation, V-curve, inverted V-curve, power factor control

9.4 Power angle characteristic of cylindrical rotor machine
9.5 Two-reaction model of salient pole machine
9.6 Power angle characteristic cylindrical salient pole machine

Laboratory:

1) Magnetic Circuit Study.
- Calculate and measure BV & H for a magnetic circuit
- Compare the relative permeabilities of two different sample cores.

2) Two winding transformer
- Carry out o/c test and s/c test on a single phase transformer to evaluate equivalent circuit.
- Examine exciting current harmonics.

3) DC machine Study
- Study speed control using variable armature voltage and variable field current on dc shunt motor

- Study voltage regulation of a dc shunt generator

4) Induction machine study
   - Measure torque-speed characters of a three phase induction motor
   - Measure power factor and efficiency of the motor at various loading condition

5) Synchronous machine study
   - Study of frequency and voltage control of a synchronous generator

Text books:

1) A. E. Fitzgerald, C. kingsley and S.D. Umans, "*Electric Machinery*" 4th ed. McGraw-Hill Book Company, New York 1983
2) Bhag S. Guru and Huseyin R. Hiziroglu, *"Electric Machinory and Trans former*", Harcourt Brace Jovanovich, Inc., New York, 1988.

NUMERICAL METHODS
EG601SH

Lecture : 3 **Year : 3**
Practical : 3 **Part : A**

COURSE OBJECTIVES: To present the theory of numerical computational procedures for solving engineering problems. Solution of ordinary and partial differential equations will be included.

1.0 Solution of Nonlinear Equations: (10 hours)
- 1.1 Review of calculus, continuity, differentiability, intermediate value theorem, Taylor's theorem
- 1.2 Absolute, relative, and round off errors, error bounds for computational errors
- 1.3 Bisection method, its error bounds and convergence
- 1.4 Newton's method, secant method and their convergence
- 1.5 Fixed point iteration, its convergence properties,
- 1.6 Zeros of polynomials by Horner's method

2.0 Interpolation and Approximation: (10 hours)
- 2.1 Taylor's polynomial approximation, Lagrange's interpolation
- 2.2 Newton's interpolation and divided differences
- 2.3 Iterative interpolation
- 2.4 Cubic spline interpolation
- 2.5 Least squares method of fitting continuous and discrete data or functions

3.0 Numerical Differentiation and Integration: (5 hours)
- 3.1 Numerical differentiation formulas
- 3.2 Newton-Cote's numerical integration formulas, composite numerical integration
- 3.3 Romberg integration algorithm
- 3.4 Gaussian integration formulas

4.0 Linear Algebraic Equations: (10 hours)
- 4.1 Review of the properties of matrices
- 4.2 Matrix form of Gaussian elimination, pivoting strategies, ill-conditioning
- 4.3 Cholesky's and related algorithms for matrix factorization
- 4.3 Eigen values and eigen vectors and the power method

5.0 Solution of ordinary Differential Equations: (7 hours)
- 5.1 Euler's method for solving ordinary differential equations of 1st order and other related methods
- 5.2 Runge-Kutta methods
- 5.3 Extension to higher order equations
- 5.4 Initial value problems
- 5.5 Boundary value problems

6.0 Solution of partial Differential Equations: (3 hours)

6.1 Introduction to the solution of partial differential equations

6.2 Engineering examples

Reference Books:

1.0 W. Cheney and D. Kincaid, "Numerical Mathematics and computing", Edition, Brooks/Cole publishing Co.,1985.

2.0 C.F. Gerald and P. O. Wheatley, "Applied Numerical Analysis", 4th Edition, Addison-Wesley Publishing Company, New York.

3.0 S. Yakowitz and F. Szidarovszky, "An Introduction to Numerical Computations", 2nd Edition, Macmillan publishing Co., New York.

Reference Book for Programs in C:

1.0 W.H. press, B. P. Flannery et. al., "Numerical Recipes in C", 1st Edition, Cambridge Press,1988.

COMMUNICATION II
(English)
EG604SH

Lecture: 1 **Year: 3**
Tutorial:3 **Part: A**

Course Description:

This course is designed for the B. E. Level I year II part students of Civil, Mechanical and III year I part students of Electrical, Electronics and Computer. It intends to develop and strengthen in students the communication skills in the English language with emphasis on writing, reading and speaking.

Course Objectives:

This course intends to develop skills in:

- understanding and using varieties of English.
- public speaking and mass communication.
- preparing and conducting meeting.
- faster / extensive reading.
- writing description, technical talk, seminar paper.
- writing technical reports.

1. **Varieties of English**: **(1 hour)**
   1.1 British / American.
   1.2 Formal / Informal.
   1.3 Spoken / Written.
   1.4 Polite / Familiar and Impersonal.

2. **Mass communication:**
   2.1 Presentation of talk
   2.2 Presentation of seminar paper.
   2.3 Conduction of meeting.

3. **Extensive reading** **(4 hours)**
   3.1 Scanning
   3.2 Skimming

4. **Writing** **(10 hours)**
   4.1 Writing description: Landscape, technical processes, mechanical / electrical objects, maps, graphs, charts.
   4.2 Preparing note and writing talk.
   4.3 Writing seminar paper
   4.4 Writing agenda, minute and notice.
   4.5 Writing technical reports.

Evaluation Scheme:

A) Internal Assessment:

Report writing -	4 marks
Technical talk / Seminar paper or meeting -	4 marks
Attendance -	2 marks
Total:	**10 marks**

B) Semester Exam:

Varieties -	4 marks
reading -	8 marks
Description writing -	4 marks
Seminar paper / talk -	8 marks
Meeting -	6 marks
Report writing -	10 marks
Total:	**40 marks**
Total (A + B)	**50 marks**

Reference Books:

1.0 Anne Eisenberg, "Effective Technical Communication", McGraw - Hill. 1982.

3.0 K. W. Hope and T.E. Pearsall, "Reporting Technical Information", 5th Edition Macmillan Publishing Company, New York, 1984.

ELECTRONIC CIRCUITS II
EG632EX

Lecture: 3 | **Year: 3**
Tutorial: 1 | **Part: A**
Practical:3/2

Course objectives: Continuation of ELECTRONIC CIRCUITS I with emphasis on data conversion, instrumentation and power circuits.

1.0 Digital-To-Analog and Analog-To-Digital Conversion: (8 hours)

1.1 The R-2R ladder circuit
1.2 Unipolar and bipolar D/A converters
1.3 Count-up and tracking A/D's based on D/A's
1.4 Successive approximation A/D converts
1.5 Integrating voltage-to-time conversion A/D converters, dual and quad slope types
1.6 Sigma-delta A/D converters
1.7 Flash A/D converters

2.0 Instrumentation and Isolation Amplifiers: (4 hours)

2.1 One and two operational amplifier instrumentation amplifiers
2.2 The three operational amplifier instrumentation amplifier
2.3 Consideration of non-ideal properties
2.4 Isolation amplifier principles and realizations
2.5 Consideration of non-ideal properties

3.0 Operational Amplifier-Bipolar Transistor Logarithmic Amplifier: (2 hours)

3.1 The basic logarithmic amplifier
3.2 Non-ideal effects
3.3 Stability considerations
3.4 Anti-logarithmic operations

4.0 Log-Antilog Circuit Applications: (5 hours)

4.1 Analog multiplier based on log-antilog principles
4.2 The multifunction converter circuit
4.3 Proportional to absolute temperature (PTAT) devices
4.4 RMS to dc conversion

5.0 Communication Circuits: (10 hours)

5.1 Modulation and demodulation circuits
5.2 Frequency converters and mixers
5.3 AM and EM receiver circuits
5.4 Phase-locked loops

6.0 Switched Power Supplies: **(4 hours)**

6.1 Voltage step-down regulators
6.2 Voltage step-up regulators
6.3 Step-up/step-down regulators
6.4 Filtering considerations
6.5 Control circuits, IC switched regulator controllers

7.0 Introduction to Power Electronics: **(9 hours)**

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

Laboratory:

1.0 D/A and A/D conversion.
2.0 Operational and instrumentation amplifiers
3.0 Logarithmic amplifiers, multipliers, RMS to DC converters
4.0 AM communication circuits
5.0 FM communication circuits
6.0 Switched voltage regulator design.
7.0 Silicon-controlled-rectifier (SCR) circuit design.

Reference Books:

1.0 W. Stanely, "*Operational Amplifiers with Linear Integrated Circuits*", Charles E. Merrill Publishing Company, Toronto, 1984.
2.0 K. C. Clarke and D. T. Hess, , "*Communication Circuits: Analysis and Design*", Addison-Wesley Publishing Company, 1971.
3.0 C. W. Lander, "*Power Electronics*", 2nd Edition, McGraw-Hill Book Company, New York, 1987.
4.0 J. G. Graeme, "*Application of Operational Amplifiers: Third Generation Techniques*", The Burr-Brown Electronics Series", McGraw-Hill, New York, 1973.
5.0 N. Mohan, T. M. Undeland and W. P. Robbins*, "Power Electronics: Converters, Applications and Design*", John Wiley and Sons, New York, 1989.

SIGNAL ANALYSIS
EG634EX

Lecture: 2 **Year: 3**
Practical: 3/2 **Part: A**

Course Objectives: To study the properties of continuous and discrete signals and their application to systems.

1.0 Signal Classification: **(2 hours)**

1.1 Definition of continuous and discrete time signals such as rectangular pulses, signum functions, sinc functions, delta functions
1.2 Finite energy and finite power signals

2.0 Fourier Series: **(5 hours)**

2.1 Definition and examples of periodic signals
2.2 Fourier representation of real functions using trigonometric and complex forms
2.3 Relationship between various forms of Fourier coefficients for square waves, full-wave rectified signals, triangular waves, etc.
2.4 Spectral representation of periodic signals using line spectrum, magnitude and phase spectrum
2.5 Symmetry relationships, even and odd functions, choice of origin, time shifting, level shifting

3.0 Fourier Transforms: **(6 hours)**

3.1 Definition of the forward and reverse transforms, determination of these transforms as limiting cases of complex Fourier series
3.2 Fourier transform properties of real signals such as symmetry, time and phase shifting
3.3 The modulation theorem for Fourier transforms
3.4 Examples of the Fourier transform for the rectangular pulse and the modulated rectangular pulse
3.5 Magnitude and phase spectra
3.6 Fourier transform of the Dirac delta function, the signum function and the step function

4.0 Transmission of Signals: **(5 hours)**

4.1 Input-output relationships in the frequency domain, definition of transfer function
4.2 Distortionless transmission, the ideal lowpass filter
4.3 Simple electrical networks such as the RC and RLC filters
4.4 Response of the ideal and RC lowpass filters to a step function input
4.5 Introduction to signal transmission in communication systems

5.0 Energy and Power: **(2 hours)**

5.1 Parseval's theorem for periodic signals, auto-correlation, power spectrum
5.2 Parseval's theorem for finite energy signals, the energy density function

6.0 Impulse Response and Convolution: **(3 hours)**

6.1 Definition of time invariance for continuous discrete time systems
6.2 Convolution for discrete time systems, the convolution integral for continuous time systems
6.3 Convolution of a rectangular pulse passed through an RC filter, convolution of frequency domain signals

7.0 The Discrete Fourier Transform: **(4 hours)**

7.1 Definitions of the discrete Fourier transform (DFT) and the inverse discrete Fourier transform DFT)
7.2 Properties of the discrete Fourier transform
7.3 Relationship between the DFT and the Fourier transform
7.4 Introduction to the fast Fourier transform (FFT) algorithm

8.0 Transmission of Signals in Discrete Time Systems: **(3 hours)**

8.1 Introduction to discrete time systems, linear difference equations, the effect of the delay operation on signals
8.2 Frequency response of discrete systems
8.3 Introduction to finite duration impulse responses (FIR) systems and recursive infinite impulse response (IIR) systems

Laboratory:

The laboratory exercises in this course will consist of both hardware experiments and simulation experiments. The hardware experiments will involve the use of a spectrum analyser to examine simple periodic signals such as square waves and triangular waves as well as more complex signals such as those from voice or musical instruments. There will also be a number of hardware experiments dealing with signal transmission systems and with modulation. The software experiments will deal with the concepts of convolution, with the discrete Fourier transform and with the transmission of signals in discrete time systems.

References:

1.0 A. D. Poularikas and S. Seely, "Signals and Systems", 2nd Edition, PWS-Kent publishers, 20 Park Plaza, Boston, Mass., 1991.

POWER SYSTEM ANALYSIS
EG 647 EE

Lecture: 4 Year: 3
Tutorial: 1 Part: A

Course Objectives: To introduce and discuss the performance of electric power system, including generation, transmission and distribution; formulation and methods of analysis of large size three phase network in state operation.

1.0 Three Phase Power System: **(6 hours)**

1.1 Basic structure of power systems
1.2 Generation, transmission and distribution components
1.3 Voltage levels, voltage transformation through the networks
1.4 Per unit system: impedance. voltage, currents, power, generators, lines, transformers, advantages and applications.

2.0 Generating Plants: **(6 hours)**

2.1 Voltage waveform
2.2 Equivalent circuit- voltage source behind impedance
2.3 Single generating source versus large system
2.4 Infinite bus concept
2.5 Supply transformer connection, earthing arrangements

3.0 Transmission System: **(10 hours)**

3.1 Structure of HVDC overhead lines and cables.
3.2 Structure of HVAC overhead lines and cables.
3.3 Impedance/ Admittance of overhead lines and cables
3.4 Performance of transmission lines-short, medium and long lines
3.5 Pi and T equivalent circuit model, ABCD constants of lines
3.6 Surge impedance and surge impedance loading of transmission lines
3.7 Voltage levels, power / var transmission capability
3.8 Steady-state stability implications, series and shunt compensation
3.9 Skin effect, corona

4.0 Distribution System: **(6 hours)**

4.1 Voltage levels
4.2 Radial and loop system
4.3 Single phase and three phase ac distribution system
4.4 Distributors fed from one end and both ends, voltage drop calculation
4.5 Rural distribution system
4.6 Protection coordination in distribution system

5.0 Power System Load Flow Study: **(10 hours)**

5.1 Load characteristics, effects on voltage and frequency
5.2 Real power/ frequency balance
5.3 Reactive power / voltage balance
5.4 Solution of power system network by Bus Impedance Matrix
5.5 Solution of power system network by Bus Admittance matrix
5.6 Basic complex power flow equations for a network
5.7 Iterative approach for solving power flow equations:
Gauss-Seidal and Newton-Rapshon methods, use of computers for load flow calculations
5.8 Effect of network configuration and distribution of generation sources and major loads on live flows
5.9 Voltage profile and var compensation

6.0 Power System Stability: (10 hours)

6.1 Basic power / frequency problem
6.2 Swing curve for a single machine-infinite bus system
6.3 Steady-state, dynamic and transient stability: definition and principles; appropriate models of power system components for various stability problem situations.
6.4 Equal area criterion
6.5 Generalized swing equations for a multi-machine system
6.6 Step-by step method for solving swing equations by computer methods.
6.7 Stability enhancement techniques
6.8 Linearized equations and dynamic stability using eigenvalue method

7.0 Introduction to Power System Protection: (6 hours)

7.1 Fuses and Circuit breakers-types and applications.
7.2 Types of relays
7.3 Basic protection schemes
7.4 Protection of generators, transformers, transmission lines, distribution feeders, motors.

Text Book:

1.0 W. D. Stevenson, "*Elements of Power System Analysis*" 4th edition, McGraw-Hill, New York, 1982

Reference Books:

1.0 C. A. Gross, "*Power System Analysis*", 2nd Edition, Jhon Wiley and Sons, New York, 1986.
2.0 J. R. Neuenswander, "*Modern Power System*", International Textbook Company, 1971.
3.0 P. Kundur, "*Power System Stability and Control*", McGraw-Hill, Inc.

CONTROL SYSTEMS
EG648EE

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

COURSE OBJECTIVES: To provide information on feedback control Principles and to apply these concepts to typical physical processes. To introduce solution of typical problems.

1.0 Component Modeling, Linearization: (7 hours)
1.1 Differential equation and transfer function notations
1.2 State-space formulation of differential equations, matrix notation
1.3 Mechanical components: mass, spring, damper
1.4 Electrical components: inductance, capacitance, resistance, sources, motors, tachometers, transducers, operational amplifier circuits
1.5 Fluid and fluidic components
1.6 Thermal system components
1.7 Mixed systems
1.8 Linearized approximations of non-linear characteristics

2.0 System Transfer Functions and Responses: (10 hours)
2.1 Combinations of components to physical systems
2.2 Block diagram algebra and system reduction
2.3 Mason's loop rules
2.4 Laplace transform analysis of systems with standard input functions - steps, ramps, impulses, sinusoids
2.5 Initial and final steady-state equilibria of systems
2.6 Principles and effects of feedback on steady-state gain, bandwidth, error magnitude, dynamic responses

3.0 Stability: (4 hours)
3.1 Heuristic interpretation of the conditions for stability of a feedback system
3.2 Characteristic equation, complex plane interpretation of stability, root locations and stability
3.3 Routh-Hurwitz criterion, eigenvalue criterion
3.4 Setting loop gain using the R-H criterion
3.5 Relative stability from complex plane axis shifting

4.0 Root Locus Method: (6 hours)
4.1 Relationship between root loci and time responses of systems
4.2 Rules for manual calculation and construction of root loci diagrams
4.3 Computer programs for root loci plotting, polynomial root finding and repeated eigenvalue methods
4.5 Derivative feedback compensation design with root locus

4.6 Setting controller parameters using root locus
4.7 Parameter change sensitivity analysis by root locus

5.0 Frequency Response Methods: (4 hours)
5.1 Frequency domain characterization of systems
5.2 Relationship between real and complex frequency response
5.3 Bode amplitude and phase plots
5.4 Effects of gain time constants on Bode diagrams
5.5 Stability from the Bode diagram
5.6 Correlation between Bode diagram plots and real time response: gain and phase margins, damping ratio
5.7 Polar diagram representation, Nyquist plots
5.8 Correlation between Nyquist diagrams and real time response of systems: stability, relative stability, gain and phase margin, damping ratio

6.0 Simulation Using Microcomputer and Appropriate Software: (4 hours)
6.1 Role of simulation studies
6.2 Linear and non-linear simulations
6.3 TUTSIM as a simulation tool

7.0 Performance Specifications for Control Systems: (2 hours)
7.1 Time domain specifications: steady-state errors, response rates, error criteria, hard and soft limits on responses, damping ratio, log decrement
7.2 Frequency domain specifications: band width, response amplitude ratio

8.0 Compensation and Design: (8 hours)
8.1 Application of root locus, frequency response and simulation in design
8.2 Meeting steady-state error criteria
8.3 Feedback compensation
8.4 Lead, lag, and lead-lag compensation
8.5 PID controllers

Laboratory:

1.0 Identification of Control System Components
- establish transfer functions and block diagram of electromechanical servo system for position and velocity control

2.0 Open and Closed Loop Performance of Servo Position Control System
- note effects of loop gain on response
- record step responses and compare with those predicated by theory

3.0 Open and Closed Loop Performance of Servo Velocity Control System
- note effects of loop gain on response
- record step responses and compare with those predicated by theory

4.0 Simulation Study of Feedback System Using TUTSIM

- set up simulation model of servo system using TUTSIM on a microcomputer and repeat response tests

5.0 Design of a PID Controller
- design of a PID controller for position servo
- check design with TUTSIM
- check design on operating system

6.0 Non-Electrical Control System
- study of a hydraulic or pneumatic servo system

Textbook:

1.0 K. Ogata, “Modern Control Engineering”, 2nd Edition, Prentice Hall, Englewood Cliffs, New Jersey, 1990.

ENGINEERING ECONOMICS
EG666CE

Lecture : 3 **Year : 3**
Tutorial : 1 **Part : B**

COURSE OBJECTIVES: To provide a knowledge of the basic tools and methodology of economic studies for evaluating engineering projects in private industry, in the public sector and in the utilities area.

1.0 Introduction **(3 hours)**
- 1.1 Essential business and accounting terminology
- 1.2 Definition of cash flow
- 1.3 Economic systems

2.0 Cost Classification and Analysis **(5 hours)**
- 2.1 The elements of cost
- 2.2 Classification of cost: overhead cost, prime cost
- 2.3 Cost variance analysis
- 2.4 Job and process costing

3.0 Interest and the Time Value of Money **(6 hours)**
- 3.1 Simple interest, compound interest, interest tables, interest charts
- 3.2 Present worth
- 3.3 Nominal and effective interest rates
- 3.4 Continuous compounding and continuous compounding formula
- 3.5 Interest calculations for uniform gradient

4.0 Basic Methodologies of Engineering Economic Studies **(7 hours)**
- 4.1 Present worth and annual worth methods
- 4.2 Future worth method
- 4.3 Internal rate of return method
- 4.4 Drawbacks of the internal rate of return method
- 4.5 External rate of return method
- 4.6 Minimum attractive rate of return method
- 4.7 The payback (payout) period method

5.0 Cost/Benefit Analysis **(4 hours)**
- 5.1 Conventional cost/benefit ratio
- 5.2 Modified cost/benefit ratio
- 5.3 Breakeven analysis

6.0 Investment Decisions: **(8 hours)**
- 6.1 Comparison of alternatives having same useful life
- 6.2 Comparison of alternatives having different useful life
- 6.3 Comparison of alternatives including or excluding the time value of money

- 6.4 Comparison of alternatives using the capitalized worth method
- 6.5 Definition of mutually exclusive investment alternatives in terms of combinations of projects
- 6.6 Comparison of mutually exclusive alternatives

7.0 Risk Analysis: **(4 hours)**
- 7.1 Projects operating under conditions of certainty
- 7.2 Projects operating under conditions of uncertainty
- 7.3 Decision tree
- 7.4 Sensitivity analysis

8.0 Taxation System in Nepal: **(3 hours)**
- 8.1 Taxation law in Nepal
- 8.2 Depreciation rates for buildings, equipment, furniture, etc.
- 8.3 Recaptured depreciation
- 8.4 Taxes on normal gains
- 8.5 Taxes on capital gains

9.0 Demand Analysis and Sales Forecasting **(5 hours)**
- 9.1 Demand analysis
- 9.2 Correlation of price and consumption rate
- 9.3 Multiple correlation of price and consumption rate
- 9.4 Market research
- 9.5 Sales forecasting
- 9.6 Criteria for desirable sales forecasting procedures
- 9.7 Factors affecting accuracy of forecasting

Tutorials: 3 Assignments, 2 Quizzes, 3 Case Studies

Note:

The case studies will concentrate on economic analysis and selection of public projects, economic analysis and selection of private projects, risk analysis and demand analysis.

Textbook:

1.0 E. P. DeGramo, W. G. Sullivan and J. A. Bontadelli, 8th Edition, Macmillan publishing Company, ,1988.

References:

1.0 N. N. Borish and S. Kaplan, "Economic Analysis: For Engineering and Managerial Decision Making", McGraw-Hill.

PROBABILITY AND STATISTICS
EG671SH

Lecture: 3 **Year: 3**
Tutorial: 1 **Part: B**

Course Objectives: To provide the student with a practical knowledge of the principles and concepts of probability and statistics and their application to simple engineering problems.

1. Introduction and Descriptive Statistics: (4 hours)
- 1.1. An overview of probability and statistics
- 1.2. Pictorial and tabular methods in descriptive statistics
- 1.3. Measures of location: mean, median, quartiles, percentiles, etc.
- 1.4. Measures of variability

2. Probability: (4 hours)
- 2.1. Sample spaces and events
- 2.2. Axioms, interpretations and properties of probability
- 2.3. Counting techniques
- 2.4. Conditional probability
- 2.5. Independence

3. Discrete Random Variables and Probability Distributions: (6 hours)
- 3.1. Random variables
- 3.2. Probability distributions for random variables
- 3.3. Expected values of discrete random variables
- 3.4. The binomial probability distribution
- 3.5. The hypergeometric and negative binomial distributions
- 3.6. The Poisson probability distribution

4. Continuous Random Variables and Probability Distributions: (6 hours)
- 4.1. Continuous random variables and probability density functions
- 4.2. Cumulative distribution functions and expected values
- 4.3. The Normal Distribution
- 4.4. The Gamma Distribution
- 4.5. Chi-Squared Distribution

5. Joint Probability Distributions and Random Samples: (4 hours)
- 5.1. Jointly distributed random variables
- 5.2. Expected values, covariance and correlation
- 5.3. Sums and averages of random variables
- 5.4. The central limit theorem

6. Point Estimation: (2 hours)
- 6.1. Some general concepts of point estimation
- 6.2. Methods of point estimation

7. Interval Estimation: (3 hours)
- 7.1. Basic properties of Confidence Interval
- 7.2. Large-sample Confidence interval for population Mean and Proportion
- 7.3. A Confidence intervals for the mean of Normal Population
- 7.4. Confidence interval for the Variance and Standard Deviation of a Normal Population

8. Hypothesis Testing Procedures Based on a Single Sample: (5 hours)
- 8.1. Hypothesis and Test Procedure
- 8.2. Tests about the mean of a Normal Population
- 8.3. Large-sample Test for population mean
- 8.4. Large-sample Test for a population proportion
- 8.5. The t-test
- 8.6. Some comments on selecting a test procedure

9. Hypothesis Testing Based on Two Samples: (4 hours)
- 9.1. z-tests for differences between two population means
- 9.2. The sample t-test
- 9.3. Analysis of paired Data
- 9.4. Testing for differences between population proportions

10. Simple Linear Regression and Correlation: (4 hours)
- 10.1. The simple linear probabilistic model and principle of least square
- 10.2. Correlation, Correlation coefficient and coefficient of determination
- 10.3. Linear and non-linear Regression
- 10.4. Line of Regression and coefficient of Regression

11. The Analysis of categorical Data: (3 hours)
- 11.1. Goodness of Fit tests when category Probabilities are completely specified
  - 11.1.1. Goodness of fit for composite Hypothesis
  - 11.1.2. Two way contingency Tables

Textbook:
1.0 Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Brooks/Cole publishing Company, Monterey, California, 1982.

Reference Book:
11 Murray R. Spiegel, "Theory and Problems of Probability and Statistics", McGraw Hill, Singapore
12 D. C. Sancheti and V. K. Kapoor, "Statistics", Sultan Chand and Sons, Educational Publishers, India
13 S. C. Gupta, "Fundamental of Statistics", Himalaya Publishing House, India

14 Jeetendra P. Aryal and Arun Gautam, "Quantitative Technique Vol. II", Vidhyarthy Pustak Bhandar, Nepal
15 S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Son, India

FILTER DESIGN
EG675EX

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

Course objectives: To learn design methods for practical passive, RC active and switched-capacitor filters.

1.0 Introduction: (4 hours)

1.1 The filter design problem
1.2 Kinds of filters in terms of frequency response
1.3 History of filter design and available filter technologies

2.0 Approximation Methods: (5 hours)

2.1 Ideal lowpass, highpass, bandpass and bandstop functions
2.2 Lowpass approximations including Butterworth, Chebyshev, inverse Chebyshev and elliptic
2.3 Frequency transformations: lowpass to highpass, lowpass to bandpass and lowpass to bandstop
2.4 Bessel-Thomson approximation of constant delay

3.0 One-Port Passive Circuits: (5 hours)

3.1 Properties of passive circuits, positive real functions
3.2 Properties of lossless circuits
3.3 Synthesis of LC one-port circuits, Foster and Cauer circuits
3.4 Properties and synthesis of RC one-port circuits

4.0 Two-Port Passive Circuits: (4 hours)

4.1 Properties of passive two-port circuits, residue condition, transmission zeros
4.2 Synthesis of two-port LC and RC ladder circuits based on zero-shifting by partial pole removal
4.3 Properties of resistively-terminated lossless ladder circuits, transmission and reflection coefficients

5.0 Design of Resistively-Terminated Lossless Filters: (5 hours)

5.1 Synthesis of LC ladder circuits to realize all-pole lowpass functions
5.2 Synthesis of LC ladder circuits to realize functions with finite transmission zeros (the Darlington insertion loss method)
5.3 Impedance scaling and frequency scaling
5.4 Passband transformations to obtain a highpass, bandpass or bandstop filter from a lowpass prototype

6.0 Fundamentals of Active Circuits: (5 hours)

6.1 Ideal and real operational amplifiers, gain-bandwidth product
6.2 Active building blocks: amplifiers, summers, integrators
6.3 First order active sections
6.4 Second order active sections (biquads)

7.0 Sensitivity: (5 hours)

7.1 Definition of single parameter sensitivity
7.2 Centre frequency and Q-factor sensitivity
7.3 Sensitivity properties of biquads
7.4 Sensitivity of resistively-terminated lossless circuits

8.0 Design of High-order Active Filters: (6 hours)

8.1 Cascade of biquads
8.2 Ladder design with simulated inductors
8.3 Ladder design with frequency-dependent negative resistors (FDNR)
8.4 Leapfrog simulation of ladders

9.0 Switched-Capacitor Filters: (6 hours)

9.1 The MOS switch and the switched capacitor
9.2 Switched-capacitor circuits for analog operations: addition, subtraction, multiplication and integration
9.3 First-order and second -order switched-capacitor circuits
9.4 Leapfrog switched-capacitor filters

Laboratory:

The laboratory experiments will consist mainly of computer simulation, analysis and design of passive and active filters. Commercially- available programs for approximation, design of passive filters, analysis of active circuits and analysis of switched-capacitor circuits will be employed. Hardware implementations of some active filters will be constructed and tested.

References:

1.0 M. E. Van Valkenberg, "*Analog Filter Design*", Holt, Rinehart and Winston, Inc., New York, 1982.
2.0 W.-K. Chen, "*Passive and Active Filters: Theory and Implementations*", John Wiley and Sons, 1986. (A slightly more advanced treatment of approximation and properties of passive circuits)
3.0 R. Schaumann, M. S. Ghausi and K. R. Laker, "*Design of Analog Filters: Passive, Active RC and Switched-Capacitor*", prentice Hall, Englewood Cliffs, New Jersey, 1990.

COMMUNICATION SYSTEMS I
EG676EX

Lectures: 3 **Year: 3**
Tutorial: 1 **Part: B**
Practical: 3/2

Course Objectives: To introduce the student to analog and digital communication systems.

1.0 Analog and Digital Communication Systems: (3 hours)

1.1Analog and digital communication sources, transmitters, transmission channels and receivers
1.2 Fundamental limitations due to noise, distortion and interference and the relationships between noise, bandwidth and information
1.3 Types and reasons for modulation

2.0 Representation of Communication Signals and Systems: (4 hours)

2.1 Review of signal transfer in linear systems, the ideal lowpass filter and distortionless transmission, the importance of channel bandwidth
2.2 The Hilbert transform and its properties
2.3 Bandpass systems and band-limited signals with examples
2.4 Complex envelope representation of band-limited signals, time domain expressions, rectangular representation (in-phase and quadrature components), polar representation (envelope and phase)

3.0 Continuous Wave Linear Modulators: (10 hours)

3.1 Amplitude modulation (AM), time domain expressions and modulation index, frequency domain (spectral). representations, transmission bandwidth for AM
3.2 AM modulation for a single tone message, phasor diagram of an AM signal, illustration of the carrier and sideband components
3.3 Transmission requirements for AM, normalized power and its use in communication, carrier power and sideband power
3.4 Double sideband suppressed carrier (DSB) modulation, time and frequency domain expressions
3.5 Transmission requirements for DBS, bandwidth and transmission power for DSB
3.6 Methods of generating AM and DSB, square modulators, balanced modulators, ring modulators
3.7 Single sideband modulation (SSB), generation of SSB using a sideband filter, indirect generation of SSB
3.8 Representation of SSB signals
3.9 Transmission requirements for SSB, transmit bandwidth and power, sideband filter examples
3.10 Vestigial sideband modulation (VSB)

4.0 Demodulators for Linear Modulation: (7 hours)

4.1 Demodulation of AM signals, square law and envelop detectors
4.2 The superheterodyne receiver for standard AM radio
4.3 Synchronous demodulation of AM, DSB and SSB using synchronous detection
4.4 Effects of frequency and phase errors in the local oscillator in DSB and SSB
4.5 Demodulation of SSB using carrier reinsertion and the use of SSB in telephony
4.6 Carrier recovery circuits
4.7 Introduction to the phase-locked loop (PLL)

5.0 Frequency Modulation (FM) and phase Modulation (PM): (8 hours)

5.1 Instantaneous frequency and instantaneous phase, time domain representations for FM and PM, phasor diagram for FM and PM
5.2 FM and PM signals for a single tone message, the modulation index and phasor diagrams
5.3 Spectral representation of FM and PM for a single tone message, Bessel's functions and the Fourier series
5.4 Transmission bandwidth for FM, Carson's rule, narrow-band and wide-band FM and PM signals
5.5 Generation of FM using Armstrong's method, commercial FM requirements
5.6 Demodulation of FM and PM signals, the limiter discriminator
5.7 Commercial FM radio and stereo FM radio
5.8 Demodulation of FM using a phase-locked loop

6.0 Frequency Division Multiplexing (FDM) Systems: (3 hours)

6.1 FDM in telephony, telephone hierarchy and examples of group and supergroup generation
6.2 Satellite systems and applications, frequency division multiple access (FDMA) systems
6.3 Filter and oscillator requirements in FDM

7.0 Spectral Analysis: (5 hours)

7.1 Review of Fourier transform theory, energy and power, parseval's theorem
7.2 Power spectral density functions (pfsd), analog spectrum analyzers
7.3 The autocorrelation function, relationship between the pfsd and the autocorrelation function, pfsd's of harmonic signals, psfd's of uncorrelated (white) signals
7.4 Estimating psfd's, the periodogram, psdf's of harmonic signals
7.5 Effect of windowing on psdf estimates

8.0 Introduction to Digital Modulation Techniques: (5 hours)

8.1 Binary phase shift keying (PSK), modulator-demodulator systems

8.2 Carrier recovery circuits in PSK systems, the 180 degree phase ambiguity problem, differential phase shift keying (DPSK)
8.3 Demodulation techniques for DPSK
8.4 Quadrature amplitude modulation (QAM), four phase PSK
8.5 Binary frequency shift keying (FSK)

Laboratory: Five hardware experiments are recommended:

1.0 Lowpass and bandpass filters with applications in communications. The student will be required to design and test a 4th order filter constructed using two 2nd order sections. The filter chips used will be the Burr-Brown UAFAI and the implementation could be Butterworth, Chebyshev or Bessel.

2.0 and 3.0 Linear modulation. This experiment will familiarize the student with linear modulation methods including double sideband modulation (DBS) and amplitude modulation (AM). will be compared to envelope detection.

4.0 Power spectral density (psdf) measurement of signals. A digital spectrum analyzer will be used to measure the psdf of signals. In particular, the power spectral density of frequency modulated signals will be analyzed and compared with theory.

5.0 Demodulation of frequency modulated signals using a phase locked loop (PLL). A second order PLL to demodulate an FM signal will be designed and tested in the laboratory. The PLL chip to be used is the CD4046B.

References:

1.0 S. Haykin, "*An Introduction to Analog and Digital Communication*", Wiley, New York, 1989.
2.0 L. W. Couch II, "*Digital and Analog Communication Systems*", 2nd Edition, Macmillan Publishing Company, New York, 1987.

DIGITAL ELECTRONICS
EG677EX

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

Course objectives: To study the properties and applications of integrated digital electronic devices.

1.0 Bipolar Transistor Switching Characteristics: (6 hours)

1.1 The Ebers-Moll equations
1.2 Depletion region charge and delay time
1.3 Base region charge and the succession of steady states model
1.4 Rise, storage and fall time calculations

2.0 MOS Transistor Switching Characteristics: (6 hours)

2.1 The quadratic dc equations in pre-pinch-off and in pinch-off
2.2 Device and parasitic capacitances
2.3 Turn-on and turn-off times

3.0 Bipolar Transistor Logic Circuits: (6 hours)

3.1 Types of devices
3.2 Speed calculations, propagation delays
3.3 Power dissipation
3.4 Fan out
3.5 Noise margin

4.0 The NMOS Family of Logic Circuits: (6 hours)

4.1 Types of devices
4.2 Speed calculations, propagation delays
4.3 Power dissipation
4.4 Noise margin

5.0 The CMOS Family of Logic Circuits: (6 hours)

5.1 Types of devices
5.2 Speed calculations, propagation delays
5.3 Power dissipation
5.4 Fan out
5.5 Noise margin

6.0 Comparison of Logic Families: (2 hours)

7.0 Memory: (4 hours)

7.1 Random access memory (RAM)
7.2 Dynamic random access memory (DRAM)
7.3 Read-only memory (ROM)
7.4 Electrically erasable and programmable read only memory (EEPROM)
7.5 Comparison of memory types

8.0 Other Topics: (9 hours)

8.1 Programmable logic arrays
8.2 Very large scale integrated systems (VLSI)
8.3 Charge coupled devices (CCD's)
8.4 Integrated injection logic

<u>Laboratory:</u>

1.0 Bipolar transistor switching.
2.0 MOS transistor switching.
3.0 Bipolar transistor logic gates.
4.0 NMOS logic gates.
5.0 CMOS logic gates
6.0 Programmed logic array usage.

<u>References:</u>

1.0 D. A. Hodges and H. G. Jackson, "*Analysis and Design of Digital Integrated Circuits*", McGraw-Hill, New York, 1983.

COMPUTER GRAPHICS
EG678EX

Lecture: 3 **Year: 3**
Practical: 2 **Part: B**
Tutorial: 1

Course objectives: To present and practice the basic techniques used in computer graphics systems.

1.0 Purpose of Computer Graphics: (5 hours)

1.1 Early history of computer graphics
1.2 Engineering applications: CAD, schematic capture
1.3 Data visualization in medicine, art and engineering

2.0 Hardware Concepts: (8 hours)

2.1 Mouse, keyboard, light pen, touch screen and tablet input hardware
2.2 Raster and vector display architectures
2.3 Architecture of simple non-graphical display terminals
2.4 Architecture of graphical display terminals including frame buffer and colour manipulation techniques
2.5 Graphical architecture bottlenecks and interaction with the operating system
2.6 Specialized graphical processors and future development directions

3.0 Two-Dimensional Algorithms: (8 hours)

3.1 Direct and incremental line drawing algorithms
3.2 Bresenham algorithm
3.3 Two-dimensional world to screen viewing transformations
3.4 Two-dimensional rotation, scaling and translation transforms
3.5 Current transform concepts and advantages
3.6 Data structure concepts and CAD packages

4.0 Graphical Language: (6 hours)

4.1 Need for machine independent graphical languages
4.2 Discussion of available languages
4.3 Detailed discussion of graphical languages to be used in projects

5.0 Project Management: (4 hours)

5.1 Review of project management techniques
5.2 Review of program debugging techniques

6.0 Three-Dimensional Graphics: (10 hours)

6.1 Three-dimensional world to screen perspective viewing transform
6.2 Extension of two-dimensional transforms to three dimensions
6.3 Methods of generating non-planar surfaces
6.4 Hidden line and hidden surface removal techniques
6.5 Need for shading in engineering data visualization
6.6 Algorithms to simulate ambient, diffuse and specular reflections
6.7 Constant, Gouraud and phong shading models
6.8 Specialized and future three-dimensional display architectures

7.0 Project Development: (4 hours)

7.1 Project planning and description
7.2 Project development
7.3 Project report and presentation

Laboratory:

Computer graphics is best understood with "hands-on" experience. The laboratory exercises should consequently be directed toward introductory software concepts and familiarization with the graphical systems hardware architecture. Exercises might involve the development and comparison of various drawing algorithms or colour map animation. Exercises could be performed in either a high level language like c or a low level language like assembler.

Further exercises should familiarize the students with a high level graphics language which would then be used in the later laboratory periods in the development of a graphics project. This group project would be on an engineering topic preferably with both software and hardware aspects. The topic could be either initiated by the students or selected from a list provided by the instructor. An oral presentation with a demonstration should be part of the laboratory project report.

References:

1.0 J. D. Foley, S. K. Feiner and J. F. Hughes, "*Computer Graphics - Principles and Practices*", 2nd Edition, Addison-Wesley publishing Company, Don Mills, Ontario, Canada, 1989.

2.0 M. R. Smith and L. E. Turner, "*EPLOT - A Machine Independent Graphical Interface*", Department of Electrical and Computer Engineering, The University of Calgary. Documentation, example programs and diskette can be provided.

PROJECT ENGINEERING
EG 706 CE

Lecture : 3 **Year : 4**
Tutorial : 1 **Part : A**

COURSE OBJECTIVES: To provide the student with the fundamental concepts of initiating, planning, scheduling and controlling projects.

1.0 Introduction: (3 hours)
- 1.1 Project definition
- 1.2 Setting project objectives and goals
- 1.3 Project phases, project life cycle

2.0 Project Planning and Scheduling: (18 hours)
- 2.1 Planning function
- 2.2 Network models - CPM/PERT
- 2.3 Project scheduling with limited resources
- 2.4 Wiest's algorithms
- 2.5 Manpower leveling
- 2.6 Multiproject scheduling
- 2.7 Materials scheduling
- 2.8 Mathematical programming for minimum cost or maximum project return (simplex technique for linear programming)

3.0 Project Monitoring and Control: (10 hours)
- 3.1 Systems of control
- 3.2 Project control cycle
- 3.3 Feedback control systems
- 3.4 Cost control
- 3.5 Work breakdown structure
- 3.6 Introduction to project management information systems

4.0 Capital Planning and Budgeting: (10 hours)
- 4.1 Capital planning procedures
- 4.2 Preparation of operating budgets
- 4.3 Fixed and flexible budgets
- 4.4 Introduction to budgetary control

5.0 Impact Analysis: (4 hours)
- 5.1 Social impact analysis
- 5.2 Environmental impact analysis
- 5.3 Economic impact analysis

Textbook:

1.0 Arnold M. Ruskin and W. Eugene Estes, "Project Management", Marcel Dekker Publishers, 1982.
2.0 Joseph J. Moder and Cecil R. Phillips, "Project Management with CPM and PERT", Van Nostrand Reinhold Publishers, Latest Edition.

References:

1.0 L. S. Srinrat, "Pert and Application", East-West Press.
2.0 A. Bhattacharya and S. K. Sorkhel, "Management by Network Analysis", The Institution of Engineers (India).
3.0 Prasanna Chandra, "Projects: Preparation, Appraisal, Implementation", Tata McGraw-Hill Publishing Company Ltd., New Delhi.

ORGANIZATION AND MANAGEMENT
EG709ME

Lecture: 3 **Year: 4**
Tutorial: 2 **Part: A**

1. Introduction to organizational management **(5 hours)**
1.1. Organization
1.1.1. Organization behavior
1.1.2. Organization as Open System
1.2. Management
1.2.1. Level of Management
1.2.2. Function of Management
1.2.3. Managerial Roles
1.2.4. Importance of management
1.2.5. Models of Management
1.3. Theory of management
1.3.1. Scientific management Approach
1.3.2. Behavioral management Approach
1.3.3. Contingency and System Approach
1.4. Types of Ownership
1.4.1. Single Ownership
1.4.2. Partnership
1.4.3. Joint Stock Company
1.4.4. Public Corporation

2. Internal Organization of Companies **(5 hours)**
2.1. Policy and Executive Groups
2.2. Administrative and Functional Groups
2.2.1. Production development
2.2.2. Manufacturing
2.2.3. Marketing
2.2.4. Purchasing
2.2.5. Industrial Relation
2.2.6. Internal Finance and Office Services
2.3. Organization Structure
2.3.1. Responsibility and Authority
2.3.2. Line of Coordination
2.3.3. Types of Organization
2.3.3.1.Line Organization
2.3.3.2.Line and Staff Organization
2.3.3.3.Functional Organization
2.3.4. Span of control
2.3.5. Centralization and Decentralization

2.3.6. Organization Charts

3. Management Information System **(10 hours)**
3.1. Introduction
3.1.1. Hierarchy of Information Needs
3.1.2. Needs for MIS
3.1.3. Implementing an MIS
3.2. Information Architecture
3.2.1. Information System Model
3.2.2. Basic Problem Solving Paradigm
3.2.3. Information System for Planning Process
3.2.4. Information System for Business Process
3.2.5. Information System for Decision making Process
3.3. Computers and Management information Systems
3.3.1.1.Database information System
3.3.1.2.Networking Information System

4. Motivating and Leading People **(10 hours)**
4.1. Motivation
4.2. Role of Management
4.2.1. Theory of Motivation
4.2.2. Maslow's Hierarchy of Needs
4.2.3. Alderfer's ERG theory
4.2.4. McClelland's Theory of learned Needs
4.2.5. MacGregor's theory X-Y
4.2.6. Herzberg's Hygiene factors and Motivates
4.2.7. Role of Work in Enriching a Person's Life
4.2.8. Job design, work efficiency and work motivation, job rotation, job enlargement, job enrichment, job evaluation and merit rating
4.3. Leadership Styles
4.4. Authority and Power
4.5. Informal Organization
4.6. Praticipative management
4.6.1. Scanlon Plan, Quality Control Circles
4.7. Management by Objective
4.8. Incentive Programs
4.8.1. Profit Sharing, Individual Incentives, Group Incentives

5. Personnel Management **(5 hours)**
5.1. Job Analysis
5.2. Job Description
5.3. Hiring and Selecting staff
5.4. Wage and Salary Structure
5.5. Performance Appraisals
5.6. Collective Bargaining

6. Case Studies **(10 hours)**

6.1. The Case Study Method
- 6.1.1. What is a Case Study
- 6.1.2. Phases of the Case Study
- 6.1.3. Analysis of Case Problems

6.2. Motivation

6.3. Personnel Management

6.4. Organizational behavior

References:

COMPUTER ARCHITECTURE
EG728EX

Lecture: 3 **Year: 4**
Tutorial: 1 **Part: A**
Practical: 3/2

Course objectives: To study basic and advanced architectural concepts of computers as seen in processors used in engineering applications.

1.0 Review of Microprocessor Operations: **(5 hours)**

1.1 External characteristics of microprocessor operation: macro-flags, macro-memory, address and data signals, clock and interrupt lines
1.2 Review of microprocessor addressing modes: immediate, absolute, relative, indexed and indirect; memory timing requirements
1.3 Review of microprocessing sequencing instructions: short, long and relative jumps and subroutine calls
1.4 Overlapping of fetch, decode and execute cycles for speed improvement

2.0 Internal Architecture of a Basic Microprocessor: **(5 hours)**

2.1 Internal resources of a microprocessor: registers, data paths, control unit (CU), arithmetic logic unit (ALU)
2.2 Relationship between register transfer language (RTL) and assembly language instructions and the control and sequencing of the internal architectural resources of the processor
2.3 Methods of generating the control signals: microprogrammed and non-microprogrammed control units

3.0 Simulation of Basic Microprocessor Functionality: **(5 hours)**

3.1 Internal architecture of actual microprocessors (M6809, M68000 CISC products, Intel 8086)
3.2 Discussion of micro-code and micro-architecture of chip slice products in particular, the 2901 ALU slice and the 2910 microsequencer (AMD - silicon version; Vitess - GeAs versions)
3.3 Architecture of a microprogrammed microprocessor using chip-slice products
3.4 Simulation of microprocessor functionality using chip-slice products

4.0 Historical and Current Control Unit Architecture: **(8 hours)**
4.1 Review of control unit requirements
4.2 Distributed versus centralized control methods
4.3 Wilkes controller
4.4 Single and dual instruction controller, vertical and horizontal micro-coding
4.5 VLSI and ZILINX control methods

4.6 Modifications to control architecture to permit overlapping of control and ALU operations
4.7 The conflict between efficient microprocessor branching

5.0 Reduced Instruction Set Computers: (6 hours)

5.1 Comparison of RISC and CISC computers
5.2 Comparison of RISC and microprogrammed controllers
5.3 Analysis of architectural requirements of RISC computers
5.4 Register window systems: functionality and programming in assembler and C
5.5 Comparison of various RISC implementations (AMD29000, sun SPARC, IBM R6000)

6.0 Digital Signal Processing (DSP) Chips: (8 hours)

6.1 Examination of the characteristics of typical DSP algorithms (arithmetic and sequencing)
6.2 Ideal architecture for DSP applications
6.3 Compromises made between the ideal and real DSP chips (NEC 77230, Motorola 56001/56200/96000, TI 320 family, AMD29500 microprogrammed products)

7.0 Operating Systems: (8 hours)

7.1 Introduction to operating system kernels and their computational requirements
7.2 Memory management requirements for secure and efficient operating systems
7.3 Comparison between ideal and actual architectural features used to meet operating system requirements

Laboratory:

Students will be required to design and build a project in a digital filtering or other DSP application using a chip-slice or RISC controller.

References:

1.0 A. Tanenbaum, "*Structured Computer Organization*", 3rd Edition, prentice Hall, 1990.
2.0 D. White, "*Bit-Slice Design*", Garland, 1981. This book provides a good introduction to microprogramming. Garland has been willing in the pest to allow Xeroxing of their textbook for a nominal royalty charge of ten dollars.

Data Sheets and Other Reference Material:

1.0 AMD (Bipolar and CMOS) and Vitess (GaAs) data sheets on 2901 ALU and 2910 microsequencer
2.0 AMD Bipolar and Microprocessor Logic and Interface Data Book, 1985

3.0 AMD 29000 RISC User Manual
4.0 Motorola M6809 and M68000 CISC Data sheets
5.0 Motorola M56001, M96000 and M6200 Dedicated DSP Chips
6.0 NEC uD77230 Floating point DSP Chips
7.0 Texas Instruments 320 Data Book
8.0 MIPS and IBM RISC Data Books

COMMUNICATION SYSTEMS II
EG732EX

Lecture: 3 **Year: 4**
Tutorial: 1 **Part: A**
Practical: 3/2

Course objectives: Continuation of communication systems I with an emphasis on digital systems and the effects of noise.

1.0 Digital Communication Systems: (4 hours)

1.1 Digital communication sources, transmitters, transmission channels, and receivers
1.2 Distortion, noise, and interference
1.3 Nyquist sampling theory, sampling of analog signals, spectrum of a sampled signal
1.4 Sampling theorem for band-limited signals, effects of aliasing, reconstruction of sampled signals

2.0 Pulse Modulation Systems: (9 hours)

2.1 Pulse amplitude modulation (PAM), bandwidth requirements and reconstruction methods, time division multiplexing
2.2 Pulse duration modulation (PDM), generation of PDM signals and reconstruction methods
2.3 Analog to digital conversion, quantization and encoding techniques, application to pulse code modulation (PCM)
2.4 Quantization noise in PCM, companding in PCM systems
2.5 Time division multiplexing (TDM), examples of PAM and PCM systems
2.6 The TI PCM system in telephony
2.7 The delta modulator and its operation
2.8 Quantization noise and slope overload in delta modulators, comparison of delta modulation and PCM
2.9 Introduction to linear prediction theory with applications in delta modulation

3.0 Digital Data Communication Systems: (10 hours)

3.1 Introduction to information theory, definition of information, examples of simple sources
3.2 Information rate and Shannon's channel capacity theorem
3.3 Baseband digital communication systems, multilevel coding using PAM
3.4 Pulse shaping and bandwidth considerations, intersymbol interference (ISI)
3.5 Nyquist conditional for zero ISI, band-limited Nyquist pulses, the eye diagram
3.6 Correlative coding techniques, reducing transmission bandwidth with duobinary encoding
3.7 Spectral shaping using bipolar and modified duobinary encoding techniques

3.8 Bandpass (modulated) digital data systems, review of binary digital modulation, PSK, DPSK and FSK
3.9 M-array data communication systems, quadrature amplitude modulation (QAM) systems, four phase PSK
3.10 Applications of modems for transmission over telephone lines

4.0 Representation of Random Signals and Noise in Communication Systems: (10 hours)

4.1 Signal power and spectral representations, the autocorrelation and power spectral density (pfsd) functions
4.2 White noise, thermal noise, the psdf of white signals
4.3 Input and output relationships for random signals and noise passed through a linear time invariant system, band-limited white noise, RC filtering of white noise
4.4 The noise bandwidth of a linear time invariant system and its use in communications
4.5 Optimum detection of a pulse in additive white noise, the matched filter
4.6 Matched filter detection in baseband data communication systems
4.7 Comparison of the matched filter for rectangular pulses with first and second order suboptimum Butterworth filters
4.8 Performance limitation of baseband data communications due to noise, probability of error expressions for multilevel data signals
4.9 Relationship between signal power, noise and channel bandwidth, comparison of systems using Shannon capacity
4.10 Narrowband noise representation, generation of narrowband noise and psdf, time domain expressions for narrowband noise

5.0 Noise Performance of Analog and Digital Communication Systems: (9 hours)

5.1 Signal-to-noise ratio in linear modulation, synchronous detection of DSB
5.2 Signal-to-noise ratios for AM and SSB, comparison of DSB, SSB and AM
5.3 Effect of noise in envelope and square law detection of AM, threshold effects in nonlinear detectors
5.4 Signal-to-noise ratio for FM, SNR improvements using preemphasis and deemphasis networks
5.5 FM threshold effects, noise clicks in FM systems
5.6 Comparison of linear and exponential modulation systems for additive white band-limited noise channels
5.7 Effects of noise in modulated digital communication systems, optimum binary systems
5.8 Probability of error expressions for binary communications
5.9 Probability of error in QAM systems, comparison of digital modulation systems

6.0 Introduction to Coding Theory: (3 hours)

6.1 Block coding for error detection and correction, parity check bits and block coding
6.2 Examples of single cyclic error correcting codes
6.3 Introduction to convolution codes

Laboratory:

1.0 The delta modulator. In this experiment the effects of sampling rate, number of bits in the up-down counter are quantized and measured. The resulting family of SWR curves are compared with expected theoretical results.
2.0 Baseband data communications. A baseband communication system using NRZ signals and 2nd order transmit and receive filters is investigated. The measurements include the eye diagram and probability of error.
3.0 Correlative encoding. A correlative encoder is designed by the student and implemented in hardware. Commonly used encoders include duobinary, bipolar and modified duobinary. A corresponding digital simulation can also be used to illustrate the difference between analog and digital filtering.
4.0 Demodulation of frequency shift keying (FSK) using a phase locked loop (PLL). This is the digital counter-part of Laboratory #5 in COMMUNICATION SYSTEMS I. The PLL is designed to provide a good EYE while still ensuring that the loop stays in lock.
5.0 Digital implementation of a modem. Using computer programs, the student can digitally construct a modem and investigate the effects of channel distortion and noise. The modem to be implemented is the Bell 212A/V.22 1200 bits/second unit.

Note: A computer package can be used to replace most of the above hardware experiments. One such package is marketed by: Icucom Corporation, 48 Ford Avenue, Troy, New York 12080, (518) 247-7711 and is called "The Workstation Communications Simulator".

Reference:

1.0 S. Haykin, "*Digital Communications*", John Wiley an Sons, New York, 1988.

PROPAGATION AND ANTENNAS
EG733EX

Lecture: 3 **Year: 4**
Tutorial: 1 **Part: A**
Practical: 3/2

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

1.0 Radiation and Antenna Fundamentals: (5 hours)

1.1 Review of Maxwell's equations and the wave equation
1.2 Solution of the wave equation in free space with a plane wave and a spherical wave: wave velocity, wave impedance, Poynting's vector and polarization
1.3 Retarded potentials: EM wave generation with a conduction current, the short uniform current dipole, the radiated electric and magnetic fields
1.4 Radiation patterns and input impedance of the short uniform current dipole, the short dipole, the long dipole and the travelling wave antenna
1.5 Antenna theorems: reciprocity, superposition, Thevenin's, minimum power transfer, compensation, equality of directional patterns, equivalence of receiving and transmitting impedances

2.0 Antenna Patterns and Arrays: (6 hours)

2.1 Basic antenna parameters
2.2 Radiation patterns of the long dipole and the travelling wave antennas
2.3 Pattern multiplication: linear and two-dimensional antenna arrays, end fire and broadside arrays, the Yagi and long periodic arrays.
2.4 Aperture antenna, radiation pattern of an aperture antenna, aperture antenna gain, aperture antenna efficiency, spill over and illumination efficiencies

3.0 Propagation Between Antennas: (6 hour)

3.1 Free space propagation: power density at the receiving antenna, effective area of the receiving antenna, path loss
3.2 Plane earth propagation: the ground reflection, effective antenna heights, the two ray propagation model, the path loss
3.3 Knife edge diffraction: Fresnel zones, attenuation of a wave due to a knife edge, path loss with a knife edge

4.0 Propagation in the Radio Frequency Spectrum: (6 hours)

4.1 Medium frequency (MF) and high frequency (HF) propagation via ionospheric reflection
4.2 Very high frequency (VHF) smooth earth propagation and tropospheric scatter propagation

4.3 Microwave propagation: atmospheric bending of a radio wave, radio refractivity charts

5.0 Properties of Light in Fibres: (10 hours)

5.1 Basis of light propagation, Snell's law, total internal reflection
index fibre, the number of modes in a fibre rafractive index fibre, the number of modes in a fibre
5.2 Material and modal dispersion in fibres
5.3 Fibre losses: material absorption and scattering microbending losses
5.4 Fibre connections and splices

6.0 Light Sources: (6 hours)

6.1 Light emitting diodes
6.2 Laser diodes
6.3 Source output, angle of emission, spectral width and transient response, coupling the source into the fibre

7.0 Photodetectors: (6 hours)

7.1 The PIN photodetector
7.2 The avalanche photodiode
7.3 Photodetector sensitivity, noise and response time

<u>Laboratory:</u>

1.0 and 2.0 Properties of EM waves: reflection, refraction, diffraction, polarization
3.0 and 4.0 Radiation patterns of various types of antennas
5.0 and 6.0 Measurements on optical fibre transmission systems

<u>References:</u>

1.0 E. C. Jordan and K. G. Balmain, "*Electromagnetic Waves and Radiating Systems*", 2nd Edition, Prentice Hall, Englewood Cliffs, New Jersey, 1968.
2.0 R. E. Collin, "*Antennas and Radio Wave Propagation*", McGraw-Hill Book Company, 1985.
3.0 Gerd Keiser, "*Optical Fibre Communications*", McGraw-Hill Book Company, 1983.
4.0 K. Bullington, "*Radio propagation Fundamentals*", Bell system Technical Journal, vol.36, pp.593-626, may,1957.
5.0 T. G. Giallorenzi, "O*ptical Communications Research and Technology*", proceedings of the IEEE, vol.66, no.7, pp.744-780, July, 1978.

ENGINEERING PROFESSIONAL PRACTICE
EG766CE

Lecture : 2 **Year : 4**
Part : B

COURSE OBJECTIVES: To introduce the ethical and legal environment in which engineering is practiced.

1.0 Background Perspective: (6 hours)
1.1 Impacts and consequences of technology on society: effects of major technological developments such as printing, gunpowder, mechanization, computer, organic chemistry, communication satellites
1.2 Cultural motivations and limitations, eastern Vs western philosophy of change and development
1.3 Political and social limitations
1.4 Individual freedoms Vs societal goals
1.5 Exponential growth
1.6 Alternative use of scarce resources, causes of international tensions
1.7 Risk and overall cost/benefit ratio analysis in engineering decision making
1.8 Education and training of technologists, scientists and engineers

2.0 Ethics and Professionalism: (3 hours)
2.1 Perspective on morals, ethics and professionalism
2.2 Codes of ethics and guidelines for professional engineering practice
2.3 Relationship of the engineering profession to basic science and technology; relationship to other professions

3.0 Roles of Professional Associations: (1 hour)
3.1 Regulation of the practice of the profession, licensing, guidance for training new entrants into the profession, advice and assistance to engineering colleges, upgrading and maintaining the professional and technical competence of members, providing technical expertise as requested for the guidance and assistance of legislators, seeing to the matter of safety and general welfare of the public in engineering works

4.0 Legal Aspects of Professional Engineering in Nepal: (9 hours)
4.1 The Nepalese legal system as it affects the practice of engineering
4.2 Provision for private practice and for employee engineers
4.3 Contract law
4.4 Tendering
4.5 Contract documents
4.6 Liability and negligence
4.8 Relationship to foreign firms working in Nepal

5.0 The Roles and Practice of Professional Engineering in other Countries: (2 hours)

5.1 Other Asian countries
5.2 The USSR and Eastern Europe
5.3 Western Europe
5.4 North America

6.0 Case Studies Involving Professional Ethical Issues Chosen From a Wide Range of Topics: (9 hours)

6.1 Intellectual property rights: copyrights and patent protection
6.2 Personal privacy and large computerized data bases
6.3 Industrialization Vs protection of the environment
6.4 Risk/benefit considerations in public transportation
6.5 Engineers and the military
6.6 Science and technology for medicine
6.7 Engineers in international development

Reference Book:

1.0 Carson Morrison and Philip Hughes, "professional Engineering Practice - Ethical Aspects", McGraw-Hill Ryerson Ltd., Toronto, 1982.

TECHNOLOGY, ENVIRONMENT AND SOCIETY
EG767CE

Lecture : 2 **Year : 4**
Part : B

COURSE OBJECTIVES: To interpret the interrelationships between technology, the environment and society Environmental, social and economic consequences are considered. To assess Nepal's resources in relation to the national development plans, the role of the engineer, and also to assess the likely environmental, ecological and social consequences.

1.0 Brief History of Technology: (15 hours)
Within each time period, the sequences, major discoveries, developments, applications and impacts on the society are stressed:

1.1 The beginnings (to 3000 B.C.)
1.2 The first civilizations (3000 to 1100 B.C.)
1.3 Iron, the democratic metal (1100 B.C. to 500 A.D.)
1.4 The middle ages (500 to 1450)
1.5 Towards the modern world (1450 to 1660)
1.6 The industrial revolution, early days (1660 to 1815)
1.7 The industrial revolution in maturity (1815 to 1918)
1.8 Between two wars (1918 to 1939)
1.9 The Second World War (1939 to 1945)
1.10 Almost our time (1945 to 1965)
1.11 The information society (1965 to the present)

2.0 A Nepalese Perspective: (15 hours)

2.1 An assessment of the relationship of Nepal to the technological developments outlined above
2.2 Expected future course of Nepal in technical growth and development
2.3 Natural resource base of Nepal
2.4 Needs for infrastructure and trained manpower for development
2.5 Environmental/ecological concerns of the country: deforestation, erosion, air and water pollution as a result of human settlement and industrial growth, impact of agricultural development, soil depletion, irrigation, chemical fertilizers, herbicides and insecticides
2.6 Social consequences of change in Nepal: urbanization, mechanization, rapid communication and transportation facilities, increased levels of literacy and awareness of international affairs, greater participation and interaction with the world community
2.7 The roles of engineers and professionals in the planning and development of the country

INSTRUMENTATION II
EG771EX

Lecture : 3 **Year : 4**
Practical : 3/2 **Part : B**

COURSE OBJECTIVES: Continuation of INSTRUMENTATION I with emphasis on advanced systems and design case studies.

1.0 Analytical and Testing Instrumentation: (6 hours)

1.1 Infrared, ultraviolet and x-ray spectroscopy
1.2 Mass spectrometry
1.3 Nuclear magnetic resonance instruments
1.4 Ionizing radiation for instrumentation purpose nuclear radiation for instrumentation purposes
1.5 Non-destructive testing for industry

2.0 Microprocessor Based Instrumentation Systems: (12 hours)

2.1 Microprocessors as instrumentation system components
2.2 Basic features of microprocessors
2.3 Microprocessor hardware used in instrumentation
2.4 Basic elements of microprocessor based systems
2.5 Software for instrumentation and control applications
2.6 High level languages Vs assembly language, compilers and assemblers
2.7 Sampling theory
2.8 Interfacing between analog devices and microprocessors

3.0 Data Acquisition Systems: (3 hours)

3.1 Scanning, logging, alarming
3.2 Smoothing and filtering
3.3 Data compression
3.4 Short and long term storage, archiving

4.0 Transmission and Telemetry of Data: (6 hours)

4.1 Analog transmission
4.2 Coding and digital transmission
4.3 Transmission schemes: am, fm, microwave, fibre optic, electrical carrier, satellite
4.4 ISDN, packet data transmission

5.0 Case Studies: (12 hours)

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

1 Instrumentation for a power station including all electrical and non-electrical parameters
2 Instrumentation for a wire and cable manufacturing and bottling plant
3 Instrumentation for a beverage manufacturing and bottling plant
4 Instrumentation for a complete textile plant; for example, a cotton mill from raw cotton through to finished dyed fabric
5 Instrumentation for a process; for example, an oil seed processing plant from raw seeds through to packaged edible oil product
6 Instruments required for a biomedical application such as a medical clinic or hospital

INSTRUMENTATION II LABORATORIES - 1.5 hrs/week, 6-3 hour labs

1.0 Microprocessor structure used for instrumentation
2.0 Microprocessor programming and coding for instrumentation applications
3.0 Data acquisition and coding
4.0, 5.0 and 6.0 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:

1.0 D. M. Consodine, "*Process Instruments and Controls Handbook*", 3rd Edition, McGraw-Hill, New York, 1985.
2.0 S. Wolf and R. F. Smith, "*Student Reference Manual for Electronic Instrumentation Laboratories*", Prentice Hall, Englewood Cliffs, New Jersey, 1990.
3.0 S. E. Derenzo, "*Interfacing: A Laboratory Approach Using the Microcomputer for Instrumentation, Data Analysis, and Control*", Prentice Hall, Englewood Cliffs, New Jersey, 1990.

TELECOMMUNICATIONS
EG772EX.

Lecture: 3 **Year: 4**
Tutorial: 1 **Part: B**
Practical: 3/2

Course objectives: To continue the study of modern communication systems, their characteristics and design.

1.0 Telecommunication Networks: (6 hours)

1.1 Structure of telecommunication systems
1.2 Signals and their characteristics
1.3 Fundamentals of telephone traffic
1.4 Telephone networks
1.5 Introduction to ISDN

2.0 Transmission Media: (8 hours)

2.1 Transmission media characteristics
2.2 Transmission lines
2.3 Transformer and hybrid circuits
2.4 Signal and noise measurement

3.0 Switching Systems: (8 hours)

3.1 Switching techniques
3.2 Space division switches
3.3 Time division switches
3.4 Communication network organization

4.0 Signal Multiplexing: (6 hours)

4.1 Space division multiplex
4.2 Frequency division multiplex
4.3 Time division multiplex

5.0 Queueing Theory: (9 hours)

5.1 Characteristics of queuing models
5.2 The birth and death process
5.3 Little's formula and the M/M1 queue
5.4 Erlang's loss and delay systems

6.0 Data Communications and Computer Networking: (8 hours)

6.1 Structure of local area networks
6.2 Local area network protocols
6.3 Network interfaces
6.4 Network performance
6.5 Inter-networking
6.6 Routing and flow control

Laboratory: Six laboratory exercises to illustrate course principles.

References:

1.0 W. Stallings, "*Local Area Networks*", 3rd Edition, Macmillan, 1990.

2.0 M. Schwartz, "*Telecommunication Networks*", Addison-Wesley, 1987.

3.0 J. L. Hammond and P.J.P. O'Reilly, "*Performance Analysis of Local Networks*", Addison-Wesley, 1986.

DIGITAL SIGNAL PROCESSING
EG773EX

Lecture: 3 **Year: 4**
Practical: 3 **Part: B**

Course objectives: To introduce digital signal processing techniques and applications.

1.0 Introduction to Discrete Signals and Systems:

1.1 Discrete signals - unit impulse, unit step, exponential sequences
1.2 Linearity, shift invariance, causality
1.3 Convolution summation and discrete systems, response to discrete inputs
1.4 Stability, sum and convergence of power series
1.5 Sampling continuous signals - spectral properties of sampled signals

2.0 Difference Equation and Frequency Response:

2.1General form of the linear, shift-invariant constant coefficient difference equation - signal flow graph representation
2.2 Steady state sinusoidal frequency response derived directly from the difference equation by assuming a form of the solution as a function of EXP (jwT)
2.3 Pole-zero diagrams, frequency response relationships
2.4 Design of a notch filter from the pole-zero diagram, finite impulse response (FIR) and infinite impulse response (IIR) filters.

3.0 Z-Transform:

3.1 Definition of the Z-transform, relationship to convolution summation, one-sided and two-sided transforms
3.2 Left-sided, 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 System response
3.5 Z-transform properties - delay, advance, convolution, Parseval's theorem
3.6 Z-transform transfer function H(Z) - transient and steady state sinusoidal response, pole-zero relationships, stability

4.0 Discrete Filters:

4.1 Discrete filter structures, second order sections, ladder and wave filters, frequency response
4.2 Sampling continuous signals, spectral properties of continuous signals, aliasing
4.3 Anti-aliasing and reconstruction analog filters, effects of sample and hold at filter input and output
4.4 Digital filters, finite precision implementations of discrete filters

4.5 Scaling and noise in digital filters, finite quantized signals, quantization error, linear models

5.0 IIR Filter Design:

5.1 Classical filter design using polynomial approximations - Butterworth, Chebyshev, elliptic and Bessel forms
5.2 IIR filter design by transformation - matched Z-transform, impulse-invariant transform and bilinear transformation
5.3 Application of the bilinear transformation to IIR lowpass discrete filter design
5.4 Spectral transformations, highpass, bandpass and notch filters

6.0 FIR Filter Design:

6.1 FIR filter design by Fourier approximation, the complex Fourier series
6.2 Gibbs phenomena in FIR filter design approximations, applications of window functions to frequency response smoothing
6.3 Window functions, rectangular, Hanning, Hamming and Kaiser windows
6.4 FIR filter design by the frequency sampling method
6.5 FIR filter design using the Remez exchange algorithm
6.6 Linear phase FIR filters, unit sample response symmetry, group delay

7.0 Digital Filter Implementation:

7.1 Implementations using special purpose DSP processors, the Texas Instruments TMS320, the Motorola 5600
7.2 Bit-serial arithmetic, pipelined implementations
7.3 Distributed arithmetic implementations

8.0 The Discrete Fourier Transform:

8.1 The discrete Fourier transform (DFT) derivation
8.2 Properties of the DFT
8.3 DFT of non-periodic data, use of window function
8.4 Introduction of the Fast Fourier transform (FFT)
8.5 Power spectral density using DFT/FFT algorithms

Laboratory:

1.0 Introduction to digital signals - sampling properties, aliasing, simple digital notch filter behaviour
2.0 Response of a recursive (IIR) digital filter - comparison to ideal unit sample and frequency response, coefficient quantization effects
3.0 Scaling, dynamic range and noise behaviour of a recursive digital filter, observation of nonlinear finite precision effects

4.0 Response of a non-recursive (FIR) digital filter order bandpass filters implemented using cascade second order sections and wave or ladder filters, comparison of implementations

5.0 Use of DET and FFT transforms

References:

1.0 A. V. Oppenhein, "*Discrete-Time Signal Processing*", Prentice Hall, 1990.

PROJECT COURSE
EG777EX

Consultation: 6 **Year: 4**
Part: B

Course objectives: To plan and complete an individual electronics engineering design project under the supervision of an instructor and to prepare written reports and give oral presentations.

General procedures:

The project course will involve working on a design project under the supervision of either a staff member in the Electronics and Computer Engineering Department or a carefully selected industrial associate. The subject of the project should be as relevant as possible to the local industrial environment and may, in fact, be selected in consultation with an industrial firm or government department. Since a choice of an elective related to the project Course must be made at the beginning of Part A of the fourth year, a decision of at least the general area of the project topic will have to be decided at that time. Course requirements will include:

1.0 A detailed project proposal (6 to 10 double-spaced pages) including a literature survey to be submitted to the course coordinator within two weeks of the start of the project course. This proposal will be evaluated by the course coordinator and the project supervisor and will account for 10% of the final course grade.

2.0 A written mid-term progress report (10 to 12 double-spaced pages) to be submitted before the end of the 7th week of the term. An oral presentation (15 minutes plus 15 minutes for questions) will take place during the 8th week of term at a time convenient to the course coordinator, the supervisor and the student. The mid-term written and oral reports will account for 25% of the final course grade.

3.0 A final written report (20 to 25 double-spaced pages) will be submitted at the end of the 14 th week of the term. This report will be evaluated by the course coordinator, the supervisor and a third examiner selected by the course coordinator and will account for 40% of the final course grade.

4.0 An oral defence of the final report to be conducted during the 15th week of the term at a time convenient to the course coordinator, the supervisor, the third examiner and the student. The oral defence will account for 25% of the final course grade.

POWER ELECTRONICS
Elective
(Offered by EE department)

Lecture: 3
Tutorial: 1
Laboratory: 3/2

COURSE OBJECTIVES: To introduce high power solid state devices and their applications, including performance analysis in power conditioning

1.0 Power Electronic Devices: (5 hours)

1.1 Basic operating principles of power semiconductors: power diodes, thyristors, power transistors, gate turn-off devices
1.2 Electrical characteristics and equivalent circuits
1.3 Physical structures, mounting and cooling requirements,

2.0 Single Phase AC to DC Conversion: (4 hours)

2.1 Power diode half-wave rectification
2.2 Thyristor half-wave rectification, phase control, pulse
2.3 Full wave rectification using diodes and thyristors
2.4 Waveform and ripple content, filtering

3.0 Three Phase AC to DC Conversion: (4 hours)

3.1 Rectification using diodes and thyristors
3.2 DC voltage control

4.0 Single phase and Three phase DC to AC Inversion: (11 hours)

4.1 Chopper circuits using power transistors
4.2 Thyristor ac line commutated inverters, half-wave and
4.3 Self commutated inverters
4.4 Reactive power requirements for inversion
4.5 Effect of unity and non-unity power factor loads
4.6 Harmonics and filtering

5.0 Switched Power Supplies: (6 hours)

5.1 Voltage step-down regulators
5.2 Voltage step-up regulators
5.3 Step-up/step-down regulators
5.4 Filtering considerations

Control circuits, IC switched regulator controllers

6.0 HVDC Power Transmission: (15 hours)

6.1 AC line commutated converters for reversible power flow on a dc line
6.2 6-pulse and 12-pulse operation, triggering systems
6.3 Filter requirements
6.4 Series/parallel connection of converters to achieve high voltage/high current capability
6.5 Constant voltage and constant extinction angle control of converter operation, power flow reversal
6.6 Effect of ac system short circuit capacity on inverter operation
6.7 Converter faults and fault recovery
6.8 Series/parallel connection of converters to achieve high voltage, high current capability
6.9 Constant voltage and constant extinction angle control of converter operation, power flow reversal
6.10 Effect of AC short circuit capacity on inverter operation
6.11 Converter faults and fault recover

Reference:

1.0 C. W. Lander, "*Power Electronics*", 2nd Edition, McGraw-Hill Book Company, New York, 1987.

Laboratory:

1.0 Power Electronic Device Characteristics
- basic characteristics of power transistors, diodes thyristors (SCRs)
- single phase, full wave and bridge rectifiers with resistive loads
- single phase SCR controller with UJT trigger

2.0 Three-phase Rectification
- three phase bridge rectifiers with diodes and with SCRs
- rectification for inductive loads

3.0 DC to AC Conversion Using Chopper Circuits
- study of small motor control

4.0 DC to AC Conversion Using 3-phase Bridge
- study of waveforms with resistive load

5.0 AC to DC Reversible Power Transfer
- full range firing control system for reversible power flow

6.0 Harmonics and Filter Requirements
- study of dc and ac harmonics in full wave 3-phase bridge rectifying system

ANALOG CONTROL SYSTEMS
Elective
(Offered by EE department)

Lecture: 3
Tutorial: 1
Practical: 3/2

Course objectives: To continue the study of analog control systems started on CONTROL systems to include system identification, optimization and nonlinear control systems.

1.0 Dynamical System and Properties: (8 hours)

1.1 System concept
1.2 Observability and controllability
1.3 Stability and sensitivity
1.4 Reliability and availability

2.0 System Identification: (10 hours)

2.1 System identification by transfer function measurement
2.2 System identification by spectral analysis
2.3 Auto-correlation and cross-correlation
2.4 Power densities
2.5 Error analysis

3.0 Nonlinear Control Systems: (12 hours)

3.1 Linear approximations
3.2 Saturation constraints
3.3 Digital simulation
3.4 Describing functions
3.5 Phase plane analysis
3.6 Adaptive control

4.0 Optimization: (15 hours)

4.1 Extrema of functions
4.2 Lagrange multiplier methods
4.3 Kuhn-Tucker conditions
4.4 Saddle-point conditions
4.5Extrema of functionals
4.6 Variation problems
4.7 Euler-Lagrange equations
4.8 Optimal control of dynamical systems
4.9 Dynamic programming and the maximum principle

Laboratory:

1.0 System identification by transfer function measurement
2.0 System identification by spectral using random signals
3.0 Nonlinear system simulation
4.0 Nonlinear system control implementation
5.0 Optimization calculations
6.0 optimal control of a system

Reference:

1.0 K. Ogata, "*Modern Control Engineering*", 2nd Edition, Prentice Hall, Englewood Cliffs, New Jersey, 1990.

DIGITAL CONTROL SYSTEMS
Elective
(Offered by EE department)

Lecture: 3
Tutorial: 1
Practical: 3/2

Course objectives: To present the basic concepts of analysis and design of sampled data and digital control.

1.0 Introduction to Discrete-Time Control Systems: (8 hours)

1.1 Principle features of discrete-time control systems
1.2 Quantizing and coding signals
1.3 Data acquisition and data transfer

2.0 The z-Transform: (10 hours)

2.1 Basic principles of the z-transform
2.2 Z-transforms of simple functions
2.3 Inverse z-transforms
2.4 Important properties for control system applications
2.5 Impulse sampling
2.6 Z-transform from convolution integral
2.7 Reconstruction of original signal from samples
2.8 S to z-plane mapping
2.9 Stability in the z-domain

3.0 Z-Transform Methods for Analysis of Control Systems (10 hours)

3.1 Discrete-time equivalents of continuous-time filters
3.2 Discrete-time equivalents of analog controllers
3.3 System response calculations: steady-state and transient
3.4 The root locus method
3.5 Frequency response method

4.0 Design and Compensation of Discrete-Time Control Systems: (8 hours)

4.1 Digital filters: structures, implementation, frequency response properties, applications
4.2 Control system controllers: structures, hardware/software features, responses to control signals, use of root locus and frequency domain concepts
4.3 Phase-lead and phase-lag compensator design for discrete-time systems
4.4 PID controller design and selection of parameters for discrete-time systems

5.0 Discrete-Time State-Space Equations: (9 hours)

5.1Discretization of the continuous-time state-space equations
5.2 Pulse transfer function matrix
5.3 Stability assessment from the discretized state space equations

Laboratory:

1.0 Relay control
2.0 X-Y plotter control
3.0 Angular position control
4.0 DC motor control
5.0 Generator control
6.0 AC motor control
7.0 Robot control

Reference:

1.0 K. Ogata, "*Discrete-Time Control Systems*", Prentice Hall, Englewood Cliffs, New Jersey, 1987.

OPTICAL FIBRE COMMUNICATIONS
Elective

Lecture: 3
Tutorial: 1
Practical: 3/2

Course objectives: An in-depth continuation of the study of material relating to optical fibre communication devices and networks begun in PROPAGATION devices and networks begun in PROPAGATION and ANTENNAS.

1.0 Review of Electromagnetics: (8 hours)

1.1 Maxwell's equation in cartesian coordinates
1.2 Analysis of the slab waveguide
1.3 Dispersion and attenuation
1.4 Maxwell's equation in cylindrical coordinates
1.5 Step-index and graded-index fibres
1.6 Dispersion and attenuation

2.0 Fibre properties: (8 hours)

2.1 Fibre chemistry
2.2 Production techniques
2.3 Measurement of fibre properties

3.0 Optical Transmitters and Receivers: (12 hours)

3.1 Light emitting diodes
3.2 Lasing diodes
3.3 Source output, angle of emission, spectral width and transient response
3.4 Modulation techniques
3.5 The PIN photodetector
3.6 The avalanche diode
3.7 Photo detector sensitivity, noise and response time
3.8 Demodulation techniques

4.0 Interconnect and Switches: (8 hours)

4.1 Fibre splices
4.2 Fibre connectors
4.3 Coupling sources to fibres
4.4 Coupling receivers to fibres

5.0 Fibre Optic Networks: (9 hours)

5.1 Multi-terminal analog and digital network analysis and design

5.2 Optical fibre local area networks
5.3 Optical switching
5.4 Integrated optics

Laboratory:

1.0 Power/current response of LED's, system frequency response
2.0 LED-fibre, fibre-photodiode, fibre-fibre coupling efficiency
3.0 Fibre numerical aperture and attenuation
4.0 Analog transmission
5.0 Digital transmission

References:

1.0 E. C. Jordan and K. G. Balmain, "*Electromagnetic waves and Radiating Systems*", 2nd Edition, Prentice Hall, Englewood Cliffs, New Jersey, 1968
2.0 R. E. Collin, "*Antennas and Radio Wave Propagation*", McGraw-Hill Book Company, 1985.
3.0 G. Keiser, "*Optical Fibre Communications*", McGraw-Hill Book Company, 1983.

Useful Reference Papers:

1.0 K. Bullington, "*Radio propagation Fundamentals*", Bell System Technical Journal, vol.36, pp.593-626, May,1957.
2.0 T. G. Giallorenzi, "*Optical Communications Research and Technology*", Proceedings of the IEEE, vol.66, no.7, pp.744-780, July, 1978.

SATELLIITE COMMUNICATION
Elective

Lecture: 3
Tutorial: 1
Practical: 3/2

Course objective: To present an introduction to satellite communication systems.

1.0 Introduction: (3 hours)

1.1 History of the development of satellite communications
1.2 Geostationary satellite communications
1.3 Frequencies and satellite orbit
1.4 Signal intensity and signal-to-noise ratio
1.5 Multiple access and commercial satellite systems

2.0 Satellite Orbit and Radio Spectrum (6 hours)

2.1 Models in satellite development
2.2 Satellite stabilization and its life
2.3 Tracking and control of communication satellites
2.4 Geostationary satellite characteristics

3.0 Satellite Orbit and Radio Spectrum (6 hours)

3.1 Use of orbit and frequency band
3.2 Interference between satellite systems
3.3 Inhomogeneity of satellite system parameters

4.0 Satellite Radio Wave Propagation: (5 hours)

4.1 Effects of atmosphere
4.2 Effects of ionosphere
4.3 Interference with terrestrial radio relay stations

5.0 Satellite Antennas: (5 hours)

5.1 Basic aperture antennas and parameters
5.2 Polarisation techniques
5.3 Tracking systems
5.4 Antenna measurement techniques

6.0 FM Transmission Systems: (5 hours)

6.1 FM system in satellite communications, CCIR recommendations
6.2 Design of links for multi-chanel telephony

6.3 Details of INTELSAT IV-A system
6.4 Energy dispersal of multi-channel telephone circuits

7.0 Digital Satellite Communication Systems: (5 hours)

7.1 Advent of digital satellite communications
7.2 Digital modulation (PSK, FSK, **....**)
7.3 TDMA systems
7.4 Digital speech interpolation
7.5 Error correction
7.6 Digital transmission of TV signals

8.0 Earth Stations: (5 hours)

8.1 Earth stations, classification and facilities
8.2 Antennas and orthogonal polarization
8.3 High power transmitter techniques
8.4 LNA and receiver techniques
8.5 TV transmission techniques

9.0 Maritime Satellite Communications: (5 hours)

9.1 Features of maritime satellite communication systems and CCIR recommendations
9.2 Modulation and demodulation systems
9.3 Signaling system access control
9.4 Ship-earth station equipment
9.5 Coast earth station equipment

Laboratory: Six laboratory exercises based on departmentally-available equipment, industrially-available equipment and computer simulation.

References:

1.0 K. Miya, "*Satellite Communications Technology*", KDD Engineering and Consulting Ltd.

2.0 K. Miya et al, "*From Semaphore to Satellite*", Satellite Communications Engineering, Lattice Co., 1965.

3.0 R. G. Gould and Y. F. Lum, "*Communication Satellite Systems, an overview of the Technology*", IEEE Press, 1977.

4.0 J. J. Spilker, "*Digital Communication by Satellite*", Prentice Hall, m1977.

ADVANCED TOPICS COMPUTING
Elective

Lecture: 3
Tutorial: 1
Practical: 3/2

Course Objective: To continue the study of computer operating and data handling systems.

1.0 Principles of Operating Systems: (12 hours)
- 1.1 Process management and scheduling
- 1.2 Concurrency
- 1.3 Process cooperation
- 1.4 Memory management
- 1.5 Software

2.0 The DOS Operating Systems: (12 hours)
- 2.1 System configuration files
- 2.2 Autoexec files
- 2.3 Hare drives, disk drives
- 2.4 Directory and file handling capabilities
- 2.5 Graphics capabilities
- 2.6 Networking systems

3.0 The UNIX Operating System: (9 hours)
- 3.1 File systems
- 3.2 Filters
- 3.3 Pipelines
- 3.4 Reduction
- 3.5 C-shell
- 3.6 UNIX system software tools
- 3.7 Structural programming techniques

4.0 Data Structures: (12 hours)
- 4.1 Data structure representation and description
- 4.2 Algorithms for data structure manipulation
- 4.3 Performance analysis of algorithms
- 4.4 Applications including graphs, inverted files, trees, sorting and hashing
- 4.5 Introduction to database systems

Laboratory: Software exercises and study of practical examples culminating in a fairly sophisticated project.

References:

1.0 C. A. Ziegler, "*Programming System Methodologies*".