B.E. DEGREE
IN
CIVIL ENGINEERING

Year : I

Part : II

Teaching Schedule							Examination Scheme							
							Theory			Practical			Total	Remark
S. N.	Course Code	Course Title	L	T	P	Total	Assesment Marks	Final		Assesment Marks	Final			
								Duaration hours	Marks		Duaration hours	Marks		
1	SH 451	Engineering Mathematics - II	3	2		5	20	3	80				100	
2	ME 451	Engineering Drawing II	1		3	4				60	3	40	100	
3	EX 451	Basic Electronics Engineering	3	1	1.5	5.5	20	3	80	25			125	
4	SH 452	Engineering Physics	4	1	2	7	20	3	80	20	3	30	150	
5	CE 451	Applied Mechanics	3	2		5	20	3	80				100	
6	EE 451	Basic Electrical Engineering	3	1	1.5	5.5	20	3	80	25			125	
		Total	**17**	**7**	**8**	**32**	**100**	**15**	**400**	**130**	**6**	**70**	**700**	

ENGINEERING MATHEMATICS II

SH 451

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

Course Objective:

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

1. Calculus of Two or More Variables **(6 hours)**

1.1 Introduction: limit and continuity
1.2 Partial derivatives
  1.2.1 Homogeneous function, Euler's theorem for the function of two and three variables
  1.2.2 Total derivatives
1.3 Extreme of functions of two and three variables; Lagrange's Multiplier

2. Multiple Integrals **(6 hours)**

2.1 Introduction
2.2 Double integrals in Cartesian and polar form; change of order of integration
2.3 Triple integrals in Cartesian, cylindrical and spherical coordinates;
2.4 Area and volume by double and triple integrals

3. Three Dimensional Solid Geometry **(11 hours)**

3.1 The straight line; Symmetric and general form
3.2 Coplanar lines
3.3 Shortest distance
3.4 Sphere
3.5 Plane Section of a sphere by planes
3.6 Tangent Planes and lines to the spheres
3.7 Right circular cone
3.8 Right circular cylinder

4. Solution of Differential Equations in Series and Special Functions (9 hours)

4.1 Solution of differential equation by power series method
4.2 Legendre's equation
4.3 Legendre polynomial function; Properties and applications.
4.4 Bessel's equation
4.5 Bessel's function of first and second kind. Properties and applications

5. Vector Algebra and Calculus **(8 hours)**

5.1 Introduction
5.2 Two and three dimensional vectors

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

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

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

References:

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

ENGINEERING DRAWING II

ME 451

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

Course Objective:

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

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

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

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

1.3 Simplified Representations of Standard Machine Elements

2. Pictorial Drawings (20 hours)

2.1 Classifications: Advantages and Disadvantages

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

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

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

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

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

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

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

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

3.5 Standard Piping Symbols and Piping Drawing

4. Detail and Assembly Drawings (20 hours)

4.1 Introduction to Working Drawing

4.2 Components of Working Drawing: Drawing Layout, Bill of Materials, Drawing Numbers

4.3 Detail Drawing

4.4 Assembly Drawing

4.5 Practices of Detail and Assembly Drawing: V-block Clamp, Centering Cone, Couplings, Bearings, Antivibration Mounts, Stuffing Boxes, Screw Jacks, etc

Practical:

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

9. Detail Drawing
10. Assembly Drawing I
11. Assembly Drawing II
12. Building Drawing

References:

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

BASIC ELECTRONICS ENGINEERING
EX 451

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

Course Objectives:

To understand the electronics elements and their functionality, basic understanding of analog and digital systems and their applications

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

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

2. Diodes **(6 hours)**

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

3. Transistor **(8 hours)**

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

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

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

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

5.1 Introduction
5.2 Wired and wireless communication system

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

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

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

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

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

Practical:

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

References

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

ENGINEERING PHYSICS
SH 452

Lecture : 4 **Year : I**
Tutorial : 1 **Part : II**
Practical : 2

Course objectives:

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

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

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

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

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

3. Acoustics **(3 hours)**

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

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

4.1 Interference,
  4.1.1 Intensity in double slit interference,
  4.1.2 Interference in thin films,
  4.1.3 Newton's rings,
  4.1.4 Hadinger fringes
4.2 Diffraction,
  4.2.1 Fresnel and Fraunhoffer's diffraction,
  4.2.2 intensity due to a single slit;
  4.2.3 diffraction grating,
  4.2.4 x-ray diffraction, x-ray for material test
4.3 Polarization,
  4.3.1 double refraction,
  4.3.2 Nichol prism, wave plates,
  4.3.3 optical activity, specific rotation

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

5.1 Lenses, combination of lenses,
5.2 cardinal points,

5.3 chromatic aberration

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

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

6.2 Fiber Optics,
- 6.2.1 self focusing,
- 6.2.2 applications of optical fiber

7. Electrostatics **(8 hours)**

7.1 Electric charge and force,
7.2 electric field and potential,
7.3 electrostatic potential energy,
7.4 capacitors, capacitor with dielectric,
7.5 charging and discharging of a capacitor

8. Electromagnetism **(11 hours)**

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

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

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

9.1 Maxwell's equations,
9.2 wave equations, speed,
9.3 E and B fields,
9.4 continuity equation,
9.5 energy transfer

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

10.1 Quantization of energy;
10.2 electrons and matter waves;
10.3 Schrodinger wave equation;
10.4 probability distribution;
10.5 one dimensional potential well;
10.6 uncertainty principle;
10.7 barrier tunneling

Practical:

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

References:

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

APPLIED MECHANICS
CE 451

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

Course Objective:

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

1. Introduction **(2 hours)**

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

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

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

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

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

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

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

5. Friction **(2 hours)**

5.1 Laws of Friction, Static and Dynamic Coefficient of Friction, Angle of Friction: Engineering Examples of usage of friction
5.2 Calculations involving friction in structures: Example as High Tension Friction Grip bolts and its free body diagram

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

6.1 Introduction to Structures: Discrete and Continuum

6.2 Concept of Load Estimating and Support Idealizations: Examples and Standard symbols
6.3 Use of beams/frames in engineering: Concept of rigid joints/distribute loads in beams/frames.
6.4 Concept of Statically/Kinematically Determinate and Indeterminate Beams and Frames: Relevant Examples
6.5 Calculation of Axial Force, Shear Force and Bending Moment for Determinate Beams and Frames
6.6 Axial Force, Shear Force and Bending Moment Diagrams and Examples for drawing it.

7. Analysis of Plane Trusses (4 hours)

7.1 Use of trusses in engineering: Concept of pin joints/joint loads in trusses.
7.2 Calculation of Member Forces of Truss by method of joints: Simple Examples
7.3 Calculation of Member Forces of Truss by method of sections: Simple Examples

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

8.1 Rectilinear Kinematics: Continuous Motion
8.2 Position, Velocity and Acceleration of a Particle and Rigid Body
8.3 Determination of Motion of Particle and Rigid Body
8.4 Uniform Rectilinear Motion of Particles
8.5 Uniformly Accelerated Rectilinear Motion of Particles
8.6 Curvilinear Motion: Rectangular Components with Examples of Particles

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

9.1 Newton's Second Law of Motion and momentum
9.2 Equation of Motion and Dynamic Equilibrium: Relevant Examples
9.3 Angular Momentum and Rate of Change
9.4 Equation of Motion-Rectilinear and Curvilinear
9.5 Rectangular: Tangential and Normal Components and Polar Coordinates: Radial and Transverse Components

Tutorial:

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

1. Introduction (1 hour)
   A. Theory; definition and concept type questions.
2. Basic Concept in Statics and Static Equilibrium (2 hours)
   A. Theory; definition and concept type questions.
3. Concept of Force acting on structures (3 hours)
   A. Practical examples; numerical examples and derivation types of questions.
   B. There can be tutorials for each sub-section.

4. Center of Gravity, Centroid and Moment of Inertia (4 hours)
   A. Concept type; numerical examples and practical examples type questions.
5. Friction (2 hours)
   A. Definition type; Practical example type and numerical type questions.
6. Analysis of Beam and Frame (5 hours)
   A. Concept type; definition type; numerical examples type with diagrams questions.
   B. There can be tutorials for each sub-section.
7. Analysis of Plane Trusses (5 hours)
   A. Concept type; definition type; numerical examples type questions.
   B. There can be tutorials for each sub-section.
8. Kinematics of Particles and Rigid Body (4 hours)
   A. Definition type; numerical examples type questions.
   B. There can be tutorials for each sub-section.
9. Kinetics of Particles and Rigid Body: Force and Acceleration (4 hours)
   A. Concept type; definition type; numerical examples type questions.
   B. There can be tutorials for each sub-section.

References:

1. F.P. Beer and E.R.Johnston, Jr. ,"Mechanics of Engineers- Statics and Dynamics", Mc Graw-Hill.
2. R.C. Hibbeler, Ashok Gupta, "Engineering Mechanics-Statics and Dynamics", New Delhi, Pearson.
3. I.C. Jong and B.G. Rogers, "Engineering Mechanics- Statics and Dynamics",
4. D.K. Anand and P.F. Cunnif, "Engineering Mechanics- Statics and Dynamics",
5. R.S. Khurmi, "A Text Book of Engineering Mechanics",
6. R.S.Khurmi, "Applied Mechanics and Strength of Materials",
7. I.B.Prasad, "A Text Book of Applied Mechanics",
8. Shame, I.H., "Engineering Mechanics-Statics and Dynamics", Prentice Hall of India, New Delhi.

BASIC ELECTRICAL ENGINEERING

EE 451

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

Course Objectives:

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

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

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

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

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

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

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

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

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

5. Alternating Quantities **(3 hours)**

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

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

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

7. Power in AC Circuits **(4 hours)**

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

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

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

Practical:

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

Prove Y-Δ transformation
Exercise on phasor diagrams for three-phase circuits

6. Measurement of Voltage, current & power in a three-phase circuit
   Two-wattmeter method of power measurement in R, RL and RC three phase circuits
   Watts ratio curve

References:

1. J. R. Cogdell, " Foundations of Electrical Engineering", Prentice Hall, Englewood Chiffs, New Jersy, 1990.
2. I. M. Smith," Haughes Electrical Technology", Addison-Wesley, ISR Rprint,2000