First Year 'all common' Subjects for:

- Civil Engineering
- Civil & Rural Engineering
- Computer Engineering
- Electronics & Communication Engineering
- Electrical & Electronics Engineering

First Year 'Partial Common' subjects for:

- BEIT
- BE Software

Table of Contents

1. MEC 119.3 Applied Mechanics I (3-2-0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:

This course has been developed to provide the basic knowledge of engineering mechanics to the students of engineering so that it would be beneficial to understand structural engineering. The knowledge of mechanics can utilized in wide range of engineering applications using Newton's laws of motion and mechanical equilibrium of different force system. This course shall be considered as a basic for all branches of Engineering of Pokhara University in first year of undergraduate program.

Course Contents:

1. Introduction (2 hrs)

1.1 Definition and scope of Applied Mechanics
1.2 Concept of Statics and Dynamics
1.3 Concept of Particle
1.4 Concept of Rigid, Deformed and Fluid Bodies
1.5 Fundamental Concepts and Principles of Mechanics: Newtonian Mechanics
1.6 System of Units

2. Review of Coordinate System (2 hrs)

2.1 Cartesian Coordinate System
2.2 Polar Coordinate System
2.3 Cylindrical Coordinate System
2.4 Spherical Coordinate System
2.5 Review of Vector Algebra

3. Forces acting on particles and rigid body (7 hrs)

3.1 Types of Forces: Point Force, Transitional and Rotational Force- Relevant Examples
3.2 Resolution and Composition of Forces- Relevant Examples
3.3 Principle of Transmissibility and Equivalent Forces- Relevant Examples
3.4 Moments: Moment of a Force about a point and an axis- Relevant Examples
3.5 Theory of Couples:: Relevant Examples
3.6 Resolution of a Force into Forces and a Couple- Relevant Examples
3.7 Resultant of Force and Moment for a System of Force: Examples

4. Basic Concept of Static Equilibrium (2 hrs)

4.1 Concept of Load types, Load Estimation and Support Idealizations- Examples and Standard Symbols
4.2 Free Body Diagram- Relevant Examples
4.3 Physical Meaning of Equilibrium and its essence in structural application
4.4 Equation of Equilibrium in Two/Three Dimensions

5. Friction Forces (3 hrs)

5.1 Introduction
5.2 Types of Friction and its Coefficients: Static and Dynamic
5.3 Laws of Friction
5.4 Angle of Friction

5.5 Engineering Examples of usage of Friction

6. Center of Gravity, Centroid and Moment of Inertia (6 hrs)

6.1 Concept and Calculation of Centre of Gravity and Centroid of Line/Area /Volume – Examples
6.2 Concept and Calculation of Second Moment of Area/ Moment of Inertia and Radius of Gyration- Relevant Examples
6.3 Use of Parallel Axis Theorem: Relevant Examples

7. Analysis of Beam (5hrs)

7.1 Introduction Beam
7.2 Use of statically determinant beam
7.3 Relationship between Load, Shearing Force and Bending Moment
7.4 Calculation and drawing of Axial Force, Shear Force and Bending Moment

8. Analysis of Truss (4 hrs.)

8.1 Introduction to determinant truss
8.2 Use of truss in engineering application
8.3 Analysis of force by method of joint
8.4 Analysis of force by method of section

9. Kinematics of Particles and Rigid body (6 hrs)

9.1 Rectilinear Kinematics: Continuous Motion
9.2 Position, Velocity and Acceleration of a Particle and Rigid body
9.3 Determination of Motion of Particle and Rigid body
9.4 Uniform Rectilinear Motion of a Particles
9.5 Uniformly Accelerated Rectilinear Motions of Particles
9.6 Curvilinear Motion of a Particle
9.7 Rectangular Components of velocity and Acceleration
9.8 Introduction of Tangential and Normal Components
9.9 Radial and Transverse Components

10. Kinetics of Particles and Rigid body: Force and Acceleration (6 hrs)

10.1 Newton's Second Law of Motion and Momentum
10.2 Equation of Motion and Dynamic Equilibrium: Relevant Examples
10.3 Angular Momentum: Rate of Change and Conservation
10.4 Motion of Various Particles and Relative Velocity
10.5 Equation of Motion- Rectilinear and Curvilinear
10.6 Rectangular Components: Tangential and Normal
10.7 Polar Coordinates: Radial and Transverse Components

11. Moment and Energy in Rigid body (2 hrs)

11.1 Introduction to Moment and Energy
11.2 Conservation of Linear and Angular Momentum

Text Books:

1. "Engineering Mechanics-Statics and Dynamics", Shames, I. H. 3rd ed., New Delhi, Prentice Hall of India, 1990.
2. "Mechanics of Engineers-Statics and Dynamics", F. P.Beer and E. R. Johnston, Jr. 4rh Edition, Mc Graw-Hill Book Co., New York, USA (Asia Editions), 1987.

References:

1. "Engineering Mechanics-Statics and Dynamics", R.C. Hibbeler, Ashok Gupta, 11th edition. New Delhi, Pearson, 2009.
2. "Engineering Mechanics- Statics and Dynamics", I.C. Jong and B.G. Rogers.
3. "Engineering Mechanics- Statics and Dynamics", D.K. Anand and P.F. Connif.
4. "Engineering Mechanics of Solids", Egor .P. Popov, 2nd Edition, New Delhi, Prentice Hall of India, 1996.

5. "Engineering Mechanics- Statics & Dynamics", Dr. D.S. Kumar,S.K. Kataria & Sons, New Delhi, Reprint 2011.
6. Practice guide in Applied Mechanics, D. B. Pandit, Ramesh Khanal

2. ELE 105.3 Basic Electrical Engineering (3-1-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. To analyze electric circuits (A.C. & D. C).
2. To work on electrical instrumentation projects.
3. To operate, distinguish and use electrical devices and machines.

Chapter	Content	Hrs.
1	**Introduction**	2
	Role of electricity in modern society, Energy sources and production, generation, transmission and distribution of electrical energy, consumption of electricity	
2	**DC Circuit Analysis**	15
	Circuits concepts (lumped and distributed parameters), linear and nonlinear parameter, passive and active circuits, Circuit elements (Resistance, capacitance and inductance), their properties and characteriscts in a geometrical and hardware aspects, color coding, Series of parallel compilation of resistances, Equivalent resistance and its calculation, star-delta transformation, concept of power, energy and its calculations, short and open circuit, ideal and non-ideal sources, source conversion, voltage divider and current divider formula, Kirchhoff's current and voltage laws, nodal method and mesh method of network analysis (without dependent source), network theorem (i.e Superposition, Thevonin's, Norton's), maximum power transfer.	
3	**Single Phase AC Circuits Analysis**	10
	Generation of EMF by electromagnetic induction, Generation of alternating voltage, sinusoidal functions-terminology (phase, phase angle, amplitude, frequency, peak to peak value), average values and RMS or effective value of any types of alternating voltage or current waveform, phase algebra, power triangle, impedance triangle, steady state response of circuits (RL, RC,RLC series and parallel) and concept about admittance, impedance reactance and its triangle), instantaneous power, average real power, reactive power, power factor and significance of power factor, resonance in series and parallel RLC circuit, bandwidth, effect of Q factor in resource.	
4	**Poly-phase AC Circuit Analysis**	6
	Concept of a balanced three phase supply, generation and differences between single phase over three phase system, star and delta connected supply and load circuits. Line and phase voltage\current relations, power measurement, concept of three phase power and its measurement by single and two wattmeter method	

5 Electric Machines **12**

Review of magnetic circuits

Transformers: Principle of operations, features, equivalent circuits, efficiency & regulation, open circuit & short circuit tests

DC motors: Performance & operation, basic characteristics of motors & generators, speed control & selection of motors

AC machines: Induction motors (working principles, construction features and uses), Synchronous motors (working principles, construction and uses)

Textbook

1. Boylested, Albert , "Introduction of Electric circuit" Prentice Hall of India Private Limited, New Delhi
2. Tiwari, S.N, "A first course of electrical engineering" att. Wheeler & Co.Ltd Allabhad.

References:

1) Thereja B. L & Thereja A. K " A text book of Electrical Technology, S Chand Publication.
2) Jain& Jain" ABC of Electrical Engineering""

Laboratory Work:

1. To measure current, voltage and power across the passive components.
2. To verify Kirchhoff's Current Law (KCL) & Kirchhoff's Voltage Law (KVL)
3. To verify Thevenin's Theorem.
4. To verify maximum power transfer theorem.
5. To verify superposition theorem.
6. To measure three phase power by using two wattmeter
7. To determine efficiency and voltage regulation of a single-phase transformer by direct loading.
8. To study open circuits & short circuits tests on a single phase transformer
9. To study the speed control of dc shunt motor by.
    i. Varying the field current with armature voltage held constant field control.
    ii. Varying the armature voltage with field current held constant armature control.
10. To study open circuits and load test on a dc shunt generator (separately excited)
    i. To determine magnetization characteristics
    ii. To determine V-I characteristics of a dc shunt generator

3. CHM 103.4 Chemistry (4-1-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. Analyze chemical behavior of materials
2. Analyze the water quality.
3. Analyze environmental aspects of various elements and compounds.

Chapter	Content	Hrs.
1.	**Ionic Equilibria and Electro Chemistry**	10
	Introduction and types of buffer solutions, mechanism, Henderson- Hassel Balch equation, electro chemical cells, Galvanic cell, cell notation, cell reaction, cell potential, single electrode potential , standard electrode potential, electro chemical series & its applications, Nernst equation, corrosion, its type, mechanism and control.	
2	**General Inorganic Chemistry**	10
	Ionization energy, electro negativity, electron affinity, characteristic properties of S and P block elements, introduction of Transition metals, characteristic properties of transition metals (electronic configuration, atomic radii, variable oxidation states, complex formation, color and magnetic properties.	
3	**General Organic Chemistry**	10
	Reaction intermediates: carbocations, carbanions and carbon free radicals, stereoisomerism	
	Organic reaction mechanism: Nucleophilic substitution reactions (SN1&SN2), Electrophilic aromatic substitution, Elimination (E1 & E2), Electrophilic and free radical addition reaction	
4	**Polymer Chemistry**	10
	Polymer and polymerization, basic concepts , types of polymerization (addition and condensation), thermoplastics and thermosetting plastics, preparation, properties and uses of : polyethylene, PVC, Teflon, Bakelite's, Nylon, polyester, polyurethelene and silicon, rubber, processing of natural rubber and vulcanization	
5	**Analytical Chemistry**	6
	Introduction and application of following analytical techniques: fractional distillation, chromatography (paper, thin layer) NRM, Mass spectroscopy	
6	**Industrial Chemistry**	4
	Introduction of paints, chemistry of paints, lubricants and its classification, cement, chemistry of cement, manufacture & its setting mechanism, Explosives: TNT, TNG	
7	**Environmental Chemistry**	10
	Water pollution- causes of water pollution, acid rain, alkalinity COD, DO, Hardness,(effects to human	

health), control

Air pollution: causes, global warming and climate change ozone layer depletion and CFC, control measures

Soil pollution: causes, effects and its control measures

Laboratory works
Objectives

- Use techniques apparatus and instructions properly
- Interpret, evaluate and report upon observations and experimental results
- Design/plan on investigation, select techniques, apparatus and materials
- Evaluate methods and suggest possible improvements

Laboratory works

1. Determine of total alkalinity of given water sample
2. Determination of hardness of water sample by complexometric titration
3. Determination of free chorine in the given water sample
4. Preparation of buffer and determination of pH of the solution
5. Estimation of DO in the given water sample
6. Estuation of COD in the given water sample
7. To separate the ink mixture by paper chromatography or TLC (Demo)
8. To purify a sample of mixture of crude alcohol and petroleum by fractional distillation (Demo)
9. To estimate carbon monoxide gas in the car exhaust (Demo)

Text books:

1. Physical Chemistry, B.S. Bahl and G.D. Tuli
2. Advanced inorganic Chemistry, J. D. Lee
3. Advance Organic Chemistry, Morisson and Boyd 6th edition
4. Engineering Chemistry (with experiments), Sunita Rattan , 4th edition Publisher of Engineering and Computer books

Reference Books:

1. Satya Prakash, Tuli, Basu, Madan: Advanced Inorganic Chemistry, S. Chanda & Company Ltd, New Delhi
2. Polymer Science, V.R. Gowariker, N. V. Vishwanathan
3. Environmental Chemistry, Anil Kumar Datta
4. Advanced Organic Chemistry, A. Bahl and B. S. Bahl
5. Text book of Chemistry P.N. Chaudhary and M.L. Bhusal
6. Lab manual of Engineering Chemistry by S.K. Bhasin and Sudha Rani

4. ENG 104.2 Communication Technique (2-2-1)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:
The main objectives of this course are:

4. To develop the ability to deliver technical knowledge orally in English.
5. To be able to comprehend and take notes after listening.
6. To fasten reading skills in technical and non-technical reading materials.
7. To develop summarizing skills in writings.
8. To write reports, letters, description on technical talks, seminar papers, memoranda, application

Chapters Content **Hrs.**

1 Review of Written English **2**

- Identification of Sentence and clause
- Classification of sentence (simple, compound, complex)
- transformation of sentences

2 Oral Communication and Note Taking **9**

- Variety of English (BrE, AmE, formal, informal, polite, familiar, tentative)
- General rules of pronunciation (English Vowels and Consonants)
- General rules of stress and intonations
- Oral presentation/technical talk: Environmental pollution, construction, water resources, impact of satellite communication, urban development, impact of computer in modern society

3 Technical Writing Skills **10**

- Preparation of short memoranda (Importance, formats)
- Business letters (Importance-purposes)
- Preparation of job application and CV
- Description writing (Process, Mechanism, Place etc.)
- Calling meeting and writing minutes, notification, preparation of agenda

4 Reading Skills **9**

- Comprehension questions and exercises from:
- The use and the misuse of science, Road foundation, Beauty, Custom, The story of an hour (Kate Chopin), Knowledge and wisdom, Freedom, Letter from foreign grave (D. B Gurung), Natural Resources of Nepal: Forests & Water (Mani Bhadra Gautam)
- Note making and precise writing from any passage

Tutorial Works:

1. Some general rules of pronunciation..
2. To present a seminar paper/report/proposal.
3. To participate in a group discussion.
4. To conduct a meeting.
5. To prepare and practice to face an interview.

Textbook:

1. Andrea J. Rutherford. *Basic Communication Skills for Technology*. 2nd Edition. Addision Wesley. Pearson Education Asia (LPE) ISBN: 8178082810
2. Khanal Arjun, Communication Skills in English, Sukunda Pustak Bhawan, 2010

Reference Books:

1. Anne Eisenberg, *Effective Technical Communication*, Mc-Graw Hill 1982.
2. V.R. Narayanaswami, *Strengthen your writing*, Orient Longman, Madras.
3. Champa Tickoo & Jaya Sasikumar, *Writing with a Purpose*, Oxford University Press, Bombay.
4. A handbook of pronunciation of English words (with 90-minute audio cassettes) Communication Skills in English.
5. Chopin, Kate. "The Story of an Hour", *Creative Delights*
6. *Gautam Shreedhar, Creation & Criticism: A Miscellaneous Thought*
7. *Gautam Mani Bhadra, Essays, Stories, Passages, Paragraphs and Letter writing for the Young Learners, Nirantar Prakashan, Kathmandu, 2008*

5. MTH 111.3 Engineering Mathematics I (3-2-0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:

After the completion of this course students will be able to apply the concept of calculus (Differential and integral), analytical geometry and vector in their professional courses.

Chapter	Content	Hrs.
1	**Limit, Continuity and Derivative:**	15

i. Limit, continuity and Derivative of a function with their properties
ii. Mean values Theorem with their application
iii. Higher order derivative
iv. Indeterminate forms
v. Asymptote
vi. Curvature
vii. Ideas of curve tracing
viii. Extreme values of functions of single variables

2	**Integration with its Application:**	17

i. Basic integration, standard integral, definite integral with their properties
ii. Fundamental theorem of integral calculus (without proof)
iii. Improper integral
iv. Reduction formulae and use of beta Gamma functions
v. Area bounded by curves
vi. Approximate area by Simpsons and Trapezoidal rule,
vii. Volume of solid revolution

3	**Two dimensional geometry:**	7

i. Review (circle, Translation and rotation of axes)
ii. Conic section(parabola, ellipse, hyperbola),
iii. Central conics (Introduction only).

4.	**Vector Algebra:**	6

i. Review of vector and scalar quantity
ii. Space coordinates
iii. Product of two or more vectors
iv. Reciprocal system of vectors and their properties
v. Equations of lines and planes by vector methods

Text Books:

1. Engineering Mathematics I: Prof. D.D Sharma (Regmi), Toya Narayan Paudel, Hari Prasad Adhikari, Sukunda Publication Bhotahity , Kathmandu
2. Calculus and analytical geometry: George B Thomas, Ross L. Finney

Reference Books:

1. Calculus with analytical geometry: E.W. Swokoswski.
2. Coordinate Geometry: Lalji Prasad.
3. Vector Analysis: M. B. Singh
4. Integral Calculus: G.D. Panta.

6. MTH 121.3 Engineering Mathematics II (3 – 2 – 0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objective:

The main objective of this course is to provide the basic knowledge of three dimensional geometry, Calculus of several variables, differential equation, Laplace transform. After the completion of this course, students can use their knowledge in their professional course.

Chapter	Content	Hrs
1	**Three Dimensional geometry :** i. Review of direction cosines, direction ratios, Planes ii. Straight lines iii. Sphere and its tangent plane iv. Cone and cylinder(definitions, standard equation only)	12
2	**Partial derivatives and Extreme values for function of two or more variables:** i. Definitions, total derivatives, Chain rule, Eulers theorem for function of two or three variables, its application ii. Extreme values for two or more variables	6
3	**Laplace transformation:** i. Definition ii. Derivation of formulae iii. Application of laplace transform, iv. Inverse laplace transform v. Convolution theorem on laplace transform and application	8
4	**Differential equation:** i. Order and degree of differential equation ii. First order differential equation with their solutions (separable, reducible to separable form exact ness condition), linear and Bernoulies equation) iii. Second order differential equation (Homogeneous and non homogeneous) with constant coefficient as well as variable coefficients. iv. Initial value problem. v. Power Series solution vi. Legendres and Bessel equation with their solution, properties and application	13
5.	**Double Integral:** i. Definitions, Fubinis theorems (statement only) ii. Change of order, iii. Change Cartesian integral to equivalent polar integral iv. Area and volume by double integral	6

Text Books:

1. Engineering Mathematics II: Prof. D.D Sharma (Regmi), Toya Narayan Paudel, Hari Prasad Adhikari, Sukunda publication, Bhotahity, Kathmandu.
2. Advance Engineering Mathematics : Erwin Kreyszig.

Reference Books:

1. Calculus with analytical geometry: E.W. Swokoswski.
2. Algebra: G.D Pant
3. Three Dimensional Geometry: Y.R Sthapit, B.C Bajracharya
4. Calculus and analytical geometry: George B Thomas, Ross L. Finney

7. MEC 109.2 Engineering Drawing (0-0-6)

Evaluation:

	Theory	Practical	Total
Sessional	-	50	50
Final	-	50	50
Total	-	100	100

Course Objectives:

1. To develop sketching, lettering and drafting skills
2. To draw projections, drawings of various geometric figures.
3. To draw assembly of machine parts.
4. To develop ability of preparing working drawings

Course Contents:

1. Instrumental Drawing, Practices and Techniques (12 hrs)

Equipment and metals, Description of drawing instruments, auxiliary equipment and drawing materials, Techniques of instrument drawing, pencil sharpening, securing paper, proper use of T-squares, triangles, scales, dividers, compasses, erasing shields, French curves, inking pens.

Freehand Technical Lettering

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.

Dimensioning

Fundamentals and Techniques: size and location dimensioning, IS conversion; Use of scales, measurement units, reducing and enlarging drawings; General dimensioning practices: placement of dimensions aligned and unidirectional recommended practice, some 50 items.

2. Applied Geometry (24 hrs)

Plane geometrical construction: Bisecting and trisecting lines and angles, proportional division of lines, construction of angles, triangles, squares, polygons, constructions using tangents and circular archs. Methods of drawing standard curves such as ellipse, parabolas, hyperbolas, involutes, spirals, cycloid and helices (cylindrical and helical); 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

Basic Descriptive Geometry

Introduction: Application of descriptive geometry principles to the solution of problems involving positioning of objects in three-dimensional space; The projection of points, and planes in space; Parallel lines; True length of lines: horizontal, inclined and oblique lines; Perpendicular lines; Bearing of a line; Point view of end view of a line; Shortest distance from a point to a line; Principal lines of a plane; Edge view of a plane; True shape of an oblique plane;

Intersection of a line and plane; Angle between a line and a plane; Angle between two non-intersecting (skew) lines; Dihedral angle between two planes; Shortest distance between two skew lines.

3. Theory of Projection Drawing (24hrs)

Perspective projection drawing; Orthographic projection; Axonometric projection; Oblique projection; First and third angle projection;

Multi-view Drawings

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. Orthographic drawings: Making an orthographic drawing, Visualizing objects from the given views; Interpolation of adjacent areas; True-length lines; Representation of holes; conventional practices.

Sectional views

Full section view; Half section; Broken section; Revolved section; Removed (detail) sections; Phantom of hidden section; Auxiliary sectional views; Specifying cutting planes for sections; conventions for hidden lines, holes, ribs, spokes.

Auxiliary Views

Basic concept and use of auxiliary views; Drawing methods and types of auxiliary views; Symmetrical and unilateral auxiliary views; Projection of curved lines and boundaries; Line of intersection between two planes; True size of dihedral angles; True size and shape of plane surfaces.

4. Development and Intersections (15hrs)

Development: General concepts and practical considerations, Development of a right or oblique prism, cylinder, pyramid and cone; Development of truncated pyramid and cone; Triangulation method for approximately developed surfaces; Transition pieces for connecting different shapes; Development of a sphere; Intersections: Lines of intersection of geometric surfaces; Piercing point of a line and a geometric solid; intersection lines of two planes; Intersection 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 cone.

5. Machine Drawing (15hrs)

Introduction: production of complete design and assembly drawings; Fundamental techniques: size and location dimensioning; placement of dimension lines and general procedures; standard dimensioning practice (IS system); Limit dimensioning: nominal and basic size, allowance, tolerance, limits of size, clearance fit, interference fit; basic hole system and shaft systems; Thread and standard machine assembly elements: screw threads: ISO standards, representation and dimensioning; Fasteners: type and drawing representation, keys, collars, joints, springs bearings; Assembly drawings: drawing layout, bill of materials, drawing layout, bill of materials, drawing numbers.

Laboratory Work:

Freehand technical lettering and use of drawing instruments; Dimensioning; Geometrical and Projection drawing; Descriptive geometry; Projection and multiview drawings; Sectional views; Auxiliary views, Freehand sketching and visualization; Development and intersections; machine and assembly drawings.

Reference Books:

8. Luzadder, *Fundamentals of Engineering Drawing*, Prentice Hall of India Ltd., 8th edition, 1981.
9. French, C.J. Vierck and R.J. Foster, *Engineering Drawing and Graphic Technology*, McGraw-Hill, 1981.
10. Machine drawing P.S. Gill, S.K. Kataria and Sons, India, 7th Edition, 2008.

8. MEC 178.1 Mechanical Workshop (0-0-3)

Evaluation:

	Theory	Practical	Total
Sessional	-	100	100
Final	-	-	-
Total	-	100	100

Course Objectives:

To provide instructions and practical experience in basic mechanical workshop methods

Course Contents:

Chapters	Content	Hrs.
1	**Mechanical Workshop Materials** Introduction to mechanical workshop, Basics of steel and cutting materials, Common non-ferrous metals, Important mechanical properties.	4
2	**Measurement and Measuring Equipment**	1.5
3	**Bench Tools and Basic Hand Operations** Filing, Sawing, Sheet metal working, screw thread and screw thread cutting	1.5
4	**Joining Processes** Riveting, Soldering, Brazing, Welding	1.5
5	**Introduction to Machine Tools** Elements of machine tools, Cutting actions and tooling	1.5
6	**Familiarization with Basic Machine Tools** Lathe, Milling machine, Drill presses, Power saws, Shaping Machine and Grinding machines	5

Practical:

6. To convert a metallic job piece into a prescribed form using mechanical bench tool.
7. To turn a cylindrical job piece to prescribed dimension by using lathe machine.
8. To convert a metallic job piece to prescribed dimension by using milling machine.
9. To provide surface finish to a metallic piece by using the shaper machine.
10. To weld required metallic pieces together by using electric arc and gas welding, to given shape and size.
11. To make knot & bolt of given size and type
12. To make tray/dust bin/ pen holder or similar item with sheet metal.

Reference Books:

11. Anderson and E.E. Tatro, *Shop Theory*, McGraw-Hill 5th edition, 1942.
12. Lascoe, C.A. Nelson and H.W. Porter, *Machine Shop Operation and Setups*, American Technical Society, 1973.

13. *Machine Shop Practice – Volume II*, Industrial Press, New York, 1971.
14. Oswald, *Technology for Machine Tools*, McGraw-Hill Ryerson, 3rd edition.
15. Oberg, Jones and Gorton, *Machinery's Handbook*, 23rd edition, Industrial Press, New York

9. CMP 103.3 Programming in C (3-0-3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:
The object of this course is to acquaint the students with the basic principles of programming and development of software systems. It encompasses the use of programming systems to achieve specified goals, identification of useful programming abstractions or paradigms, the development of formal models of programs, the formalization of programming language semantics, the specification of program, the verification of programs, etc. the thrust is to identify and clarify concepts that apply in many programming contexts:

Chapter	Content	Hrs.
1	**Introduction** History of computing and computers, programming, block diagram of computer, generation of computer, types of computer, software, Programming Languages, Traditional and structured programming concept	3
2	**Programming logic** Problems solving(understanding of problems, feasibility and requirement analysis) Design (flow Chart & Algorithm), program coding (execution, translator), testing and debugging, Implementation, evaluation and Maintenance of programs, documentation	5
3	**Variables and data types** Constants and variables, Variable declaration, Variable Types, Simple input/output function, Operators	3
4	**Control Structures** Introduction, types of control statements- sequential, branching- if, else, else-if and switch statements, case, break and continue statements; looping- for loop, while loop, do—while loop, nested loop, goto statement	6
5	**Arrays and Strings** Introduction to arrays, initialization of arrays, multidimensional arrays, String, function related to the strings	6
6	**Functions** Introduction, returning a value from a function, sending a value to a function, Arguments, parsing arrays and structure, External variables, storage classes, pre-processor directives, C libraries, macros, header files and prototyping	6

7 Pointers **7**

Definition pointers for arrays, returning multiple values form functions using pointers. Pointer arithmetic, pointer for strings, double indirection, pointer to arrays, Memory allocation-malloc and calloc

8 Structure and Unions **5**

Definition of Structure, Nested type Structure, Arrays of Structure, Structure and Pointers, Unions, self-referential structure

9 Files and File Handling **4**

Operating a file in different modes (Real, Write, Append), Creating a file in different modes (Read, Write, Append)

Laboratory:

Laboratory work at an initial stage will emphasize on the verification of programming concepts learned in class and use of loops, functions, pointers, structures and unions. Final project of 10 hours will be assigned to the students which will help students to put together most of the programming concepts developed in earlier exercises.

Textbooks:

1. Programming with C, Byran Gottfried
2. C Programming, Balagurusami

References

1. A book on C by A L Kely and Ira Pohl
2. The C Programming Language by Kerighan, Brain and Dennis Ritchie
3. Depth in C, Shreevastav

10. CMP 104.3 Object Oriented Programming in C++ (3-1-3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

- To familiarize with Object Oriented Concept.
- To introduce the fundamentals of C++
- To enable the students to solve the problems in Object Oriented technique
- To cope with features of Object Oriented Programming

Course Contents:

Chapter	Content	Hrs.
1	**Thinking Object Oriented** Object oriented programming a new paradigm, a way of viewing world agent, types of classes, computation as simulation, coping with complexity, nonlinear behavior of complexity, abstraction mechanism	4
2	**Classes and Methods:** Review of structures, classes and inheritance, state, behavior, method, responsibility, encapsulation, data hiding, Functions: friend function, inline function, static function, reference variable, default argument	7
3	**Message, Instance and Initialization** Message, message passing formalization, message passing syntax in C++, mechanism for creation and initialization (constructor and its types), Issues in creation and initialization: memory map, memory allocation methods and memory recovery	6
4	**Object Inheritance and Reusability** Introduction to inheritance, Subclass, Subtype, Principle of Substitutability; Forms of polymorphism and their implementation in C++,inheritance merits and demerits, composition and its implementation in c++, The *is-a* rule and *has-a* rule, Composition and Inheritance contrasted, Software reusability	9
5	**Polymorphism** Polymorphism in programming language, Varieties of polymorphism, compile time polymorphism, function overloading, operator overloading, type conversion, polymorphic variable, run time polymorphism, object pointer, this pointer, virtual function, overriding, deferred method, pure polymorphism.	8
6	**Template and generic programming** Generic and template functions and classes, cases study: container class and the	4

standard template library, Exception handling

7 Object oriented Design **7**

Reusability implies non- interference, Programming in small and programming in large, components and behaviors, role of behaviors in OOP, CRC, sequence diagram, Software components, formalizing the interface, interface and implementation, Design and representation of components, coming up with names, implementation components, integration of components

Laboratory Work

There shall be 20 exercises in minimum, as decided by the faculty. The exercises shall encompass a broad spectrum of real-life and scientific problems, development of small program to the development of fairly complex subroutines, programs for engineering applications and problem solving situations. Laboratory assignments will be offered in groups of two to four for evaluation purpose. In general, the Laboratory Work must cover assignments and exercises from the following areas:

1. Data types – control structures, functions and scoping rules.
2. Composite data types, C++ strings, use of " Constant " keyword, pointers and references
3. Classes and data abstraction
4. Inheritance, abstract classes and multiple inheritance
5. Friend functions, friend classes and operator overloading.
6. Static class members
7. Polymorphism, early binding and late binding
8. C++ type conversion
9. Exception handling
10. Function templates, class templates and container classes.

Textbooks:

1. Budd, T., *An Introduction to Object Oriented Programming*, Second Edition, Addison-Wesley, Pearson Education Asia, ISBN: 81-7808-228-4.
2. R. Lafore, *Object Oriented Programming in Turbo C++*, Galgotia Publications Ltd. India, 1999

Reference Books:

1. E Balaguruswamy, Object Oriented Programming with C++, Third Edition
2. Tata McGraw-Hill ISBN:0-07-059362-0, Parson David, Object Oriented Programming with C++, BPB Publication\ISBN817029-447-9

11. PHY 102.4 Physics (4-2-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

The main objectives of this course are:

1. To apply the theory of simple Harmonic motion in different elastic systems.
2. To apply theory of wave propagation and knowledge of resonance.
3. To apply and analyze the Optical properties in different optical systems.
4. To make use of fundamentals of electromagnetic equipment.
5. To use the knowledge of basic physics in different engineering fields.

Chapter	Content	Hrs
1	**Mechanical Oscillation** Introduction and equation of Simple Harmonic Motion, energy in Simple Harmonic Motion, oscillation of mass –spring system, compound pendulum	4
2	**Wave motion** Introduction of wave, wave velocity and particle velocity, types of waves, equation, energy, power and intensity of plane progressive wave, standing wave and resonance.	4
3	**Acoustics** Reverberation of sound, absorption coefficient, Sabines formula, introduction, production and applications of ultrasonic wave	4
4	**Physical Optics** Interference: introduction, coherent sources, interference in thin films due to reflected and transmitted light, Newton's Ring (3) Diffraction: introduction, fraunhoffer diffraction at single silt and double silt diffraction grating (2) Polarization: introduction, double refraction, Nicol prism, optical activity, specific rotation, wave plates (3)	8
5	**Laser and Fiber Optics** Introduction of laser, spontaneous and stimulated emission, optical pumping, He-Ne laser, Ruby Laser, use of laser, Propagation of light waves, types of optical fiber, applications of optical fiber	4
6	**Electrostatics** Electric charge, electric force, electric flux, electric potential, Gauss law and its applications, electric field intensity and electric potential due to dipole, electric potential due to quadrupole, capacitors, electrostatic potential energy, dielectrics and gauss law charging and discharging of capacitor	8

7 Electricity and magnetism **10**

Electric current, resistance, resistivity and conductivity, atomic view of resistivity, magnetic field, magnetic force, Lorentz force, Hall effect, Biot-Savart's law and its applications, force between two parallel conductors, Ampere's circuital law and its applications, Faraday's law of electromagnetic induction, self-induction R-L circuit, energy stored in magnetic field and magnetic energy density

8 Electromagnetism **9**

LC oscillation, Damped oscillation, forced oscillation and resonance, Maxwell's equations displacement current, wave equations in free space, continuity equation, E and B fields, poynting vector, radiation pressure

9 Photon and matter waves **4**

Photon, group velocity and phase velocity, De brogile wavelength, Schrodinger wave equation, one dimensional potential well, tunneling effect

10 Semiconductors and super conductivity **5**

Introduction, types of semiconductors Dopping, P-N Junction, Metal- semiconductor junction, junction breakdown, junction capacitance, electrical conduction in metals, insulators and semiconductors according to band theory of solids, introduction to superconductor

Textbooks:

3. Fundamental of Physic by Robert Rescnick and David Hallday
4. A Text Book of Engineering Physics, T. R. Lamichane
5. A text book of optics by Subramanyam and Brijlal
6. Modern physics by R. Murugason

Reference Books:

16. Concept of physic by H.C Verma
17. Modern Engineeering Physic by A.S Basudeva
18. Electronics by B.L Thereja
19. Principles of Electronics, V. K. Meheta

Laboratories:

1. To determine the acceleration due to gravity & radius of gyration by single bar pendulum.
2. To determine the frequency AC mains by using son mater apparatus
3. To determine the wave length by using diameter of Newton's ring
4. To determine the wave length of laser light by using diffraction grating
5. To determine the value of Modulus of Elasticity of the material given and Moment of Inertia of Circular disc using torsional pendulum
6. To determine the capacitance of given capacitor by charging and discharging through resistor
7. To determine the low resistance of a given wire and resistance per unit length of the wire by using Carey-foster bridge
8. To plot a graph current and frequency in an LRC series circuit and to find: i) the resonance frequency
   ii) the quality factor

Lab textbook: B. Sc Practical Physics by C. L. Arora

12. MEC 189.2 Thermal Science (2-1-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

The broad objective of this course is to provide working knowledge of theories and applications of thermal science. The specific objectives of the course are:

1. To make able to apply laws of thermodynamics in various systems.
2. To make able to distinguish the cycles in various engines, and pumps.
3. To make able to calculate energy/quantity of heat transfer by conduction and radiation.

Chapter **Content** **Hrs.**

1 Concept and definitions **2**

Thermodynamics, Applications of thermodynamics, Thermodynamic system, Macroscopic and microscopic and microscopic Approaches,

Properties and state of a substance: Thermodynamic properties and types, State, path, process, cycle.

- Processes (definition, characteristics, features, Examples): Quasi-equilibrium(states) process, Reversible process, Irreversible process,
- Specific volume, Pressure, Atmospheric pressure, Gauge pressure, Absolute pressure
- Equality of temperature: Zeroth law of thermodynamics

2 Properties of pure substances **3**

- Pure substance: Homogenous in composition, Homogenous in chemical aggregation, Invariable in chemical aggregation
- Vapour-liquid solid phase equilibrium in pure substance: Steam generation(formation) process from ice to steam, Wet steam and quality, T-v diagram of water, P-v Diagram of water, P-t diagram of water
- Equations of state for a simple compressible substance:
- Tables and diagrams of thermodynamic properties
- Determination of Specific volume, Specific enthalpy and Specific entropy of wet and superheated steam

3 Work and heat **2**

Definition of work: in mechanics and in thermodynamics,

Work done in quasi-equilibrium process

Displacement work, Work done in different reversible processes:

- Isochoric process
- Isobaric process
- Isothermal process
- Polytrophic process
- Definition of heat: comparison between heat and work,

4 First law of thermodynamics **4**

- First law for cycle: First law for closed system undergoing a cycle, Verification of this low by wheel paddle experiment
- First law for process: Difference between stored and internal energy, Stored energy
- Internal energy: Joule's law and its verification
- Enthalpy
- Specific heats: Specific heat capacity of gas at constant volume, Specific heat capacity of gas constant pressure
- First law as a rate equation:
- Conversation of mass and the control volume
- First law for control volume
- **Steady state steady flow process:** Assumption, Steady state steady flow energy equation(SFEE), Application of SFEE: Heat exchanger, nozzle, diffuser, turbine, Rotary compressor, Throttling device, Boiler
- Uniform state uniform flow process: Assumptions, 1st law for uniform state uniform flow process

5 Second law of thermodynamics **3**

- Heat engines: 4 components diagram and the schematic diagram, efficiency

Refrigerator and heat pump: 4 components diagram and schematic diagram, COP of refrigerator and heat pump

- **Second law:** Limitation of first law of thermodynamics, Kelivn-Plank statement, Clausius statement

  - Equivalence of Kelvin-Plank and Clausius statements:
  - Factors causing irreversibility
  - Carnot theorem
  - Thermodynamic temperature scale

6 Entropy **4**

Inequality of Clausius, Entropy as a property of a system, Entropy of pure substance, Entropy change in reversible process, lost work, principle of increase of entropy, Entropy change of an ideal gas, the poly-topic process for an ideal gas, concepts of reversibility, irreversibility and availability

7 Some Power Cycles **4**

- Vapor Power Cycles: Rankine cycle (working process, efficiency, Effect of pressure and temperature on Rankine cycle)
- Air Standard Cycles: Air standard cycles: Carnot cycle (Working processes & Efficiency), Brayton cycle (Working processes & Efficiency)
- Internal combustion engines: Otto cycle (Workings processes & Efficiency), Diesel cycle (Working processes & Efficiency), Comparison between Otto an diesel cycle

8 Heat transfer **7**

- Modes of heat transfer: Conduction, Convection, radiation
- Conduction : Fourier's law (Statement, Mathematical modeling, Assumption for this laws, Thermal conductivity
- One dimensional steady state heat conduction: Through a plane, Through a hollow cylinder, Through a hollow sphere
- Composite wail: Heat flow through multilayer plane slabs, Numerical on wall of planes, cylinders and spheres in series.
- Thermal resistance and conductance: Electrical analogy of the conduction heat flow
- Overall heat transfer co-efficient: Heat transfer through a plane slab separating two fluid media
- Basic laws of radiation: Emissive power and emissivity, Stefan-Boltzmann;s law, Kirchoff;s law, Wei's displacement law
- Black and gray bodies: Reflectivity, absorptive and transmissibility, Black and grey bodies
- Radiant exchange between infinity parallel planes
- Newton's law
- Mechanism of forced and free convection
- Dimensionless parameters: Reynold's number, Nusselt's number, Pradndtl's number

9 Introduction to Refrigeration System **1**

Introduction, Refrigeration cycle

Laboratory Work:

1. To measure the pressure, specific volume and temperature
2. To find out the efficiency of a compressor.
3. To measure the rate of heat transfer by conduction.
4. To measure performance of a small internal combustion engine
5. To measure the heat transfer by thermal radiation.
6. To measure the performance of a Refrigeration/Heat pump

Textbooks:

1. Howell J.R. and R.O. Buckius, *Fundamentals of Engineering Thermodynamics*, McGrow-Hill Publishers, 1994.

Reference Books:

1. Van Wylen, G.J. and Richard E. Sonntag, *Fundamentals of Classical Thermodynamics*, Wiley Eastern Limited, New Delhi, 1989.
2. Bayazitoglu, Y. and M. Necati Ozisik, *Elements of Heat Transfer*, McGraw-Hill Book Company, 1998.
3. Kreith, F., *Principles of Heat Transfer*, International Text book Company, Scranton Pennsylvania, 2nd Edition, I965.

MTH 211.3 Engineering Mathematics III (3-2-0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:
The main objectives of this course is to provide the basic knowledge of linear algebra, vector calculus, fourier series, linear programming by graphical and simplex methods. After the completion of this course, students can use their knowledge in their professional course.

Course Contents:

1. Matrix and Determinant: (8 hrs)

1.1 Review of Matrix and determinant with their properties
1.2 System of linear equation with their solutions by Gauss elimination methods
1.3 Rank of matrix
1.4 Consistency of system of linear equation
1.5 Vector space and sub space
1.6 Linear transformation
1.7 Eigen values and vectors, Cayley Hamilton theorem (statement only) and its application.

2. Vector Calculus (16 hrs)

2.1 Differentiation and integration of vectors
2.2 Gradient, divergence and curl with their properties (without proof)
2.3 Line integral: Definition of line integral, Evaluation of line integral, properties, Greens theorem, Area by Greens theorem
2.4 Surface integral: Surface integral, tangent planes, Gauss divergence theorem, Dirichelet integral
2.5 Stokes theorem

3. Infinite series (8 hrs)

3.1 Sequence and series
3.2 Necessary condition of convergence of infinite series
3.3 P-test (hyper-harmonic test)
3.4 Ratio test
3.5 Root test
3.6 Integral test
3.7 Leibnitz test and absolute convergence
3.8 Interval of convergence of power series.
3.9 Taylor and Maclaurin expansion (statement only) and its application

4. Fourier Series (6 hrs)

4.1 Periodic function, Trigonometric series, even and odd function
4.2 Fourier series of a function with period 2π and arbitrary period 2L

4.3 Fourier sine and cosine series representation of the half range function

5. Linear Programming (7 hrs)

5.1 System of Linear Inequalities

5.2 Linear Programming

5.2.1 Model Formulation

5.2.2 GraphicalSolution

5.2.3 Simplex method

5.2.4 The Dual model

5.2.5 Dual Simplex Method

Text Books:

1. Kreyszig, Erwin.*Advance Engineering Mathematics*(8th edition). New Delhi:Wiley-Easter Publication.
2. Paudel, Toya Narayan.*Engineering Mathematics III*, Bhotahity: Sukunda publication.

References:

1. Thomas, George B.& Finney,Ross L.*Calculus and Analytical Geometry.*
2. Swokoswski, E.W.*Calculus with Analytical Geometry.*
3. Singh, M.B.*Vector Analysis.*
4. Pant, G. D.*Algebra.*

ELE 226.2 Electrical Engineering Materials (2-2-0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:
The purpose of the course is to provide a basic understanding of the electric and magnetic properties of materials used in electrical and electronics engineering.

Course Contents:

1. Theory of Metals (3 hrs)
- 1.1. Elementary quantum mechanical ideas
- 1.2. Free electron theory, Energy well model of a metal and Density of states function
- 1.3. The Fermi-Dirac distribution functions, Thermionic emission, Work function and The Fermi level at equilibrium, Contact Potential

2. Free Electron Theory of Conduction in Metals (4 hrs)
- 2.1. Thermal velocity of electrons at equilibrium, Lattice scattering, Mean free time between collisions and Drift velocity of electrons in an electric field
- 2.2. Diffusion of electrons, Diffusion coefficient, Einstein's relationship between mobility and diffusion coefficients
- 2.3. Chemical and physical properties of common conduction of materials such as As, Au, Ag, Cu, Al, Mn, N etc.

3. Conduction in Liquid and Gases (2 hrs)
- 3.1. Ionic conduction in electrolytes
- 3.2. Electrical conduction in gas arc discharges in electric breakdown

4. Dielectric Materials (4 hrs)
- 4.1. Macroscopic effects, Polarization, Dielectric constant and Dielectric losses
- 4.2. Frequency and temperature effects and Dielectric breakdown
- 4.3. Ferro electricity and piezoelectricity
- 4.4. Properties of common dielectrics such as glass, Porcelain, Polyethylene, PVC, Nylon, bakelite, rubber, mica, transformer oil etc.

5. Magnetic Materials (5 hrs)
- 5.1. Ferromagnetism, Ferrimagnetisms, Para magnetism
- 5.2. Domain structure, Hysteresis loop, Eddy current losses, Soft magnetic materials
- 5.3. Fe-Si alloys, Ni-Fe alloys, ferrites for high frequency transformers
- 5.4. Square loop materials for magnetic memory, relaxation oscillators, hared magnetic materials such as carbon steels alnico and barium ferrites

6. Semiconducting Materials (8 hrs)

6.1. Band structure of group iv materials, Energy gap, density of states function
6.2. Femi-Dirac distribution function
6.3. Hole and electron densities in an intrinsic crystal
6.4. Effective densities of states, intrinsic concentration, Femi level of energy at equilibrium
6.5. Group iii and group iv impurities, acceptors and donors, p-and n-type materials
6.6. Energy band diagrams for uniformly-doped and graded p-and n-type materials
6.7. Generation PN, recombination of electrons and holes, concept of lifetime
6.8. Mobility and diffusion coefficients for electrons and holes in semiconductors
6.9. Transport and continuity equations for electrons and holes, concept of diffusion length, energy band diagram for a p-n junction
6.10. Contact potentials, metal-semiconductor contacts

7. Semiconductor Materials Procession (4 hrs)

7.1. Crystal growing, doping by solid state diffusion, ion implantation
7.2. Oxidation Photolithography, the planar process, metallization, contacts

Text Book:

R.A. Colcaseer Ands. Diehi-Nagle, *Materials and Devices for Electrical Engineers and Physicists*, McGraw-Hill, New York, 1985.

Reference:

R.C. Jaeger, *Introduction to Microelectronic Fabrication-Volume IV*, Addison-Wesley Publishing Company Inc., 1988.

ELX 223.3 Electromagnetic Fields and Waves (3-1-0)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

The purpose of the course is to provide the knowledge of fundamental laws of static electric and magnetic fields. It also provides sound understanding of the functional laws of dynamic electric and magnetic fields so that students can apply electromagnetic field and wave theory in the generation, transmission and measurement techniques.

Course Contents:

1. **Coulomb's Law and Electric Field intensity** **(3 hrs)**
   - 1.1 Coulomb's Law
   - 1.2 Electric field intensity
   - 1.3 Field due to point charges and continuous charge distribution
   - 1.4 Fields of a line charge and sheet of charge

2. **Electric Flux Density and Gauss's Law** **(3 hrs)**
   - 2.1 Electric flux density
   - 2.2 Gauss's law in integral form
   - 2.3 Application of Gauss's law
   - 2.4 Boundary condition at a conductor surface

3. **Divergence** **(2 hrs)**
   - 3.1 Concept of divergence
   - 3.2 Maxwell's first equation and applications
   - 3.3 Vector operator
   - 3.4 Divergence theorem

4. **Energy and Potential** **(3 hrs)**
   - 4.1 Electric energy
   - 4.2 Potential and potential difference
   - 4.3 Potential field of a point charge and systems of charges
   - 4.4 Potential gradient
   - 4.5 Electrical intensity as the negative gradient of a scalar potential
   - 4.6 Conservative fields
   - 4.7 Electric energy density

5. **Electrostatic Field in Material Media** **(2 hrs)**
   - 5.1 Polarization
   - 5.2 Free and bound charge densities
   - 5.3 Relative permittivity

5.4 Capacitance calculations

6. Boundary Value Problems in Electrostatics (6 hrs)

6.1 Laplace's and Poisson's equations
6.2 Uniqueness theorem
6.3 One dimensional boundary value problems
6.4 Two-dimensional boundary value problems
6.5 Relaxation methods and numerical integration
6.6 Graphical field plotting
6.7 Capacitance calculations

7. Current and Current Density (2 hrs)

7.1 Conservation of charge
7.2 Continuity of current
7.3 Point form of Ohm's law
7.4 Relaxation time constant

8. Magnetostatics (3 hrs)

8.1 Biot-Svart's law
8.2 Magnetic intensity and magnetic induction
8.3 Ampere's circuital law
8.4 Applications

9. Curl (3 hrs)

9.1 Concept of curl
9.2 Stokes theorem
9.3 Magnetic flux and magnetic flux density
9.4 Ampere's law in point form
9.5 Scalar and vector magnetic potentials
9.6 Derivation of steady magnetic field laws
9.7 Boundary value problems

10. Magnetic Force and Material Media (2 hrs)

10.1 Magnetic force
10.2 Magnetization and permeability
10.3 Magnetic boundary condition
10.4 Magnetic circuits

11. Time-Varying Force and Material Media (2 hrs)

11.1 Faraday's law
11.2 Inadequacy of ampere's law with direct current
11.3 Conflict with continuity equation
11.4 Displacement current
11.5 Maxwell's equation in point form
11.6 Maxwell's equation in integral form
11.7 Retarded potential

12. Wave Equation **(8 hrs)**

12.1 Wave motion in free space
12.2 Perfect dielectric and losses medium
12.3 Wave impedance
12.4 Skin effect, AC Resistance
12.5 Pointing vector
12.6 Reflections and refraction of uniform plane wave
12.7 Reflection and transmission coefficient
12.8 Standing wave ratio
12.9 Impedance matching
12.10 Radiation from a dipole antenna
12.11 Wave guides

13. Transmission Lines **(4 hrs)**

13.1 Types of transmission mediums
13.2 Characteristics impedance
13.3 Power and signal transmission capability of lines
13.4 Field and Lumped circuit equivalents
13.5 Traveling and standing waves
13.6 Reflection termination and impedance matching
13.7 Short and long lines
13.8 Graphical solution of the transmission lines

14. Basic Concepts of Waves Guides **(2 hrs)**

Laboratory Experiments:

1. Mapping of Electrostatic Field on Electro-Conducting paper
2. Determination of the Dielectric Constant of an insulator
3. Display of Magnetic Hysteresis
4. Measurement of standing waves on Transmission Lines, Reflections, Power Measurements
5. Use of Smith Chart and plotting
6. RF modeling by using DNS Software

Text Book

1. W.H. Hayt, *Engineering Electromagntic*, Tata McGraw Hill book company, New Delhi.

Reference

J.D Kraus and K.R Carver, *Electromagnetic*, Prentice Hall India Ltd

ELX 213.3 Electronic Devices (3-1-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

The purpose of the course is to provide knowledge of principles of electronic devices and circuits. Moreover, it provides a method for analysis of semiconductor devices.

Course Contents:

1. **Semiconductor diode** **(8 hrs)**
   - 1.1 Review of conduction in semiconductors
   - 1.2 Theory of p-n junction
   - 1.3 Band structure of p-n junction
   - 1.4 The p-n junction as a diode
   - 1.5 The effects of temperature in V-I characteristics
   - 1.6 Space- charge of transition region capacitance and its effects
   - 1.7 Diffusion capacitance and its effects
   - 1.8 Diode switching times
   - 1.9 Zener diode
   - 1.10 Tunnel diode
   - 1.11 Construction
   - 1.12 Characteristics and Applications of Schottky diode
   - 1.13 Varactor diode and Metal Oxide Varister
2. **Non-Linear Model** **(2 hrs)**
   - 2.1 Basic properties of non-linear elements
   - 2.2 Non-linear circuit analysis (Graphical/ Algebraic analysis methods)
   - 2.3 Piecewise linear modeling
   - 2.4 Use and application of SPICE in analysis
3. **Bi-polar Junction Transistor (BJT)** **(7 hrs)**
   - 3.1 Construction of a BJT
   - 3.2 Working principal of BJT
   - 3.3 Modes of operation Transistor Configuration
   - 3.4 Analytical expression for transistor characteristics
   - 3.5 Input-output characteristics of CB, CE and CC transistor configurations
   - 3.6 α,β,γ and their relationship
   - 3.7 Avalanche effect
   - 3.8 Early Effect
   - 3.9 Reach – through
   - 3.10 The EBERS-Moll equations
   - 3.11 BJT switching time
   - 3.12 Maximum voltage rating

4. **BJT biasing and Thermal Stabilization (6 hrs)**
   - 4.1 Biasing and its needs
   - 4.2 Types of biasing (fixed bias, collector to bias, Voltage divider or self bias)
   - 4.3 DC/AC load line, Quiescent or Qpoint
   - 4.4 Stability and stability factor of biasing circuit
   - 4.5 Design of biasing circuit
   - 4.6 Bias compensation (diode compensation for V_{BE} and I_{CO})
   - 4.7 Thermal runway and stability.

5. **The Small Signal Low Frequency Analysis Model of BJT (7 hrs)**
   - 5.1 Low frequency hybrid model
   - 5.2 Measurement of h parameter
   - 5.3 Transistor configurations and their hybrid model
   - 5.4 Expression for Current gain, Voltage gain, input impedance and output impedance of two port BJT network
   - 5.5 Analysis of a transistor amplifier circuit using h-parameters
   - 5.6 Expression for voltage gain, current gain, input impedance and output impedance of CE,CB and CC configurations using h-model
   - 5.7 Comparison of characteristics of CB, CE and CC, Transistor as an amplifier

6. **The Junction Field Effect Transistor (JFET) (6 hrs)**
   - 6.1 Comparison between BJT and JFET
   - 6.2 Construction and types of JFET, Working Principal of JFET
   - 6.3 The pinch-off voltage and its importance
   - 6.4 Drain and transfer characteristics
   - 6.5 Trans-conductance, Biasing and load line
   - 6.6 V-I characteristics
   - 6.7 Configuration of JFET (CS,CD,CG), small signal model and analysis of CS, CD, CG, generalized FET Amplifier
   - 6.8 Uni-Junction transistor

7. **The Metal Oxide Semiconductor (3 hrs)**
   - 7.1 Construction and Working Principles of DMOSFET ,EMOSFET ,and CMOS load line biasing
   - 7.2 V-I characteristics
   - 7.3 Small signal analysis Model of MOSFET

8. **Clippers, Champers and Rectifiers (6 hrs)**
   - 8.1 Rectifier, Half Wave and Full Wave (Center tapped and Bridge) rectifier
   - 8.2 Average Value RMS value
   - 8.3 Ripple factor, Rectification efficiency , Form factor of half wave and full wave rectifier
   - 8.4 Diode clipper and Clamper harmonic components
   - 8.5 Filters: inductor and capacitor filters- L section and P-I section filters

Laboratory:

1. Familiarization with equipment
2. Measurement of characteristics of PN Diode and Zener diode
3. Study of half wave and full wave rectifier circuits
4. Study of full wave rectifier (Center tap and Bridge) rectifier circuits
5. Study of Clipper Circuits
6. Measurement of input and output characteristics of CB, CE configurations
7. Measurement of input and output characteristics of JFET
8. Measurement of input and output characteristics of NMOS
9. Measurement of input and output characteristics of PMOS
10. Measurement of input and output characteristics of CMOS

Text Books:

1. S. Sedra and KC. Smith, *"Microelectronics Circuits"* Holt Rinebart and Winston, New York.
2. J Milliman and Halkias*, "Electronics Devices and Circuits"* Mc Graw Hill
3. T.F Bogart "*Electronic Devices and Circuits*" PHI
4.

References:

1. V.K Mehta, " *principles of Electronics* " S Chand & Co. Fifth edition
2. MN. Horenstein," *Microelectronic Circuits and Devices*" second edition, Prentice Hall of india
3. Dhruba Banjade, Electronic Devices, Sukunda Prakashan, Kathmandu, Nepal

ELX 212.3 Logic Circuits (3-1-3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:
The purpose of the course is to provide basic knowledge of logic systems. Moreover, it enables to design a basic digital computer.

Course Contents:

1. **Introduction** **(3 hrs)**
   - 1.1 Numerical representation
   - 1.2 Digital number system
   - 1.3 Digital and analog system

2. **Number System and Codes** **(6 hrs)**
   - 2.1 Binary to decimal and decimal to binary conversions
   - 2.2 Octal, hexadecimal number system and conversions
   - 2.3 Binary Arithmetic 1's complement and 9's complements
   - 2.4 Gray code
   - 2.5 Instruction codes
   - 2.6 Alphanumeric characters
   - 2.7 Modulo2 system and 2's complement
   - 2.8 Binary Coded Decimal (BCD) and hexadecimal codes
   - 2.9 Parity method for error detection

3. **Boolean Algebra and Logic Gates** **(4 hrs)**
   - 3.1 Basic definition
   - 3.2 Basic properties and theorem of Boolean algebra
   - 3.3 DeMorgan's Theorem
   - 3.4 Logic gates and truth tables
   - 3.5 Universality of NAND and NOR gates
   - 3.6 Tristate logic

4. **Simplification of Boolean Function** **(5 hrs)**
   - 4.1 Venn diagram and test vectors
   - 4.2 Karnaugh maps up to five variables
   - 4.3 Minimum realization
   - 4.4 Don't care conditions
   - 4.5 Logic gates implementation
   - 4.6 Practical design steps

5. **Combination Logic** **(4 hrs)**

5.1 Design procedure
5.2 Adders and subtractors
5.3 Code conversion
5.4 Analysis procedure
5.5 Multilevel NAND and NOR circuits,
5.6 Parity generation and checking

6. **MSI and LSI Components in Combinational Logic Design** **(6 hrs)**
   6.1 Binary adder and subtractor,
   6.2 Decimal adder
   6.3 Magnitude comparator
   6.4 Decoder and encoder
   6.5 Multiplexer and demultiplexer
   6.6 Read-only memory (ROM)
   6.7 Programmable Logic Array (PLA)

7. **Sequential Logic** **(6 hrs)**
   7.1 Event driven model and state diagram
   7.2 Flip-flops and their types
   7.3 Analysis of clocked sequential circuits
   7.4 Decoder as memory devices
   7.5 State reduction and assignment
   7.6 Synchronous and asynchronous logic
   7.7 Edge triggered device
   7.8 Master slave flip-flops
   7.9 JK and T flip-flops

8. **Registers, Counters and Memory Unit** **(6 hrs)**
   8.1 Registers
   8.2 Shift registers
   8.3 Superposition of registers
   8.4 Generation of codes using registers
   8.5 Ripple
   8.6 Synchronous and Johnson Counters
   8.7 Design of multiple input circuits
   8.8 Random Access Memory (RAM)
   8.9 Memory decoding
   8.10 Error-correction code
   8.11 Output hazards races

9. **Arithmetic Logic Units** **(5 hrs)**
   9.1 Nibble adder
   9.2 Adder/ subtractor unit
   9.3 Design of arithmetic logic unit
   9.4 Status register
   9.5 Design of shifter
   9.6 Processor unit
   9.7 Design of accumulator

Laboratory Work:

1. Familiarization with logic gates.
2. Encodes and decodes
3. Multiplexer and demultiplexer
4. Design of simple combination circuits.
5. Design of adder/subtractor
6. Design of flip-flop
7. Design of counter
8. Clock driven sequential circuits
9. Conversion of parallel data into serial format.
10. Generation of timing signal for sequential system.

Text Books:

2. M. Mano, Digital Logic and Computer Design, Prentice Hall of India 1998.
3. M. Mano, Computer System Architecture, Prentice Hall of India, 1998.

Reference:

1. M. Mano, Digital Design, Prentice Hall of India, 1998.

ELE 215.3 Network Theory (3-1-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:
The purpose of the course is to provide the knowledge of network equations and the behavior of network. Moreover, it provides in-depth knowledge to develop one-port and two port networks with given network functions.

Course Contents:

1. **Review of Network Analysis** **(2 hrs)**
   Mesh and Nodal analysis

2. **Circuit Differential Equations (Formulation and Solutions)** **(5 hrs)**
   2.1 The differential operator
   2.2 Operational impedance
   2.3 Formulation of circuit differential equations
   2.4 Complete response (transient and steady state) of first order differential equations with or without initial conditions

3. **Circuit Dynamics** **(7 hrs)**
   3.1 First order RL and RC circuits
   3.2 Complete response of RL and RC circuit to sinusoidal input
   3.3 RLC circuit
   3.4 Step response of RLC circuit
   3.5 Response of RLC circuit to sinusoidal inputs
   3.6 Damping factors and Damping Coefficients.

4. **Review of Laplace Transform** **(5 hrs)**
   4.8 Definition and properties
   4.1 Laplace transform of common forcing functions
   4.2 Initial and final value theorem
   4.3 Inverse Laplace transform
   4.4 Partial fraction expansion
   4.5 Step response of RL, RC and RLC circuit
   4.6 Sinusoidal response of RL, RC and RLC circuits
   4.7 Exponential response of RL, RC and RLC circuits

5. **Transfer Functions** **(4 hrs)**
   5.1 Transfer functions of network system
   5.2 Poles and Zeros

5.3 Time domain behavior from pole-zero locations
5.4 S Routh'- Hurwitz's stability Criteria

6. Fourier Series and Transform (4 hrs)
6.1 Evaluation of Fourier coefficients for periodic non-sinusoidal waveform
6.2 Fourier Transform
6.3 Application of Fourier transforms for non-periodic waveforms

7. Frequency Response of Network (7 hrs)
7.1 Magnitude and phase responses
7.2 Bode plots and its applications
7.3 Concept of ideal and non-ideal low pass, high pass, band pass, and band reject filters

8. One-port Passive Network (7 hrs)
8.1 Properties of one-port passive network
8.2 Positive Real Function
8.3 Properties of RL, RC and LC network
8.4 Synthesis of RL,RC and LC networks using Foster's and Cauer's method
8.5 Properties of RLC one-port network

9. Two-port Passive Network (7 hrs)
9.1 Properties of two-port network
9.2 Reciprocity and symmetry
9.3 Short circuit and Open circuit parameters
9.4 transmission parameters
9.5 Hybrid parameter
9.6 Relation and transformations between sets of parameters
9.7 Equivalent T and π section representation

Laboratory:
1. Transient and steady state responses of first order Passive network
   1.1 Measurement of step, impulse and ramp response of RC and RL circuit using oscilloscope
   1.2 Measurement of sinusoidal response of RC and RL circuit using oscilloscope
2. Transient and Steady state responses of second order Passive network
   2.1 Measurement of step, impulses and ramp response of RLC series and parallel network using oscilloscope
   2.2 Measurement of sinusoidal response of RLC series and parallel network using oscilloscope
3. Measurement of Frequency responses of first order and second order circuits
4. Measurement of Harmonic content of a waveform
5. Conversion of a T network into a network and measurement of network response
6. Synthesis of one-port network function and verify the responses using oscilloscope

Text Book:
4. M.E., Van Valkenburg *Network Analysis*, Third Edition Prentice Hall of India, 1995.

References:

2. M. L. Soni, and J. C. Gupta, *Course in Electrical Circuits Analysis*, Dhanapat Rai & Sons, India.
3. K.C. Ng, *Electrical Network Theory*, A.H. Wheeler and Company (P) Limited, India.

Electrical Machines (3-1-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. To Provide the Knowledge of electromechanical energy conversion Principles.
2. To understand the principles of rotating and non-rotating electrical machines.
3. To understand the application of electrical machines.

Course Contents:

1. Introduction **(3 hrs)**

1.1 Magnetic circuits and Ampere's law
1.2 Types of magnetic circuit
1.3 Ferromagnetic materials, Hysteresis curve, Hysteresis & Eddy current losses,
1.4 Faraday's Laws of electromagnetic induction,
1.5 Self & mutual inductances,
1.6 Magnetically coupled circuits.

2. Transformers **(10 hrs)**

2.1 Ideal transformer,
2.2 Transformer on No-load, Transformer on load, Phasor Diagram
2.3 Real transformer & equivalent circuit, EMF Equation, Looses in transformer,
2.4 open circuit & shot circuit tests, Efficiency & voltage regulation, Efficiency & voltage regulation, Autotransformer,
2.5 Three phase transformer, Parallel operation of transformer,
2.6 Auto-frequency transformer, Instrument transformer (potential & current transformers).

3. DC Machines **(10 hrs)**

3.1 Construction & working principle of dc machine,
3.2 EME & Torque equation, Circuit model,
3.3 Method of excitation, Armature reaction & commutation, Compensating windings,
3.4 Basic performance equations for the dc machines: magnetization curve & effect of armature MMF on machine and calculations,
3.5 Characteristics of DC Generators (Separately excited, shunt, series & compound),
3.6 DC motor starting: shunt & compound motor starters, series motor starters:
3.7 Speed control of DC motors by varying the armature-circuit resistance, by varying the field flux & by varying the armature terminal voltage, Efficiency of DC machines,
3.8 DC machine-applications.

4. DC Synchronous Machines **(13 hrs)**

4.1 Principal of operation, classification & construction-salient pole & cylindrical rotor,

4.2 EMF equation.

4.3 Voltage regulation of an alternator by synchronous impedance method & mmf method, Determination of synchronous impedance (Open Circuit & Short Circuit characteristics) & Zero PF Method

4.4 Power developed by a synchronous generator, Losses & efficiency, Power angle characteristics:

4.5 Synchronous motors: Equivalent circuit & Phasor diagram Power & torque, Effects of Excitation on armature current & power factor, V-curve, Hunting staring & applications.

4.6 Parallel operation of alternator, Method of synchronization.

5. Poly-phase Induction Machines **(6 hrs)**

5.1 Construction, Principal of operation, slip,

5.2 induction motor as transformer, Emf & current, Equivalent circuit & Phasor diagram Power developed, Torque-slip characteristics, Starting losses and efficiency

5.3 No load and Blocked rotor test.

6. Fractional Kilowatt Motors **(3 hrs)**

6.1 Single phase induction motor:

6.2 Double field revolving theory,

6.3 Starting AC series motor, Universal motor, Stepper motors, Servo motors.

Practical:

1. Determination of exact equivalent circuit of a transformer.
2. Parallel operation of single phase transformers.
3. Determination of voltage regulation of an alternator by synchronous impedance method.
4. Determination of losses & efficiency of an alternator.
5. Determination of equivalent circuit of a single phase or three phase induction motor.

Text Book:

I. J. Ngrath & D.P. Kothari, *Electric Machines*, Tata McGraw Hill, India.

Reference Books:

1. E. Fitzgerald, C. Kinsley & S. Dumans, *Electric Machinery*, Tata MvGraw Hill, India Ltd. 1984.
2. P.S. Bhimra, *Electrical Machinery*, Khanna Publisher, India.
3. M.G. Say, *AC Machnies.*
4. Dr. Kohli, *A Laboratory Course in Electrical Machnie*, Nemchand & Bros. Roorkee

Electronic Circuits (3-1-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course objective:
To extend students' knowledge and skill in the understanding of practical electronic circuits.

1. **Low Frequency Transistor Amplifier Circuits** **(8 hrs)**
   - 1.1. Review of low frequency AC and DC models
   - 1.2. $\mathbf{r}_e$ model of BJT
   - 1.3. Single stage amplifier
     - 1.3.1. Expression for voltage gains and current gains
     - 1.3.2. Input and output impedance of single stage amplifiers,
     - 1.3.3. Emitter followers amplifier,
   - 1.4. Multistage amplifier,
   - 1.5. Method of coupling,
     - 1.5.1. Expression for voltage gains and current gains,
     - 1.5.2. Input and output impedance for 2-stage RC coupled amplifier,
   - 1.6. n-stage cascaded amplifiers
     - 1.6.1. Gain calculation
     - 1.6.2. Choice of configuration in a cascade
     - 1.6.3. Darlington-pair amplifier

2. **Frequency Response of Amplifiers** **(4 hrs)**
   - 2.1. Distortions: Amplitude, frequency and phase distortion
   - 2.2. Frequency and phase responses
   - 2.3. Coupling and bypass capacitors
   - 2.4. Miller effect
   - 2.5. Lower cut-off/upper cut-off (3dB) frequency bandwidth of RC coupled amplifiers
   - 2.6. Gain bandwidth product
   - 2.7. Frequency response of RC stages
   - 2.8. Effects of bypass capacitors in frequency response

3. **Large Signal Amplifiers** **(5 hrs)**
   - 3.1. Classification of large-scale power amplifiers
   - 3.2. Analysis of large signal model
   - 3.3. Push-pull amplifiers
   - 3.4. Transformer coupled and complementary push-pull stages
   - 3.5. Amplifier efficiency
   - 3.6. Harmonic distortions
   - 3.7. Cross-over distortions and minimization techniques
   - 3.8. Class and tuned power amplifiers
   - 3.9. Power dissipation and heat sink

4. **Feedback Amplifiers** **(5hrs)**
   - 4.1. Classification of feedback amplifiers,
   - 4.2. Advantages and disadvantages of Negative feedback
     - 4.2.1.Gain
     - 4.2.2.Stability

4.2.3. Bandwidth extensions
4.2.4. Signal to noise ratio
4.2.5. Input and output impedances
4.3. Negative feedback configurations
4.3.1. Voltage series,
4.3.2. Voltage shunt
4.3.3. Current series
4.3.4. Current shunt
4.4. Feedback loop stability

5. Differential Amplifiers **(4 hrs)**
5.1. Ideal characteristics
5.2. Salient features
5.3. BJT differential amplifier
5.4. Types of differential amplifiers
5.5. AC/DC analysis of dual input balanced output differential amplifier
5.6. CMMR and its importance
5.7. Techniques to improve CMRR
5.8. Applications of differential amplifier

6. Operational Amplifiers **(7 hrs)**
6.1. Fundamentals of Operational Amplifiers (Op-Amp)
6.2. Characteristics and features of ideal and non-ideal Op-Amp
6.3. Block diagram of Op-Amp
6.4. Dual input balanced output emitter coupled differential amplifier and its applications
6.5. Op-Amp parameters
6.5.1. Voltage gain
6.5.2. Common mode and differential mode gain
6.5.3. CMMR
6.6. Circuits design considerations,
6.6.1. Input bias current
6.6.2. Slew rate
6.6.3. Virtual ground
6.7. Applications of Op-Amp
6.7.1. Comparators
6.7.2. Differentiating and Integrating Circuits
6.7.3. Monostable multivibrators
6.7.4. Astable multivibrators
6.7.5. Schmitt Triggers
6.7.6. Clock Pulse Generators
6.8. FET Op-Amp and High frequency Applications

7. Oscillators **(5 hrs)**
7.1. Importance of positive feedback in oscillators' circuits
7.2. Conditions for oscillations (Barkhausen Criteria of oscillation)
7.3. Wien-Bridge oscillator
7.4. Phase shift oscillator
7.5. Tuned LC oscillators
7.6. Crystal oscillators and frequency stability
7.7. Basic concept of voltage controlled oscillators (VCO)

8. Logarithmic Amplifier **(3 hrs)**
8.1. The basic logarithmic Amplifier
8.2. Design of basic logarithmic amplifier circuit
8.3. Stability considerations,

8.4. Antilogarithmic operations
8.5. Applications
8.5.1. Analog multiplier based on log antilog principles,
8.5.2. Multifunction converter circuit (square and square root circuit)

9. Regulated power supplies **(4 hrs)**

9.1. Review of rectifiers
9.2. Regulated and unregulated power supplies
9.3. Transistor series and transistor shunt regulators
9.4. Integrated voltage regulators for positive and negative output voltages
9.5. Variable output voltages
9.6. Concept of switch mode regulators (Buck regulators and Boost regulators)

Laboratory Experiments:

1. Measurement of gain in single stage and multistage amplifiers.
2. Measurement of frequency response of feedback amplifiers.
3. Design and study of characteristics of power amplifiers.
4. Measurement of characteristic of voltage and current amplifiers with feedback.
5. Design of RC phase shift, Hartley and Colpits oscillator circuits and their verifications.
6. Measurement of Regulation in series regulator against change in input voltage and load resistance.

Text Books:

1. Jacob Millman & Christors C. Halkias, *Electronic Devices and Circuits*, Tata McGraw Hill, India.
2. Theodore F. Bogart, *Electronic Devices and Circuits*, Universal Book Stall, India.
3. R. Gayakwad, *Op-Amps and Linear Integrated Circuits,* PHI

References:

1. Roberst Boylestad & Louis Nashelsky, *Electronic Devices and Circuit Theory,* Prentice – Hall, India, Edition: 7th Edition
2. Allen Mottershead, *Electronic Devices and Circuits*, Prenticre- Hall, India
3. Albert Paul Malvino, *Electronic Principles*, Tata Mc Graw Hill, India
4. S. Sedra and K.C. Smith, *Microelectronic Circuits*, Holt, Rinehart and Inc., New York, Edition: 4

Engineering Mathematics IV (3-2-0)

Evaluation:

	Theory	Practical	Total
Internal	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:

After completion of this course students will be able to

- to explain and apply theorems of complex variables in their required applied problems.
- to apply concepts of Fourier and Z-transform in the signal processing.
- to study wave and diffusion equations in Cartesian, cylindrical, and polar coordinates.

Course Contents:

Unit I: Complex variable **12 hrs**

1.1 Review of complex numbers with their properties
1.2 De Moirves Theorem
1.3 Function of complex variables,
1.4 Conformal mappings
1.5 Analyticity , necessary condition of analyticity
1.6 Cauchy integral theorem, Cauchy integral formula, Extension form of Cauchy integral formula,
1.7 Taylor and Laurent series
1.8 Singularities, zeros, poles, complex integration, residue theorem

Unit II: Z-transform **9 hrs**

2.1 Definition, one sided and two sided z transform
2.2 Linear Time invariant system, Unit impulse function
2.3 Properties of z transform, region of convergence
2.4 Inverse Z transform by residue and partial fraction
2.5 Parseval theorem, convolution
2.6 Application (Solution of difference equation)

Unit III: Fourier Integral and Fourier Transform **7 hrs**

3.1 Fourier series in complex form
3.2 Fourier integral, Sine integral and cosine integral
3.3 Fourier transform, cosine transform, sine transform
3.4 Inverse Fourier transform, Parseval identity
3.5 Convolution theorem and its applications

Unit IV: Partial Differential Equation **14 hrs**

4.1 Definition with examples
4.2 Method of separation of variables

4.3 Derivation and solutions of Wave equations (one and two dimensional) and their applications.
4.4 Wave equation by D Alembert's method
4.5 Derivation and solution of heat equation (one and two dimensional)and their application
4.6 Laplacian equation [Cartesian, polar, cylindrical, spherical form(statement only)], their solutions.
4.7 Engineering applications of partial differential equation.

Unit V: Curve in space **3 hrs**

5.1 Ellipsoid, hyperboloid, Paraboloid, cylinder, cone (Standard equations, their sketch)
5.2 Tangent line and tangent plane on the space curve

Text books:

1. E. Kreyszig, *Advanced Engineering Mathematics*,8th edition Wiley-Easter Publication, New Delhi
2. H. K. Dass & R. Verma, Higher Engineering Mathematics, First edition, S. Chand & Company Limited, New Delhi

Reference Books:

1. Digital Signal Processing: J. G. Proakis, Prentice Hall of India.
2. V Sundaran, R Bala Subramanayam, K. L . Laxminarayanam, *Engineering Mathematics* , Volume II
3. A. V. Oppenheim, *Discrete-Time Signal Processing*, Prentice Hall, India Limited, 1990.
4. K. Ogata, *Discrete-Time Control System*, Prentice Hall, India Limited, 1993.

Instrumentation (3 -2 -2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. To provide knowledge of instrumentation.
2. To give knowledge of measurements.
3. To develop skills of instrumentation system.

Course Contents:

1. Introduction to Instrumentation System **(3 hrs)**

1.1 Components of Instrumentation and their function,
1.2 Basic concepts of Transducer
1.3 Signal conditioning and transmission
1.4 Output device
1.5 Type of signals in instrumentation.

2. Signal Measurements **(12 hrs)**

2.1 Units and standards of measurements
2.2 Measuring instruments
2.3 Performance parameters (static and dynamic)
2.4 Concepts of bridges: Wheat stone bridge, Kelvin's bridge, Maxwell's bridge, Hay's bridge, Capacitance bridge, Schering bridge & Errors, probability of errors, normal distribution

3. Physical Variables and transducers **(12 hrs)**

3.1 Physical variables and their types (Electrical, Mechanical, Process, bio-physical variable)
3.3 Transducer principle of operations
3.4 Input and output characteristics and applications of transducers (resistive, capacitive, inductive, voltage and currents)
3.5 Calibrations and error in transducers.

4. Signal Conditioning and Processing **(8 hrs)**

4.1 Importance of signal conditioning
4.2 Signal amplification, filtering, and wave shaping
4.3 Instrumentation Amplifier
4.4Op-Amp in instrumentation
4.5 Isolation amplifiers: principles and essentials of isolation amplifiers
4.6 Amplifier Applications
4.7 Interference signals and their elimination
4.8 Signal conversion (Analog – to – digital, Digital – to analog).

5. Data Transmission **(4 hrs)**

5.1 Transmission types
5.2 Transmission schemes
5.3 Data transmission system and standards.

6. Output Devices **(3 hrs)**

6.1 Indication instruments
6.2 Magnetic data recorders
6.3 Strip – chart, X-Y display unit and Plotter.

7. Data Acquisition Systems **(3 hrs)**

7.1 Components of Analog and Digital Data Acquisition System
7.2 Use of Data Acquisition Systems
7.3 Modern trends in data acquisition system.

Laboratory:

1. Conversion of physical variables into electrical signal.
2. Signal conditioning using active devices or Op-Amp.
3. Measurement of physical variables using various Bridges.
4. Error measurements in instrumentation system.
5. Observation of interference in instrumentation and their remedy.
6. Transmission of signal in different mediums.
7. Conversion of analog signal into digital and digital into analog signal.

Text Book:

A. D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 1996.

Reference Books:

1. S. Wolf and R.F.M. Smith, *Student Reference Manual for Electronic Instrumentation* Laboratories, prentice Hall of India, 1996.
2. E.O. Deobelin, *Measurement System: Application and Design*, McGraw Hill, 1990.
3. A.K. Sawhney, *A Course in Electronic Measurements and Instrumentation,* Dhanpat Rai and Sons, India, 1998.
4. C.S. Rangan, G.R Sarma and V.S.V Mani, *Instrumentation Devices and Systems*, Tata McGraw Hill, India, 1992.
5. D.M. Considine, *Process Instruments and Control Handbooks*, McGraw Hill 1985.

Microprocessors (3 – 1 – 2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

The Objective of this course is to provide the knowledge of

1. the architecture and organization of a Microprocessor (8085/8086).
2. the Basic operations, programming and application of Microprocessor.
3. the Interfacing I/O devices with the Microprocessor.
4. the foundation for the microprocessor based system design.

1. Introduction to Microprocessors **[4 hrs]**

1.1 Evolution of Microprocessors
1.2 Von Neumann and Harvard architecture
1.3 Microprocessor & Micro controller
1.4 Internal architecture of 8 bit Microprocessor 8085
1.5 concept of fetch, decode and execution

2. Assembly Language Programming **[10 hrs]**

2.1 Instruction Formats (Opcodes, mnemonics and operands)
2.2 8085 Instruction Sets
2.3 Functional Architecture of 8085
2.4 Addressing Modes of 8085
2.5 Data Transfer Instructions, Arithmetic and Logic Instructions, Program Control
Instructions (Jump Instructions, Subroutine Call)
2.6 Timing Diagram
2.7 RTL Instruction descriptions
2.8 Assembly language program

3. Bus Structure, Memory and I/O Interfacing **[13 hrs]**

3.1 Bus Structure: Bus structure, Synchronous and Asynchronous data bus, Address bus, Read/Write operations and bus timing (READ Cycle, WRITE Cycle).
3.2 Memory Interfacing: Types of Memory, RAM and ROM Interfacing with Timing Considerations, DRAM Interfacing, Memory mapped I/O, I/O mapped I/O.
3.3 I/O Interfacing: Concept of Interrupt, Interrupts of 8085 (Programmed I/O, Interrupt Driven I/O), DMA, Parallel I/O (8255-PPI), Serial I/O (8251/8250), 8259-Programmable Interrupt Controller, 8237-DMA Controller.

4. 16-bit Microprocessor and Programming **[13 hrs]**

4.1 Internal Organization of 8086
4.2 Bus Interface Unit & Execution Unit
4.3 Pin diagram

4.4 Instruction Set
4.5 Addressing Modes of 8086
4.6 Assembly language programming (Simple Sequence programs, jumps, flag and conditional jumps, if-then programs)
4.7 One Pass and Two Pass Assemblers
4.8 Assembler Directives
4.9 Procedures and Macros
4.10 System Timing Diagrams
4.11 Functional Chips (8284A Clock Generator, 8282 Address Latch, 8286 transceiver, 8288 Bus Controller)
4.12 Interrupt and Interrupt service procedures
4.13 Interrupt Vector Table
4.14 Introduction to Intel 80386.

5. Data Communication Basics **[5 hrs]**

5.1 Serial and Parallel Data Communication
5.2 Asynchronous Serial Data Communications
5.3 Serial data transmission methods and standards (RS232/RS-232C, RS422/423A)
5.4 Synchronous Serial Data Communication and Protocols (BISYNC).

Laboratory Works:

1. Assembly language program using 8085 microprocessor kit. Program should comprise the use of all types of instructions and addressing modes.
2. Assembly language programming with 8086 family. Program should comprise the use of all types of instructions and addressing modes.
3. The programming should include the concept of Arrays and the concept of Multiplications and Division operations on Microprocessor.
4. Assembly language programming, using any type of Assembler, which should include the different functions of Interrupt (Int 10h, and Int 21h).

Text Books:

1. R. Gaonkar, *Microprocessor Architecture, Programing & Application*, Penram International Publishing.
2. Hall D. V., *Microprocessors Interfacing*, TMH (2nd Edition)
3. Liu G. A. Gibson, *Microcomputer Systems: The 8086 / 8088 Family*, PHI 2nd Ed.

Reference Books:

1. M. Rafiquzzaman, *Microprocessors Theory & Applications*, PHI
2. Kenneth J. Ayala, *The 8051 Micro controller*, Penram International Publishing 1996
3. Kip Irvine, Maxwell Macmillan, *Assembly language for the IBM PC*
4. K. Gosh, Prentice Hall, *Introduction to 8085 Microprocessor for Engineers and Scientists*

Numerical Methods (3-1-3)

Evaluation:

	Theory	Practical	Total
Internal	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. To introduce numerical methods for interpolation, regressions, and root finding to the solution of problems.
2. To solve elementary matrix arithmetic problems analytically and numerically.
3. To find the solution of ordinary and partial differential equations.
4. To provide knowledge of relevant high level programming language for computing, implementing, solving, and testing of algorithms.

Course Contents:

1. Solution of Nonlinear Equations **(10 hrs)**

1.1 Review of calculus and Taylor's theorem
1.2 Errors in numerical calculations
1.3 Bracketing methods for locating a root, initial approximation and convergence criteria
1.4 False position method, secant method and their convergence, Newton's method and fixed point iteration and their convergence.

2. Interpolation and Approximation **(7 hrs)**

2.1 Lagrangian's polynomials
2.2 Newton's interpolation using difference and divided differences
2.3 Cubic spline interpolation
2.4 Curve fitting: least squares lines for linear and nonlinear data

3. Numerical Differentiation and Integration **(5 hrs)**

3.1 Newton's differentiation formulas
3.2 Newton-Cote's, Quadrature formulas
3.3 Trapezoidal and Simpson's Rules
3.4 Gaussian integration algorithm
3.5 Romberg integration formulas.

4. Solution of Linear Algebraic Equations **(10 hrs)**

4.1 Matrices and their properties
4.2 Elimination methods, Gauss Jordan method, pivoting
4.3 Method of factorization: Dolittle, Crout's and Cholesky's methods
4.4 The inverse of a matrix
4.5 Ill-Conditioned systems
4.6 Iterative methods: Gauss Jacobi, Gauss Seidel, Relaxation methods
4.7 Power method.

5. Solution of Ordinary Differential Equations **(8 hrs)**

5.1 Overview of initial and boundary value problems
5.2 The Taylor's series method
5.3 The Euler Method and its modifications
5.4 Huen'smethod
5.5 Runge-Kuttamethods
5.6 Solution of higher order equations
5.7 Boundary Value problems: Shooting method.

6. Solution of Partial Differential Equations **(5 hrs)**

6.1 Review of partial differential equations
6.2 Elliptical equations, parabolic equations, hyperbolic equations and their relevantexamples.

Laboratory:

Use of Matlab/Math-CAD/C/C++or any other relevant high level programming language for applied numerical analysis. The laboratory experiments will consist of program development and testing of:

1. Solution of nonlinear equations
2. Interpolation, extrapolation, and regression
3. Differentiation and integration
4. Linear systems of equations
5. Ordinary differential equations (ODEs)
6. Partial differential equations (PDEs)

Text Books:

1. Gerald, C. F. & Wheatly, P. O. *Applied Numerical Analysis* (7th edition).New York: Addison Wesley Publidhing Company.
2. Guha, S. & Srivastava, R. *Numerical Methods: For Engineers and Scientists*. Oxford University Press.
3. Grewal, B. S. & Grewal, J. S. *Numerical Methods in Engineering & Science (*8thedition). New Delhi: Khanna publishers. 2010.
4. Balagurusamy, E. *Numerical Methods*. New Delhi: TataMcGraw Hill. 2010.

References:

1. Moin, Parviz. *Fundamentals of Engineering Numerical Analysis*. Cambridge University Press, 2001.
2. Lindfield, G. R. & Penny, J. E. T. *Numerical Methods: Using MATLAB*. Academic Press. 2012.
3. Schilling, J. & Harris, S.L. *Applied Numerical Methods for Engineers using MATLAB and C*. Thomson publishers, 2004.
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Advanced Electrical Machines (3 – 0 – 1)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. To impart the knowledge on principles of electromagnetic energy conversion
2. To provide the knowledge of synchronous machines, other special machines their application and control

Course Contents:

1. Principle of electromechanical conversion (8 hrs)

1.1 Basic electromagnetic laws, Force and Torque in magnetic field systems
1.2 Energy Balance ,Singly excited magnetic field system ,Field and co energy concept
1.3 Energy flow in electromechanical devices
1.4 Reluctance torque in rotating machine
1.5 Doubly xcited magnetic field systems
1.6 Torque for single phase cylindrical rotor machine
1.7 Torque for single phase salient pole machine
1.8 Force and torque in Permanent Magnet systems

2. Synchronous Generator (10 hrs)

2.1 Constructional details, Operating principle, EMF equations,
2.2 Winding factors, Harmonics in generated voltages and their suppression
2.3 Armature reaction, synchronous impedance, phasor, diagram
2.4 Load characteristic, Regulation and its determination from sync. Impedance method, Zero p.f. methods
2.5 Two reaction Theory for salient pole machine, Vector diagram with d-q axis leakage reactance
2.6 Power and torque developed by Synchronous generator
2.7 Transient condition of an alternator, Transient and sub-transient reactance

3. Parallel Operation of Alternators (4 hrs)

3.1 Parallel operation, concept of infinite bus
3.2 Synchronizing with infinite bus bars, synchronizing power
3.3 Real and reactive power sharing due to change in excitation and input power. effect of R/X ratio

4. Synchronous Motor (4 hrs)

4.1 Operating principle, phasor diagram, Starting methods,
4.2 Effects of excitation, V and Λ curves,
4.3 Hunting effect and its prevention
4.4 Power angle characteristics of cylindrical salient pole and rotor machine
4.5 Two reaction model of salient pole machine
4.6 Synchronous condenser and its applications.

5. Induction type Machine (IM) (4 hrs)

5.1 Starting of induction motors, methods of starting and types of starters
5.2 Double cage and deep rotor bar rotor machines
5.3 Speed control: resistance control, pole changing, cascading, injected emf into rotor, variable frequency methods
5.4 Induction generator theory and application.
5.5 Double field theory and Cross field theory for 1phase IM
5.6 Types and characteristics of 1Phase IM

6. Three Phase Transformers (4 hrs)

6.1 Introduction, phasor diagram and effective ratio for all possible connections and open delta connection
6.2 Harmonic and In-rush current
6.3 Tertiary winding transformer operation and advantages

7. Special Machines (8 hrs)

7.1 Permanent magnet material for electrical machine
7.2 Square wave Permanent magnet brushless machine
  7.2.1 Torque and Emf equation
  7.2.2 Torque and speed characteristics
  7.2.3 Motor with 120^0 and 180^0 magnet arc commutation
  7.2.4 Winding inductance calculation
7.3 Permanent magnet sync. Machine
  7.3.1 Torque and Emf equation
  7.3.2 Torque and speed characteristics
  7.3.3 Winding inductance calculation
7.4 Switched Reluctance Motor
  7.4.1 Poles , phase and windings
  7.4.2 Static torque production , energy conversion loop
  7.4.3 Partition of energy and effect of saturation
  7.4.4 Drive circuits
7.5 Stepper Motor
  7.5.1 Variable reluctance
  7.5.2 Single stack VRM and Multi stack VRM
  7.5.3 Torque Vs stepping rate characteristics , Drive circuits

8. Temperature rise in Electrical Machine (3 hrs)

8.1 Heating and cooling time curve , Duty cycles
8.2 Rating machines , Choice of rating of motors
8.3 Methods of Ventilation and cooling

Practical:

1. Determination of V curve of Synchronous Motor
2. Synchronization of three phase alternator to supply
3. Determination of power sharing of parallel connected alternators and study of effects of excitation and input power
4. Simulation in dynamics of electrical machine and effect of disturbances

References

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2. Alexander and Langsdr of,*Theory of Alternating Current Machine* , ISBN: 9780070994232
3. Puchstein, A. F., Lloyd, T. C, *Alternating Current Machine*. John Wiley & Sons, Inc., New York.
4. T.J.Miller. *Brushless permanent magnet machine and Reluctance Motor Drive* Oxford Science Publication
5. Ramu Krishana. *Permanent Magnet Synchronous and Brushless DC Motor Drives CRC Press.*
6. J. B. Gupta. *Theory and Performance of Electrical Machine* S. K. Kataria & Sons.
7. Bhag S. Guru and Huseyin R. Hiziroglu *Electrical Machinary and Transformers*
8. P.S. Bimbhra *Generalized Theory of Electrical Machine* Khanna Publication 1987

Control Systems (3-1-2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. To provide knowledge of feedback Control Principles.
2. To design and implement PID control system.

Course Contents:

1. Concept of Control System (3 hrs)

1.1 Introduction to control system, History of automatic control system,

1.2 Open-loop and closed-loop control system (feedback control systems), Human control system Effect of feedback on gain, System stability and sensitivity, External noise to the system,

1.3 Types of feedback control system, Liner versus non-linear and Time-invariant versus –variant systems.

2. Mathematical Modeling of Physical System (6hrs)

2.1 Complex variables and the s-plane, poles and zeros locations and their significance, Differential equations of physical systems,

2.2 Classical and Laplace transforms methods in solutions of differential equations, Modeling of electrical and mechanical system elements, Modeling of thermal, Fluid and fluidic component, Mixed systems modeling,

2.3Sensors, Encoders and DC Motors in control system, Linearized approximations of non-linear characteristics.

3. System Transfer Functions and Responses (5 hrs)

3.1 Combinations of components to physical systems,

3.2 Block diagram and SFG algebra, Impulse response and transfer function of linear single-input single –output systems and multivariable systems,

3.3 Laplace transform analysis of systems with standard input functions-steps, Ramps, Impulses, Sinusoids, Initial and final steady-state equalibria of systems,

3.4 principles and effects of feedback on steady-state gain, Bandwidth, Error magnitude, Dynamic responses, Decomposition of transfer functions.

4. State-Variable Analysis (4 hrs)

4.1 Vector-matrix representation of state equations, State transition matrix and eqations and their relationships with higher order differential equations,

4.2 State-space Formulation of a system, Relationship between state equations and transfer functions,

4.3 Characteristic equation, Eigenvalues and eigen vectors.

5. Stability (4 hrs)

5.1 Heuristic interpretation of the conditions for stability of a feedback system, BIBO, Characteristic equation,

5.2 Complex plane interpretation of stability, Root locations and stability, Routh-Hurwitz criterion, Eigenvalue criterion,
5.3 Setting loop gain using the R-H criterion, Relative stability from complex plane axis shifting, Stability test, BIBO, Zero-input**.**

6. Ti me-Domain Analysis of Control Systems (5 hrs)

6.1 Time response of continuous system, Unit-step response and time-domain specifications, Steady-state error,
6.2 Transient response of second order system, Time-domain analysis of a position-control system,
6.3 Effects of adding poles and zeros on transfer function, Dominant poles of transfer function.

7. Root Locus Technique (6 hrs)

7.1 Relationship between Root-Loci and time responses of systems,
7.2 Rules for construction of Root-Loci diagrams, Computer solutions for Root-Loci plotting, Polynomial root finding and repeated eigenvalue methods,
7.3 Derivative feedback compensation design with Root-Locus, Setting controller parameters using root locus ,
7.4 Parameter change sensitivity analysis by root locus methods.

8. Frequency Domain (Response) Method (5 hrs)

8.1 Frequency domain characterization of systems,
8.2 Relationship between real and complex frequency response, Bode amplitude and phase plots, Effects of time constants on Bode plot, Stability analysis from the Bode plot, Correlation between Bode plots and real time response: gain and phase margins, Damping ratio, Effects of adding poles and zero on frequency response,
8.3 Nyquist stability criterion with minimum phase transfer function, Correlation between Nyquist diagrams and real time response of systems: stability, Relative stability, Gain and phase margin, Damping ratio,
8.4 The Nichols chart and its application, Sensitivity studies.

9. Performance Specifications for Control Systems (2 hrs)

9.1 Time domain specifications: steady state errors, Response rates, Error criteria, Hard and soft limits on responses,
9.2 Damping ratio, Log decrement, Frequency domain specifications: Band width, Response amplitude ratio.

10. Design of Control System (5 hrs)

10.1 Application of Root-Locus, Frequency Response and computer simulation in control system design,
10.2 Meeting steady-state error criteria, Feedback compensation, Lead, Lag, and Lead-lag compensation,
10.3 Design of PID controllers, Pole-Zero cancellation design of Robust control system, Forward and feed forward controllers.
*With control System Toolbox.

Laboratory:

1. Identification of control system components
   -Establish transfer function and block diagram of a servo system for position and velocity control.
2. Open and closed loop performance of servo position control system.
   - Check effects of loop gain on response
   - compare results with theory
3. Open and closed loop performance of servo velocity control system.
   - check effects of loop gain on response
   - compare results with theory
4. Simulations MATLAB and TUTSIM as a simulation tools.
5. Design a PID controller
   - design of a PID controller for position control servo
   - verify design with TUTSM
6. Non-electrical control system
   - study of a hydraulic or pneumatic servo system

Text Books:

1. K.Ogata, *Modern Control Engineering*, 2nd Edition, Prentice Hall, Englewook Cliffs, New Jersey, 1990.
2. B.C. Kuo, *Automatic Control Systems*, prentice Hall of India.

Organization and Management (2-0-0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:
To make the students able to understand and analyze the professional environment where they have to practice their profession. This course will also help them in bringing attitudinal as well as behavioral change.

Course Contents:

1 Introduction (2 hrs)

1.1 Meaning and concept of management
1.2 Functions of management
1.3 Scope and application of management
1.4 Importance of management

2 Organization (4 hrs)

2.1 Meaning and concept of organization
2.2 Characteristics of organization
2.3 Principles of organization
2.4 Formal and informal organizations
2.5 Organization chart
2.6 Types of organization-line
  2.6.1 Line and staff
  2.6.2 Functional and matrix.
2.7 Authority and responsibility and their interrelationships.

3 Motivation and Leadership (6 hrs)

3.1 Concept of motivation
3.2 Incentives
3.3 Theories of motivation: Need hierarchy, Dual Factoral, Expectancy and Achievement theories.
3.4 Leadership styles: Participative management, Management by objectives, management by exception,
3.5 Learning organizations

4 Human Resource Management (6 hrs)

4.1 Meaning and functions of human resource management
4.2 Recruitment
4.3 Job analysis, Job specification, Job description
4.4 Elements of compensation

4.5 Human resource development: Training (on the job and off the job)
4.6 Performance appraisal

5 Introduction to Industrial Relations (6 hrs)

5.1 Meaning of Industrial Relations
5.2 Trade union
  5.2.1 Collective bargaining
  5.2.2 Trade union movement in Nepal
5.3 Employee grievances
5.4 Employee Discipline
5.5 Employee health and safety
5.6 Compensation and its relation with industry
5.7 Challenges of industrial relations in Nepal
5.8 Methods of improving industrial relations in Nepal

6 Human Behavior and Conflict Management (7 hrs)

6.1 Concept of Human Behavior and Conflict Management
6.2 Types of Conflict Management
6.3 Conflict Management and its impact to the HRM
6.4 Modes of Conflict Management
  6.4.1 Negotiation
  6.4.2 Facilitation
  6.4.3 Mediation
  6.4.4 Arbitration
  6.4.5 Legal action

References:

1. Harold Koontz and Heinz Weihrich, Essentials of Mangement
2. Govinda Ram Agrawal, Organization and Management in Nepal.
3. C.B Mamoria, Personnel Managemnt
4. Fred Luthans Organizational Behavior, (McGraw Hill)

Probability and Statistics (3 – 2 – 0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objective:
This course is designed to familiarize the students with basic knowledge about probability and statistics. After successful completion of this course students would be able to understand and apply the concept ofpresentation and summarization of data, probability and probability distributions,sampling and estimation, hypothesis testing, simple regression and correlation.

Course Contents:

1. Introduction of Statistics and Presentation of Data (4 hrs)
- 1.1 Introduction of statistics
- 1.2 Application of statistics in engineering
- 1.3 Variables, types of variable: numerical and categorical variable
- 1.4 Sources of data: primary and secondary source
- 1.5 Presentation and classification ofdata: stem- and-leaf displays
- 1.6 Frequencydistribution
- 1.7 Diagrammatic and graphical presentation of data: Pareto diagram
- 1.8 Pie-diagram, histogram, frequency curve and frequency polygon
- 1.9 Cumulativefrequency curve or ogive curve

2. Summarizing and Describing the Numerical Data (4 hrs)
- 2.1 Measure of central tendency (mean ,median, mode), partition values
- 2.2 Measure of variation: range, inter-quartile range, standard deviation
- 2.3 Coefficient of variation
- 2.4 Box and whisker plot

3. Probability (5 hrs)
- 3.1 Random experiment, sample space, event and types of events, counting rule
- 3.2 Various approaches to probability
- 3.3 Laws of probability-additive, multiplicative
- 3.4 Conditional-probability and independence
- 3.5 Baye's theorem

4. Random Variable and Probability Distribution (12 hrs)
- 4.1 Random variable: discrete and continuous random variable
- 4.2 Probability mass function
- 4.3 Expectation, laws of expectation (addition and product law)
- 4.4 Discrete probability distribution: Binomial distribution, Poisson distribution,Hyper Geometric distribution and Negative binomial distribution

4.5 Probability density function,cumulative distribution functions, expected values ofcontinuous random variables
4.6 Continuous probability distribution: rectangular distribution, exponentialdistribution, Gamma distribution, Beta distribution, Normal distribution, Log-Normal distribution

5. Bi-variate Random Variables and Joint Probability Distribution (3 hrs)

5.1 Joint probability mass function,joint probability density function,joint probability distribution function
5.2 Marginal probability mass function, marginal probability density function,conditional probability mass function
5.3 Sums and average of random variables

6. Sampling and Estimation (5 hrs)

6.1 Population and samples
6.2 Sampling distribution of mean
6.3 Types of sampling: probability and non-probability sampling
6.4 Determination of sample size
6.5 Central limit theorem and its application
6.6 Estimation: concept of point and interval estimation, criteria of good estimator, interval estimation, maximum likelihood estimation
6.7 Confidence interval for population mean and population proportion

7. Testing of Hypothesis (7 hrs)

7.1 Null and alternative hypothesis, level of significance, type I and type II error, critical value, P-value, one and two tailed test, steps involved in hypothesis testing
7.2 One Sample test for mean and proportion
7.3 Two sample test for mean (independent and dependent) and proportion

8. Simple Linear Regression and Correlation (5 hrs)

8.1 Simple correlation and its properties
8.2 Concept of simple regression analysis, estimation of regression coefficient by using least square estimation method
8.3 Standard error, coefficient of determination.

Text Book:

Johnson, Richard A. *Probability and Statistics for Engineers* (8th edition). New Delhi: PHI learning private limited. 2011.

References:

1. Devore, Jay L. *Probability and Statistics for Engineering and the Sciences* (8th edition). New Delhi: Cengage learning.
2. Sheldom, M. Ross. *Probability and Statistics for Engineers and Scientist* (4th edition). New Delhi: Cengage Learning.
3. Shrestha, Hridya B. *Statistics and Probability* (2nd edition).Kathmandu: Ekata Books Distributer Pvt. Ltd.

Signal and Systems (3 – 1 – 2)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. Make students familiar with the basics of signals and their types.
2. Enable students to explain the properties of continuous and discrete time signals and to conduct their analysis and synthesis.
3. Make student familiar with basics of systems and to study their behavior.

Course Contents:

1 Introduction (6 hrs)

1.1 Signals: Transformations of independent variables, Definition of continuous and discrete time signals,
1.2 Types of signals and their properties such as sinusoidal signal, Rectangular pulses, Step function, Signum functions, Sinc functions, Delta function.
1.3 Odd and even signals,
1.4 Energy and power signals.
1.5 Systems: Types and properties of systems.

2 Fourier Analysis for continuous and Discrete Time Signals (10 hrs)

2.1 Fourier Series: Definition of periodic continuous time and discrete time signals period,
2.2 Fundamental and harmonics, Harmonically related complex exponential and Fourier representation of periodic signals, analysis and synthesis of periodic signals, Spectral representation of periodic signals using line spectrum for magnitude and phase spectrum, Symmetry relationships,
2.3 Even and odd functions, choice of orgin, Time shifting, Level shifting.
2.4 Fourier Transforms: Definition of the forward and reverse transforms,
2.5 Representation of aperiodic continuous time and discrete time signals, CTFT, DTFT, Magnitude, Phase and energy density spectrum,
2.6 Properties of Fourier transform: Linearity, Periodicity, Duality, Time shifting property, Convolution property, Modulation property, Parseval's Theorem, Fourier transform of the Dirac delta function, the signum function, the step function, the periodic function and the constant.

3 The Discrete Fourier Transforms (DFT) (9 hrs)

3.1 Definition and applications,
3.2 Frequency domain sampling and for reconstruction, Forward and Reverse transforms,
3.3 Relationship of the DFT to other transforms,
3.4 Properties of the Discrete Fourier Transform: Periodicity, Linearity and symmetry properties, Multiplication of two DFTs and Circular convolution, Time reversal, Circular time shift and Multiplication of two sequences circular frequency shift, Circular correlation and Parseval's Theorem,
3.5 Efficient computation of the DFT: FFT/IFFT Algorithms.

4 Energy and Power (2 hrs)

4.1 Parseval's theorem for periodic signals, Auto-correlation, Power spectrum,
4.2 Parseval's theorem for finite energy signals, The energy density function.

5. Linear Time Invariant System (6 hrs)

5.1 Definition of time-invariance and time-variance for continuous and discrete time systems,
5.2 Impulse response and convolution: Convolution sum and the convolution integral,
5.3 Properties of Linear Time-invariant system, LTI systems described by Differential and difference equations,
5.4 Block diagram representation of LTI systems, Convolution of a rectangular pulse passed through an RC filter.

6 Transmission of Signals (5 hrs)

6.1 Input-output relationships in the frequency domain, Definition of transfer function, Distortion less transmission, the ideal lowpass filter and impulse response,
3.6 Introduction to signal transmission in communication systems.

7 Transmission of Signals in Discrete Time Systems (7 hrs)

7.1 Introduction to discrete time systems, Linear difference equations, the effect of the delay operation on signals,
7.2 Introduction to finite duration Impulse Responses (FIR) systems and Infinite Impulse Response (IIR) systems,
7.3 Frequency response of FIR and IIR system, Implementation of FIR and IIR system.

Laboratory:

1 Software simulation using MATLAB software
2 The hardware experiments will involve the use of a spectrum analyzer to examine simple periodic signals such as square waves and triangular waves as well as more complex signals such as those from voice or musical instruments.
3 There will also be a number of hardware experiments dealing with signal transmission systems and with modulation.
4 Convolution DFT and FFT will be performed using software in computer.

Text Book:

A. V. Oppenheim and A.S Willsky, Signals and Systems, PHI Publication.

References:

1. A.D Pularikas and S. Seely, signals and Systems, 2nd Edition, PWS-Kent Publishers, 20 Park Plaza, Boston, Mass, 1991.
2. Charles L. Phillips, John M. Part, Evea A. Risking; “Signals, System and Transform”, Prentice Hall, Latest Edition.
3. Haykin, Simon and Vanveen, Barry, Signals and System, Weley, Latest Edition
4. Poularikas, A. D. and Seely, S. Signals and Systems, PWS Engineering, Latest edition.

Transmission and Distribution System (3 – 2 – 0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:

1. To provide the knowledge of electrical power transmission and distribution system.
2. To impart the knowledge of evaluation technique of transmission and distribution systems parameters.

Course Contents:

1. Structure of Power System and Few Other Accepts (4 hrs)

1.1 Structure of Electrical Power System, Types of Generating Systems
1.2 Load Curves, Unit Generated Per annum, load duration curves, types of load and typical demand and diversity factor
1.3 Selection of generating units, peak load and base load
1.4 Power Factor, its improvements and economic power factor
1.5 Per Unit Modeling of Power System Network
1.5.1 Advantage
1.5.2 P.U. impedance of two and three winding transformers

2. Resistance and Inductance of Transmission Line (6 hrs)

2.1 Line resistance, line Inductance, skin effect
2.2 Inductance of single conductor, inductance due to internal and external flux linkage
2.3 Inductance of single phase two wire
2.4 Inductance of three phase transmission line with symmetrical spacing, Inductance of
2.5 transposed line
2.6 Self and mutual inductance, inductance of composite conductor, Self GMD and
2.7 mutual GMD
2.8 Inductance of three phase double circuit

3. Capacitance of Transmission Line (4 hrs)

3.1 Electrical field and potential differences
3.2 Capacitance of single phase and three phase line
3.3 Capacitance of three phase double circuit
3.4 Effect of earth on capacitance

4. Performance of Transmission Line (7 hrs)

4.1 Types of transmission line. Vector diagram, Voltage regulation for short and medium T. L.

4.2 Long transmission line, voltage waves, attenuation propagation delay, SIL, equivalent pi model
4.3 Two Port network, ABCD Parameters of different model of TL
4.4 Power flow trough transmission line, receiving and sending end power circle diagram
4.5 Voltage compensation from circle diagram
4.6 Voltage control methods, shunt and series compensation

5. Electrical Supply System (3 hrs)

5.1 Typical A.C. Power supply schemes, comparison of DC and AC transmission systems
5.2 Advantage of high transmission voltage, various system of power transmission
5.3 Comparisons of conductor material for different overhead transmission system
5.4 Economic choice of transmission voltage and conductor size

6. Mechanical Design of Overhead Line (7 hrs)

6.1 Main component of overheads line, conductor materials
6.2 Line supports, insulators, types of insulator
6.3 Potential distribution of overhead insulation, string efficiency
6.4 Method to improve string efficiency
6.5 Corona, factors affecting corona
6.6 Advantage and disadvantage of corona and methods reducing corona effect
6.7 Sag, calculation of sag of overhead lines
6.8 Effect of Ice loading and wind pressure in sag
6.9 Skin, Ferranti, proximity effects

7. Underground Cables (4 hrs)

7.1 Structure of Cables and materials for undergraduate cables, Cables for three phases Services
7.2 Insulation resistance of single core cable, capacitance of single core cable, di-electrical strength and most economical size
7.3 Grading of Cable, capacitance grading and inter sheath grading
7.4 Capacitance of three phase cable and measurement of capacitance
7.5 Permissible current capacity, types of cable fault

8. Distribution Systems (4 hrs)

8.1 Introduction, DC and AC distributers, Distributor fed from single end with tapping at different points and UDL (Uniform Distributed load)
8.2 Distributor fed from both end with tapping at different points and UDL
8.3 Ring Distributor and ring distributer with interconnectors
8.4 Feeder, types and design consideration

9. Load Flow Studies (6 hrs)

9.1 Introduction, Classification of buses, formation of Y bus of Network
9.2 Basic load flow equation for voltage and power
9.3 Gauss Seidel Methods for load flow and limitation of this method

Test Books:

1. C. L. Whadwa *Electrical Power System*. New Age International.
2. B. R. Gupat *Power System Analysis and Design* S. Chand Limited.

References:

1. John Joseph Grainger, William Damon Stevenson *Power System Analysis* MCGRAW-HILL Higher Education.
2. William D. Stevenson *Elements of Power System* Analysis. Mcgraw-Hill Book Comp.
3. D. Das *Electrical Power System*
4. V.K. *Mehta Principle of Power System*. S. Chand Company and Limited
5. Kothari & Nagrath *Power System Engineering*