

**GOVT.
OF
ORISSA**

**DIRECTORATE OF TECHNICAL
EDUCATION & TRAINING,
ORISSA, CUTTACK**

www.dtetorissa.gov.in

**STATE COUNCIL FOR TECHNICAL
EDUCATION AND VOCATIONAL
TRAINING, ORISSA,
BHUBANESWAR**

www.sctevtorissa.in

CURRICULUM DEVELOPMENT CELL

Revision of Syllabi - 2009

Diploma in Electrical Engineering

DISCIPLINE : ELECTRICAL ENGG.

SEMESTER - FIFTH

Sl. No	Subject	Teaching Scheme(Hours/Week)			Evaluation scheme					Total Marks
		L	T	P	Theory			Practical		
					End Exam	Internal Assessment		End Exam	Sessional	
						Class Test	Assignment			
1.	ENERGY CONVERSION- II	4	1	-	80	15	5			100
2.	POWER ELECTRONICS & DRIVES	4	-	-	80	15	5			100
3.	COMPUTER APPLICATION – II	4	-	-	80	15	5			100
4.	ELECTRICAL DRAWING - II	2	-	6				100	50	150
	PRACTICAL									
1.	ELECTRICAL MACHINES LAB			6				75	25	100
2.	COMPUTER APPLICATION – II Lab			3				50	25	75
3.	POWER ELECTRONICS LAB			4				50	25	75
		18	2	19						750

DISCIPLINE : ELECTRICAL ENGG.

SEMESTER - SIXTH

Sl. No	Subject	Teaching Scheme(Hours/Week)			Evaluation scheme					Total Marks
		L	T	P	Theory			Practical		
					End Exam	Internal Assessment		End Exam	Sessional	
						Class Test	Assignment			
1.	Entrepreneurship & Industrial Management	4			80	15	5			100
2.	Electrical Installation & Estimating	4	1		80	15	5			100
4.	UTILISATION OF ELECTRICAL ENERGY & TRACTION	4	1	-	80	15	5			100
4.	Switch Gear and Protective Devices.	4	1		80	15	5			100
5.	Elective(Any One) i) HVDC Transmission ii) Power System Operation iii) Microprocessor and peripheral device	4	1		80	15	5			100
	PRACTICAL									
1.	Electrical Works Psactice			6				75	25	100
2.	Project & Seminar			6				100	50	150
		18	3	18						750

1. ENGINEERING MATHEMATICS-III

Total Period: 60
Periods 4hrs

Exam: 3 Hours
Total Marks: 100
Theory- 80
IA: 20 (15+5)

A. Rationale:

The subject Engineering Mathematics-III is a common paper for engineering branches. This subject includes Matrices, Laplace transform, Fourier Series, Differential equation and Numerical methods etc. for solution of Engineering problems.

B. Objectives:

On completion of study Engineering Mathematics-III the student will be able to:

- Apply matrices in Engineering mechanics, electrical circuits & linear programming.
- Transform Engineering problem to mathematical models with the help of differential equation & familiarize with the methods of solving by analytical method, transform method, operator method & numerical method.
- Solve algebraic & transcendental equations by iterative methods easily programmable in computers.
- Analyse data & develop interpolating polynomials through method of finite difference.

C. Topic wise distribution of periods

Sl No	Topic	Periods
1.	Matrices	04
2.	Linear Differential equation	12
3.	Laplace transform	12
4.	Fourier series	12
5.	Numerical methods	04
6.	Finite difference & Interpolation	12
7.	Numerical solutions of ordinary differential equation	04

D. COURSE CONTENT:

1. MATRICES

- 1.1 Define rank of a matrix.
- 1.2 Perform elementary row transformation to determine rank of a matrix.
- 1.3 Define Rouch'e Theorem for consistency of a system of linear equations in unknowns.
- 1.4 Solve simultaneous linear equations in three unknowns testing consistency.

2. LINEAR DIFFERENTIAL EQUATION

- 2.1 Define homogeneous & non-homogeneous differential Equations with constant coefficient with examples.
- 2.2 Find general solution of linear differential equations in terms of C.F. & P.I.
- 2.3 Derive rules of finding C.F & P.I in terms of operator D.
- 2.4 Explain methods of variation of parameter to solve equation of the form $y'' + py' = qy = f(x)$
- 2.5 Describe methods of solutions of Cauchy's & Legendre's linear differential equation with variable coefficient.
- 2.6 Define partial differential equations.
- 2.7 Form partial differential equations by eliminating arbitrary constants & arbitrary functions.
- 2.8 Solve partial differential equations of the form $Pp + Qq = R$.
- 2.9 Derive rules of finding C.F and P.I of Homogeneous linear partial differential equation with constant coefficient.

2.10 Solve Engineering Problems on 2.2-2.9

3. LAPLACE TRANSFORM (L.T)

- 3.1 Define Gamma function and establish $[n+1=n!]$ and find $[(1/2)+\sqrt{\pi}]$ (No problem)
- 3.2 Define Laplace transform of a function $f(t)$ & inverse Laplace transform.
- 3.3 Derive L.T of standard functions and explain existence conditions of L.T.
- 3.4 Explain linearity, shifting and change of scale properly of L.T
- 3.5 Formulate L.T. of derivatives, integrals, multiplication by t^n division by t .
- 3.6 Drive formula of inverse L.T.
- 3.7 State and derive convolution theorem.
- 3.8 solve linear differential equation with constant coefficient associated with initial condition using transform method.
- 3.9 Define unit step function and derive second shifting property.
- 3.10 Solve engineering problem on 3.3 to 3.9

4 FOURIER SERIES (F.S):

- 4.1 define periodic function
- 4.2 state Dirichlet's condition for the Fourier expansion of a function and its convergence.
- 4.3 Express periodic function $f(x)$ satisfying Dirichlet's conditions as a Fourier series in
- 4.4 State Euler's formulae.
- 4.5 Obtain F.S of continuous & function having discontinuously
- 4.6 Obtain F.S of function having arbitrary period.
- 4.7 Define even and odd function and obtain their F.S.
- 4.8 Explain half range series
- 4.9 Solve problem on 4.1 to 4.8

5 NUMERICAL METHODS:

- 5.1 Appraise limitation of analytic methods of solution of algebraic & transcendental equations
- 5.2 Derive iterative formula for finding solution of a algebraic & transcendental equation by

A Bisection method

B Method of false position

C Newton – Raphson method

- 5.3 Solve problem on 5.2

6. FINITE DIFFERENCE & INTERPOLATION

- 6.1 Explain finite difference & form table for forward and backward difference.
- 6.2 Explain difference of a polynomial and express it in factorial notation.
- 6.3 Define shift operator E and establish relation between E and difference operator Δ .
- 6.4 Derive Newton's forward and backward interpolation formula for equal intervals.
- 6.5 State Lagrange's interpolation formula for unequal intervals.
- 6.6 Define numerical differentiation using forward and backward difference.
- 6.7 Explain numerical integration and state

- a) Newton-cote's formula.
 - b) Trapezoidal rule
 - c) Simpson's 1/3 rule
- 6.8 Solve problems on 6.1 to 6.7
7. NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS
- 7.1 State and explain formula for solving ordinary differential equations using
- a) Taylor's series method
 - b. Euler's method
 - c) Runga-kutta method up to 4th order.
8. CLASS TEST
- The Three Class Tests to be conducted in equal interval of five contact weeks.
- The submission of assignments in the above topics and solution of simple problems if required to be doe at the end of each chapter.

RECOMMENDED BOOKS

Higher Engineering Mathematics by Dr. B.S Grewal.

2. PRINCIPLE OF MECHANICAL ENGINEERING

Total Period: 75
Periods 05 p/w

Exam: 3 Hours
Total Marks: 100
Theory- 80
IA: 20

A. Rationale :

This subject has been introduced with a view to provide adequate understanding of properties of steam, thermodynamic laws, Boilers, Turbines, Condensers to the students of electrical engineering since these form the basic and fundamental aspect for drive mechanisms used in electrical generation and power plant.

B. Objectives:

On completion of the course content the students will be able to:

- 1- Explain the principle of working of Boilers, Turbines and condensers
- 2-State the different types of boilers and Turbines and their uses.
- 3-Explain the properties of steam.
- 4-State and explain thermodynamic laws.

Topic wise distribution of periods.

Sl No	Topics	Periods
1.	THERMODYNAMICS	05
2.	PROPERTIES OF STEAM	05
3.	BOILERS	09
4.	STEAM ENGINES	09
5.	STEAM TURBINES	06
6.	CONDENSER	04
7.	I.C.ENGINE	04
8.	HYDROSTATICS	05
9.	HYDROKINETICS	05
10.	HYDRAULIC DEVICES AND PNEUMATICS	05

C. COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES.

1. THERMODYNAMICS

- 1.1 State Unit of Heat and work, 1st law of thermodynamics.
- 1.2 State Laws of perfect gases
- 1.3 Determine relationship of specific heat of gases at constant volume and constant pressure.

2. PROPERTIES OF STEAM

- 2.1 Use steam table for solution of simple problem
- 2.2 Explain total heat of wet, dry and super heated steam

3. BOILERS

- 3.1 State types of Boilers
- 3.2 Describe Cochran ,Babcock Wilcox boiler
- 3.3 Describe Mountings and accessories

4. STEAM ENGINES

- 4.1 Explain the principle of Simple steam engine
- 4.2 Draw Indicator diagram

- 4.3 Calculate Mean effective pressure, IHP and BHP And mechanical efficiency.
- 4.4 Solve Simple problem

5. STEAM TURBINES

- 5.1 State Types
- 5.2 Differentiate between impulse and reaction Turbine

6. CONDENSER

- 6.1 Explain the function of condenser
- 6.2 State their types

7. I.C.ENGINE

- 7.1 Explain working of two stroke and 4 stroke petrol and Diesel engines.
- 7.2 Differentiate between them

8. HYDROSTATICS

- 8.1 Describe properties of fluid
- 8.2 Determine pressure at a point ,pressure measuring instruments.

9. HYDROKINETICS

- 9.1 Deduce equation of continuity of flow
- 9.2 Explain energy of flowing liquid
- 9.3 State and explain Bernoulli's theorem

10.0 HYDRAULIC DEVICES AND PNEUMATICS

- 10.1 Intensifier
- 10.2 Hydraulic lift
- 10.3 Accumulator
- 10.4 Hydraulic ram
- 10.5 Maintenance of hydraulic machines.
- 10.6 Introduction to pneumatics, pneumatic as power transmission device.
- 10.7 Different pneumatic elements used in pneumatic circuits.
- 10.8 Working principle of pressure regulators.
- 10.9 Pneumatic circuit diagram for typical mechanical unit.

3. CIRCUIT & NETWORK THEORY

Total period ;75
Periods 5 p/w

Exam 3Hrs
Total marks ; 100
Theory 80
IA; 20

A. Rationale

Study of magnetic and electric circuits are essential in study of electrical engineering. In every branch and sub-branch of electrical engineering study of circuits and network constitutes the basic and fundamental aspect of deriving insight into the functioning and analysis of electrical network, instruments and machineries .

B. Objectives ;

1. To develop the concept on Electrical Circuit Parameters
2. To develop problem solving ability on Magnetic Circuit
3. To develop knowledge of different Magnetic Circuits
4. To make network analysis using Kirchhoff's Law
5. To use network theorems in circuit solving
6. To develop knowledge of Resonance Behaviour
7. To develop knowledge of response of R-L,R-C and R-L-C circuits
8. To define and derive network functions for one and two port network
9. To develop knowledge of filters and their circuit characteristics and application

Topic wise Distribution of periods

<u>Sl. No</u>	<u>Topic</u>	<u>Periods</u>
1.	PARAMETERS OF ELECTRIC NETWORKS	06
2.	MAGNETIC CIRCUITS	08
3.	COUPLED CIRCUITS	08
4.	DC NETWORK ANALYSIS	08
5.	D C NETWORK THEOREMS	13
6.	AC CIRCUITS	08
7.	NETWORK TRANSIENTS	09
8.	NETWORK FUNCTIONS AND PARAMETERS	08
9.	FILTERS	07

C. Course Contents in terms of specific objectives.

1. PARAMETERS OF ELECTRIC NETWORKS
 - 1.1 Resistance Parameter
 - 1.2 Linear and non-linear Resistor
 - 1.3 Open Circuit and Short Circuit
 - 1.4 Effect of Temperature on conductors
 - 1.5 Inductance Parameter
 - 1.6 Linear and non-linear Inductors
 - 1.7 Capacitance Parameter
 - 1.8 Capacitance in series and parallel
 - 1.9 Numerical Solutions

2. MAGNETIC CIRCUITS

- 2.1 Electromagnetism
- 2.2 Classification of materials
- 2.3 Explain Magnetizing force, Magnetic intensity, Magneto motive force, Magnetic flux and magnetic intensity and their relation.
- 2.4 B-H Curve
- 2.5 State Cycle of Magnetization and Magnetic Hysterisis, Hysterisis loop
- 2.6 Define Permeability, Permeance & Reluctance
- 2.7 Define Magnetic circuit and its comparisons with Electric circuit.
- 2.8 Solve problems in Series and series-parallel Magnetic circuit

3. COUPLED CIRCUITS

- 3.1 Self Inductance
- 3.2 Mutual inductance
- 3.3 Magnetic coupling
- 3.4 Coefficient of coupling and solution of related problems
- 3.5 Dot convention to differentiate supporting and opposing electromagnetic fields
- 3.6 Coupled coils in series
- 3.7 Equivalent T Circuit for magnetically Coupled Circuit

4. DC NETWORK ANALYSIS

- 4.1 Active Elements
- 4.2 Network Topology
- 4.3 Network Variables
- 4.4 Loop Currents, Tie Set schedule
- 4.5 Node Voltages, Cut Set Schedule
- 4.6 Loop Current Network Analysis
- 4.7 Nodal Voltages Network Analysis
- 4.8 Solutions of D C Circuits by Kirchoff's Laws

5. D C NETWORK THEOREMS

- 5.1 Solve numerical problems using Super position theorem, Thevenin's theorem, Norton's theorem
- 5.2 State and Explain
 - i. Maximum power transfer theorem
 - ii. Millman's Theorem, Substitution Theorem, Compensation Theorem and Reciprocity Theorem
- 5.3 Solve numerical problems on Maximum power transfer theorem, Millman's Theorem, Substitution Theorem, Compensation Theorem and Reciprocity Theorem
- 5.4 Network reduction using Star-delta Transformation
- 5.5 Ladder network
- 5.6 Bridged T network

6. A C CIRCUITS

- 6.1 Revision on A C through Resistance, Pure Inductance & Pure Capacitance

- 6.2 Revision on A C through R-L, R-C & R-L-C Series circuits
- 6.3 A C through R-L-C Parallel circuits
- 6.4 Parallel and Series-Parallel network solution
- 6.5 Series Resonance
- 6.6 Band width, Quality factor & selectivity and their numerical solutions
- 6.7 Parallel Resonance
- 6.8 Wave trap and series-parallel Tuning

7. NETWORK TRANSIENTS

- Transient Conditions
- Some Common Forcing Functions and their Laplace Transforms
- Step Response of an R-L Circuit
- Time Constant
- Decay of Current in R-L Circuit
- Step Current Response of R-L Circuit
- Step Response of R-C Circuit
- Discharging a Capacitor
- Step Current Response of R-C Circuit
- Step Response of R-L-C Circuit
- Step Current Response of Parallel R-L-C Circuit

8. NETWORK FUNCTIONS AND PARAMETERS

- Network functions for one port and two port
- Network functions for Series Parallel structure and Ladder Network
- Network functions for General Networks
- Time Domain Response and Frequency Response
- Open Circuit Impedance Parameter
- Short Circuit Admittance Parameter
- ABCD parameters
- T- Circuit Representation of Two Port
- Π Circuit Representation of Two Port

9. FILTERS

- Introduction
- Describe Low Pass Filters
- Describe High Pass Filters
- Describe Band Pass Filters
- Describe Band Stop Filters
- Describe their characteristics and applications

TEXT BOOK

Fundamentals of Electrical Networks by B R Gupta and Vandana Sinha

RECOMMENDED BOOKS;

1. Electrical Technology by B.L. Thereja and A.K. Thereja

2. Electrical Technology by J.B.Gupta.
3. Electrical & Electronics Engineering for Scientists and Engineers
by K.A.Krishnamurthy and M.R.Raghuveer.
4. Principle of Electrical Engineering by Dawes, Vol. I &II.

N.B. After completion of each topic the students are required to submit assignment on concepts and applications. It is also required to solve mathematical problems as and when applicable.

4. ANALOG AND DIGITAL ELECTRONICS

Total Period: 75
Periods 05 p/w

Exam: 3 Hours
Total Marks: 100
Theory- 80
IA: 20

A. Rationale:

Electrical engineering in various field makes use of electronic devices and circuits. The modern electrical plants take help of electronic circuits for control ,starting etc. And as such the solid state devices are found in use. So it was felt to provide a subject having electronic devices and circuits for the electrical students. A study of Practical circuits and components herein have been dealt with in the theoretical approach.

B. Objectives :

1. To develop knowledge on the characteristics of different types of diodes, transistors, UJT ,FET ,MOSFET and to draw a comparison in their characteristics and application
2. To develop knowledge of their application.
3. To describe the technique of development of LSI, MSI, VLSI chips and other popular chips
4. To develop the knowledge of measurement of voltage ,current ,phase and frequency using CRO
5. To develop the knowledge of different oscillator circuits and to identify the difference between them and their frequency relation.

Topic wise Distribution of periods

Sl No	Topic	periods
1.	SEMI CONDUCTOR THEORY	06
2.	TRANSISTOR	06
3.	OSCILLATOR	06
4.	UJT ,Tunnel diode ,FET , MOSFET	06
5.	CRT, CRO	05
6.	OPERATIONAL AMPLIFIER (OP-AMP)	08
7.	REGULATED POWER SUPPLY	07
8.	Number System and Codes	08
9.	Combinational Logic	08
10	Synchronous Sequential Logic	08
11	ELEMENTARY IDEA ABOUT ICs	07

C. Course Contents in terms of specific objectives.

1. SEMI CONDUCTOR THEORY

- 1.1 Insulators and Semi-Conductors, State Types
- 1.2 Donor and acceptor impurities
- 1.3 P.N Junction as diode
- 1.4 Characteristics of P N junction diode
- 1.5 Half wave and full wave rectifiers, ripple factor, JI & T filter

2. TRANSISTOR

- 2.1 Transistors, Construction, type & working of a transistor as an amplifiers.

- 2.2 C.E , C.B, CC mode connection of transistor and their characteristics current amplification factor.
- 2.3 Transistor operation with load line (AC an DC), forward current gain & cascading of amplifier
- 2.4 Different types of biasing, class A, class B & class C operation, operation of complimentary symmetry and push pull amplifier.

3. OSCILLATOR

- 3.1 Explain principle of oscillation, damped and sustained oscillation.
- 3.2 Explain Essential requirement of an oscillator
- 3.3 State different types of oscillation.
- 3.4 Describe Turned collector.
- 3.5 Describe Hartley oscillator.
- 3.6 Describe Collpitt's oscillator.
- 3.7 Describe phase shift oscillator
- 3.8 Describe wien's bridge & crystal oscillator

4 UJT ,Tunnel diode ,FET , MOSFET :

- 4.1 Explain the working principle of UJT ,Tunnel diode ,FET , MOSFET
- 4.2 V-I characteristics of the UJT ,Tunnel diode ,FET , MOSFET .
- 4.3 Develop the amplifier circuit with FET & MOSFET.

5. CRT, CRO ,

- 5.1 Cathode Ray Tube (CRT)
- 5.2 Cathode Ray Oscilloscope (CRO), block diagram, its application to measure voltage, current, phase, frequency.

6. OPERATIONAL AMPLIFIER (OP-AMP)

- 6.1 Define OP-AMP.
- 6.2 Block diagram of OP-AMP.
- 6.3 Pin connection of popular OP-AMP chip
- 6.4 Virtual ground, working principle
- 6.5 Inverting amplifier adder subtractor, integrator, differentiator, comparator, non inverting amplifier ,Voltage Follower, Relaxation Oscillator, Sine Wave Generator Triangular Wave Generator.

7. REGULATED POWER SUPPLY

- 7.1 Regulated power supply
- 7.2 Develop Regulated power supply using a single Zener and Resistor
- 7.3 Series Regulator
- 7.4 Shunt Regulator
- 7.5 Controlled Regulator using OP-Amp
- 7.6 Study of IC 723 ,three terminal regulators.

8. Numbers System and Codes

- 8.1 Binary Number, Octal and Hexadecimal numbers
- 8.2 Base Conversions
- 8.3 Complements, Signed Binary Numbers
- 8.4 Binary Codes- BCD Codes, ASCII Character Code, Codes for serial data transmission and storage.
- 8.5 Boolean Algebra and Logic Gates , NOT, AND, OR, NOR, NAND, XOR gates

9. Combinational Logic

9.1 Combinational Circuits; Binary Adder-Sub tractor, Binary Multiplier, Magnitude Comparator
9.2 Decoders, Encoders.

10. Synchronous Sequential Logic

10.1 Sequential Circuit, Latches, Flip-flop, Analysis of Clocked sequential Circuits

10.2 Registers and Counters, Shift Register, Ripple Counters, Synchronous Counters, Asynchronous Counter, Ring Counters

10.3 Memory and Programmable Logic, Random Access Memory (RAM), Memory Decoding, Read only Memory, Programmable Array Logic, Sequential Programmable Devices.

11. ELEMENTARY IDEA ABOUT ICs (Analog & Digital)

11.1 Technique of development of circuit Element in IC.

11.2 MSI, LSI, VLSI (definition)

11.3 Describe Linear ICs and Digital ICs (names of popular chip and connection)

11.4 Digital Integrated Logic Circuits RTL, DTL, TTL, ECL, MOS and CMOS logic circuits. Switch –level-Modeling with HDL.

TEXT BOOKS

1. Digital Design, by M. Morries Mano,
2. Principle of electronics – V.K. meheta.

REFERENCE BOOKS:

- 1 Solid State Device and Circuits -S.P Bali.
- 2 Electronics : Fundamentals and Applications by D.Chattopadhyay and P.C Rakshit.
- 3 A text of Electronis by S.L.Kakani and K.C.Bhandari.
- 4 Digital Design – Principle & Practice, 3rd Edition by John F. Wokerly, Pub. Pearson Education

5.

ELECTRICAL ENGINEERING MATERIALS

1. CONDUCTING MATERIALS

1.1 Introduction

1.2 Classification of conducting materials into low- resistivity and high resistivity materials.

1.3 Low Resistivity Materials and their Applications.

Copper, Silver, Gold, Aluminium, Steel, Stranded conductors, Bundle conductors ,Low Resistivity Copper, Brass, Bronze ,Beryllium copper alloy.

1.4 High Resistivity Materials and their applications

1.5 Tungsten, Carbon, Platinum, Mercury

1.6 Super Conducting materials. Electrical Machines, Power cables, Electromagnets.

2. Conductors and insulators

2.1 Semiconductors

2.2 Electron Energy and Energy Band Theory

2.3 Semiconductor materials, Covalent bonds

2.4 Intrinsic Semiconductors & Extrinsic Semiconductors

2.5 Type materials & P-Type materials

2.6 Majority and Minority Carriers

2.7 Semiconductors materials

2.8 Applications of semiconductor materials

2.9 Germanium and silicon rectifiers

2.10 Copper-oxide and selenium rectifiers

2.11 Temperature –sensitive resistors or thermistors

2.12 Photoconductive cells, Photovoltaic cells

2.13 Varistors, Transistors, Hall effect generators & Solar power

3. Electrical Properties

Insulation Resistance

Dielectric Strength , Dielectric constant, Dielectric loss

Visual Properties

Mechanical Strength, Viscosity, Porosity, Solubility, Machinability

Melting Points, flash points ,volatility

Thermal Conductivity, Thermal expansion, Heat resistance

Classification of insulating materials on the basis of operating temperatures

Effect of temperature increase on life of insulator

Chemical Resistance, Hygroscopicity

Fibrous materials, Impregnated fibrous materials

Non-resinous materials, Insulating liquids

Ceramics, Piezo Electric Ceramic Transducer Elements

Mica and Mica Products, Asbestos and Asbestos products

Glass, Natural and Synthetic rubbers

Insulating resins their products(plastics)

Laminates and adhesives : Enamels and Varnishes

Commonly used insulating gases, Air, Nitrogen and Hydrogen, Sulphur hexafluoride

4. Dielectric Materials

Dielectric Constant of permittivity, Polarisation, Dielectric loss

Gaseous Dielectrics, Liquid dielectrics, Solid Dielectrics, Properties of Dielectrics

Applications of Dielectrics

5. Magnetic Materials

Diamagnetism, Para magnetism, Ferromagnetism

Magnetisation Curve, Hysteresis, Eddy currents, Curie Point

Magnetostriction, Soft and Hard Magnetic Materials

Pure iron, Iron-silicon alloys, Grain oriented sheet steel

Magnetic anisotropy, Annealing, Nickel iron alloys, Soft ferrites

Hard magnetic materials, Carbon steel, tungsten steel, cobalt steel, Alnico, Hard ferrites

6. Structural Materials

Protective Materials

Lead, Steel tapes ,wires and strips

Thermocouple materials, Bimetals

Soldering materials

Fuse and fuse material

Dehydrating material

7. Rotary Switches

Slide Switches, Sensing Switches/ Sensors

Electromagnetic relay, Power Relays, Telephone relay

Card Actuated Relay, Sensitive Relay, Solid state Relays

Classification of relays

Audio Connectors, RF Connectors

Advantages of Optical Fibre Cable

Optical Fibre Connectors

PR 1. MECHANICAL ENGG. LAB.

Total Period:90
Periods: 6p/w

Examination :4 Hours
Total Marks : 100
Practical-75
Sessionals -25

1. APPLIED MECHANICS & MATERIAL TESTING

- 1.1 Determination of M.A.,V.R. and efficiency of Screw Jack.
- 1.2 Determination of friction co-efficient of bearing.
- 1.3 Determination of Young's module by Searle's Apparatus.
- 1.4 Determination of M.A.,V.R. and efficiency of wheel train.
- 1.5 Determination of Bending stress in beam using strain gauge.
- 1.6 Study of Universal Testing Machine and determination of tensile stress and Young's module of M.S . specification.

2. HYDRAULICS & HYDRAULIC MACHINE LAB

- Study of pressure measuring advices such as (a) Piezometer (b) Simple manometer
- Study of venturimeter
- Verification of Bernoulli's theorem
- Model Study of Centrifugal pumps, Francis, Turbine, Kaplan turbine and Pelton wheel

3. HEAT ENGINE LAB

- Study of Cochran Boiler
- Study and demonstration of Steam Engine
- Study and demonstration of Diesel Engine
- Study and demonstration of Petrol Engine

PR 2. ELECTRONICS LABERATORY PRACTICE

Total Period: 90
Periods : 6 P/W

Exam: 3 Hours
Total Marks: 100
Practical- 75
IA: 25marks

1. Identification of different types of resistors, capacitors, choke coils, transformers. switches ,fuses, connectors ,PCB etc and tools used in electronic workshop, study of colour code
2. Identification of different types of circuit elements and circuits as per drawing
3. Practice on: a) Multimeters (analog and digital type), b) Low frequency signal generator and c) C.R.O.
4. Study of Zener and tunnel diode, LDR, VDR , Thermistors and their characteristics
5. Assembling of half wave, full wave bridge rectifiers, study the output waveforms, the input and output voltage levels (peak and RMS) without and with T filters.
6. Assembling of single stage transistor amplifier; measure Z_{in} , Z_{out} . Plot its frequency response curve and find its band width.
7. To determine the static characteristic of Bipolar transistor.
8. Verification of Network Theorems- Superposition theorem, Thevenin's theorem, Maximum Power Transfer theorem.
9. Study of D.C. and A.C. transients RL, RC, and RLC circuits.
10. Determination of parameters of a 2 port network Z, Y, H and ABCD parameters.
11. Circuit drawing for PCB's with required accuracy

RECOMMENDED BOOKS

1. Laboratory Manual for Introductory Electronic Experiments by L.K. Maheswari and M.M.S. Anand.

PR3. TECHNICAL SEMINAR

Total period:45

Period : 3 P/W

: Sessionals; 25

Exam : 25

A. Rationale :

It is necessary to develop the communication skill both for verbal and written presentation of facts and data. For developing the skill of presenting the fact related to technical matter in terms of oral presentation the seminar is to be arranged. For developing the skill of presenting the report of any observed phenomena the preparation of report is needed. The job is designed in such a way that both the verbal and writing skill as well as presentation techniques will be developed.

B. Objectives:

After successful completion of this seminar, the student will be able to

1. Present the facts or data or concept through a seminar for developing vocal communication skill.
2. Interacting with the audience during questionnaire session.
3. Write the report containing synopsis content and other description with suitable display item.
4. Presentation will be either OHP/Power point presentation or chart display etc.

C: COURSE CONTENT:

Classes should be divided into smaller groups of not more than in each group. One group should be assigned a topic for the seminar. The topic should be usually related to their course of studies or should be of general interest. Every student of the group should prepare on a particular aspect of the main topic with active support and guidance from a teacher guide. The student should be encouraged to extensively use the library facilities and also to collect relevant material from different Technical Magazines and journals. Each student should be usually asked to present his paper on the topic of the Seminar within 15 minutes after which a question answer session may follow for 5 minutes. The Sr. Lecturer or Sr. faculty member should preside over the Seminar and ensure its smooth conduct. The student should be encouraged to use Audio-Visual Aids and other modern teaching methods during presentation of the topics in the Seminar. The Chairman should give the valedictory address and offer suggestions for quality improvement of the Seminar. The Chairman should give the valedictory address and offer suggestions for quality improvement of the Seminar. Each student at-least speaks for a minimum of two times during the semester.

The Sessionals Records should be maintained and evaluated by a team of faculty members and the final marks awarded by the team.

1. ENERGY CONVERSION-I

Total Period: 75
Periods: 5p/w

Examination: 3 Hours
Total Marks: 100
Theory-80 IA-15+5

A. Rationale:

The application of DC generators and motors in modern industries are still in practice. The electrical technicians have to look after the installation, operation and control of such machine. So the knowledge of these machines is felt essential. The subject energy Conversion-1 deals with DC machines and transformers. Transformers of various voltage ratios and KV/, ratings are in wide use in industries as well as in distribution and transmission. So an early knowledge of the technicians about transformers is necessary for which it is dealt with broadly in the fourth semester syllabus.

B. Objectives:

1. To acquire knowledge of construction, and control of the DC machines.
2. To acquire knowledge of performance of DC machines and transformers of all types.
3. To acquire knowledge of testing and maintenance of transformers and DC machines.

Topic wise distribution of periods.

Sl.no	Topic	Periods
1.	DC GENERATORS	19
2.	DC MOTORS	19
3.	SINGLE PHASE TRANSFORMER	19
4.	AUTO TRANSFORMER, C.T. AND P.T.	10
5.	THREE PHASE TRANSFORMER	08

C. Course content in terms of specific objectives:

1. D.C.GENERATORS.

- 1.1 Explain principle of operation
- 1.2 Explain Constructional feature
- 1.3 Armature winding, back pitch, Front pitch, Resultant pitch and commutator pitch
- 1.4 Simple Lap and wave winding (problems on winding diagram)
- 1.5 Explain Different types of D.C. machines Shunt, Series and Compound machine with problem solving methods.
- 1.6 Explain Armature reaction in D.C. machine & commutation.
- 1.7 Explain Methods of improving commutation (Resistance and emf commutation)
- 1.8 Explain role of inter poles and compensating winding. (solve problems)

1.9 Characteristics of D.C Generators with problem solving methods and uses of different types of D.C. Generators.

1.10 Concept of critical resistance causes of failure of development of emf.

1.11 Explain losses and efficiency of D.C. machines, condition for maximum efficiency And numerical problems

1.12 Explain parallel operation of D.C. Generators. (solve problems)

2. D.C.MOTORS

2.1 Explain D.C. Motor principle

2.2 State Significance of back emf in D.C. Motor.

2.3 Derive voltage equation of Motor

2.4 Derive torque (Equation of Armature Torque and shaft Torque) (solve problems)

2.5 Explain performance characteristics of shunt, series and compound motors and their application. (solve problems)

2.6 Explain methods of starting shunt, series and compound motors , (solve problems)

2.7 Explain speed control of D.C. shunt motors by

2.7.1 Flux control method

2.7.2 Armature voltage (rheostatic) Control method.

2.7.3 Solve problems

2.8 Explain Speed control of series motors by Flux control method and series parallel method.

2.9 Explain determination of efficiency of D.C. Machine by break test method

2.10 Explain determination of efficiency of D.C. Machine by Swibburne's Test method.

2.11 Explain Losses & efficiency and condition for maximum power and solve numerical Problems.

3. SINGLE PHASE TRANSFORMER

3.1 Explain working principles

3.2 Explain Transformer Construction-Arrangement of core & winding in different types of transformer-Brief ideas about transformer accessories such as conservator, tank, breather explosion vent etc.

3.3 Explain types of cooling methods

3.4 State the procedures for Care and maintenance

3.5 Derive EMF equation

3.6 Voltage transformation ratio

3.7 Explain Transformer on no load and on load phasor diagrams.

3.8 Explain Equivalent Resistance, Reactance and Impedance.

3.9 Explain phasor diagram of transformer with winding Resistance and Magnetic leakage

3.10 Explain Equivalent circuit and solve numerical problems

3.11 Calculate Approximate & exact voltage drop of a Transformer

3.12 Calculate Regulation of various loads and power factor.

3.13 Explain Different types of losses in a Transformer. (solve problems)

3.14 Explain Open circuit test

3.15 Explain Short circuit test

3.16 Explain Efficiency ,efficiency at different loads and power factors, condition for maximum efficiency(solve problems)

3.17 Explain All Day Efficiency(solve problems)

3.18 Explain determination of load corresponding to Maximum efficiency

3.19 Explain parallel operation of single phase transformer.

4. AUTO TRANSFORMER

- 4.1 Explain constructional features
- 4.2 Explain Working principle of single phase Auto Transformer.
- 4.3 State Comparison of Auto transformer with an two winding transformer (saving of Copper)
- 4.4 State Uses of Auto transformer
- 4.5 Explain Tap changer with transformer (on load and off load condition)

5. THREE PHASE TRANSFORMER

- 5.1 State and show Type of connection –Star –Star, Star-Delta, Delta-Star and Delta-Delta.
- 5.2 Explain parallel operation and state conditions for Parallel operation
- 5.3 Maintenance schedule of power transformer.

TEXT BOOK

- 1. Electrical Technology - II by B.L. Thareja and A.K Thareja

RECOMMENDED BOOKS

- 2. Electrical Technology by J.B.Gupta.
- 3. Testing maintenance and repair of electrical machine and equipment-by Jaggi
- 4. Energy convention systems by R.D. Begamudre.
- 5. Fundamentals of Electrical Machines by B.R. Gupta and V. Singhal
- 6. Electrical Machines by Dr. S. K. Bhattacharya.

N.B. After completion of each topic the students are required to submit assignment on concepts and Applications. It is also required to solve mathematical problems as when applicable.

2. ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

Total period: 75
Periods: 5 p/w

Examination: 3 Hours
Total marks: 100

Theory-80

A. Rationale:

The subject “Electrical measurement and measuring instruments” is important in the field of electrical engineering. The subjects deals with the methods of measuring voltage, current, power, energy, frequency ,power factor & parameters like resistance, inductance and capacitance and constructional detail and principle of operation of the instruments used for such measurements. Also it provides the methods to extend the range of low range instruments to measure higher values. A power measurement includes measurement of DC power, AC single phase power and AC three phase power. The detailed classification of all instruments used for the above measurement is dealt up carefully. Also regarding accuracy, precision, resolution and errors and their correction felt very important and have been fully discussed.

B. Objectives;

1. To acquire the knowledge of selecting various types of instruments for similar purpose like measurement of voltage, current, power, powerfactor, frequency etc.
2. To learn the connection of different types of electrical measuring instruments.
3. To learn the adjustment of different instruments.
4. To understand the working principle and construction of the electrical instruments.
5. To solve different numerical problems associated with the instruments best on their design Formula.

Topic wise Distribution of periods

Sl.No	Topic	Periods
1.	MEASURING INSTRUMENTS	10
2.	ANALOG AMMETERS AND VOLTMETERS	08
3.	WATTMETERS AND MEASUREMENT OF POWER	07
4.	ENERGYMETERS AND MEASUREMENT OF ENERGY	05
5.	MEASUREMENT OF SPEED, FREQUENCY AND POWER FACTOR	05
6.	INSTRUMENT TRANSFORMER	10
7.	MEASUREMENT OF RESISTANCE	07
8.	MEASUREMENT OF INDUCTANCE AND CAPACITANCE	05
9.	DIGITAL INSTRUMENTS	05

C. Course content in terms of specific objectives

1. MEASURING INSTRUMENTS

- 1.1 Define Accuracy, precision, Errors, Resolutions Sensitivity and tolerance.
- 1.2 Classification of measuring instruments
- 1.3 Explain Deflecting, controlling and damping arrangements in indicating type of instruments
- 1.4 Calibration of instruments

2. ANALOG AMMETERS AND VOLTMETERS

Describe Construction , principle of operation ,errors, ranges merits and demerits of

- 2.1 Moving iron type instruments
- 2.2 Permanent Magnet Moving coil type instruments
- 2.3 Dynamometer type instruments
- 2.4 Rectifier type instruments
- 2.5 Induction type instruments
- 2.6 Extension of range of instruments by use of shunts and Multipliers
- 2.7 Solve Numericals

3. WATTMETERS AND MEASUREMENT OF POWER

- 3.1 Describe Construction, principle of working Dynamometer type wattmeter and types
- 3.2 What are the Errors in Dynamometer type wattmeter and method of their correction
- 3.3 Discuss L P F Electro- Dynamometer type wattmeters
- 3.4 Discuss Induction type wattmeters
- 3.5 Measurement of Power in Single Phase and Three Phase Circuit

4. ENERGY METERS AND MEASUREMENT OF ENERGY

- 4.1 Introduction
- 4.2 Motor Meters and errors in it
- 4.3 Single Phase and polyphase Induction type Energy meters – construction, working errors, compensation and adjustments
- 4.4 Testing of Meters

5. MEASUREMENT OF SPEED, FREQUENCY AND POWER FACTOR

- 5.1 Tachometers, types and working principles
- 5.2 Principle of operation and construction of Mechanical and Electrical resonance Type frequency meters
- 5.3 Principle of operation and working of Dynamometer type single phase and three phase power factor meters
- 5.4 Synchrosopes –objectives and working
- 5.5 Phase Sequence Indicators and its working

6. INSTRUMENT TRANSFORMER

- 6.1 Explain Current Transformer and Potential Transformer
- 6.2 Explain Ratio error, Phase Angle error and Burden
- 6.3 Clamp-On Ammeters
- 6.4 State Use of CT and PT

7. MEASUREMENT OF RESISTANCE

7.1 Classification of resistance

7.2 Explain Measurement of low resistance by voltage drop and potentiometer method & its use to Measure resistance.

7.3 Explain Measurement of medium resistance by wheat Stone bridge method and substitution Method.

7.4 Explain Measurement of high resistance by loss of charge method

7.5 Explain construction & principle of insulation(meggers)and earth resistance

7.6 Explain construction and principles of Multimeters

8. MEASUREMENT OF INDUCTANCE AND CAPACITANCE

Explain measurement of inductance by

8.1 Maxwell's Bridge method

8.2 Anderson Bridge method

8.3. Owen Bridge method

Explain measurement of capacitance by

8.4 De Sauty Bridge method

8.5 Schering Bridge method

8.6 LCR Bridge method

9. DIGITAL INSTRUMENTS

9.1 Merits and Limitations of Digital Techniques

9.2 Digital-to-Analog Conversion and analog-to-digital Conversion

9.3 Display devices-Segment Displays,

9.4 Digital Voltmeters (DVM)

9.5 Characteristics of Digital Meters

9.6 Digital Multimeters

TEXT BOOK

1. Electrical Measurement and Measuring instruments by J B Gupta

REFERENCE BOOKS:

1. Electrical Measurement and Measuring instruments by E.W. Golding and H. Widdis

2. Electrical and Electronics Measuring instruments and Measurements by A.K. Sawhney.

3. Electrical Measurement and Measuring instruments by S.R.Paul

4. Electrical and Electronics Measurement & Instrumentation by R.K. RAJPUT.

3. INSTRUMENTATION AND CONTROL ENGINEERING

Total Period: 60
Periods: 4p/w

Examination: 3Hours
Total marks: 100
IA: 15+5

A. Rationale: Due to wide spread automation in industry the study of instrumentation and control is felt essential. Since the whole system is a combination of analogue and digital system, the topics of both the system have been studied along with the topics of sensors, their characteristics and interfacing technique of both analogue and digital system under this subject.

B. Objectives:

1. To acquire knowledge of the construction, characteristics and methods of usage of sensors and transducers.
2. To acquire knowledge of remote control using servo-mechanism.
3. To derive transfer functions for simple circuit for marking circuit calculation e.g. with use of block diagram Algebra.
4. To acquire knowledge of Stable Behaviour of circuit and to work out for stability

Topic wise distribution of periods

S.L. No.	Topic	periods
1.	SENSING DEVICES	13
2.	DEVICES USED FOR MEASURING OR SENSING	12
3.	ELEMENTS OF SERVOMCHANISM	09
4.	DERIVATION OF TRANSFER FUCTION	06
5.	BLOCK DIAGRAM ALGEBRA	10
6.	STABILITY OF A SYSTEM	10

C. Course content in terms of specific objectives:

1. SENSING DEVICE

1.1 Classify sensing device: Passive and active (mechanical, electrical); state properties of transducers: name transducers using electrical properties e.g. resistance, capacitances, inductance.

1.1.1 Different types of resistance transducers e.g. potentiometer types, Strain gauge (gauge Factor), Thermistors, Light dependent resistor.

1.1.2 Inductive transducer variable reluctance type Linear Variable Differential Transformer(LVDT)

1.1.3 Capacitive Transducer; Variable area, distance material; capacitive transducer for displacement measurement and vibration pick up.

1.1.4 Other types of Transducers; Piezo electric device ,Photoelectric device, Hall effect Transducer,D.C.tachogenerator,A.C.Tachogenerator,Thermocouples,digital Transducer magnetic pick up.

2. DEVICES USED FOR MEASURING OR SENSING

State and explain Force, Torque, Strain, Pressure, Velocity and acceleration.

State and explain Temperature measurement with PT resistance thermometer, thermocouple, and optical pyrometer.

4. ELEMENTS OF SERVOMECHANISM

Explain Servomotor (D.C. & A.C.)

Explain Synchro transmitter and Receiver.

Explain Servo amplifier

Explain Phase Sensitive Rectifier

Explain Gear box

Load

Study of layout of a complete servo system Showing (a) Synchro Transmitter and Receiver (b) Phase Sensitive Rectifier (c) D.C. amplifier (d) D.C. Motor (e) Gear box and load.

5. DERIVATION OF TRANSFER FUNCTION FOR

Derive Transfer Function:

R-L Circuit

R-C Circuit

6. BLOCK DIAGRAM ALGEBRA

State and Explain:

Block in cascade, summing junction, canonical Form of a feedback system, reduction of blocks, Multi-input systems.

7. STABILITY OF A SYSTEM

Derive characteristic equation.

Explain S-Plane

Explain Poles & Zeros

Apply Routh stability criterion

RECOMMENDED BOOKS

1. Basic control Engineering by B.Yousefzadeh(publishes :pitman)
2. Automatic Control Systems by S.N.Verma
3. Principles of Industrial Instrumentation by D.Patranabis
4. Industrial Instrumentation & control –S K Singh
5. Control system Engineering by I.J.Nagrah and M.Gopal.
6. Control systems by N.K.Sinha
7. Industrial Instrumentation by Al Sutco,Dr.Jerry D.Foulk
8. Industrial process Control systems by Dale Patrick and Stephen Fardo.
9. Automatic control system by Benjamin C.Kuo

N.B. After completion of each topic the students are required to submit assignment on concepts and applications. It is also required to solve mathematical problems as and when applicable.

4. ELECTRICAL DRAWING -I

Total Period: 120
Periods: 8 p/w

Examination: Hours
Total Marks: 150
Theory-100
Sessional-50

A. Rationale Drawing is the language of Engineers. They translate drawing to design and vice versa. Any job which is to be completed for implementation is required to be done within and optimal time span and efficiency. The engineering drawing helps in achieving this Drawing and design are the tools for engineers in the field keeping in view the prescribed standards of BIS in the Indian situation. So in Chapter II symbols prescribed by the BIS have been introduced for use in Electrical Drawing. Such symbols will be found in use in all other Chapters.

B. Objectives

1. To acquire the skill in presenting job specification using standard symbols, norms and standards of BIS and electricity rules regarding section of components circuit accessories and equipment
2. To acquire the skill in presenting list of components with full specification.
3. To acquire the skill in presenting an object in different views, sectional views in third angle projection.
4. To acquire the skill of drawing assembled views from views from views of parts and vice versa.
5. To acquire the skill in presenting an object in free hands sketch.

Topicwise Distribution of periods

SL. No.	Topic	Periods
1.	JOINT AND COUPLINGS	16
2.	ELECTRICAL SYMBOLS	09
3.	WIRING DIAGRAM	20
4.	DRAW DC MACHINE PARTS (Dimensional Drawing)	16
5.	DRAW A.C. MACHINE PARTS (Dimensional Drawing)	16
6.	DRAW 1-PHASE TRANSFORMER(Assembly Drawing)	16
7.	DRAW 3-PHASE TRANSFORMER(Assembly Drawing)	12
8.	ELECTRICAL LAYOUT OF BUILDING	15

C. Course Content terms of specific objectives:

1. JOINT AND COUPLINGS

- 4.1 Draw Cotter joint with list of components
- 4.2 Draw Knuckle joint with list of components
- 4.3 Draw Flange coupling with list of components

2. ELECTRICAL SYMBOLS AS PER BIS PRACTICES OF EQUIPMENT AND FITTINGS USED IN HOUSE WIRING,LABS AND POWER HOUSES.

3. DRAW WIRING DIAGRAM OF FOLLOWING WITH LIST OF COMPONENTS

- 3.1 3 point D.C motor starter
- 3.2 4 point D.C motor starter
- 3.3 Drum controller
- 3.4 DOL starter
- 3.5 Star delta starter

- 3.6 Auto Transformer Starter
- 3.7 Rotor resistance starter
- 3.8 control 2 lamp form 5 position
- 3.9 Relay operated bell circuits
- 3.10 Officer-PA response circuit

4. DRAW D.C. PARTS (Dimensional Drawing)

- 4.1 Pole with pole shoes (D.C.)
- 4.2 Commutator(D.C.)
- 4.3 Armature(D.C.)

5. DRAW A.C. MACHINE PARTS (Dimensional Drawing)

- 2.1 Alternator Stator without winding
- 2.2 Alternator Rotor for salient pole type
- 2.3 Alternator Rotor for smooth cylindrical type 5.1 Simple lap winding
- 5.2 Simple wave winding

6. DRAW 1-PHASE & 3-PHASE TRANSFORMER(Assembly Drawing)

- 6.1 Stepped core type
- 6.2 Plane shell type

7. DRAW 1-PHASE & 3-PHASE TRANSFORMER(Assembly Drawing)

- 7.1 core type
- 7.2 shell type

**8. DRAW ELECTRICAL LAYOUT OF BUILDING
INSTALLATION WITH LIST OF MATERIALS**

- 8.1** Draw lay out diagram of Electrical Installation (E.I)of one room building
- 8.2** Draw lay out diagram of E I of one bed room building
- 8.3** Draw lay out diagram of E I of one bed room building
- 8.4** Draw single line wiring diagram of E I of double bed room building

RECOMMENDED BOOK:

- 1. Electrical Engineering Drg. & Estimating by C.R. Dargon
 - 2. Machine drawing by T. Jhon and T.G. Jones
 - 3. Electrical Engineering drawing by prof. S.K. Bhattacharya
 - 4. Electrical drawing by K.L. Narang
- N.B After completion of each topic the student are required to submit assignment on concepts and applications. It is also required to solve mathematical problem as and when applicable.

5. GENERATION TRANSMISSION & DISTRIBUTION OF ELECTRICAL POWER

Total period:75
Period : 5 P/W (4+1)

Examination: 3Hrs
Total Marks: 100
Theory: 80
I.A:15+5

A. RATIONALE:

Power system comprises generation, transmission and distribution. In this subject generation , transmission and distribution, types of generation schemes , transmission with transmission loss and efficiencies , different type of sub-stations , different type of distribution schemes , EHV AC and HV DC transmission , underground cable and economics aspects involved are dealt with. Further types of tariff are briefly included to give brief and overall idea to the technicians.

B. OBJECTIVES:

To acquire knowledge of:

1. Different schemes of generation with their block diagram.
2. Mechanical and electrical design of transmission lines and numerical problems.
3. Types of cables and their methods of laying and testing.
4. Different schemes of distribution with problem solving
5. Different types of sub- stations.
6. Economic aspects of power supply system with problem and type of tariff of electricity.

C: Topic wise distribution of periods.

Sl.No	Topics	periods
1	GENERATION OF ELECTRICITY	08
2	TRANSMISSION OF ELECTRIC POWER	06
3	OVER HEAD LINE	08
4	PERFORMANCE OF SHORT & MEDIUM LINES	08
5	EHV TRANSMISSION	10
6	DISTRBUTION SYSTEM	10
7	UNDERGROUND CABLES	07
8	ECONOMIC ASPECTS	07
9	TYPES OF TARIFF	03
10	SUBSTATION	08

D : COURSE CONTENTS IN TERMS OF SPECIFIC OBJECTIVES.

1. GENERATION OF ELECTRICITY
 - 1.1 Give Elementary idea on generation of electricity From Thermal/Hydel/Nuclear
 - 1.2 Draw lay out of typical generating stations.
2. TRANSMISSION OF ELECTRIC POWER
 - 2.1 Draw layout of transmission and distribution scheme.
 - 2.2 Specify choice of voltage, efficiency of transmission
 - 2.3 State and explain Kelvin's law for economical size conductor.
 - 2.4 Explain corona and corona loss on transmission lines.
3. OVER HEAD LINES
 - 3.1 State types of supports, size and spacing of conductor.

- 3.2 calculation of size of stay wires, stays and struts taking into account I.E rules, Types of conductors
- 3.3 State types of insulator and cross arms
- 3.4 Derive for sag in overhead line with support at same level and different level (approximate formula effect of wind, ice and temperature on sag simple problem)

4. PERFORMANCE OF SHORT & MEDIUM LINES
- 4.1 Calculation of regulation and efficiency
5. EHV TRANSMISSION
- 5.1 Explain EHV AC transmission.
- 5.2 Explain Reasons for adoption.
- 5.3 Workout problems involved limitations.
- 5.4 Explain HV DC transmission
- 5.5 State Advantages and Limitations.
6. DISTRIBUTION SYSTEMS
- 6.1 Explain Radial and ring main system of distribution with problems.
- 6.2 Give Elementary idea or inter connection of power stations.
- 6.3 Workout Simple calculation on distribution network (single phase and three phase A.C.)
- 6.4 Explain Three phase four wire system arrangement.
7. UNDERGROUND CABLES
- 7.1 Explain cable insulation with diagram
- 7.2 State Types of L.T & H.T. cables with construction features.
- 7.3 State and Explain Methods of cable laying.
- 7.4 for Localisation of cable faults-Murray and Varley loop test for open circuit fault.
8. ECONOMIC ASPECTS
- 8.1 State and Explain Causes of low power factor
- 8.2 Explain Methods of improvement of power factor.
- 8.3 Define & Explain Load curves.
- 8.4 Define & Explain Demand factor
- 8.5 Define & Explain Maximum demand
- 8.6 Define & Explain Load factor
- 8.7 Define & Explain Diversity factor
- 8.8 Define & Explain Plant capacity factor
- 8.9 Define & Explain Off peak load
9. TYPES OF TARIFF
- 9.1 Explain Flat rate and two part tariff and block rate tariff with problems
10. SUBSTATION
- 10.1 Draw and Explain lay out of LT, HT and EHT substation.
- 10.2 Draw and Explain Earthing of Substation, transmission and distribution lines.

TEXT BOOK

1. A course in Electrical power by S.L Uppal
2. A course in Electrical power by Sony Gupta & Bhatnagar

REFERENCE BOOKS :

1. Electrical power by V.K.Mehta
2. Electrical power by H.V.Despande.

N.B. After completion of each topic the students are required to submit assignment on concepts and applications. It is also required to solve mathematical problems as and when applicable.

6. ELECTRICAL LAB PRACTICE-I

Total Period :90

Periods: 6 P/w

Examination-4 Hours

Total Marks-150

Practical-100, Ses-50

1. Measurement of earth resistance of an Earthing installation.
2. Study of a drum controller & 3-point DC motor starter connecting and running of DC motors.
3. (a) Study of different part, identification of terminals and testing of insulation resistance of a D.C. machine. (b) Dismantling and assembling of a D.C. machine and testing.
4. Determination OCC and external characteristics of shunt generator.
5. Maintain constant voltage of D.C. generator at different load conditions.
6. Speed variation of D.C. motor by (a) field /flux control (b) Armature resistance variation (Series and shunt motors)
7. Determination of efficiency of a D.C motor by brake test.
8. Determination of efficiency of a 1-phase transformer by direct loading.
9. Parallel operation of a 1-phase Transformer. (a) Equal impedance (b) Different impedance.
10. Parallel operation of a 3-phase Transformer.
11. Identification of terminals, OC test SC test and measurement of iron loss, No load current and no load P.F and measurement of copper loss and computation of Z_{eq} , R_{eq} and X_{eq} of a 1-phase transformer and determination of regulation.
12. Prepare a report on transformer accessories and cooling methods of a substation.
13. Test various domestic electrical appliances (at least three).

RECOMMENDED BOOKS:

Laboratory Courses in Electrical Engineering. By S. G. Tarnekar, S. D. Naik...

7. WORKSHOP PRACTICE

Total Period :90

Periods: 6 P/w

Examination-4 Hours

Total Marks-100

Practical-50, Ses-50

CARPENTRY

- 1.1 Name of carpentry tools and uses
- 1.2 Different operations
(a) Sawing, (b) planing, (c) Chiseling (d) Measuring & Marking
- 1.3 Different types of timbers used by carpenters, substitutions of timbers.
- 1.4 Jobs- (a) Slot, Notch
(b) Mortise and tenon joint
(c) Single dovetail joint

TURNING

Study of S.S. and S.C Lathes and their accessories practice in lathe work involving various operations Such as plane turning, step turning taper turning, knurling and external V Threading one job only.

DIRECTORATE OF TECHNICAL EDUCATION & TRAINING, ORISSA, CUTTACK www.dtetorissa.gov.in	STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ORISSA, BHUBANESWAR www.sctevtorissa.in
CURRICULUM DEVELOPMENT CELL	

TEACHING & EVALUATION SCHEME

DISCIPLINE : ELECTRICAL ENGG.

SEMESTER – FIFTH

Sl. No	Subject	Teaching Scheme(Hours/Week)			Evaluation scheme					Total Marks
		L	T	P	Theory			Practical		
					End Exam	Internal Assessment		End Exam	Sessional	
						Class Test	Assignment			
1.	ENERGY CONVERSION- II	4	1	-	80	15	5			100
2.	POWER ELECTRONICS & DRIVES	4	-	-	80	15	5			100
3.	COMPUTER APPLICATION – II	4	-	-	80	15	5			100
4.	ELECTRICAL DRAWING - II	2	-	6				100	50	150
PRACTICAL										
1.	ELECTRICAL MACHINES LAB			6				75	25	100
2.	COMPUTER APPLICATION – II Lab			3				50	25	75
3.	POWER ELECTRONICS LAB			4				50	25	75
		18	2	19						750

SYLLABUS

FIFTH SEMESTER ELECTRICAL ENGINEERING

1. ENERGY CONVERSION-II

Total period: 75
Periods; 5 p/w(4+1)

Examination: 3 Hours
Total marks :100
Theory -80
IA: 15+5

A. Rationale:

Modern industries are mostly equipped with AC machines, because supply of AC system is prevailing in the country. So the higher level diploma students of fifth semester are given a scope to study all most all electrical machines like synchronous generators, synchronous Motors, induction motors, single phase induction motors and fractional horse power motors and other special machines in this subject of Energy conversion II .The chapters deal with Machine construction, working principles, starting, speed control and performance characteristics with mathematical problems whenever applicable.

B. Objectives:

1. To describe various parts, their material specification with suitable reasoning and working principle of induction motor, synchronous motor ,synchronous generators, single phase AC motors and fractional horse power and other special machines.
2. To describe their operating principle and working characteristics.
3. To describe the losses and efficiency of all three phase machine like induction motor, synchronous motor, synchronous generator.
4. To describe methods of starting and speed control of AC motors.
5. To workout problems on generator EMF and load sharing of alternators.
6. To describe different test on such three phase machine.
7. To derive torque equation of above motors.

C: Topic wise distribution of periods.

Sl.No	Topics	periods
1.	ALTERNATOR	15
2.	SYNCHRONOUS MOTOR	10
3.	INDUCTION MOTOR	20
4.	SINGLE PHASE INDUCTION MOTOR	10
5.	AC COMMUTATOR MOTORS	10
6.	THREE PHASE TRANSFORMERS	10

D : COURSE CONTENT IN TERMS OF SPECIFIC OBJECTIVES.

1. ALTERNATOR

- 1.1 State types of alternator
- 1.2 Describe constructional details of non salient and salient pole rotor
- 1.3 Describe constructional details of stator
- 1.4 Explain armature winding, short pitch winding, pitch factor, distribution factor.
- 1.5 Derive E.M.F equation.
- 1.6 Explain Armature reaction.
- 1.7 Explain Alternator on load. (Solve problems)
- 1.8 Draw the phasor diagram of loaded alternator. (Solve problems)
- 1.9 Draw the characteristic of Alternator
- 1.10 State and explain open circuit and short circuit tests (Solve problems)
- 1.11 Determination of regulation of Alternator by direct loading and synchronous impedance method
- 1.12 Explain parallel operation and load division using synchroscope & dark and bright lamp method.

2. SYNCHRONOUS MOTOR

- 2.1 Explain construction
- 2.2 Explain principles of operation, phasor diagram
- 2.3 Explain Effect of varying load with constant excitation
- 2.4 Explain Effect of varying excitation with constant load
- 2.5 Derive Torque, Power developed
- 2.6 Explain power angle characteristics of cylindrical rotor motor.
- 2.7 Explain Effect of excitation on Armature current and power factor.
- 2.8 Explain Hunting & function of Damper Bars
- 2.9 State application

3. INDUCTION MOTOR

- 3.1 Explain and derive production of rotating magnetic field
- 3.2 Explain principles of operation
- 3.3 Explain constructional feature-squirrel cage and slip rings induction motors
- 3.4 Explain & derive Slip and relationship with rotor copper losses
- 3.5 Derive Torque during starting and running.
- 3.6 Derive for Rotor copper losses, rotor output and gross Torque.
- 3.7 Derive relation between full load torque and starting torque etc.
- 3.8 Derive condition for maximum torque under running condition
- 3.9 Derive Torque-Speed and load current speed characteristics.
- 3.10 Explain and state Methods of starting, different types of starter
- 3.11 Explain speed control by pole changing, Rotor Rheostatic control, voltage control.
- 3.12 Describe motor enclosures
- 3.13 Explain Induction Generator's and state its applications.

4. SINGLE PHASE INDUCTION MOTOR

- 4.1 Explain Single phase Rotating-Field theory of 1-phase induction motor.
- 4.2 Explain Ferrari's principle, net torque
- 4.3 Explain capacitor motor with principle
- 4.4 Explain split phase motor with principle.
- 4.5 Explain Shaded pole motors with principle
- 4.6 Explain their speed torque characteristics performance characteristics, applications.

5. AC COMMUTATOR MOTORS

- 5.1 Explain single phase series motor & Universal motors with principle.
- 5.2 Explain Repulsion Motors with principles

6. THREE PHASE TRANSFORMERS

- 7.1 Explain Grouping of windings, Advantages.
- 7.2 Explain Parallel Operation of the three phase Transformers
- 7.3 Explain Tap changer (On/Off load tap changing)
- 7.4 State Maintenance of Transformers.

TEXT BOOK

A text book of Electrical Technology by B.L. Theraja

RECOMMENDED BOOKS

- 1 Electrical Machines by I.J. Nagarth & D.P. Kothari
 - 2. Advanced Electrical Technology by H.Cotton
 - 3. Energy Conversion System by R.D.Begamudre.
 - 4. Electrical Machines by S.K.Bhattacharyya
- N.B. After completion of each topic the students are required to submit assignment on concepts and applications. It is also required to solve mathematical problems as and when applicable.

2. POWER ELECTRONICS

Theory – 4 p/w
Total Theory 60p

Examination: 3Hrs
Total Marks: 100
Theory: 80
I.A:15+5

A. RATIONALE:

The Power Electronics and drives is an inter disciplinary area using the members of thyristors family to control the electronics switching action and the principle of control theory. This subject is mainly applicable for Industrial application. In this subject the concept of AC line conditioning and different type of welding and heating has also been included.

B. OBJECTIVE

On completion of the subject the students will be able to

1. Understand principle, construction & application of different power devices used in industry.
2. State principle of DC Regulated Power supply.
3. Explain working of various DC regulator- using ICs.
4. Understand principle of AC regulated power supply.
5. Explain various protection methods for power semiconductor devices.
6. Understand principle of circuit break.
7. Describe and explain various methods & principle for controlling speed of DC motor.
8. State and explain various methods & principle for controlling speed of AC motor.
9. Explain principle of working & uses of Polyphase rectifiers.
10. Understand principle of working of Inverter & chopper.
11. Understand principle of working Resistance Welding.
12. Explain principle of working of Industrial & Di-electric heating.
13. Explain principle of working of UPS,CVT.
14. Understand working principle of Battery Charger.

C: Topic wise distribution of periods.

Sl.No	Topics	periods
1.	Power devices	13
2.	DC regulated power supply	09
3.	AC regulated power supply	09
4.	Protection of power semi conductor	05
5.	DC motor control	06
6.	AC motor control	08
7.	Rectifier ,Inverter & Chopper	13
8.	Welding & Industrial heating	07
9.	Un Interruptible power supplies	05
Total		75

D : COURSE CONTENTS IN TERMS OF SPECIFIC OBJECTIVES.

1. POWER DEVICES

- 1.1 Discuss construction, working principle of SCR.
- 1.2 State device specification & nomenclature
- 1.3 Describe the methods for turn on and turn off.
- 1.4 Describe triggering circuits.
- 1.5 Discuss various application of SCR.
- 1.6 Describe construction, application working principle of different power devices i. e .DIAC, TRIAC,UJT,LASER,GTO,SCS..
- 1.7 Discuss principle of operation & application for other power devices i.e. power diode, power transistor & power MOSFET
- 1.8 State principle of temperature control.

2. DC REGULATED POWER SUPPLY

- 2.1 Explain basic principle of Regulated power supply.
- 2.2 Discuss Series & Shunt Regulated power supply.
- 2.3 Explain working principle of following regulated ICs.
 - 2.3.1 IC 723
 - 2.3.2 IC78XX, 79XX, LM317, LM337
- 2.4 Explain concept of tracking regulator.
- 2.5 Explain principle of working & application of Switch Mode Power Supply.(SMPS).
- 2.6 Explain concept of Block regulator, Buck Boost regulator.

3. AC REGULATED POWER SUPPLY

- 3.1 Discuss principle of working of manual control regulator.
- 3.2 Discuss concept of tap changing.
- 3.3 Explain principle of working and application of Auto Transformer.
- 3.4 State the concept of BBT in automatic regulator.
- 3.5 Discuss step regulator.
- 3.6 Explain Servo regulator.

4. PROTECTION OF POWER SEMICONDUCTOR DEVICES

- 4.1 Discuss protection of power devices
- 4.2 State selection of devices.
- 4.3 Describe over voltage protection.
- 4.4 Discuss protection against.
 - 4.4.1 High di/dt
 - 4.4.2 High dv/dt
- 4.5 State basic idea of fuse protection.
- 4.6 State principle working & uses of circuit breaker.
- 4.7 Design snubber circuit using RC network
- 4.8 Explain protection against supply & load side transients.
- 4.9 State concept of cooling & heat sinks.

5. DC MOTOR CONTROL

- 5.1 Explain DC motor characteristics.
- 5.2 Explain types of speed control by
 - 5.2.1 Armature voltage control.
 - 5.2.2 Field current control.
- 5.3 Explain control rectifier devices.
- 5.4 Explain phase looked loop control of DC motor

6. AC MOTOR CONTROL

- 6.1 Explain characteristics of Induction motor.
- 6.2 Discuss types of speed variation by following method.
 - 6.2.1 Stator voltage control
 - 6.2.2. Frequency
 - 6.2.3 Closed loop.
 - 6.2.4 Cycle converter motor control.
- 6.3 Explain types of feedback.

7. RECTIFIERS, INVERTER, CHOPPER (USING CONTROLLED RECTIFIER)

- 7.1 Discuss following single –phase rectifiers
 - 7.1.1 Half wave rectifier.
 - 7.1.2 Full wave rectifier using center tap transformer.
 - 7.1.3. Full wave bridge rectifier.
- 7.2 Explain single –phase half wave rectifier with inductive load.
- 7.3 Explain single –phase full wave rectifier using RL load.
- 7.4 Discuss 3 phase rectifier with delta-star connected rectifier (single way)
- 7.5 Discuss 6 phase half wave rectifier with inter phase transformer
- 7.6 State principle type & uses of chopper.
- 7.7 State principle inverter & converter.
- 7.8 Explain series inverter & parallel inverter & its application.
- 8. WELDING & INDUSTRIAL HEATING.
 - 8.1 Discuss resistance welding process & type.
 - 8.2 State principle of inductance heating, merits and application.
 - 8.3 State principle of Dielectric heating & application.
- 9. UN INTERRUPTIBLE POWER SUPPLIES
 - 9.1 Explain working principle & use of UPS (on line & stand by)
 - 9.2 Describe principle of working of constant voltage transformer states uses
 - 9.3 Discuss automatic battery charger.

RECOMMENDED BOOKS

- 1 Industrial electronics by S.N Biswas.
- 2 Industrial power electronics by H.C.Ril.
- 3 Power electronics by M.S.Rasid.
- 4 Power electronics by P.C.Sen.
- 5 Power electronics by B.S.Bimra.
- 6 Power electronics by V.Subhramanyan.

3. COMPUTER APPLICATION-II

Examination: 3Hrs

Theory – 4 p/w
Total Theory 60p

Total Marks: 100
Theory: 80

A. RATIONALE :-

Computers are now-a-days necessary in human routine life. At each and every stage, we find its importance. In technical side, engineers are using computers extensively to solve their design problems, to create and to generate optimum designs, to prepare the design drawings, and preparations of project reports and routine correspondence, including site reports, critical decision support tables and summerising the facts in feedback.

Engineering drawing is an effective language for artisan to chief engineer. Here, an attempt is made to generate different skills like drawing an object through AutoCAD, report writing through MS-Word and to generate work sheets, data manipulation, graphs, for decision support system through MS-Excel.

B. OBJECTIVES

After successful completion of the subject, students will be able to

1. Get acquainted with different steps of development of a system.
2. Get acquainted with fundamentals of spreadsheet to work with Excel.
3. Get acquainted with fundamentals of Database & work with Access.
4. Get acquainted with basics of Visual Basic as a front-end tool.
5. Get acquainted with wiring programs using array, pointer ,function ,Structure & union, Strings & file in C.
6. Get acquainted with AUTOCAD & its use.

C: Topic wise distribution of periods.

Sl. No	Topics	periods
1.	Introduction to Computer system and software, Operating environments and Windows	04
2.	Introduction to CAD, Drawing & Editing drawing	30
3.	Report Writing using MS-WORD	10
4.	Worksheet & Graph preparation using MS-EXCEL	12
5.	Introduction to Internet	04

COURSE CONTENT

1. Introduction to Computer system and software,
 - Understand computer applications and its software requirements.
 - Know operating system and its use.
 - Use operating system commands.
 - Appreciate the use of computerized drafting.

2. Introduction to CAD, Drawing & Editing drawing

- Introduction to CAD software, Co-ordinate system, ACAD Demonstration and use drawing files, save, quit, end
- Identify the main menu and other menu options of AUTOCAD, Window, Word and Excel
- Commands POINT, LINE, P.LINE, OFFSET, ORTHO “,Drawing CIRCLE, ELLIPSE
- Drawing ARC with its various options “
- PDMODE, DIVIDE, MEASURE Command “
- Use of commands like BREAK, TRIM, ERASE, OSNAP, " REDRAW
- Use of commands like UNITS, UCS, LIMITS, SNAP, GRID, “ ZOOM, PAN
- DIMENSION BY DEFAULT & BY REQUIREMENT “
- BLOCK, INSERT, MINSERT, HATCH
- Draw any given Engineering drawing 1 room,2 bed room building
- Draw any given Engineering drawing 1 room,2 bed room building with E. I.
- Draw any given Engineering drawing DC Machine parts
- Draw any given Engineering drawing AC Machine parts
- Draw any given Engineering drawing motor starters
- Measure length and area of displayed object
- Edit stored drawing
- Edit stored report
- Distinguish different software
- Print/Plot the drawing, report, and letter.
- Appreciate the concept of Graphics user Interface

3. Report writing using MS-WORD

- Identify the main menu and other menu options of Window, Word
- Operate computer system. Different commands in MS-Word
- Introduction to WORD processor, data entry, save, quit, Demonstration and use retrieve.
- Basic settings, page layout, sizing, left and right margins, justification, tabulation “
- Editing text using deleting character, word, line, etc. search and replace, cut, copy, paste, move, sort file read and write file. "
- Apply parameter passing techniques using dialogue boxes.
- Understand the economy factor.
- Writing of different files, Editing, modify, copy, paste, mail, merge, delete etc (with all commands) in MS-Word
- Print the table/report/drawing

4. Worksheet & Graph preparation using MS-EXCEL

- Introduction to worksheet, workbook, cell, row, column, data entry, open, save, quit, help "
- Editing data, clean, insert, delete/copy/move cell/row/ column, formula and function for data entry,
- Worksheet settings, width of column, colour, heading, hide & display, align data, bold, italics, orientation
- Freeze cell/row/column, split, sort, filter " Chart sheet, save, colour types, legend " Prepare a worksheet and preview, page break, margins, header, footer, gridlines. Print a worksheet, workbook, workbook reference, managing directory and hard disc. Demonstration and use “
- Prepare and Handle multiple reports.
- Relate different data
- Select the software according to use requirement.
- Print the table/report/drawing
- Transfer the document to other computers using floppy/CD/DVD/PEN DRIVE
- Identify the menu/toolbar/dialog box/settings

- Identify different hardware of the computers
- Modify drawings/reports as per requirements.

5. Introduction to Internet

- . Introduction to Internet “,browse, download, upload, manipulate files (WORD, PDF etc)
- . Introduction to web page language

REFERENCES

1. Mastering AUTOCAD George Omura
2. Inside AUTOCAD Raker & Rice
3. MS Office Instant Reference
4. Windows Inside Peter Norton
5. Teach Yourself WINDOWS AI Steven

4. ELECTRICAL DRAWING II

Total period;120
Periods; 8p/w

Examination;4 Hours
Total marks ;150
Theory -100
Sessional-50

A. Rationale ;

A technician can take help of an engineering drawing to understand the machines and accessories. So electrical drawing II is introduced to the final year technical student in their 5th semester with assembled and dissembled views of machine like, Three phase alternator, induction motors, transformers of various types .Circuit diagrams of AC motors starters, single phase and three phase winding diagrams and alternators and induction motors with conventional symbols.

Sketching as to BIS and REC specification and symbol of electrical earthing installation, SP and DP structures and substations of 132/33 kv and 33/11 kv type. This will enable them to follow engineering drawing in the working environment.

B. Objectives;

- 1 To draw assembled view of dissembled parts of machines and transformers.
- 2 To draw dimensional drawing of machines
- 3 To develop the ability to identify different parts of electrical machines and prepare list of materials for various parts
- 4 To draw circuit diagram for different AC motor starters
- 5 To follow BIS and REC standard to draw earthing installation and SP and DP Structures and stay sets for line supports
- 6 To use various symbols to draw the single line diagram of 132/33 kv and 33/11 kv substations

Topic wise Distribution of periods

Sl. No.	Topic	
Periods		
1	SKETCHING AS PER BIS AND R.E.C.SPECIFICATION	16
2.	SKETCHING SINGLE LINE DIAGRAM OF SUBSTATION	16
3.	DRAWING OF VARIOUS PARTS OF THREE PHASE INDUCTION MOTOR	16
4.	COMPUTER AIDED ELECTRICAL DRAWING	20
5.	COMPUTER AIDED ELECTRONIC DRAWING.	20
6.	DESIGN OF SINGLE PHASE TRANSFORMER USING COMPUTER SOFTWARE	16
7.	DESIGN OF THREE PHASE INDUCTION MOTOR USING	
8.	COMPUTER SOFTWARE	16

C. Course content in terms of specific objectives;

- 1 Draw Sketches of the following as per B.IS. and REC specifications
 - 1.1 Earthing installation
 - 1.2 Single pole and double structure for LT And IIT distribution lines.
 - 1.3 Stay arrangements
2. Draw single line diagram of substation
 - 2.1 Single line diagram of a 132/33 kv Grid substation and 33/11 kv distribution substation
 - 2.2 Single line diagram of a 11/0.4 kv distribution substation
 - 2.3 Different bus bar arrangements
3. Draw Dimensional Drawing of various parts of 3-phase Induction Motor such as
 - 3.1 Stator
 - 3.2 Squirrel cage rotor
 - 3.3 Phase wound type rotor.
4. **COMPUTER AIDED ELECTRICAL DRAWING USING SOFT WARE.**
 - 4.1 Draw Electrical symbols (take Print out)
 - 4.2 Draw D.C. m/c parts (take print out)
 - 4.3 Draw A.C. m/c parts (take print out)
 - 4.4 Draw R-L series circuit (take print out)
 - 4.5 Draw R-C series circuit (take print out)
 - 4.6 Draw R-L-C series circuit (take print out)
 - 4.7 Draw A.C. & D.C. winding diagrams (take print out)

5. COMPUTER AIDED ELECTRONIC DRAWING.

- 5.1 Draw Electronic Symbol (take Print out)
- 5.2 Draw rectifier circuit (take print out)
- 5.3 Draw Amplifier circuit (take print out)
- 5.4 Draw Oscillator circuit (take print out)

6. DESIGN OF SINGLE PHASE TRANSFORMER USING COMPUTER SOFTWARE

- 6.1 Awareness of available software
- 6.2 Design of single phase transformer using software for given data (take print out)

7. DESIGN OF THREE PHASE INDUCTION MOTOR USING COMPUTER SOFTWARE

- 7.1 Awareness of available software
- 7.2 Design of three phase induction motor using software for given data (take print out)

RECOMMENDED BOOKS;

- 1 .Electrical Drawing by K.L.Narang
 2. Electrical Drawing and estimating by C.R.Dargon.
- N.B After completion of each topic the students are required to submit assignment on concept and applications .It is also required to solve mathematical problems as and when applicable.

PR 1. ELECTRICAL LAB PRACTICE-II

Total period:90
Period : 6 P/W

Examination: 4Hrs
Total Marks: 100
Practical : 75
Sessional-25

1. Study of direct on line starter, star-delta starter, auto transformer starter and rotor resistance starter -connecting and running a 3-phase induction motor and measurement of starting current.
2. Perform acceptance test on 3 - phase squirrel cage / slip ring Induction motor as per I.S
3. Perform no load & blocked rotor test on Induction motor & draw circle diagram.
4. Control the speed of Induction motor using electronic circuit.(Thyristor, DIAC and TRIAC)
5. Reverse the direction of rotation of single phase and three phase Induction motor
6. Heat run test of 3-phase transformer.
7. OC and SC test of alternator and determination of regulation by synchronous impedance method.
8. Determination of regulation of alternator by direct loading.
9. Parallel operation of two alternators.
10. Measurement of power of a 3-phase circuit to a 3-phase wattmeter.
11. Connection of 3-phase energy motor to a 3-phase load and measurement energy.
12. Study of voltage and current ratio of a 3-phase silicon controlled rectifier.
13. Connection and running of 1-phase motor -(a) Capacitor start motor(b) Shaded pole motor and Repulsion motor
14. Study of an OCB.
15. Study of induction type over current/ reverse power relay
16. Study of a Buchholz's relay
17. Study of an earth fault relay.

PR2. COMPUTER APPLICATION-II LAB

Period/week:4 Hours(Pr)
Total Contact hrs:60

End Exam-75marks
Sessional :25marks

LABORATORY EXPERIENCES TO BE PERFORMED

1. Introduction to the computer system Demonstration and use and computer software
2. Introduction to the operating system, file " identification, extension, bytes, directory.
3. Introduction to CAD software, Co-ordinate system, ACAD Demonstration and use drawing files, save, quit, end
4. Use commands POINT, LINE, P.LINE, OFFSET, ORTHO "
5. Draw CIRCLE, ELLIPSE "
6. Draw ARC with its various options "
7. PDMODE, DIVIDE, MEASURE Command "
8. Use of commands like BREAK, TRIM, ERASE, OSNAP, " REDRAW
9. Use of commands like UNITS, UCS, LIMITS, SNAP, GRID, " ZOOM, PAN
10. Use of commands like PEDIT, DONUT, POLYGON, " COPY, MIRROR, MOVE
11. Use of commands like ARRAY, CHAMFER, FILLET, " SOLID, OOPS

12. DIMENSION BY DEFAULT & BY REQUIREMENT “
13. TEXT BY DEFAULT & STYLE REQUIRED “
14. BLOCK, INSERT, MINSERT, HATCH “
15. LAYER ,COLOR ,LINETYPE “
16. LAYER SETTINGS “
17. PRINT DRAWING “
18. drawing Preparation Assignment -Draw any given Engineering drawing 1 room,2 bed room building
1 room,2 bed room building with E. I.- Draw any given Engineering drawing DC Machine parts
- Draw any given Engineering drawing AC Machine parts- Draw any given Engineering drawing motor starters
19. Introduction to WORD processor, data entry, save, quit, Demonstration and use retrieve.
20. Basic settings, page layout, sizing, left and right margins, justification, tabulation “
21. Editing text using deleting character, word, line, etc. search and replace, cut, copy, paste, move, sort file
read and write file. "
22. Introduction to worksheet, workbook, cell, row, column, data entry, open, save, quit, help "
23. Editing data, clean, insert, delete/copy/move cell/row/ column, formula and function for data entry,
24. Worksheet settings, width of column, colour, heading, hide & display, align data, bold, italics, orientation
Freeze cell/row/column, split, sort, filter "
25. Chart sheet, save, colour types, legend "
26. Prepare a worksheet and preview, page break, margins, header, footer, gridlines. Print a worksheet, workbook, workbook reference, managing directory and hard disc. Demostration and use “
27. Introduction to Internet “
28. Introduction to web page language. “

PR3. POWER ELECTRONICE LAB

Total period 75
No of periods: 5 p/w

Exam:4 hours
Sessional: 25
Examination: 50

1. Study switching characteristics of a transistor.
2. Study switch mode regulator.
3. Study Inverter circuit.
4. Study SCR characteristics Triggering of SCR (a) Phase controlled
(b) UJT controlled
(c) Cosine controlled
5. Study TRIAC characteristics and full wave voltage control method of it.
6. Study DIAC characteristics
7. Study drive circuit for SCR & TRIAC using DIAC.
8. Study drive circuit for SCR & TRIAC using UJT.
9. Study UPS & CVT.
10. Study servo stabilizer.
11. Construct battery charger.

12. Construct voltage regulation using IC 78XX, 79XX, LM317
13. Construct & test IC regulation using IC723.
14. To obtain characteristics of the IGBT.
15. To study control of DC load using SCR full control bridge rectifier.
16. To study series Inverter and single-phase Cyclo-converter.
17. To study chopper circuit.
18. To perform the speed control of DC motor using SCR & UJT.

DIRECTORATE OF TECHNICAL EDUCATION & TRAINING, ORISSA, CUTTACK www.dtetorissa.gov.in	STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ORISSA, BHUBANESWAR www.sctevtorissa.in
CURRICULUM DEVELOPMENT CELL	

TEACHING & EVALUATION SCHEME

DISCIPLINE :ELECTRICAL ENGG.

SEMESTER – SIXTH

Sl. No	Subject	Teaching Scheme(Hours/Week)			Evaluation scheme					Total Marks
		L	T	P	Theory			Practical		
					End Exam	Internal Assesment		End Exam	Sessional	
						Class Test	Assign-ment			
1.	Entrepreneurship & Industrial Management	4			80	15	5			100
2.	Electrical Installation & Estimating	4	1		80	15	5			100
4.	UTILISATION OF ELECTRICAL ENERGY & TRACTION	4	1	-	80	15	5			100
4.	Switch Gear and Protective Devices.	4	1		80	15	5			100
5.	Elective(Any One) i) HVDC Transmission ii)Power System Operation iii) MICROPROCESSOR AND ASSEMBLY LANGUAGE PROGRAMMING	4	1		80	15	5			100
	PRACTICAL									
1.	Electrical Works Psactice			6				75	25	100
2.	Project & Seminar			6				100	50	150
		18	3	18						750

SYLLABUS

SIXTH SEMESTER ELECTRICAL ENGINEERING

1. ENTREPRENURSHIP & INDUSTRIAL MANAGEMENT

Period/week;-5(4+1)

Total period -75

Examination-3 Hrs

End Exam -80 marks

I.A.-15+5

Total -100

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No	Topic	Periods
1.	Concept of Organisation & Enterprise	08
2.	Management	09
3.	Entrepreneurship & Management of S.S.Is	03
4.	Financial Accounting & Cost Control	03
5.	Stores & Marketing Management	03
6.	Human Resource Management	03
7.	Industrial Sickness	04
8.	The Factories Act 1948	05
9.	Workmen's Compensation & Payment of Wages Act	08
10	Industrial Dispute Act	04
11	Trade Union Act	04

A. RATIONALE

The course intends to provide the fundamental aspects of entrepreneurship as a means for self employment Management function in an organization coordinates various resources to allow the manufacturing activities to continues on a sustained basis. It is essential that the diploma engg. are given exposure industrial activities.

Various statutory rules acts regulations have been instituted in India by central / state Govt. to ensure that the workmen are not exploited and they can earn their livelihood with respect. As a supervisor / manager has to work in an industry under binding of such rules and act. They should have a fair idea of such rules / regulation.

B. OBJECTIVIES:

On completion of the course the student will be able to:

1. Understand the concept of different forms of organization & Management function.
2. Explain the concept of an entrepreneur in industrial environment & detailed idea of SSI and various related aspects.
3. Learn about financial accounting and cost control.
4. Know the different areas of management relating to stores & finance, production, sales & marketing and human resource in the organization.
5. Have a comprehensive idea on the some important legislation relating to factory, workmen's compensation payment of way, industrial disputes and trade union.

COURSE CONTENT:

1. Concept of Organization & Enterprise & Management
 - 1.1 Define & state the features of Business
 - 1.2 Explain the components of Business
 - 1.3 State the nature of different forms of Business organization.
 - 1.4 Define Management & differentiate Management with Administration.
 - 1.5 Discuss the function of Management.
 - 1.6 Discuss the principles of Scientific Management.
 - 1.7 Explain Organization structure and delegation of authority & responsibility.
 - 1.8 State the principles of a sound Organization.
2. Entrepreneurship & Management of S.S.Is
 - 2.1 Define and state the meaning of "Entrepreneurship"
 - 2.2 Discuss the Entrepreneurship characteristics.
 - 2.3 Explain the role of an Entrepreneur in industrial development.
 - 2.4 Define S.S.I. Ancillary, Tiny, Cottage, Medium, & large scale industries.
 - 2.5 Explain the features of SSI.
 - 2.6 Discuss the criteria for section SSI.
 - 2.7 Prepare a preliminary & detailed project report of a SSI.
 - 2.8 Enumerate the incentive available to SSI as per IPR.
 - 2.9 State the input required for setting up a SSI.
 - 2.10 Discuss the institutional support to SSI at state and National level(OSFC,OSIC,IPICOL,IDCO,SIDBI,IDBI,ICCI, & Commercial Banks)
3. **Financial Accounting & Cost Control**
 - 3.1 State the different types of Accounts & explain the double entry system of book keeping.
 - 3.2 Explain journal, Ledger, Trial Balance & Cash Book.
 - 3.3 Explain the components of Final Accounts and Balance sheet..
 - 3.4 Define cost and explain its elements.
 - 3.5 prepare a simple cost sheet.
 - 3.6 Explain cost- volume profit relationship & break- even- point.
4. **Stores & Financial Management**
 - 4.1 State the procedures involved in purchasing.
 - 4.2 Explain the centralized & decentralized purchasing.
 - 4.3 State the meaning & importance of Inventory control.
 - 4.4 Explain the different stores records Bin card, stores Ledger & Good Received Note etc.
 - 4.5 State the meaning & importance of Financial Management in context with S.S.I.
 - 4.6 Explain the type of capital Fixed & working.
 - 4.7 Discuss briefly the components of working capital management.
5. **Production Management:**
 - 5.1 State the importance of production, planning & control
 - 5.2 Discuss the steps involved in production planning & control
6. **State & Marketing Management**
 - 6.1 Discuss the importance of sales & marketing management.
 - 6.2 Mention & explain different selling methods
 - 6.3 Explain the product policy briefly. (Types of product, Packaging, Branding, Pricing, Cost plus pricing variable policy, price strategy)

6.4 Enumerate the techniques of sales promotion.

6.5 Explain Advertising & its media.

7. Human Resource Management

7.1 Mention the different sources of recruitment

7.2 Explain the different methods of selection.

7.3 Discuss the different training method.

7.4 State the need of performance appraisal.

8. Industrial Sickness

8.1 Define & explain the meaning of industrial sickness.

8.2 State the causes of Sickness

8.3 Explain the remedial measures to avoid industrial sickness.

9. The Factories Act

9.1 State the meaning objectives of Factories Act

9.2 Outline the various provisions related to Health, Safety, welfare, Hours of work, Holidays, Wage, Employment of Women, Accidents, diseases, Penalties & Procedures.

9.3 Explain the duties of Factor Inspector.

10. Workmen's Compensation & Payment of wages Act.

10.1 State the rules regarding Workmen's Compensation

10.2 Explain the employees liability for Compensation

10.3 State the obligations and right of employer.

10.4 Give the meaning of Payment of wages Act.

10.5 State the different rules for payment of minimum wages.

10.6 State the provisions of E.P.F. & E.S.I.

11. Industrial Dispute Act

11.1 Outline the objects & meaning of Industrial Dispute Act.

11.2 State the causes of Industrial Dispute .

11.3 Explain the measures for prevention of Industrial Disputes.

12. Trade Union Act.

12.1 State the meaning & functions of Trade Union

12.2 Explain the features of Trade Union Act.1926

BOOKS RECOMMENDED

1. Industrial Engineering & Management –O.P.Khana

2. Entrepreneurial Development-Gupta & Srivastav

3. Small Scale Industry-Vasanta Desai

4. Business Organization-Sharma & Gupta

5. Principles & Practice of Management –L.M.Prasad

6. Entrepreneurship for Engineers-B.N.Badhei

7. Industrial Law-N.D.Kapoor

2. ELECTRICAL INSTALLATION AND ESTIMATING

Total period-75
Period-5p/w

Examination-3 Hrs
Total Marks-100
Theory-80
I.A.-15+5

RATIONALE;

In the power transmission and distribution sectors, before taking a project ,an estimate of material is required in various stages like i)transmission line construction ii)distribution line construction iii)erection of domestic installation iv) service connection to industrial installation.

A calculation of number of different materials in the form of an estimate is prepared by the technician. Hence this subject Electrical installation and Estimating introduced in the final semester.

OBJECTIVES

1. To write down detailed specification and numbers required of different materials.
2. To determine the size and material of conductor and cable from electrical and mechanical consideration .As such to prepare a detailed list of materials with complete specifications.

Topic Wise Distribution of periods

Sl. No.	Topic	Periods
1.	Internal wiring	08
2.	IE rules and standards	06
3.	Estimate of material for domestic wiring	07
4.	Estimate of material for workshop wiring	07
5.	Estimate of material for single phase service connection	08
6.	Estimate of material for service connection to factory	08
7.	Estimate of materials for L.T. Distribution	09
8.	Estimate of materials for H.T. Distribution	11
9.	Material estimate for substation	11

COURSE CONTENT ;-(In terms of specific objectives)

1 INDIAN ELECTRICITY RULES

- 1.1 Definitions, Ampere, Apparatus, Accessible, Bare, cablew, circuit, circuit breaker, conductor , voltage(low,medium,high,EH), live,dead, cut-out, conduit, system, danger, Installation, earthing system, span, volt, switch gear, etc...
- 1.2 General safety precautions, rule 29, 30, 31,32, 33, 34, 35, 36, 40, 41, 43, 44, 45, 46
- 1.3 General conditions relating to supply and use of energy: rule 47, 48, 49, 50, 51, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70
- 1.4 O H lines : Rule 74, 75, 76, 77, 78, 79, 80, 86, 87, 88, 89, 90, 91

2. ELECTRICAL INSTALLATIONS

- 2.1 Electrical installations, domestic, industrial, Wiring Systems, Internal distribution of Electrical Energy, Methods of Wiring, Systems of Wiring, Wire and Cable, Conductor Materials Used in Cables, Insulating Materials, Mechanical protection, Types of cables Used in Internal wiring, Multi- Stranded Cables, Voltage Grinding of Cables, General Specifications of Cables
- 2.2 ACCESSORIES: Main Switch and Distribution Boards, Conduits, Conduit Accessories and Fittings, Lighting Accessories and Fittings, Fuses, Important Definitions, Determination of Size of Fuse –Wire ,Fuse units, Earthing conductor, Earthing, IS Specifications Regarding Earthing of Electrical installations, Points to be earthed, Determination of size of Earth Wire and earth Plate for Domestic and Industrial Installations, Material Required For GI Pipe Earthing

2.3 LIGHTING SCHEME ; Aspects of Good Lighting Services, Types of Lighting Schemes, Design of Lighting Schemes, Factory Lightning, Public Lighting Installations, Street Lighting, General Rules for wiring, Determination of Number of Points (Light, fan, socket ,outlets), Determination of total load, Determination of Number of Sub- circuits.

3. INTERNAL WIRING

- 3.1 Type of internal wiring, cleat wiring, CTS wiring, wooden casing capping, metal sheathed wiring, conduit wiring, their advantage and disadvantages comparison and applications.
- 3.2 Prepare one estimate of materials required for CTS wiring for small domestic installation of one room and one verandah within 25 m² with given light ,fan,& plug points.
- 3.3 Prepare one estimate of materials required for conduit wiring for small domestic installation of one room and one verandah within 25 m² with given light ,fan,& plug points.
- 3.4 Prepare one estimate of materials required for concealed wiring for domestic installation of two rooms and one latrine , bath, kitchen & verandah within 80 m² with given light ,fan,& plug points
- 3.5 Prepare one estimate of materials required for erection of conduct wiring to a small workshop installation about 30 m² and load within 10 KW .

4. OVER HEAD INSTALLATION

- 4.1 Main components of overhead lines, Line supports, Factors Governing Height of pole, Conductor Materials, Determination of size of conductor for Overhead transmission line, Cross arms, Pole brackets and Clamps, Guys and Stays, Conductors configuration, spacing and Clearances, Span lengths, Overhead line Insulators, Types of Insulators, Lightning Arresters, Danger plates, Anti- climbing devices, Bird Guards, Beads of Jumpers, Jumpers, Tee –offs, Guarding of Overhead lines.
- 4.2 Prepare an estimate of materials required for LT distribution line within load of 100 KW Maximum and standard spans involving calculation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation consideration using AAC.
- 4.3 Prepare an estimate of materials required for LT distribution line within load of 100 KW Maximum and standard spans involving calculation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation consideration using ACSR.
- 4.4 Prepare an estimate of materials required for HT distribution line (11 KV) within 2 km and load of 2000 KVA Maximum and standard spans involving calculation of the size of conductor (from conductor chart), current carrying capacity and voltage regulation consideration using ACSR.

5. OVER HEAD SERVICE LINES

Components of service lines, service line (cables and conductors), bearer wire, lacing rod, Ariel fuse, service support, energy box and meters etc.

Prepare one estimate of materials required for service connection to a factory building with load within 15 KW using insulated wire.

Prepare one estimate of materials required for service connection to a factory building with load within 15 KW using bare conductor and insulated wire combined.

6 Prepare one materials estimate for following types of transformer substations.

(a) Pole mounted substation

(b) plinth Mounted substation

RECOMMENDED BOOKS

1. Electrical Estimating and Costing by Gupta.
2. Electrical Wiring, Estimating & costing by Dr.S.L.Uppal.
3. Electrical Drawing & Estimating C.R.Dargon.
4. Electrical Engineering by K.B.Raina and S.K.Bhattacharya

N.B. After completion of each topic the students are required to submit assignment on concepts and applications. It is also required to solve mathematical problems as and when applicable.

3. SWITCH GEAR AND PROTECTIVE DEVICES

Total period -75
Periods -5p/w

Examination-3Hrs
Total Marks-100
Theory-80
I.A.-15+5

RATIONALE;-

Switch gear and protection plays an important role in the protection off Electrical power system. Since the demand of Electrical power is increasing the job of generation ,transmission & distribution of Electrical energy is becoming very completed .To maintain the energy supply to the consumer switching producer with protection are to be maintained Moreover new models of Switch gear and protection circuits are also being developed. The use of interconnection bus with National power grid is practiced now a days .For this reason the technicians involved in maintenance and operation of this type of switch gear and protecting devices need to be trained in proper manners. In the subject information on above context have been included so that the updated knowledge can be given to the students of Diploma in Electrical Engineering.

OBJECTIVES;

To acquire the knowledge of ;-

- (a) the basic principles of protection of feeders and electrical devices like transformer
- (b) the devices used in Protection Circuit
- © Fundamental principles of construction operation
- (d) Testing of Protective systems and switch gears

Topic wise Distribution of Periods

Sl.No	Topics	Periods
1.	Faults in power system	12
2.	Fuses	06
3.	Circuit Breaker	18
4.	Protective system	22
5.	Lightning Arrestors & Surge Divertors	10
6.	Introduction to State Relays	07

Course Content of terms of specific objectives.

1. FAULTS IN POWER SYSTEM

- 1.1 State Sources of fault
- 1.2 State Limitation of fault current, percentage reactance, base KVA
- 1.3 Calculation of symmetrical three phase short circuit current.
- 1.4 State types of reactors and their uses.
- 1.5 Methods of locating reactors for generators Bus bars and feeders.

2. FUSES

- 2.1 Explain Importance of fuse material
- 2.2 Explain fusing current
- 2.3 Explain HRC fuse with different characteristics and its uses.

3. CIRCUIT BREAKERS

- 3.1 Explain Principles of arc extinction
- 3.2 Explain current interruption in circuit breakers
- 3.3 Explain Restriking
- 3.4 Explain Resistance switching
- 3.5 Explain Current chopping and switching off unloaded transmission lines
- 3.6 Explain Air break switches
- 3.7 Explain Working principle of all circuit breakers
- 3.8 Explain Air Circuit breaker and Air blast circuit breaker
- 3.9 Explain Rating of circuit breaker.

4. PROTECTIVE SYSTEM.

- 4.1 Explain Essential Qualities of good protective system principal of relaying, Primary and back-up protection.
- 4.2 State Types of Relays (Armature attraction type relay plunger type, Induction type ,Balance beam type relay) Over current, Overload No volt relay.
- 4.3 Explain protection of feeder by over current and earth fault relay.
- 4.4 Explain direction relay and its applications.
- 4.5 Explain Merz price circulating current principle, bias differential relay and its application to generator and transmission protection.
- 4.6 Explain distance protection (off-set mho relay, reactance relay)
- 4.7 Explain Buchholz relay (single float and double float type)
- 5. LIGHTING ARRESTORS AND SURGE DIVERTORS**
- 5.1 Explain concept of lightning phenomenon, voltage and frequency of lighting.
- 5.2 Explain Necessity of protection against lighting in power system.
- 5.3 Explain principle of Horn-gap and Metal oxide type lighting arrester.
- 6. INTRODUCTION TO STATIC RELAYS**
- 6.1 State Advantage of static relays
- 6.2 Explain Instantaneous over current relays
- 6.3 Explain the working principle of IDMT relays

TEXT BOOK

Electrical power by S.L.Uppal

RECOMMENDED BOOKS

1. Electrical power by Soni ,Gupta and Bhatnagar.
 2. Electrical power system and Design by M.V .Despande
 3. Switchgear and protection by V.K.Meheta
- N.B. After completion of each topic the students are required to submit assignment on concepts and applications. It is also required to solve mathematical problems as and when applicable.

4. UTILIZATION OF ELECTRICAL ENERGY AND TRACTION

Total period-60
Period-4p/w

Examination-3 Hrs
Total Marks-100
Theory-80
I.A.-15+5

RATIONALE;

There is great demand for utilization of electrical power in various fields in the form of power for electrolysis and illumination, electrical heating, electrical welding, electrical traction and for electrical drives. Hence these aspects are taken care of in the subject of utilization of electrical energy and traction to give exposure of the student in the senior 6th Semester level.

OBJECTIVES

1. To acquire knowledge of principle of ionic dissociation and electrolysis and loss involving in the process ,usage of this process.
- 2.To compare the advantages of the electrical heating over others and to acquire knowledge of Types of electrical heating as employed in the electrical overn induction furnaces and arc furnaces and dielectrical ovens.
3. To acquire knowledge of principle of arc welding and resistant welding, their types and single and multi operator type are welding plants.
4. To define various terms used in illumination engineering to design lighting schemes with specific attention to laws of illumination to explain the working and construction and use of flour sent lamp, SV lamp ,H.P MV and Neon lamps.
- 5.To classify various types of industrial drives and to choose the right type of drive considering their strating and running characteristics.
6. To classify various methods of traction and traction motor and type of control and types of breaking.

Topic Wise Distribution of periods

Sl. No.	Topic	Periods
1.	Electrical Process	08
2.	Electrical Heating	08
3.	Principles of Arc Welding	08
4.	Illumination	12
5.	Industrial Derives	10
6.	Electric Traction	14

COURSE CONENT IN TERMS OF SPECIFIC OBJECTIVES

1. ELECTROLYTIC PROCESS

- 1.1 Explain fundamental principle of ionic dissociation.
- 1.2 State Faraday's laws of electrolysis
- 1.3 State Simple examples of extraction of metals.
- 1.4 Give Elementary idea about commercial usefulness of electrode position

2. ELECTRICAL HEATING

- 2.1 State Advantage of Electrical Heating.
- 2.2 Explain Mode of heat transfer and Stephen's Law of Radiation and Radiant heater.
- 2.3 Discuss Heating resistance ovens.
- 2.4 Explain principle of core type and coreless type induction furnaces.
- 2.5 Explain principles of direct are and indirect arc furnaces.
- 2.6 Explain Directive heating and its applications.

3. PRINCIPLES OF ARC WELDING

- 3.1 Explain principle of arc welding.
- 3.2 Explain D.C &A.C phenomena
- 3.3 Explain study of D.C &A.C. arc welding plants of single and multi-operation type.
- 3.4 Explain types of arc welding.

- 3.5 Explain principles of resistance welding
- 3.6 Explain Descriptive study of resistance welding plant.

4. ILLUMINATION

- 4.1 Radiant efficiency
- 4.1.2 Luminous flux
- 4.1.3 Luminous intensity
- 4.1.4 Lumen
- 4.1.5 Intensity of illumination
- 4.1.6 MHCP
- 4.1.7 MSCP
- 4.1.8 MHSCP
- 4.1.9 Brightness
- 4.1.10 Solid angle
- 4.2. Explain polar curves
- 4.3 Explain the inverse square law and the cosine law.
- 4.4 Describe light distribution and control and related definitions like maintenance factor and depreciation factors.
- 4.5 Design simple lighting schemes and depreciation factor.
- 4.6 Explain Filament lamps, effect of variation of voltage on working of filament lamps.
- 4.7 Explain Discharge lamps.
- 4.7.1 State Basic idea about excitation in gas discharge lamps.
- 4.7.2 State constructional features and operation of :-
Fluorescent lamp. (PL and PLL Lamps)
- 4.7.3 Sodium vapour lamps.
- 4.7.4 High pressure mercury vapour lamps.
- 4.7.5 Neon signs.
- 4.7.6 High lumen output & low consumption Fluorescent lamps.

5. INDUSTRIAL DRIVES:

- 5.1 State group and individual drive.
- 5.2 Explain choice of electric drives.
- 5.3 Explain starting and running characteristics of DC and AC motor
- 5.4 State Application of :
DC motor
3 phase induction motor
3 phase synchronous motors
Single phase induction, series and repulsion motor industry.

6 ELECTRIC TRACTION

- 6.1 Explain system of traction.
- 6.2 Explain DC and AC traction motor.
- 6.3 Explain single phase motor for traction.
- 6.4 Explain control of motor
 - 6.4.1 tapped field control
 - 6.4.2 Multi-unit control
 - 6.4.3 Metadyne control

- 6.4.4 Rheostatic control 11
- 6.5 Explain Braking of the following types
 - 6.5.1 Regenerative Braking
 - 6.5.2 Braking with 1-phase series motor
 - 6.5.3 Magnetic Braking

RECOMMENDED BOOKS

- 1 A course of electric power by Soni, Gupta & Bhatnager.
 2. Utilization of Electrical Energy by E.I. Taylor
 3. Utilization of Electrical Energy by Reaction by G.C. Gerg.
- N.B. After completion of each topic the students are required to submit assignment on concepts and applications. It is also required to solve mathematical problems as and when applicable.

5. ELECTIVE (Any One)

Total period-60
Period-4p/w

Examination-3 Hrs
Total Marks-100
Theory-80
I.A.-15+5

i) H V D C TRANSMISSION AND DISTRIBUTION (ELECTIVE)

1. General Background

Energy Transmission. Hierarchical AC Transmission voltages levels. Tasks .Choice. Applications. EHV-AC transmission. Configuration, Engineering features ,Rated voltages ,Number of circuits, Intermediate Substations ,Compensation of Reactive power. HVDC systems. Applications & Types , Bipolar, Back-to-back, Multi-Terminal HVDC. Criterion of choice. Limitations, Configuration, Equipment in HVDC substations, HVDC Cable transmission. Interconnected AC networks. Voltage Control and frequency control. Power flow in AC line and in HVDC line.AC and HVDC Interconnections. EHV –AC versus HVDC. Economic comparison. Prospects of HVDC. Transmission planning. Communication in Transmission Network. Scope of subject. Summary and questions.

HVDC Transmission

2. HVDC Power Flow

Subscripts and symbols. Thyristor principle and control. Power conversion principle. Direct voltage U_d-1 and U_d-2 . Power at Rectifier-end P_d-1 . Power at Inverter-end P_d-2 . Power loss in DC system. Power in middle of HVDC line. Power at sending end. Power at receiving end. General equations. Solved Numerical Examples on P_d and U_d . Summary and questions.

3. Steady State U_d/I_d Characteristic

Functional Requirements.AC and DC Questions. Steady state U_d/ I_d characteristics. Principle of Stable Operation. Intersection of rectifier and Inverter characteristics. Margin control. Setting of Rectifier control and inverter control .Reversal of HVDC Power flow.Operating modes of Bipolar 2T HVDC system. Start and loading and stopping of HVDC power flow.Summary.

4. Converter Connections, Rectifier and Inverter Waveforms

Rectifier Bridge Connections and waveforms on AC and DC side six pulse Bridge (Graetz Bridge).12-pulse Bridge. Phase control and delay Angle. Effect of phase control on DC voltage. Valve voltage. Inversion. Connections of Converter Bridge. Commutating Reactance. Angle of Overlap Extinction Angle. Control of DC voltage.Configuration of Bipolar 2T HVDC system, valves and converters.

5. Equations of voltage and current on AC and DC side.

Assumptions Average and RMS value. Symbols. Rectifier No load Voltage Equation with Zero delay Angle and with delay angle.Control DC voltage. Voltage equation for S- unit Converter. Rectifier voltage. With ξ and u . Current on Primary and secondary sides. Fundamental component Of current. Rating of converter transformer. Equivalent circuit of Rectifier. Characteristics of rectifier. Equation of Inverter Equivalent circuit of inverter.Complete Equivalent circuit of HVDC system. Terms and definitions .Rectifier and inverter Equations. Minimum extinction angle.Practical Significance of equations summary and questions.

6. Fundamental of Harmonics and Network Harmonic Impedance

Fourier Analysis. Characteristic Harmonics .Terms and definitions.Fourier series. Characteristics AC current Harmonics. Non characteristic AC current Harmonics. Harmful effects. Interaction with AC Network. Adequateness of AC Harmonic Filters. summary and questions.

7. Harmonic Filters

Terms and definitions. Filter. Surge Suppressors, Damping circuits. Resonance. Quality Factor. Band width. Shunt filters. Series filters. Acceptable level of Harmonics. Configuration of AC Filters.Design of AC Filters. Design of Single frequency tuned filters. Double Frequency Tuned Filters.Cost considerations of AC Harmonic Filters. Rating of AC Capacitors in Tuned Branch. Harmonics in DC voltage. DC Harmonics Filters. summary and questions.

8. Reactive power Compensation in HVDC Substations

Reactive power requirements of HVDC Converters, P.Q.S, Reactive power Q required by converter, and HVDC Substation. Reactive power equations. Effect of delay angle and Extinction angle. Short circuit Ratio (SCR).Impedance of AC Network. Equivalent short circuit ratio.SCR in Planning of HVDC .Transient voltage rise. summary and questions.

9. Earth Electrode and Earth Return.

Terms and definitions. Objectives. Location and Configuration of Earth electrode. Material of anode Sea electrode. Current density. Resistance of earth electrode.Earth resistance of Straight Electrode.

10. Configuration and Lay out of HVDC Terminal

Configuration of terminal station. Lay out of a Bipolar Terminal Station. Concept behind lay out. Choice of converter connections. Valve hall and control building Converter Valves.HVDC Yard.

Rihand Delhi Bipolar HVDC system. Back to Back HVDC Coupling station. summary and questions.

11. HVDC Circuit breaker and Metallic Return Transfer Breaker and Parallel Tap Circuit breaker.

Application of MRTB and Parallel Tap. Interruption of DC Currents of high switching energy. Commutation principle Commutation circuit.Switching energy Main Circuit Breaker. Metallic Return Transfer Breaker.(MRTB). Types of HVDC Circuit Breakers.A,B .Capability and characteristics of HVDC Breaker. Switching Times Short circuit Ratio. Effective short circuit ratio. Parallel tapping of HVDC line. Summary and Questions.

12. Multi-Terminal HVDC Systems.

Two pole HVDC with earth return, Substation poles in different locations. MTDC system with Series connected converters. Control of parallel connected HVDC system. Reversal of power in a terminal of HVDC system. Three TDC system with parallel tapping .Two pole reversal in 3 TDC system. HVDC Breakers in MTDC system. Applications of MTDC system. Worlds First commercial 3 TDC System. Worlds First 5 TDC System . Configuration and Type of HVDC system. Summary and Questions.

13.Protective Zones and Protective systems in HVDC Substations.

Faults in HVDC Systems. Fault clearing of DC Transmission line. Protective zones in HVDC Systems .Protection systems in HVDC Substation. HVDC line protection, clearing of line faults and re-energising of line. Abnormal operating conditions in converter transformer Protection. AC filter protection. Protection of AC Bus bars and AC yard equipment. Summary and Questions.

14.CONVERTER TRANSFORMERS

Transportation of converter Transformers. Alternatives connections in Main circuit..Construction and Installation. MVA Rating of converter Transformers. Rated Quantities of Converter Transformers Withstand strength ,Noise levels ,Windings .On- Load Tap Changer .Bushings, Creepage Insulation of

valve winding. Polarity Reversal .Stresses on Insulation of valve winding. Polar formers. Standard specifications of converter Transformers. Type Tests and Routine Test of Converter Transformers. Summary and Questions.

15.DCCT and DCVT in HVDC Substations

DC voltage Measuring Systems.DC current Measuring System. Summary.

ii) POWER SYSTEM OPERATION (ELECTIVE)

1. SOURCES OF ELECTRICAL ENERGY

- 1.1 Explain importation of electric power plant.
- 1.2 State and explain source of electrical energy.
- 1.3 Explain conventional and non- conventional method of electric power generation.
- 1.4 Given block diagram of hydro electric thermal and nuclear power plant.

2. RENEWABLE ENERGY

Explain with block diagram

- 2.1 Solar Generation.
- 2.2 Tidal Generation.
- 2.3 Wind power Generation.
- 2.4 Geothermal power Generation.

3. ECONOMICAL LOADING AND ECONOMIC ASPECTS

- 3.1 Explain factors governing plant location.
- 3.2 Explain selection of site.
- 3.3 No of units load, curves
- 3.4 Economic loading of the plant.
- 3.5 Capacity scheduling, inter connection of power system and load division.
- 3.6 Cost of generation of electrical energy.

4. MAJOR EQUIPMENTS

- 4.1 Show and explain Arrangement of Generators and Bus Bars
- 4.2 Show Panel equipments
- 4.3 Control Panel equipments
- 4.4 Electrical and Mechanical measuring devices
- 4.5 Repair and maintenance scheme in the plant
- 4.6 Necessity of store and spare

5. SUB-STATION PROTECTIVE EQUIPEMENTS

- 5.1 Explain Necessity and arrangement of protective devices
- 5.2 Explain protective devices for
 - 5.2.1 Alternator
 - 5.2.2 High voltage transformer
 - 5.2.3 Bus bars
- 5.3. Explain Reactors with location and use.
- 5.4 Explain protective devices for transmission lines

6. SUB-STATION

State & Explain

- 6.1 Classification & Choice
- 6.2 Advantages of cut door- substation.
- 6.3 Bus bar arrangements of high voltage and low voltage side.
- 6.4 Control panel equipments
- 6.5 Commissioning testing
7. POLLUTION IN THE POWER PLANT
- 7.1 Sources of pollution
- 7.2 Process control for water, Air, Solid Waste
- 7.3 Methods adopted for minimizing pollution
8. VOLTAGE CONTROL
- 8.1 Explain method of voltage control by reactive power sharing

RECOMMENDED BOOKS

1. Electrical Power by S.L. Uppal
2. Power by P.C. Sharma
3. Electrical power system and design by M.V. Deshpande
6. Testing maintenance and repair of electrical machine and equipment by Jaggi.

N.B. After completion of each topic the students are required to submit assignment on concepts and applications. It is also required to solve mathematical problems as and when applicable.

iii) MICROPROCESSOR AND ASSEMBLY LANGUAGE PROGRAMMING

1. RATIONALE:

This course gives understanding of fundamentals of microprocessor, its architecture and working. It develops the programming skill of the 8085, which is useful for interfacing peripherals. It also gives an overview of microprocessor and its applications.

4. OBJECTIVES :

The student should be able to :

1. Understand the functioning of the microprocessor thoroughly
2. Write programs in 8085 assembly language.
3. Know the salient features of the advanced microprocessor
4. Know the working of the micro-controller.

TOPICS

1. MICROPROCESSOR ARCHITECTURE & MICROPROCESSOR SYSTEM,

- 1.1 Microprocessor Architecture and its operation: Microprocessor initiated operations and 8085 BUS organisation, Internal data operations and 8085 registers.
- 1.2 Memory: Memory organisation, Memory map, Memory read and write.
- 1.3 Microcomputer system
- 1.4 8085 Microprocessor: Block diagram, Address and data bus, control and status signals, Power-supply and clock frequency, Interrupts and externally initiated operations, serial I/O ports, BUS timings, Flags.

2. 8085 INSTRUCTION AND TIMING,

2.1 Instruction classification: Review of 8085 operations

2.2 Instruction Formats: Single bytes, Two bytes and Three bytes instructions, Opcode format, Instruction Timings and operation status, simple programs.

3. 8085 INSTRUCTION SET,

3.1 Data transfer instructions.

3.2 Arithmetic Instructions.

3.3 Logical operations.

3.4 Branch operations.

3.5 Stack, I/O and Machine control Instructions.

3.6 Simple programs using 8086 Instructions.

4. PROGRAMMING TECHNIQUES,

4.1 Looping, Counting and Indexing.

4.2 Logic operations

4.3 Counter and Timing delays.

4.4 Stack and Subroutines.

4.5 Code conversion, BCD Arithmetic and 16 Bit data operations.

5. ADVANCE MICROPROCESSOR,

5.1 8086 /8088 Architecture

5.2 32 bit Microprocessor 80386: Introduction/ Architecture

5.3 The Intel Pentium processor: Internal block diagram

5.4 RISC processor: Introduction & features

6. MAIN MEMORY SYSTEM,

6.1 Types of main memory

6.2 CPU read/write timing

6.3 SRAM and ROM interface requirement

6.4 Interfacing dynamic RAM

6.5 Troubleshooting the memory module

7. MICRO-CONTROLLER,

7.1 Architecture and its operation

7.2 Memory organisation

7.3 Comparison between microprocessor and micro-controller

7.4 Applications

. REFERENCES:

1. Microprocessor Arch., Programming & by R.S. Gaonkar -

2. The 8080/85 Family:

Design, Programming & Interfacing by John Ufferbeck

3. Introduction to microprocessor by A.P. Mathur

4. 8080 assembly language programming by Lance A. Leventhal

5. The 8086/8088 family: Design, Gross & Interfacing by John Uffenbeck –

6. ELECTRICAL WORKSHOP PRACTICE

Total Period ;90
Period 6p/w

Examination-4 Hrs
Total Marks-100
Practical-50
Sessional-50

1. Preparation of pipe Earthing installation for residential buildings
2. Preparation of Britannia T-joint and Married joint.
3. Connection and Testing of fluorescent lamp, high pressure M.V. Lamp, sodium vapour lamp, metal halide lamps, CFL and latest developed lamps--measure inductance of each choke.
4. Prepare battery charger
5. Residential building wiring practice for CTS and conduit wiring and testing.
6. Fault finding & repairing of fan motor
7. Fault finding & repairing of D.C. Generator
8. Battery charging and test the voltage and specific gravity.
9. Construction of a fan speed regulator using TRIAC.
10. Fault finding of D.C. motor starter and A.C. MOTOR STARTER
11. Power cable jointing with cable box and jointing compounds.
12. Using crimping tools and sockets for LT & HT cables.

7. PROJECT WORK & SEMINAR

Total period 120

Total marks -100
End Exam-50
Sessional-50

RESONALE

The project work is to integrate the knowledge, skill and attitudes developed after completion of the subjects for developing competency in a particular specialized job. In this activity the role of teacher is a facilitator co-ordinator. The students will select a topic, perform design work, place the indents and get the raw materials either from the department or from the local market and implement the design. The leadership quality, Coordination of job and maintaining a good communal harmony is important factor of this type of activity. It is the process, which is to be evaluated along with students knowledge and their dedication. The success of the project is no doubt the goal but the group activity will also be critically evaluated.

OBJECTIVES

On completion of the project work the students will able to

1. Select a suitable topic
2. Designing of the job.
3. Scheduling the job
4. Indenting
5. Procuring of materials
6. Developing leadership quality
7. Developing cost awareness
8. Effective utilization of time
9. Develop marketing strategies

COURSE CONTENT (in terms of specific objectives)

TOPIC-1 MINOR PROJECT .

(Group of 4 to 5 students)

Suggested list of projects

- Some Fabrication of small equipment/machines/ circuits

1. Fabrication of a Tube light Choke
2. Assembly of small electronic circuits
3. Assembly of an experimental boards.
4. Fabrication/ rewinding of no-volt coil. (N.V.C.)
5. Preparation of printed circuit board. (PCB)
6. Designing, Testing a Battery eliminator
7. Small audio amplifier (7-watt.)
8. Automatic water level controller.
9. Earthing of electrical machines/ equipment etc.
10. Preparation of useful charts for Laboratory.

TOPIC -2 MAJOR PROJECT (Group of 4 to 5 students)

- Suggested Major projects for reference.

1. Rewinding of 3 phase small induction motor. (1 H.P)
2. Design and Fabrication of small transformer. (Up to 1 KVA)
3. Rewinding of single phase motor (FHP).
4. Rewinding of Universal motor (FHP)
5. Fabrication and assembly of 3 phase D.O.L. or star delta starter.
6. Single phase voltage stabilizer. (500 V A)
7. Assembly of auto transformer (3 Amp)
8. Assembly of desert cooler.
9. Electronic speed control of motor.
10. Digital Thermometer.
11. Single phasing preventor.
12. Prepare wiring layout of Polytechnic building.
13. Rewinding of ceiling fan.
14. Fabrication of some electronic items like, Digital wall clock, Emergency tube light, cassette player AM /FM Receiver (2 band), B/W T.V., sequence timer, intercom etc.
15. Preparation of layout of Thermal, Hydro or nuclear power plant on Acrylic sheet.
16. Preparation of layout of Thermal, Hydro or nuclear power plant on Acrylic sheet.

TOPIC-3 ELECTRICAL MAINTENANCE PROJECT OR TECHNICAL REPORT OF A NEARBY INDUSTRY.

- * Overhauling of 3 phase induction motor.
- * Overhauling of 1 phase induction motor.
- * Maintenance of power transformer.
- * Maintenance of circuit breaker.
- * Maintenance of D.O.L. Starter.
- * Maintenance of 3 phase star delta starter.
- * Maintenance of rotor resistance starter.
- * Maintenance of D.C. shut motor starter.
- * Maintenance of portable generating set.
- * Maintenance of Battery.
- * Maintenance of Loading rheostat.
- * Maintenance of Single phase/ 3 phase variac
- * Maintenance of D.C. motor

NOTE :-

A group of 4 to 5 students have to perform any one exercise and prepare its report.

In the project work there are Three main topics. In topic No. 1 one minor project is to be prepared. In topic no. 2 one major project is to be prepared and in topic No. 3 one project on maintenance is to be undertaken.

Project report should be in details, which includes list of components used, testing of component, fabrication and work distribution, testing and fault finding, drawing of circuit diagram and costing etc.

SEMINAR :-

Project report should be defended in the classroom in the presence of at least two

Experts (better to be one from industries) and Questions and doubts from the students as well as from experts should also be invited.(The weightage of T.W. should be on seminar by student)

: POWER STATION ENGINEERING

1. RATIONALE:

The consumption of electrical energy is universally accepted as a tool for measuring the living standard of the nation and its people. Therefore, the growth of power industries play an important role in the economic development of the nation. The scientists of every nation are in search of new energy sources for power generation which are more advantageous than conventional energy sources and easily available. With this technological advances, nation needs skill based, trained technocrats in different areas like, system analysis, equipment installations, testing, commissioning, operation, safety, maintenance etc. The technocrats should also be aware in pollution control, chemical analysis of fuels and safety areas. Essential efforts are made in this course to ensure that students develop above skills and awareness of different areas to become successful technocrats.

OBJECTIVES:

1. Draw the layout of different power station.
2. List the specifications of PowerStation auxiliaries.
3. Understand the testing methods of control and power cables.
4. Understand the importance of interconnected system.
5. Solve the numerical problems on power plant economy.
6. List the methods of pollution control in power station.
7. Observe safety measures applied in power station.
8. Understand the importance of chemical analysis of fuels.
9. Understand the personal setup of modern power stations.

5. TOPICS AND SUB-TOPICS:

1. POWER STATION EQUIPMENT AND THEIR LAYOUT.

- 1.1 Electrical and mechanical equipment and their auxiliaries of
 - (i) Thermal
 - (ii) Hydro and
 - (iii) Nuclear Power Station (Specification, performance and applications)
- 1.2 Layout of above Power stations and control room.
- 1.3 Performance of alternator with infinite bus bar.
- 1.4 Performance and applications of synchronous motor.
- 1.5 Vector group of power transformer.
- 1.6 Unit transformer and station transformer.

2. POWER AND CONTROL CABLE.

- 2.1 Ratings and Testing of power cable.
- 2.2 Advance methods of fault location.
- 2.3 Types of cable joints, connections and terminations.
- 2.4 Comparison of power and control cable.

3. INTERCONNECTED SYSTEMS.

- 3.1 Inter connections of power stations.
- 3.2 Inter connections of substations.
- 3.3 Load sharing.
- 3.4 Power limit of inter connector.
- 3.5 Functions of load dispatch centre (LDC)

4. POWER PLANT OPERATION ECONOMY.

- 4.1 Components for total cost of generation per unit.
- 4.2 Methods for depreciation calculation.
- 4.3 Interpretation of load curves.
- 4.4 Effect of load curves on cost per KWH.

5. POLLUTION AND ITS CONTROL IN POWER STATIONS.

- 5.1 Types of pollution in different Power stations.
- 5.2 Control of pollution.
- 5.3 Effect of pollution on environment.
- 5.4 Standardization for environment protection.
- 5.5 Methods for reducing pollution.

6. SAFETY MEASURES IN MODERN POWER STATION

- 6.1 Possible hazards in power station
- 6.2 Indian Electricity (I.E) rules for general safety.
- 6.3 Preventive measures for safety.
- 6.4 Safety devices applied to different equipment.
- 6.5 Safety tools and equipment used in power station

7. CHEMICAL ANALYSIS OF FUELS AND WATER.

- 7.1 Chemical analysis of coal and lignite (only data)
- 7.2 Chemical analysis of oil and gas (only data)
- 7.3 Chemical analysis of water (only data)
- 7.4 Merits and demerits of different fuels.

8. POWER STATION MANAGEMENT.

- 8.1 Organization structure of modern power station
- 8.2 Responsibilities and duties of personal.
- 8.3 Delegation of power.
- 8.4 Record keeping in power station
- 8.5 GEC Code for materials.

Note: The students may be sent for visit of near by power station and make observations regarding the content of this course.

MICRO CONTROLLER

RATIONALE:

The microprocessor has been with us for some Twenty Five years but it has limited applications, more complicated hardware, limited use with computer and more cost resulted in failure in market on other hand micro controller which is a true computer on a chip more simple in hardware, millions of application more general purpose device and capable of having several different functions depending on the wishes of the programmer. So now a day, use of micro controller is increasing in industries and therefore, it is necessary for the students to study this course.

OBJECTIVES:

After studying this subject, student will able to

- Study design and maintain the micro controller circuits
- Programme for micro controllers for different operations and applications in industries
- Develop different use of micro controller.

TOPICS:

1. MICROPROCESSORS AND MICRO CONTROLLERS

- 1.1 Microprocessors - general idea and block diagram
- 1.2 Micro controller
- 1.3 Block diagram of a micro controller
- 1.4 Introduction to micro controller
- 1.5 Operating principle
- 1.6 Comparison between microprocessor and micro controller

2. 8051 MICRO CONTROLLER HARDWARE

- 2.1 Introduction
- 2.2 8051 micro controller hardware
- 2.3 8051 block diagram
- 2.4 Function of each block
- 2.5 8051 Programming model
- 2.6 8051 DIP Pin assignment
- 2.7 8051 oscillator and clock
- 2.8 Ceramic resonator oscillator circuit
- 2.9 Program counter and data pointer
- 2.10 A and B CPU registers
- 2.11 Flags and the program status word PSW
- 2.12 Internal memory
- 2.13 Internal RAM
 - Internal RAM organization

- 2.14 Stack and stack pointer
- 2.15 Special function registers
- 2.16 Internal ROM
- 2.17 Input / output Pins Ports and circuits
 - Port 0 Pin configuration
 - Port 1 pin configuration
 - Port 2 pin configuration
 - Port 3 pin configuration
- 2.18 External memory
 - Connecting external memory
- 2.19 Counters and timer
 - TCON and TMOD function registers
 - TCON (Timer control) function registers
 - TMOD Time mode control Function Register
 - Timer counter interrupts
 - Timer mode 1, 2 & 3
- 2.20 Serial Data input / output
- 2.21 Interrupts
 - Introduction
 - Types of interrupts

3. MOVING DATA

- 3.1 Introduction
- 3.2 Addressing Modes
- 3.3 External Data Moves
- 3.4 Code memory Read-only Data Moves
- 3.5 Push and Pop opcodes
- 3.6 Data exchanges
- 3.7 Example programs

4. LOGICAL ARITHMETIC OPERATIONS

- 4.1 Introduction
- 4.2 Byte level logical operation
- 4.3 Bit level logical operation
- 4.4 Rotate and swap operation
- 4.5 Flags
- 4.6 Incrementing and decrementing
- 4.7 Additions
- 4.8 Subtraction
- 4.9 Multiplications and division
- 4.10 Decimal arithmetic
- 4.11 Example programs
- 4.12 Jump and call program range
- 4.13 Calls and subroutines
- 4.14 Interrupts and returns

5. 8051 MICRO CONTROLLER DESIGN

- 5.1 Introduction
- 5.2 Micro controller specifications
- 5.3 A micro controller design
 - External memory and memory space decoding
 - Reset and clock circuit
 - Expanding I/O
- 5.4 Timing Subroutines
- 5.5 Lookup table for 8051
- 5.6 Serial data transmission

6. APPLICATIONS

- 6.1 Introduction
- 6.2 Interface keyboards to 8051 based micro controller
- 6.3 Interface LED & LCD display
- 6.4 Interface the micro controller system to A/D and D/A converters
- 6.5 8051 Data communications modes example programmes
- 6.6 Data acquisition systems

REFERENCES:

1. The 8051 Micro controller Architecture, Programming and Applications - Kenneth J. Ayala
2. Microprocessor and Micro controllers - B.P.Singh