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 Computer Engineering field. The details of the course are as follows.

1. Title of the Course:

Bachelor of Engineering in **Computer Engineering**.

2. Objective of the Course:

To train students in technical and analytical skills required to enable them to function and practice as professional Computer engineer on all aspects of Computer 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, CT - Computer 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 Year: **August 1998**
Second Year: **August 1999**

Revision of First Year and Second Year: August 2000
Third and Fourth Year: August 2000

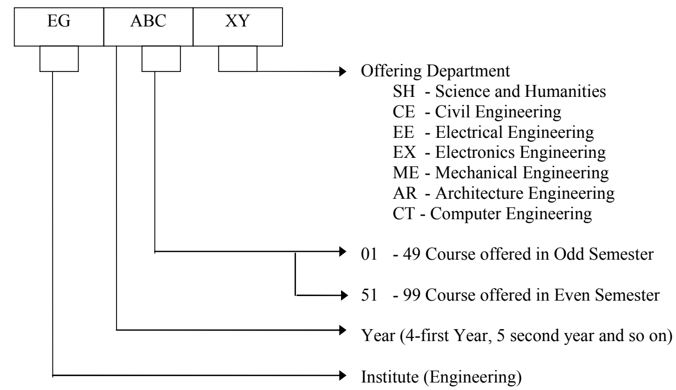
Note:
Division:

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:



Bachelor Degree
in
Computer Engineering

Year: I Part: A

S.N	Course Code	Course Title	L	T	P	Total	Theory Assessment	Theory Final Duration	Theory Final Marks	Practical Assessment*	Practical Final Duration	Practical Final Marks	Total	Remarks
	Teaching Schedule						Examination Schedule							**Remarks**
1	EG401SH	Mathematics I	3	2	-	5	20	3	80	-	-	-	100	*Continuous Assessment
2	EG402SH	Physics	4	1	2	7	20	3	80	20	3	30	150	
3	EG442CT*	Computer Programming I	3	-	3	6	20	3	80	50	-	-	150	
4	EG404SH	Communication I (English)	1	3	-	4	10	1.5	40	-	-	-	50	
5	EG431ME	Engg. Drawing I	1	-	3	4	-	-	-	60	3	40	100	
6	EG432ME	Workshop Tech.	1	-	3	4	-	-	-	50	-	-	50	
7	EG439CE	Applied Mechanics	3	1	-	4	20	3	80	-	-	-	100	
		Total	16	7	11	34	90	13.5	360	180	6	70	700	

***Common to Electronics Engineering effective from academic year 2057/58**

Bachelor Degree
in
Computer Engineering

Year: I Part: B

S.N	Course Code	Course Title	L	T	P	Total	Theory Assessment	Theory Final Duration	Theory Final Marks	Practical Assessment*	Practical Final Duration	Practical Final Marks	Total	Remarks
	Teaching Schedule						**Examination Schedule**							**Remarks**
1	EG469ME	Ther. Dyn/Heat Tran.	3	1	1.5	5.5	20	3	80	25	-	-	125	*Continuous Assessment
2	EG471SH	Mathematics II	3	2	-	5	20	3	80	-	-	-	100	
3	EG403SH	Chemistry	3	1	2	6	20	3	80	10	3	15	125	
4	EG476EE	Elect. Engg. Material	3	1	-	4	20	3	80	-	-	-	100	
5	EG477EE	Electric Circuit I	3	1	3	7	20	3	80	50	-	-	150	
6	EG481ME	Engg. Drawing II	1	-	3	4	-	-.	-	60	3	40	100	
		Total	16	6	9.5	31.5	100	15	400	145	6	55	700	

Bachelor Degree
in
Computer Engineering

Year: II Part: A

S.N	Course Code	Course Title	L	T	P	Total	Theory: Assessment	Theory: Final Duration	Theory: Final Marks	Practical: Assessment*	Practical: Final Duration	Practical: Final Marks	Total	Remarks
Teaching Schedule							Examination Schedule							Remarks
1	EG501SH	Mathematics III	3	2	0	5	20	3	80	-	-	-	100	*Continuous Assessment
2	EG542CT*	Computer Programming II	3	-	3	6	20	3	80	50	-	-	150	
3	EG527EE	Electric Circuit II	3	1	1.5	5.5	20	3	80	25	-	-	125	
4	EG532EX	Semiconductor Dev.	3	1	1.5	5.5	20	3	80	25	-	-	125	
5	EG533EX	Logic Circuits	3	0	3	6	20	3	80	50	-	-	150	
6	EG540CT	Basic Computer Concepts	3	1	1.5	5.5	20	3	80	25	-	-	125	
		Total	18	5	10.5	33.5	120	18	480	175			775	

<u>*Common to Electronics Engineering effective from academic year 2057/58</u>

Bachelor Degree
in
Computer Engineering

Year: II Part: B

S.N	Course Code	Course Title	L	T	P	Total	Theory: Assessment	Theory: Final Duration	Theory: Final Marks	Practical: Assessment*	Practical: Final Duration	Practical: Final Marks	Total	Remarks
Teaching Schedule							Examination Schedule							Remarks
1	EG561SH	Applied Math	3	2	0	5	20	3	80	-	-	-	100	*Continuous Assessment
2	EG576EE	Instrumentation I	3	1	1.5	5.5	20	3	80	25	-	-	125	
3	EG572EX	Electronic Circuit I	3	1	1.5	5.5	20	3	80	25	-	-	125	
4	EG573EX	Microprocessor	3	1	3	7	20	3	80	50	-	-	150	
5	EG577EE	Electrical Machines	3	1	1.5	5.5	20	3	80	25	-	-	125	
6	EG574EX	Electromagnetics	3	1	1.5	5.5	20	3	80	25	-	-	125	
		Total	18	7	9	34	120	18	480	150			750	

Bachelor Degree
in
Computer Engineering

Year: III Part: A

S.N	Course Code	Course Title	L	T	P	Total	Theory Assessment	Theory Final Duration	Theory Final Marks	Practical Assessment*	Practical Final Duration	Practical Final Marks	Total	Remarks
	Teaching Schedule						**Examination Schedule**							**Remarks**
1	EG601SH	Numerical Methods	3	0	3	6	20	3	80	50	-	-	150	*Continuous Assessment
2	EG604SH	Communication II (English)	1	3	0	4	10	1.5	40	0	-	-	50	
3	EG631CT	Data Structures and Algorithms	3	1	3	7	20	3	80	50	-	-	150	
4	EG 632CT	Theory of Computation.	3	0	0	3	20	3	80	0	-	-	100	
5	EG 633CT	Computer Architecture & Design	3	1	1.5	5.5	20	3	80	25	-	-	125	
6	EG634CT	Microprocessor Based Instrumentation	3	1	1.5	5.5	20	3	80	25	-	-	125	
7	EG648EE	Control System	3	1	1.5	5.5	20	3	80	25	-	-	125	
		Total	19	7	10.5	36.5	130	19.5	520	175			825	

Bachelor Degree
in
Computer Engineering

Year: III Part: B

S.N	Course Code	Course Title	L	T	P	Total	Theory Assessment	Theory Final Duration	Theory Final Marks	Practical Assessment*	Practical Final Duration	Practical Final Marks	Total	Remarks
	Teaching Schedule						**Examination Schedule**							**Remarks**
1	EG666CE	Engg. Economics	3	1	-	4	20	3	80	-	-	-	100	*Continuous Assessment
2	EG671SH	Prob./Statistics	3	1	-	4	20	3	80	-	-	-	100	
3	EG679CT	Comm. Systems	4	1	3	8	20	3	80	50	-	-	150	
4	EG678EX	Computer Graphics	3	1	3	7	20	3	80	50	-	-	150	
5	EG682CT	Operating System.	3	-	1.5	4.5	20	3	80	25	-	-	125	
6	EG681CT	Database Management System	3	1	3	7	20	3	80	50	-	-	150	
7	EG677CT	Minor Project	-	-	4	4				50	Viva	25	75	
		Total	19	5	14.5	38.5	120	18	480	225		25	850	

Bachelor Degree
in
Computer Engineering

Year: IV Part: A

Teaching Schedule							Examination Schedule							Remarks
							Theory			Practical			Total	
							Assess ment	Final		Assess ment*	Final			
S.N	Course Code	Course Title	L	T	P	Total		Duration	Marks		Duration	Marks		
1	EG706CE	Project Engg.	3	1	0	4	20	3	80	-	-	-	100	*Continuous Assessment
2	EG709ME	Org. and Mangmt	3	2	0	5	20	3	80	-	-	-	100	
3	EG741CT	Computer Network	3	1	3	7	20	3	80	50	-	-	150	
4	EG742CT	Software Engg.	3	-	1.5	3	20	3	80	25	-	-	125	
5	EG743CT	Artificial Intelligence	3	1	1.5	5.5	20	3	80	25	-	-	125	
6	EG745CT	Elective I	3	1	1.5	5.5	20	3	80	25	-	-	125	
		Total	18	6	7.5	30	120	18	480	125			725	

Bachelor Degree
in
Computer Engineering

Year: IV Part: B

Teaching Schedule							Examination Schedule							Remarks
							Theory			Practical			Total	
							Assess ment	Final		Assess ment*	Final			
S.N	Course Code	Course Title	L	T	P	Total		Duration	Marks		Duration	Marks		
1	EG766CE	Engg. Prof. Practice	2	-	-	2	10	1.5	40	-	-	-	50	*Continuous Assessment
2	EG767CE	Tech. Env. & Society	2	2	-	4	10	1.5	40	-	-	-	50	
3	EG773EX	Digital Signal Processing	3	-	1.5	4.5	20	3	80	25	-	-	125	
4	EG778CT	Simulation and Modeling	3	1	1.5	5.5	20	3	80	25	-	-	125	
5	EG781CT	Information System	3	1	1.5	5.5	20	3	80	25	-	-	125	
6	EG777CT	Project	-	-	6	6	-	-	-	100	Viva	75	175	
7	EG795CT	Elective II	3	1	1.5	5.5	20	3	80	25	-	-	125	
		Total	16	5	12	33	100	15	400	200			775	

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**", 20th 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
EG442CT

Lecture: 3 **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 C.

1. Introduction to Computers **(3 hours)**
1.1 Historical development and Generation of 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

2. Problem Solving Using Computer **(4 hours)**
2.1 Problem Analysis
2.2 Algorithm Development & Flowcharting
2.3 Coding
2.4 Compilation and Execution
2.5 Debugging and Testing
2.6 Program Documentation

3. Introduction to C **(3 hours)**
3.1 Data types in C
3.2 Arithmetic Expressions
3.3 Structure of C Program

4. Input and Output **(3 hours)**
4.1 Formatted I/O
4.2 Character I/O
4.3 Programs Using I/O statements

5. Structured Programming Fundamentals **(7 hours)**
5.1 Sequential Structure
5.2 Selective Structure
5.3 Repetitive Structure
5.4 Programs Using Decision making statements and Looping

6. Functions **(5 hours)**
6.1 Introduction
6.2 Function definition and return statement
6.3 Function Prototypes
6.4 Function invocation, Call by value & Call by reference
6.5 Concept of Local, Global, Automatic and Static variables

6.6 Recursive Functions

7. Arrays, Pointers, and Strings **(10 hours)**
7.1 Introduction to Arrays
7.2 Inputting and Outputting Arrays
7.3 Manipulation of Arrays
7.4 Pointers
7.5 Relationship between Arrays and Pointers
7.6 Pointers Arithmetic
7.7 Arrays as function arguments
7.8 Dynamic memory allocation
7.9 String & String handling Functions

8. Structures **(5 hours)**
8.1 Introduction
8.2 Declaring and defining Structures
8.3 Arrays of Structures
8.4 Structures within Structure
8.5 Structure containing Arrays

9. Files and File handling in 'C' **(5 hours)**

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

Laboratory:

12 laboratory exercises with assignments growing in complexity from entering and running a small given program to the development of program which utilizes the knowledge drawn from entire course.
Out of 3 remaining laboratory sessions, 2 laboratory sessions will be used for developing simple project type experiment and 1 session for evaluation.

References:

1. Kelly & Pohl, "*A Book on C*", Benjamin/Cummings, 1984.
2. Brian W. Keringhan & Dennis M. Ritchie, "*The 'C' Programming Language*", PHI
3. Bryons S. Gotterfried, "*Programming with 'C'* " , TMH
4. Stephen G. Kochan, " *Programming in C*", CBS publishers & distributors.
5. B. Ram, "*Computer Fundamentals* "

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

Textbook:
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_N1 and S_N2 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

Textbooks:

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

<u>Laboratory:</u>

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.

<u>Textbook:</u>

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
EG542CT

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

Objectives: The course objective is to familiarize students with the Object-Oriented Analysis, Design and Programming. The practical component of this course is based on C++.

1.0 Overview **(2 hrs)**
- 1.1. Procedural programming and issues with procedural programming
- 1.2. Why Object-Oriented programming
- 1.3. Object-Oriented concepts
  - 1.3.1. Abstraction
  - 1.3.2. Encapsulation
  - 1.3.3. Inheritance
  - 1.3.4. Polymorphism
- 1.4. Advantages of Object-Oriented programming

2. Introduction and History of C++ **(3 hrs)**
- 2.1. Why C++
- 2.2. History and Evolution of C++
- 2.3. Features of C++

3. **C++ Language basic syntax** **(3 hrs)**
- 3.1. Fundamental data types
- 3.2. Declarations and definitions
- 3.3. Derived types
- 3.4. Standard conversions and promotions
- 3.5. Statements
- 3.6. Arrays and pointer in C++
- 3.7. const
- 3.8. Enumeration
- 3.9. Flow control
- 3.10. Comments

4. **Functions (Methods) in C++** **(4 hrs)**
- 4.1. Syntax of functions
- 4.2. Functions name overloading
- 4.3. Default arguments
- 4.4. Inline functions
- 4.5. Variable arguments
- 4.6. Return types
- 4.7. Parameter passing

5. **Support for classes in C++** **(5 hrs)**
- 5.1. Class syntax
- 5.2. Data Encapsulation (public, protected, private modifiers)
- 5.3. Inheritance
- 5.4. Scope resolutions operator
- 5.5. "this" pointer
- 5.6. static or class member functions
- 5.7. Unions in C++
- 5.8. Accessibility of member functions and member variables

6. **Exceptions to C++ Encapsulation** **(1 hr)**
- 6.1. Friend functions
  - 6.1.1. Overloading and friend functions
- 6.2. Friend classes

7. **Object Initialization and Destruction (3 hrs)**
- 7.1. Constructors - need for constructors
- 7.2. Syntax of constructors
- 7.3. Syntax of destructors
- 7.4. Unions and Constructors
- 7.5. Other Constructors
  - 7.5.1. Copy constructors

8. **Overloading Operators** **(3 hrs)**
- 8.1. Operator overloading - justification
- 8.2. Friends vs. Member functions
- 8.3. Streams Operator overloading

9. **Inheritance - Foundation for reuse** **(5 hrs)**
- 9.1. Types of inheritance
- 9.2. When to use inheritance
- 9.3. Motivation for inheritance
- 9.4. Derivation of C++ classes
- 9.5. Scope of inherited member functions
- 9.6. Scope of inherited member variables
- 9.7. Class structure in memory
- 9.8. Inheritance and operator functions
- 9.9. Multiple inheritance
- 9.10. Constructor for multiply derived classes
- 9.11. Destructors for multiply derived classes
- 9.12. Virtual base classes

10. **Polymorphism and Dynamic Binding** **(3 hrs)**
- 10.1. Virtual Functions
- 10.2. Pure Virtual functions and Abstract classes

11. Input/Output (5 hrs)

11.1. Stream based input/output
11.2. Input/Output class hierarchy
11.3. File Input/Output
11.4.

12. Advanced C++ topics

12.1. Templates (3 hrs)
  12.1.1. Reuse via type parameters
  12.1.2. Declaring container classes
  12.1.3. Template Constructs
  12.1.4. Standard Template Library

12.2. Run Time Type Information (1 hr)
12.3. Namespaces (1 hr)
12.4. Exceptions (3 hrs)
  12.4.1. What are Exceptions
  12.4.2. Benefits of Exception Handling
  12.4.3. Exception Handling Syntax: catch, throw and try
  12.4.4. Error handling in libraries
  12.4.5. Passing error handling

Laboratories:

There shall be 12 lab exercises covering features of object-oriented programming. By the end of this course each student must complete a major programming project based on OOP.

References:

1. Robert Lafore, "*Object-Oriented Programming in C++*", Galgotia Publications, India.
2. Deitel & Deitel, "*C++ How to Program*", 2/e , Prentice Hall
3. Navajyoti Barkakati , "*Object-Oriented Programming in C++*", Prentice Hall of India

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

Laboratory:

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

Reference Books:

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

BASIC COMPUTER CONCEPT
EG540CT

Lecture: 3 — **Year: II**
Tutorial: 1 — **Part: A**
Practical: 1.5

1. Fundamentals **(2 hours)**
- 1.1 Evolution of Computer
- 1.2 Classification
  - 1.2.1 Operation: Analog and Digital
  - 1.2.2 Uses: General purpose and Specific purpose
  - 1.2.3 Capacity: Mainframe, Mini, Personal, and Super computer

2. Basic Architecture **(7 hours)**
- 2.1 Building blocks of a PC
  - 2.1.1 CPU
  - 2.1.2 Memory
  - 2.1.3 Input
  - 2.1.4 Output
- 2.2 The Storage devices: Floppy Disk and Harddisk
- 2.3. Introduction of Peripherals

3. Operating System **(4 hours)**
- 3.1 Definition and Classification
- 3.2 Functions of Operating System
- 3.3 DOS
- 3.4 Windows
- 3.5 Mac OS
- 3.6 Unix
- 3.7 OS/2

4. Programming Languages, Interpreters and Compilers **(4 hours)**
- 4.1 Introduction and basic elements of programming language
- 4.2 Classification of programming language
- 4.3 Characteristics of Computer program
- 4.4 Assembler, Interpreter, and Compiler
- 4.5 Introduction to programming languages

5. Software Applications **(5 hours)**
- 5.1 Word Processor
- 5.2 Spreadsheet
- 5.3 Database
- 5.4 Graphics
- 5.5 Engineering

5.6 Customized Packages

6. Peripherals and Accessories **(10 hours)**

6.1 Printer/Plotter
6.2 Scanner
6.3 Mouse/Digitizer
6.4 CD-ROM/Optical Drive/Tape Drive

7. Network and Internet **(12 hours)**

7.1 Peer to peer and Dedicated server types
7.2 Topologies: Bus, Ring and Star
7.3 Network Cabling: 10Base2, 10BaseT, 10Base5, 100BaseT, Hub, Terminator, T
7.4 Networking Operating System: Novell NetWare, Windows NT, LANtastic, Windows95, SCO Unix, Banyan Vines, LAN Manager
7.5 Advantages, Disadvantages
7.6 The Internet

8. Computer Application **(1 hour)**

8.1 Computer Application
8.2 Impact of Computers on Society
8.3 Future development

<u>Laboratory:</u>

1. Six lab exercises covering computer hardware and Software.
2. Demonstration of Computer Network.

<u>References:</u>

1. Winn Rosch, "*Hardware Bible*"
2. P. K. Sinha, "*Computer Fundamentals*"

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.

<u>Textbook:</u>

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

<u>Laboratory:</u>

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

<u>Reference Books:</u>

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.

<u>Laboratory:</u>

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

<u>References:</u>

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.

DATA STRUCTURE AND ALGORITHM
EG 631 CT

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

Objectives: Course objectives is to provide fundamental knowledge of Data Structure and its design. To provide the knowledge of various algorithms.

1.0 Concept of data structure **(2 hours)**
- 1.1 Abstract Data Type
- 1.2 Implementation of Data structure

2.0 The Stack and Queue **(6 hours)**
- 2.1 Stack as an ADT
- 2.2 Stack operation
- 2.3 Stack application: Evaluation of Infix, Postfix, and Prefix expressions
- 2.4 Queue as an ADT
- 2.5 Operations in queue, Enqueue and Dequeue
- 2.6 Linear and circular queue
- 2.7 Priority queue

3.0 List **(3 hours)**
- 3.1 Definition
  - 3.1.1 Static and dynamic list structure
  - 3.1.2 Array implementation of lists
  - 3.1.3 Queues as list

4.0 Linked lists **(6 hours)**
- 4.1 Link list as an ADT
- 4.2 Dynamic implementation
- 4.3 Operations in linked list
- 4.4 Linked stacks and Queues
- 4.5 Doubly linked lists and its applications

5.0 Recursion **(4 hours)**
- 5.1 Principle of recursion
- 5.2 TOH and Fibonacci sequence
- 5.3 Applications of recursion

6.0 Trees **(6 hours)**
- 6.1 Concept
- 6.2 Operation in Binary tree
- 6.3 Tree search, insertion/deletions
- 6.4 Tree traversals (pre-order, post-order and in-order).

6.5 Height, level, and depth of a tree
6.6 AVL balanced trees and Balancing algorithm
6.7 The Huffman algorithm
6.8 B-Tree

7.0 Sorting **(5 hours)**

7.1 Types of sorting: internal and external
7.2 Insertion and selection sort
7.3 Exchange sort
7.4 Merge and Radix sort
7.5 Shell sort
7.6 Heap sort as priority queue
7.7 Big 'O' notation and Efficiency of sorting

8.0 Searching **(5 hours)**

8.1 Search technique
8.2 Sequential, Binary and Tree search
8.3 General search tree
8.4 Hashing
8.4.1 Hash function and hash tables
8.4.2 Collision resolution technique

9.0 Graphs **(8 hours)**

9.1 Representation and applications
9.2 Graphs as an ADT
9.3 Transitive closure
9.4 Warshall's algorithm
9.5 Graphs types
9.6 Graph traversal and Spanning forests
9.6.1 Depth First Traversal and Breadth First traversal
9.6.2 Topological sorting: Depth first, breadth first topological sorting
9.6.3 Minimum spanning trees
9.6.4 Kruskal's and Round-Robin algorithms
9.7 Shortest-path algorithm
9.7.1 Greedy algorithm
9.7.2 Dijkstra's Algorithm

<u>Laboratory:</u>

There shall be 12 lab exercises based on C or C++

1. Implementations of stack
2. Implementations of linear and circular queues
3. Solutions of TOH and Finbonacci Recursion
4. Implementations of linked list: singly and doubly linked
5. Implementation of trees: AVL trees, Balancing of AVL

6. Implementation of Merge sort
7. Implementation of search: sequential, Tree and Binary
8. Implementation of Graphs: Graph traversals
9. Implementation of hashing
10. Implementations of Heap

<u>References:</u>

1. Y. Langsam, M.J. Augenstein and A. M. Tenenbaum, "*Data Structures using C and C++*", PHI
2. G. W. Rowe, "*Introduction to Data Structure and Algorithms with C and C++*", PHI
3. R.L. Kruse, B. P. Leung, C. L. Tondo, "*Data Structure and Program design in C*", PHI
4. G. Brassard and P. Bratley, "*Fundamentals of Algorithms*", PHI

THEORY OF COMPUTATION
EG632CT

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

Course Objective: To provide an idea of the theory of formal languages, automata and complexity theory.

1.0 Finite automata and regular expression: **(5 hours)**
1.1 Finite state system
1.2 Non-deterministic finite automata
1.3 Regular expression

2.0 Properties of regular sets: **(4 hours)**
2.1 The plumbing lemma for regular sets
2.2 Closure properties of regular sets
2.3 Decision algorithms for regular sets

3.0 Context-free grammers: **(8 hours)**
3.1 Derivative trees
3.2 Simplification of context-free grammars
3.3 Normal forms

4.0 Pushdown automata: **(4 hours)**
4.1 Pushdown automata and context-free grammars

5.0 Properties of context-free languages: **(6 hours)**
5.1 The pumping lemma for CFL's
5.2 Closure properties of CFL's
5.3 Decision algorithms for CFL's

6.0 Turing Machines: **(5 hours)**
6.1 Computable languages and functions
6.2 Church's hypothesis

7. Undecidability **(5 hours)**
7.1 Properties of recursive and recursively languages
7.2 Universal turing machines and undecidable problem
7.3 Recursive function theory

8. Computational complexity theory: **(4 hours)**

9. Intractable problems: **(4 hours)**
9.1 Computable languages and functions
9.2 NP-complete problems

References:

1. H.R. Lewis, and C.H. Papadimitriou, " *Element of the theory of Computation*". Eastern Economy Edition, Prentice Hall of India
2. R. McNaughton, " *Elementary Computability, Formal languages and Automata*", Prentice Hall of India
3. E. Engeler, " *Introduction to the Theory of Computation*", Academic Press

COMPUTER ARCHITECTURE AND DESIGN
EG 633 CT

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

Objectives: To provide basic architectural and designing concepts of computers. This course gives comprehensive view of basic computer architecture.

1. **Central Processing Unit : (8 hours)**
    1.1 Hardwired and Microprogramed
    1.2 Arithmetic Logic Unit
    1.3 Instruction
    1.4 Addressing Modes
    1.5 Data transfer and manipulation program control (status, branch, subroutine call, interrupt)

2. **Arithmetic Processor Design : (8 hours)**
    2.2 Addition and Subtraction algorithm
    2.3 Multiplication and Division algorithm
    2.4 Logical Operation
    2.5 Processor Configuration
    2.6 Design of Control Unit

3. **Memory System : (10 hours)**
    3.1. Microcomputer memory
    3.2. Characterization of Memory System
    3.3. Random Access Memory (DRAM, SRAM)
    3.4. ROM
    3.5. Memory Hierarchy
    3.6. Memory Mapping

4. **I/O Organization : (10 hours)**
    4.1. Peripheral devices
    4.2. Basic I/O Interface
    4.3. I/O Technique (Async. Data transfer, DMA, Priority Interrupt)
    4.4. I/O Processor
    4.5. Data Command Processor

5. **The PnP System Architecture: (9 hours)**
    5.1. ISA, PCI and PCMCIA
    5.2. PnP Device configuration
    5.3. PnP Card Resource Requirements
    5.4. PnP BIOS and OS
    5.5. PnP POST and Device ROMS
    5.6. PnP BIOS Services

Laboratory Exercises:

The laboratory exercises shall be Hands-on Computer architecture project aiming to familiarize students with processor, control, memory, and I/O systems.

References :

1. M. Mano, " *Computer System Architecture*"
2. A. Tanenbaum, " *Structured Computer Organization*", 3rd Edition, Prentice Hall, 1990
3. M. Morris Mano, Charles R. Kime, " *Logic and Computer Design Fundamentals*", PHI
4. Tom Shanley, " *Plug and Play System Architecture*", Addison-Wesley publishing company
5. William Stallings, " *Computer Organization and Architecture*", PHI

MICROPROCESSOR BASED INSTRUMENTATION
EG 634 CT

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

Objectives: To introduce and apply the knowledge of microprocessor, A/D, D/A converter to design instrumentation system. Also to provide the concept on interfacing with microprocessor based system and circuit design techniques.

1. **Interfacing Concept** **(4 hours)**
   1.1. Types of interfacing
   1.2. Address decoding
   1.3. Input/Output registers
   1.4. PC Interfacing techniques

2. **Methods of parallel data transfer** **(8 hours)**
   2.1. Simple input and output
   2.2. Single Handshake I/O
   2.3. Double Handshake I/O
   2.4. 8255 and interface devices, block diagram, internal structures, and modes of initialization, and interfacing to a microprocessor
   2.5. Microcomputer on instrumentation design
   2.6. Interrupt driven data transfer

3. **Interfacing A/D and D/A Converters** **(8 hours)**
   3.1. Introduction
   3.2. General terms involved in A/D and D/A converters
   3.3. Functional block diagram of 8-bit and 12-bit A/D and D/A converters
   3.4. Selection of A/D and D/A converters based on design requirements

4. **Serial and Parallel Data Communication** **(8 hours)**
   4.1. Synchronous and Asynchronous data communication
   4.2. Parity and Baud rates
   4.3. Serial Interface Device
   4.4. RS-232 serial data standard and interface
   4.5. Simplex, half duplex and full duplex operation using RS-232 port
   4.6. Connection to printer and zero modem

5. **Transmission and telemetry of data** **(5 hours)**
   5.1. Analog and Digital Transmission
   5.2. Transmission schemes
      5.2.1. Electrical carrier
      5.2.2. Fiber optic
      5.2.3. Satellite

   5.3. Data loggers

6. **Circuit Design and Layout** **(4 hours)**
   6.1. Converting requirements into design
   6.2. Reliability, fault tolerance, and high speed design
   6.3. Impedance matching
   6.4. Standard data bus and networks
   6.5. Reset and power failure detection
   6.6. Redundant Architecture
   6.7. Timing

7. **Grounding and shielding** **(4 hours)**
   7.1. Outline for grounding and shielding
   7.2. Single point grounding and grouped loop
   7.3. Noise, noise coupling mechanism and prevention
   7.4. Filtering and smoothing
   7.5. Different kinds of shielding mechanism
   7.6. Protecting against electrostatic discharge
   7.7. Line filters, isolators and transient suppressors

8. **Software for instrumentation and control applications** **(4 hours)**
   8.1. Types of software, selection and purchase
   8.2. Software models and their limitations
   8.3. Software reliability
   8.4. Fault tolerance
   8.5. Software bugs and testing

Laboratory Exercises :

The laboratory exercises deal with 8-bit or 12-bit A/D and D/A converters and communication with PC to PC using RS-232 port. There will be six exercises related with instrumentation.

1. Assembly language program
2. Simple data transfer using PPI
3. Handshake transfer using PPI
4. Interfacing of A/D converter using PPI
5. Interfacing of A/D converter using RS232 port
6. Interfacing of A/D converter using Printer port
7. Demonstration of other interfacing techniques and devices
8. Group project based on interfacing techniques and instrumentation

References:

1. D.V. Hall, "*Microprocessor and Interfacing programming and hardware*
2. K.R. Fowler, "*Electronic Instrument Design*"

3. E.O. Duebelin, "*Measurement system application and design*"
4. Linear circuit data book dealing with A/D and D/A converters

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

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.

1.0 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.

COMMUNICATION SYSTEMS
EG679CT

Lectures: 4 **Year: 3**
Tutorial: 1 **Part: B**
Practical: 3

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

1.0 Analog and Digital Communication Systems: (2 hours)

1.1 Analog 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: (2 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: (6 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: (4 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): (4 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: (1 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: (3 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 Digital Communication Systems: (2 hours)

8.1 Digital communication sources, transmitters, transmission channels, and receivers

8.2 Distortion, noise, and interference
8.3 Nyquist sampling theory, sampling of analog signals, spectrum of a sampled signal
8.4 Sampling theorem for band-limited signals, effects of aliasing, reconstruction of sampled signals

9.0 Pulse Modulation Systems: (6 hours)

9.1 Pulse amplitude modulation (PAM), bandwidth requirements and reconstruction methods, time division multiplexing
9.2 Pulse duration modulation (PDM), generation of PDM signals and reconstruction methods
9.3 Analog to digital conversion, quantization and encoding techniques, application to pulse code modulation (PCM)
9.4 Quantization noise in PCM, companding in PCM systems
9.5 Time division multiplexing (TDM), examples of PAM and PCM systems
9.6 The TI PCM system in telephony
9.7 The delta modulator and its operation
9.8 Quantization noise and slope overload in delta modulators, comparison of delta modulation and PCM
9.9 Introduction to linear prediction theory with applications in delta modulation

10.0 Digital Data Communication Systems: (8 hours)

10.1 Introduction to information theory, definition of information, examples of simple sources
10.2 Information rate and Shannon's channel capacity theorem
10.3 Baseband digital communication systems, multilevel coding using PAM
10.4 Pulse shaping and bandwidth considerations, intersymbol interference (ISI)
10.5 Nyquist conditional for zero ISI, band-limited Nyquist pulses, the eye diagram
10.6 Correlative coding techniques, reducing transmission bandwidth with duobinary encoding
10.7 Spectral shaping using bipolar and modified duobinary encoding techniques
10.8 Bandpass (modulated) digital data systems, digital modulation, PSK, DPSK and FSK
10.9 M-array data communication systems, quadrature amplitude modulation (QAM) systems, four phase PSK
10.10 Applications of modems for transmission over telephone lines

11.0 Representation of Random Signals and Noise in Communication Systems: (8 hours)

11.1 Signal power and spectral representations, the autocorrelation and power spectral density (pfsd) functions
11.2 White noise, thermal noise, the psdf of white signals

11.3 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
11.4 The noise bandwidth of a linear time invariant system and its use in communications
11.5 Optimum detection of a pulse in additive white noise, the matched filter
11.6 Matched filter detection in baseband data communication systems
11.7 Comparison of the matched filter for rectangular pulses with first and second order suboptimum Butterworth filters
11.8 Performance limitation of baseband data communications due to noise, probability of error expressions for multilevel data signals
11.9 Relationship between signal power, noise and channel bandwidth, comparison of systems using Shannon capacity
11.10 Narrowband noise representation, generation of narrowband noise and psdf, time domain expressions for narrowband noise

12.0 Noise Performance of Analog and Digital Communication Systems: (8 hours)

12.1 Signal-to-noise ratio in linear modulation, synchronous detection of DSB
12.2 Signal-to-noise ratios for AM and SSB, comparison of DSB, SSB and AM
12.3 Effect of noise in envelope and square law detection of AM, threshold effects in nonlinear detectors
12.4 Signal-to-noise ratio for FM, SNR improvements using preemphasis and deemphasis networks
12.5 FM threshold effects, noise clicks in FM systems
12.6 Comparison of linear and exponential modulation systems for additive white band-limited noise channels
12.7 Effects of noise in modulated digital communication systems, optimum binary systems
12.8 Probability of error expressions for binary communications
12.9 Probability of error in QAM systems, comparison of digital modulation systems

13.0 Introduction to Coding Theory: (5 hours)

13.1 Block coding for error detection and correction, parity check bits and block coding
13.2 Examples of single cyclic error correcting codes
13.3 Introduction to convolution codes

Laboratory: Following Ten 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.

6.0 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.

7.0 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.

8.0 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.

9.0 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.

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".

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.

OPERATING SYSTEMS
EG 682 CT

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

Objectives: To provide the basics in designing of an operating system.

1. **Principles of operating systems** **(5 hours)**
    1.1. Evolution of operating systems
        1.1.1. User driven
        1.1.2. Operator driven
        1.1.3. Simple batch system
        1.1.4. Off-line batch system
        1.1.5. Directly-coupled off-line system
        1.1.6. Multi-programmed spooling system
        1.1.7. On-line timesharing system
        1.1.8. Multiprocessor systems
        1.1.9. Multi-computer/Distributed systems

2. **Program construction utilities** **(6 hours)**
    2.1. Assembler
    2.2. Archiver
    2.3. Link editor
    2.4. Relocating loader

3. **Concurrent processes** **(5 hours)**
    3.1. Interleaving
    3.2. Non-determinism
    3.3. Process interaction sharing
    3.4. Synchronization
    3.5. Communication
    3.6. Locks
    3.7. Semaphores
    3.8. Monitors

4. **The system nucleus(kernel)** **(6 hours)**
    4.1. Context switching
    4.2. First level interrupt handling
    4.3. Kernel implementation of processes
    4.4. Kernel implementation of semaphores

5. **Scheduling** **(5 hours)**
    5.1. Priority pre-emption
    5.2. Run to completion

    5.3. Time-sliced
    5.4. Multi-level queues

6. **Input/Output** **(6 hours)**
    6.1. Polled input/output
    6.2. Interrupt driven input/output
    6.3. Device driver structure

7. **Memory management** **(6 hours)**
    7.1. Single contiguous store allocation and overlays
    7.2. Fixed partition store allocation
    7.3. Dynamic partition store allocation and fragmentation/compaction
    7.4. Virtual addressing
    7.5. Memory management policy

8. **Case study** **(6 hours)**
    8.1. Unix
    8.2. Windows NT

Laboratories:

6 Laboratories based on standard operating system

References:

1. Mark Donovan: *System programming*

DATABASE MANAGEMENT SYSTEMS
EG 681CT

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

Objectives: The course objective is to provide fundamental concept, theory and practices in design and implementation of Database Management System.

1.0 Introduction **(3 hours)**
- 1.1 Concept and applications
- 1.2 Objectives and Evolution
- 1.3 Data abstraction and data independence
- 1.4 Schema and Instances
- 1.5 Concept of DDL and DML

2.0 Data Models **(5 hours)**
- 2.1 Logical, Physical and Conceptual model
- 2.2 E-R Model
  - 2.2.1 Entities and entity sets
  - 2.2.2 Relationships and relationships sets
  - 2.2.3 E-R diagram
  - 2.2.4 Strong and weak entity sets
  - 2.2.5 Attributes and keys
- 2.3 Network Data Model
- 2.4 Hierarchical Data Model
- 2.5 Unified Modeling Language

3.0 Relational model **(3 hours)**
- 3.1 Definitions and terminology
- 3.2 Structure of relational databases
- 3.3 The relational algebra and relational calculus

4.0 Relational languages **(5 hours)**
- 4.1 SQL and QBE
  - 4.1.1 DDL and DML

5.0 Relational Database Design **(6 hours)**
- 5.1 Integrity constraints
  - 5.1.1 Domain constraints
  - 5.1.2 Functional dependencies
  - 5.1.3 Referential integrity
  - 5.1.4 Triggers
- 5.2 Multi-valued and Join Dependencies
- 5.3 Normalization

  - 5.3.1 Needs of normalization
  - 5.3.2 Normal Forms
  - 5.3.3 DKNF
- 5.3 Views design
- 5.4 Decomposition of relation schemes

6.0 Query Processing **(3 hours)**
- 6.1 Introduction to query processing
- 6.2 Equivalence of expressions
- 6.3 Query Optimization
- 6.4 Query decomposition

7.0 Filing and File structure **(5 hours)**
- 7.1 Storage devices
- 7.2 Organization of records
- 7.3 File organizations
  - 7.3.1 The sequential file organizations
  - 7.3.2 The indexed sequential file organization
  - 7.3.3 B-Tree index files
  - 7.3.4 Hashing
  - 7.3.5 Heap
- 7.4 Buffer Management

8.0 Security **(3 hours)**
- 8.1 Security and integrity violations
- 8.2 Access control and Authorization
- 8.3 Security and Views
- 8.4 Encryption and decryption

9.0 Crash Recovery **(4 hours)**
- 9.1 Failure classification
- 9.2 Backup-recovery
- 9.3 Storage hierarchy
- 9.4 Transaction model
- 9.5 Log-based recovery
- 9.6 Shadow paging

10.0 Concurrency control **(4 hours)**
- 10.1 Transaction
- 10.2 Scheduling and Serializability
- 10.3 Lock based protocols
- 10.4 Time-stamping
- 10.5 Deadlock handling
- 10.6 Multiple Granularity

11.0 Object Oriented Model **(2 hours)**

11.1 Introduction
11.2 Design of Object-Oriented Model

12.0 Distributed Model **(2 hours)**

12.1 Structure of distributed model
12.2 Design consideration
12.3 Applications

Laboratory:

There should be 12 laboratory exercises based on any standard RDBMS.

References:

1. H. F. Korth and A. Silberschatz, " *Database system concepts*", McGraw Hill
2. A. K. Majumdar and P. Bhattacharaya, "*Database Management Systems*", Tata McGraw Hill, India
3. G.C. Everest, "*Database Management*", McGraw Hill

MINOR PROJECT
EG 677 CT

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

Objectives: To learn visual programming by carrying out a small project. During the project, the student will learn visual programming tool (JAVA/Visual Basic/Visual C++ or any current trend of visual tool).
The student will also learn to formulate project documentation for his/her final year project.

The project may be on the following areas or any other area relevant to the course:

1. Simulation of signaling in Microprocessor
2. Measurement converters to be used in web pages
3. Bar chart generator in web pages
4. Calculator
5. Cross word puzzle
6. Simulation of Electronic circuits
7. Simulation of logical circuits

1. Java Programming Language: **(15 hours)**

1.1. Introduction to Java
1.2. Java grammar
1.3. Variable and data types
1.4. Operators, statements, functions
1.5. Objects
1.6. Event handlers

2. Project guidance: **(6 hours)**

3. Project on visual programming: **(39 hours)**

The project document shall include the following items:

1. Technical description of the mini project
2. System aspect of the project
    a. Baseline performance of the system
    b. Performance analysis methodology
    c. Reusability of modules in the software
3. Project sponsors if any
4. Implementation area
5. Project tasks and time schedule
6. Project team members and team leader
7. Project supervisor

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 NETWORKS
EG 741 CT

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

Objective: To teach the students about the hardware and software used in networking, the transmission media, the network structure, and the protocols involved in networking.

1.0 Introduction to Computer Networks (5 hours)
1.1. Definition, Advantages, Disadvantages, Applications
1.2. Network structure and topologies
1.3. Network architecture and OSI model
1.4. Connection oriented and connectionless services
1.5. Network examples: Public network, ARPANET, USENET, CSNET, BITNET, SNA

2.0 Local Area Networks (5 hours)
2.1 LAN primer: Network server, Network workstation
2.2 Network hardware: NIC, Cables, Hub, Storage, Backup, RAID, UPS, Printer
2.3 Network software: Peer to peer LAN, Client/server LAN
2.4 LAN scheme: CSMA/CD and IEEE 802.3

3.0 Transmission and Channel Control: The Physical Layer (8 hours)
3.1 Transmission media: Twisted pair, Coaxial, Fiber optic, Line-of-site, Satellite
3.2 Analog transmission: Telephone, Modem, RS 232 and RS 449
3.3 Digital transmission: PCM, Encoding, X.21
3.4 Channel allocation and switching: Multiplexing, Circuit switching, Packet switching
3.5 Telecommunication switching system (Networking of Telephone exchanges)
3.6 ISDN: Architecture, Interface, Signaling

4.0 Channel Access Protocols: The Data Link Layer and Medium Access Sub-layer: (8 hours)

- 4.1 Channel access: Polling, Non-polling, Peer to peer non priority, Peer to peer priority
- 4.2 IEEE standard 802 for LANs: 802.3, 802.4, 802.5
- 4.3 Fiber optic networks: FDDI, Fiber Net II, S/Net, Datakit, Fastnet and Expressnet
- 4.4 Satellite Networks: SPADE, ALOHA

5.0 The X.25 Network (5 hours)

- 5.1 X.25 and the physical layer
- 5.2 X.25 and the data link layer
- 5.3 X.25 Features: PVC, Virtual circuit, Datagram, Fast select
- 5.4 Packet Formats

6.0 Internetworking (4 hours)

- 6.1 Routing algorithms
- 6.2 Congestion control algorithms
- 6.3 Bridges, Routers and Gateways
- 6.4 X.75, Frame relay

7.0 TCP/IP (5 hours)

- 7.1. TCP/IP and internetworking
- 7.2 Related protocols, Ports and sockets
- 7.3. IP address structure
- 7.4. IP features and services
- 7.5. TCP
- 7.6. UDP and Route discovery protocols

8. Upper Layer Protocols (5 hours)

- 8.1. Network security
- 8.2. Electronic mail and X.400
- 8.3. FTAM
- 8.4. Directory service

Laboratory Exercises: Laboratory exercises to be conducted in-groups. Laboratory exercises shall be:

1. Network setup based on Novell Netware
2. Network setup based on Windows NT
3. Network setup based on Linux
4. Peer to Peer networking using Windows
5. Setup of File Server, Web Server, DNS Server, FTP Server
6. Setup of Client / Server

<u>References:</u>

1. Black, "*Computer Networks"*
2. Tanenbaum*, "Computer Networks"*
3. Rosch, "*Hardware Bible"*

SOFTWARE ENGINEERING
EG742 CT

Lecture 3 **Year: 4**
Tutorial 0 **Part: A**
Practical 3/2

Objectives: This course provides a systematic approach towards planning, development, implementation and maintenance of systems, also help developing software projects.

1.0 Review of Structural Programming: (3 hours)

- 1.1 Introduction
- 1.2 Design Considerations
- 1.3 Objective and Principles
- 1.4 Program Structure
- 1.5 Structuring of control flow
- 1.6 Modular Programming
- 1.7 Top-Down approach
- 1.8 Constrained use of go to
- 1.9 Programming Considerations
- 1.10 Structured Flowchart
- 1.11 Psudocode

2.0 Systems Analysis and development: (5 hours)

- 2.1 Introduction
- 2.2 System Concept
- 2.3 System Analysis-What and Why?
- 2.4 Methodology and Standards
- 2.5 Expression of a need
- 2.6 Preliminary Investigation and Feasibility Study
- 2.7 Specification
- 2.8 System Design
  - 2.8.1 Data Flow Diagram, Context Diagram
- 2.9 Systems Development life Cycle
- 2.10 Implementation

3.0 Program Development: (6 hours)

- 3.1 Introduction
- 3.2 Tasks of Program Development
- 3.3 Problem Definition
- 3.4 Coding
- 3.5 Debugging

3.6 Testing
3.7 Implementation
3.8 Documentation
3.9 Maintenance
3.10 Extension and Redesign

4.0 Trends in Software Development: (4 hours)

4.1 Introduction
4.2 The Evolving Role in Software.
4.3 An Industry Perspective
4.4 Some Initial Solutions
4.5 Structured Methodologies
4.6 Major Influencing Factors
4.7 Tools need for Developing Software
4.8 Current generation of Software Development tools

5.0 Computer Aided Software Engineering : (4 hours)

5.1 Introduction
5.2 An Engineering Approach to Software
5.3 Software and its increasing cost
5.4 Software error and their Impact
5.5 Software Development via an engineering ethos

6.0 Object-oriented analysis and data modeling: (5 hours)

6.1 Object-oriented concepts
- 6.1.1 Identifying objects
- 6.1.2 Specifying attributes
- 6.1.3 Defining operations
- 6.1.4 Inter object communication
- 6.1.5 Finalizing the object definition

6.2 Object-oriented analysis modeling
- 6.2.1 Classification and assembly structures
- 6.2.2 Defining subjects
- 6.2.3 Instance connections and message paths
- 6.2.4 OOA and prototyping

6.3 Data modeling
- 6.3.1 Data objects, attributes, and relationships
- 6.3.2 Entity-relationship diagrams

7.0 Object-oriented design: (8 hours)

7.1 Origins of object-oriented design
7.2 Object-oriented design concepts
- 7.2.1 Objects, operations, and messages
- 7.2.2 Design issues

- 7.2.3 Classes, instances, and inheritance
- 7.2.4 Object descriptions

7.3 Object-oriented design methods
7.4 Class and object definition
7,5 Refining operations
7.6 Program components and interfaces
7.7 A notation for odd
- 7.7.1 Representing class and object relationships
- 7.7.2 Modularizing the design

7.8 Implementation detail design
7.9 An alternative object-oriented design strategy
- 7.9.1 Design steps
- 7.9.10 A design example

7.10 Integrating odd with structured analysis and structured design

8.0 Software quality: (6 hours)

8.1 Software quality and software quality assurance
- 8.1.1 Software quality factors
- 8.1.2 Software quality assurance
- 8.1.3 SQA activities
- 8.1.4 Software quality standards: ISO, SEI

8.2 Software reviews
- 8.2.1 Cost impact of software defects
- 8.2.2 Defect amplification and removal

8.3 Formal technical reviews
- 8.3.1 The review meeting
- 8.3.2 Review reporting and record keeping
- 8.3.3 Review guidelines
- 8.3.4 A review checklist

8.4 Formal approaches to SQA
- 8.4.1 Proof of correctness
- 8.4.2 Statistical quality assurance
- 8.4.3 The clean room process

9.0 Software reliability (2 hours)

9.1 Measures of reliability and availability
- 9.1.1 Software reliability models
- 9.1.2 Software safety

10.0 Validation techniques: **(2 hours)**

10.1 Walkthroughs and inspections

10.1.1 Static analysis

10.2 Symbolic execution

10.3 System testing

10.4 Integration testing

10.5 Acceptance testing

Laboratory Exercises:

Student must do one software project in any language. The choice of project depends upon the class teacher or student.

References:

1. Edward Yourdon, and Larry L. Cantantine , "*Structured Design fundamentals of a discipline of Computer Systems*"
2. Robernt J. Thierauf ," *Systems Analysis and Design*"
3. Dr. A.K. Gupta, and S.K. Sarkar, "*System Analysis , Data Processing and Quantitative Techniques*"
4. Richard Fairley, " *Software Engineering* "

ARTIFICIAL INTELLIGENCE
EG 743 CT

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

Course Objectives: To provide basic knowledge of Artificial Intelligence and the knowledge of Machine Learning, Natural Language, Expert Systems and Neural Network.

1. **Goals in problem-solving:** **(6 hours)**
   1.1. Goal schemas, use in planning,
   1.2. Concept of non-linear planning, Means–end analysis
   1.3. Production rules systems,
   1.4. forward and backward chaining,
   1.5. Mycin-style probabilities and its application.

2. **Intelligence** **(5 hours)**
   2.1. Introduction of intelligence
   2.2. Modeling humans vs. engineering performance
   2.3. Representing intelligence using and acquiring knowledge

3. **Knowledge Representation** **(6 hours)**
   3.1. Logic
   3.2. Semantic networks
   3.3. Predicate calculus
   3.4. Frames

4. **Inference and Reasoning** **(6 hours)**
   4.1. Inference theorems
   4.2. Deduction and truth maintenance
   4.3. Heuristic search State-space representations, game playing
   4.4. Resoning about uncertainty Probability, Bayesian networks
   4.5. Case-based Resoning

5. **Machine Learning** **(8 hours)**
   5.1. Concepts of learning (based on Winston)
   5.2. Learning by analogy, Inductive bias learning
   5.3. Neural networks
   5.4. Genetic algorithms
   5.5. Explanation based learning
   5.6. Boltzmann Machines

6. **Application of artificial intelligence** **(14 hours)**
   6.1. Neural networks:
      6.1.1. Network Structure

6.1.2. Adaline, Madaline
6.1.3. Perceptron
6.1.4. Multi-layer Perceptron
6.1.5. Radial Basis Function
6.1.6. Hopfield network, Kohonen Network,
6.1.7. Elastic net model, back-propagation

6.2. Expert Systems
6.2.1. Architecture of an expert systems
6.2.2. Knowledge acquisition, induction
6.2.3. Knowledge representation, Declarative knowledge, Procedural knowledge
6.2.4. Knowledge elicitation techniques, Intelligent editing programs
6.2.5. Development of expert systems

6.3. Natural language Processing
6.3.1. Levels of analysis: Phonetic, syntactic, semantic, pragmatic
6.3.2. Machine Vision: Bottom-up approach, edge extraction, line detection, line labeling, shape recognition, image interpretation, need for top-down, hypothesis-driven approaches.

References Books:

1. E. Rich & K. Knight, *Artificial Intelligence (2nd ed.)*, McGraw-Hill, 1991
2. Haykin: Neural Networks: *A Comprehensive Fundamentals*, Macmillan, 1994
3. E. Turban, *Decision Support and Expert Systems*, Macmillan, 1993
4. R. Shingal, *Formal Concepts in Artificial Intelligence*, Chapman & Hall, 1992
5. G. Gazadar & C. Mellish, *Natural Language Processing in Prolog: and introduction to computational linguistics*, Addison-Wesley, 1989
6. D. Crookes, *Introduction to Programming in Prolog*, Prentice Hall, 1988.
7. P. H. Winston, *Artificial Intelligence (2nd ed.)*, Addison-Wesley, 1984
8. Beale & Jackson: *Neural Computing*, Aam Higler, 1990
9. Hecht-Neilson: *Neurocomputing*, Addison-Wesley, 1990
10. G. F. Luger & W. A Stubblefield, *Artificial Intelligence*, Benjamin Cummings, 1993

Laboratory:

1. Design and implementation of Expert system in problem solving
2. Lab work should cover the design and development of artificial intelligence using the LISP and Prolog software.

3. Laboratory exercises must be designed to develop Search, Inference including forward and backward chaining in Object-Oriented Language.

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**
Tutorial : 2 **Part : B**

1.0 Introduction (4 hours)

1.1 The civilization between 3000 B.C. and 1660 A.D.
1.2 The time of the early industrial revolution between 1660 and 1815
1.3 The industrial revolution in Maturity between 1815 and 1918
1.4 Influence of the first and second world wars on technology

2.0 The Technological Society (5 hours)

2.1 The machine age
2.2 The stream locomotive and its impact on transportation
2.3 The telephone and telegram and their impact on telecommunication
2.4 The automobile and its impact on mobility
2.5 Development of electronics and the silicon chips
2.6 The computer and its impact
2.7 Information as a source of knowledge and power
2.8 The information society
2.9 Importance of technology in the modern house

3.0 Society and the Environment (5 hours)

3.1 Introduction to the environment and ecosystem
3.2 Humans and their impact on the environment
3.3 Garbage collection and disposal
3.4 Sewage disposal and its pollution of the environment
3.5 Industrial waste: its generation, collection and disposal
3.6 Problems resulting from the disposal of sludge and industrial waste in rivers, lakes and canals
3.7 Impact of water pollution on the health of human and animals
3.8 Impact of water pollution on fish life
3.9 Control of the environment

4.0 Technology and the Environment (3 hours)

4.1 The environment of technology
4.2 Technology as a curse and as a blessing
4.3 Technology is now irreversible
4.4 Control of technology's adverse impacts at the design stage of machines
4.5 The gasoline powered engines and the automobile
4.6 Air pollution from automobile and truck emissions

5.0 Technology and Society (5 hours)

5.1 Technology creates the opportunity for society change

5.2 Importance of technology in controlling prices
5.3 Interaction between technology and the labour force
5.4 Society's control of technology
5.5 Effects of emissions from coal and gasoline powered engines on public health
5.6 Benefits of society from new technological inventions
5.7 Technological innovations can unmask old social problems
5.8 Impact of industrialization of societies that are not yet technologised
5.9 Shifts in employment opportunities

6.0 Green House Effects **(2 hours)**
6.1 Definition
6.2 Factors contributing to the Green House warming effects
6.3 Global impacts on land, water, agriculture, humans, animals, etc.
6.4 Present international efforts towards finding solutions

7.0 Acid Rain **(2 hours)**
7.1 Causes of acid rain
7.2 Impact of acid rain on water in lakes and rivers
7.3 Impact of acid rain on water and fish life
7.4 Possible treatments

8.0 Technological and Environmental Situation in Nepal **(4 hours)**
8.1 Industries in Nepal
8.2 Water and Air Pollution
8.3 Impact of technology on the economy in Nepal
8.4 Impact of technology on employment
8.5 Educational needs to accommodate new types of employment
8.6 Impact of technology on social values

Tutorial:
Six assignments and two quizzes.

Textbook:
Edward C. Pytlek, Donald P. Lauda & David, "*Technology Change and Society*", Publications, Inc., Worcester, Massachusetts, 1978.

DIGITAL SIGNAL PROCESSING
EG773EX

Lecture: 3 **Year: 4**
Practical: 1.5 **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.

SIMULATION AND MODELING
EG 778 CT

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

Course Objectives: To provide the knowledge of discrete and continuous system, generation of random variables, analysis of simulation output and simulation languages.

1.0 Introduction to modeling and simulation: **(5 hours)**
- 1.1 System concepts
- 1.2 System modeling
- 1.3 Mathematical models: nature and assumptions
- 1.4 Calibration and validation

2.0 Discrete and continuous systems: **(8 hours)**
- 2.1 Queuing system
- 2.2 Markov chains
- 2.3 Differential and partial differential equations

3.0 Generation of random variables: **(10 hours)**
- 3.1 Uniform random generators
- 3.2 Testing of uniform random generators
- 3.3 Methods of generating non-uniform variables
- 3.4 Inversion, rejection, composition

4.0 Analysis of simulation output: **(10 hours)**
- 4.1 Estimation methods
- 4.2 Simulation run statistics
- 4.3 Replication of runs
- 4.4 Elimination of internal bias

5.0 Simulation Languages: **(12 hours)**
- 5.1 Basic concepts of Simulation tool
- 5.2 Discrete systems modeling and simulation
- 5.3 Continuous systems modeling and simulation
- 5.4 Structural, data and control statements, hybrid simulation
- 5.5 Feedback systems: typical applications

Laboratory Exercises: Laboratory exercises using simulation and modeling packages

References:

1. J. A. Spriest and G.C. Vansteenkiste, " *Computer-Aided Modeling and Simulation*", Academic Press
2. G. Gorden, "*System Simulation*", Prentice Hall of India
3. M. Law and R. F. Perry, " *Simulation: A problem-solving approach*", Addison Wesley Publishing Company
4. M. Law and W. D. Kelton, "*Simulation Modeling and Analysis*", McGraw Hill, 1991

INFORMATION SYSTEM
EG 781 CT

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

Objectives: To introduce and apply the knowledge of Computer based information systems. Also to provide the concept to the student and designing and setting up complex Information system.

1.0 Introduction to Information System: (6 hours)
- 1.1 Definition
- 1.2 Source and types of IS
- 1.3 Manual and Computer Based IS
- 1.4 Planning and Design
- 1.5 Feasibility Assessment
- 1.6 Implementation

2.0 Basic components of Information system: (6 hours)
- 2.1 Hard wares
- 2.2 Multi-Protocol Networks
- 2.3 Communication media
- 2.4 Standard user interface

3.0 Conceptual and Detailed System Design: (5 hours)
- 3.1 Definition of Problems
- 3.2 Constraints
- 3.3 Alternative Design
- 3.4 Documentation

4.0 Implementation, Evaluation, and Maintenance of IS: (5 hours)
- 4.1 Implementation Alternatives
- 4.2 Plan for Implementation
- 4.3 Evaluation of Implemented system
- 4.4 Control and Maintenance

5.0 Parts of Information System: (5 hours)
- 5.1 Database Management System
- 5.2 Management Information System
- 5.3 Automation Process
- 5.4 Geographical Information System

6.0 Management of Information system: (5 hours)
- 6.1 MIS Planning, Design, and Implementation
- 6.2 IS for marketing, Inventory control and HRD
- 6.3 Decision Support and Expert System
- 6.4 Basic concept of Data warehousing and Data mining
- 6.5 Workgroup and Executive support system

7.0 System Design Methodology: (7 hours)
- 7.1 Check list methodology
- 7.2 Process Oriented Methodology
- 7.3 Application Generation
- 7.4 Structured Design

8.0 IS and Internets: (6 hours)
- 8.1 Internet versus Intranet
- 8.2 E-mail, Internet and ISP

Laboratory Exercises: The laboratory exercises shall include projects on designing of Information system using Object oriented methodology. Case study shall be included.

References:

1. J. Kanter, "*Managing With Information System*", Prentice Hall of India, 1992
2. V. Rajaraman, "*Analysis of Information Systems*", Prentice Hall of India, 1998
3. R.G. Hardick, J.E. Ross and J.R. elaggett, *" Information Systems for Modern Management*", PHI
4. David Kroenke, "*Management Information Systems*", Mc Graw Hill

PROJECT COURSE
EG777CT

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.

List of Electives(Elective - I and Elective-II)

1. Advanced Data Base
2. Advanced Computer Architecture
3. Automatic Control System
4. Biomedical Instrumentation
5. Geographical Information System
6. Data Warehousing and Data mining
7. Multimedia /Virtual Reality
8. Internets/ Intranets & Application
9. Switching in Telecommunication
10. Image Processing & Pattern Recognition