

**DRAFT SYLLUBUS OF DIPLOMA ENGINEERING  
( 3<sup>rd</sup> Semester to 6<sup>th</sup> Semester)**

**BRANCH : ELECTRICAL ENGINEERING**

**Under**

**TRIPURA UNIVERSITY**

**(A Central University)  
Suryamaninagar**



**DETAILED CURRICULAR STRUCTURES OF  
FULL-TIME  
DIPLOMA COURSE IN  
ELECTRICAL ENGINEERING**



## Curricular Structure

### 3<sup>rd</sup> Semester

Sl. No	Theoretical Paper					Sessional / Practical paper			
	1 <sup>st</sup> half (50mark)	2 <sup>nd</sup> half (50 mark)	Mark	CPW	Credit	Name of Sessional / practical	Mark	CPW	Credit
	Electrical Machines – I DEE-301		100	4	4	Programming in C lab DCS-304S	100	4	2
i	Circuit Theory DEE-302		100	3	3	Analog Electronics Lab DETC-308S	100	4	2
ii	Electrical Measurement & Measuring Instruments DEE/HU-303	MATH III DEE/HU-303	100	4	4	Electrical Machine Lab (Group – A) DEE-304S	100	5	2
v	Analog Electronics DETC-306		100	3	3	Network System Lab DEE-305S	100	4	2
						Electrical Workshop – I DEE-306S	100	4	2
i						Electrical Measurement & Measuring Instruments Lab DEE-307S	100	4	2
			400	14	14		600	25	12

### 4<sup>th</sup> Semester

Sl. No	Theoretical Paper					Sessional / Practical paper			
	1 <sup>st</sup> half (50mark)	2 <sup>nd</sup> half (50 mark)	Mark	CPW	Credit	Name of Sessional / Lab	Mark	CPW	Credit
i	Electrical Machines – II DEE-401		100	4	4	Communication Skill-II DHU-400S	100	4	2
ii	Electrical Engineering Materials DEE-402		100	3	3	Electrical Engineering Drawing DEE-404S	100	4	2
iii	Principles & Applications of Digital Electronics DETC-405		100	3	3	Electrical Machine Lab (Group – B) DEE-405S	100	5	2
iv	Electrical Measurement & Control DEE-403		100	4	4	Electrical Measurement & Control Lab DEE-406S	100	4	2
v						Electrical Workshop-II DEE-407S	100	4	2
Vi						Digital Electronics Lab DETC – 410S	100	4	2
			400	14	14		600	25	12

CPW = Contact hour Per Week (for Theory, Tutorial, & Sessional/practical)

Student should under go Industrial training for at least 2 week duration, corresponding grade for 2 credit (as received from industry) will be reflected on 5<sup>th</sup> semester grade card.

### 5<sup>th</sup> Semester

Sl. No	Theoretical Paper					Sessional / Practical paper			
	1 <sup>st</sup> Half (50mark)	2 <sup>nd</sup> Half (50 mark)	Mark	CPW	Credit	Name of Sessional / Lab	Mark	CPW	Credit
i	Industrial Management & DHU-501	Entrepreneurship Development DHU-501	100	4	4	Electrical system design & estimating DEE-503S	100	4	2
ii	Power Plant Engineering DEE-501		100	3+1T	3	Electrical machine design practice DEE-504S	100	5	2
iii	Transmission & Distribution of Power DEE-502		100	4	4	Power System Laboratory DEE-505S	100	4	2
iv	Industrial Electronics DETC- 503		100	3+1T	3	Industrial Electronics Laboratory DETC – 508S	100	4	2
v						Project – I DEE-506S	100	5	2
vi.						Industrial Training DIT-500S	100	-	2
			400	16	14		600	22	12

### 6<sup>th</sup> Semester

Sl. No	Theoretical Paper					Sessional / Practical paper			
	1 <sup>st</sup> half (50mark)	2 <sup>nd</sup> half (50 mark)	Mark	CPW	Credit	Name of Sessional / practical	Mark	CPW	Credit
I	Professional Ethics & Values DHU-601	Optimization Technique DHU-601	100	4	4	Switchgear & Protection Lab DEE-603S	100	4	2
ii	Electrical Installation, DEE-601	Switchgear & Protection DEE-601	100	4	4	Microprocessors & Its Applications Lab DETC-607S	100	4	2
iii	Microprocessors & Its Applications DETC-604		100	3+1T	3	Project-II DEE-604S	200	8	4
iv	Elective DEE-602 (. Opt. any one of the following)  Control Engg --.DEE-602/1 Industrial Instrumentation--DEE-602/2 Computer Network---DEE-602/3		100	3	3	Elective Lab  Control Engg Lab-- DEE-605S/1 Industrial Instrumentation Lab --DEE-605S/2  Computer Network Lab DEE-605S/3	100	5	2
V						Generic Skill	50	2	1
Vi						Final Viva DEE-606S	50	-	1
	Total			15	14			23	12

Total marks : @ 1000 per semester , Number of Contact periods : 38 per week , Total Credit : @ 26 per semester

**DETAILED SYLLABI OF THE  
DIFFERENT COURSES OFFERED IN  
3<sup>RD</sup> AND 4<sup>TH</sup> SEMESTER**





### 3<sup>RD</sup> SEMESTER

## ELECTRICAL MACHINES – I

Subject Code : DEE-301

Total Marks : 100, credit :4 , CPW :4

### DETAIL COURSE CONTENT

#### IST HALF

##### GENERAL INTRODUCTION OF ROTATING MACHINE

Faraday's laws of e.m.f. inductions and basic constructional features of generators and motors. Hetero-polar and homopolar configuration.

Space distribution of flux density and time-variation of voltage. Magnetisation curve.

##### D.C Machines:

D.C. Generator: basic principles, brief description of different parts and working, different types, e.m.f equation, building up of e.m.f in self-excited generator – applications of D.C. generator – problems on e.m.f. equation.

D.C. Motors: basic principles, significance of back e.m.f., speed and torque equation, speed-current, torque-current, speed-torque characteristics, Types – applications.

Diff. Methods of speed control of motors, starters, industrial applications – problems.

#### SECOND HALF

##### TRANSFORMERS:

Constructional details: selection of core material & winding materials considering different types of losses, insulating materials, core & coil construction, Transformer oil, Accessories: tank & radiator, breather, conservator, bucholtz relay, bushings, pressure relief valve {PRV} & explosion vent (protection from explosion).

Different types of cooling methods.

##### 1-phase Transformers:

E.m.f. equation, derivation of core losses, no-load operation, phasor diagram under no-load and load conditions, equiv-resistance and reactance, approx, equivalent circuit, dependence of circuit parameters' on V and f., impedance voltage, Regulation, Losses and efficiency (including all-day eff) – Problems .Cause of noise & vibration in transformers – Rating of transformer.

S.C. and O.C. tests – separation of eddy current and hysteresis losses – Problems.

Principle & significance of oil testing.

Types- Distribution and power transformers, Dry-type transformer, New compact transformer

Principles of 1-phase Autotransformer, tertiary winding, comparison of weight, copper loss, -- problems

Methods of tap-changing. Tap changers (off load and on-load type) – practical use – Explanation of automatic control of tap-changers with block diagram.

Conditions for Parallel operation of transformers and their significances - significance of parallel operation. Parallel operation of two 1-ph transformers – problems.

Three-phase transformer (as a single unit or 3 single-phase units) –connections & specifications, Vector grouping, Scott-connected transformer.

Checks and steps in connecting two 3-ph transformers in parallel.

## **REFERENCE BOOKS**

1. Electrical Machines by S. K. Bhattacharya – Tata McGraw Hill Publications
2. Electrical machines by M. V. Deshpande – Wheeler Publication.
3. Theory & Performance of Electrical Machine by J. B. Gupta
4. D. C. Machines and Transformers by K. Mungnesh Kumar – Vikas Publication
5. A Text Book of Electrical Technology by B. L. Thereja – S. Chand publication
6. Electrical Machine by Dr. P. K. Mukherjee & S. Chakraborty
7. AC Machines by M. G. Say
8. The performance and design of D. C. machines by A. E. Clayton.
9. Fundamentals of Electric Machine by B. R. Gupta and V. Singhal

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## **CIRCUIT THEORY**

**Subject Code : DEE-302**

**Total Marks: 100, credit :3, CPW :3**

## **DETAIL COURSE CONTENT**

### **IST HALF**

#### **NETWORKS & A.C. FUNDAMENTALS**

Definitions & explanation: Active & passive elements as well as networks – Linear & non-linear networks – Unilateral & bilateral networks.

Statement, explanation, limitation & problems on Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Super position Theorem, Star-delta conversion.

Single-phase A.C. Circuits: Concept of complex impedance – Rectangular & polar form.

R-L-C Series Circuit: Representation of impedance, voltage, current and power in complex form phasor diagram Impedance triangle – problems.

Parallel Circuit: Phasor diagram, problems (maximum 3 branches).

#### **RESONANCE & SELECTIVITY**

SERIES RESONANCE: General aspects – Impedance & phase angle of series resonant circuit – Voltages & current in series resonant circuit – Study of different curves – Quality factor – Selectivity & bandwidth – Voltage magnification – Problems – Acceptor Circuit (concept only).

PARALLEL RESONANCE: Resonant frequency for a tank circuit study of curves attaining resonance by varying frequency &  $R_L$  – Current magnification – Quality Factor – Selectivity & bandwidth – Applications – Problems – Rejector circuit (concept only).

Comparison between series & parallel resonance.

### **SECOND HALF**

#### **TRANSIENTS**

Steady State & Transient Response – Initial & Steady-state condition – Time constant DC response of RC circuit – problems. Sinusoidal response of R-L & R-C circuits – problems

**POLY PHASE CIRCUITS:** 3 phase system – Phase sequence – Advantages over 1-phase system – Inter connection of 3-phase sources & loads – Relation between line & phase values of voltage & current both in star & delta connections – 3-phase power – Problems on balanced as well as unbalance (3-phase 4-wire) system.

### **COUPLED CIRCUITS & FILTERS**

**COUPLED CIRCUITS:** Introduction, mutual coupled circuits & mutual imp, dot convention, coefficient of coupling, series & parallel connection of coupled inductors.

**LAPLACE TRANSFORMATIONS:** Definition & properties – Laplace transform of unit step, impulse, ramp, exponential, sine cosine function and periodic functions (no deviation – only formula) – Laplace transform theorems – Differential, integral, initial value & final value theorems – The inverse transformation – Convolution Integral – Applications of Laplace Transformations for solving differential equations describing simple electric circuits – problems.

Introduction to Fourier series – **Active FILTERS:** Second Order Low pass, High pass, Band pass and Band stop , Classification of Filters relating Transfer function & frequency response characteristics(conceptions & applications only).

### **REFERENCE BOOKS**

1. Network, Filters & Transmission Lines / A. Chakraborti / Dhanpat Rai Pub. Co.
2. Basic Electrical Engineering / Nagrath & Kothari / Tata McGraw-Hill
3. Basic Electrical Engineering / J.B. Gupta / S. Kataria & Sons
4. Electric Circuit Analysis / S.N.Sivanandam / Vikas
5. A Text Book of Electrical Technology Part-I / B.L. Thereja / S. Chand Pub. Co
6. Fundamentals of Electrical Networks / B.R. Gupta / Wheeler
7. Circuits & Networks / Sudhakar & Shyammohan / Tata McGraw-Hill
8. Schaum's Series of Circuit Theory / Tata McGraw-Hill

# ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS

Subject Code : DEE/HU-303

## DETAIL COURSE CONTENT

### IST HALF

Total Marks : 50, credit :2 , CPW :2

#### Definition & brief explanations of:

Range, sensitivity, true & indicated value, Errors (including limiting errors), Resolutions, Accuracy, Precision and instrument efficiency.

#### Classification of instruments:

Absolute and secondary instruments, Analog (electro-mechanical and electronic) and digital instruments, secondary Instruments - Indicating, integrating & recording instruments.

#### Basic Requirements for measurements:

Deflection torque and methods of production.

Controlling torque and controlling system (Spring Control & Gravity control system)

Damping torque & different methods of damping

Balancing of moving parts.

#### Different types of instruments:

Brief idea about construction & operating principle, Final Expression of steady state or balanced condition (no deduction), Merits and demerits, Errors and remedies, Practical ranges; Applications of – PMMC instruments, MI Instruments, Electrodynamometer type instruments, Thermocouple instruments and Induction type instruments.

Digital instruments- voltmeter, ammeter, multimeter, energy-meter. --- Elementary idea with block diagram.

#### Multi-range ammeter and voltmeter – theory and problems.

Wheatstone Bridge principle (no deduction), Working principle & construction of simple D.C. potentiometer

#### Methods of measuring diff. Electrical quantities:

Measurement of Low resistance by Kelvin's double bridge – simple problems. Principle of dynamometer type wattmeter (no description of instrument) and special features incorporated for low p.f. circuits. Measurement of 3-phase power by two-wattmeter & 3-wattmeter method.

1-phase Induction type energy meter. (Briefly mention construction and operating principle – no deductions, only final expressions for av. torque to be mentioned) Errors adjustments |

Phantom loading , Testing of energy meters. |

#### Classifications of resistances

Description of Meggar – measurement of high/insulating resistance by using it. Measurement of Inductance: ---Maxwell's inductance bridge

Measurement of capacitance: Schering Bridge

Magnetic measurements: Deterioration of B-H curve and measurement of iron losses.

#### Ref. Books:

1. A course in Electrical & Electronics Measurement – A. K. Sawhney
2. Electrical & Electronic Measurements by J.B. Gupta – S. K. Kataria Publication.
3. Electrical Measurements & Measuring Instruments by Golding & Widdis – Wheeler Publications.
4. Basic Electrical Measurement by Stout.
5. Handbook of Biomedical Instrumentation by R.S. Khandpur. —TMH publications.

**Mathematics-III (2<sup>nd</sup> Half) Total Marks : 50, credit :2 , CPW :2**

**FOURIER SERIES AND FOURIER INTEGRALS:** Periodic functions, Euler formulae for Fourier coefficients, functions having arbitrary period, even and odd functions, half range expansions, Fourier integral, Fourier cosine and sine transformations, linearity property, transform of derivatives, convolution theorem (no proof) Gamma and Beta functions, error functions - definitions and simple properties.

**PARTIAL DIFFERENTIAL EQUATIONS:** Solutions of equations of the form  $F(p, q) = 0$ ,  $F(x, p, q) = 0$ ,  $F(y, p, q) = 0$ ,  $F(z, p, q) = 0$ ,  $F_1(x, p) = F_2(y, q)$ , Lagrange's form  $Pp + Qq = R$ . Vibrating string : one dimensional wave equation, D'Alembert's solution, solution by the method of separation of variables. One dimensional heat equation, solution of the equation by the method of separation of variables, solutions of Laplace's equation over a rectangular region and a circular region by the method of separation of variables.

**PROBABILITY AND STATISTICS:** Probability distributions: random variables (discrete & continuous), probability density, mathematical expectation, mean and variance of a probability distribution, binomial distribution, Poisson approximation to the binomial distribution, uniform distribution, normal distribution.

**References:**

- 1) Ervin Kreyszig : Advanced Engineering Mathematics, Wiley Eastern
- 2) Higher Engineering Mathematics by BS Grewal : Khanna Publishers, New Delhi.
- 3) Numerical Solutions of Differential Equations by NK Jain ; Prentice Hall, Delhi.
- 4) Potter, Goldberg : Mathematical Methods, Prentice - Hall
- 5) Churchill R.V.: Fourier series and Boundary Value Problems - McGraw Hill
- 6) Irvin Miller & Freund : Probability and statistics for Engineers , Prentice Hall of India.
- 7) Engineering Mathematics, B.V.Ramana, Tata McGraw-Hill 2003.
- 8) Engineering Mathematics-I Rukmangadhachary, Pearson Education.

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# ANALOG ELECTRONICS

Subject Code :DETC-306

Total Marks : 100, Credit : 3, CPW :3

## DETAIL COURSE CONTENT

### IST HALF

#### **PASSIVE & ACTIVE CIRCUIT ELEMENTS**

RESISTORS: FUSES: Ordinary fuses (specifications)

CAPACITORS: INDUCTOR: Voltage source and current source, AC and DC signals

#### **TRANSFORMER**

Elementary idea of transformer — Features and specifications of wideband transformer — RF and AF transformer

#### **RELAYS, SWITCHES, CABLES AND CONNECTORS**

RELAY: Reed relay & solid state relays, CABLES: RF cables – High temperature cables – Low impedance cables – TV and telephone line cables – Their characteristics and specifications

MANUALLY OPERATED SWITCHES: Toggle switch – Keyboard switch – Push-button switch – Rotary switch – Thumb-wheel switch – Cross-bar multi switch – Their features and applications.4

CONNECTORS: Plugs and sockets – RF connectors – Edge connectors for PCB – Rating and specifications of connectors – Factors affecting choice of connectors – Choice of connectors for different applications

GENERAL FEATURES Of :pn junction diode, varactor diode, pin diode, tunnel diode, schottky diode-their field of application

**Zener Diode** BREAKDOWN: Zener and avalanche – Construction of Zener diode and operation of Zener diode in reverse biased condition – Characteristics and equivalent circuits, specifications – Simple voltage regulator circuit

### SECOND HALF

#### **BIPOLAR TRANSISTOR**

Construction and operation of NPN and PNP transistors-V-I characteristics, transistor in active, saturation and cut-off-CE, CB, CC configuration and their differences, definitions of current gains and their relationship. Transistor as simple amplifier & oscillator and their simple application

#### **FIELD EFFECT TRANSISTOR**

Construction, operation and VI characteristics of JFET, pinch-off voltage, drain resistance, transconductance, amplification factor and their relationship

Enhancement and depletion type MOSFET- concepts of CMOS

Differences between BJT and JFET.

#### **Operational Amplifier.**

Basic differential amplifier circuit. Importance of constant source.

Definition of-input offset voltage, input bias current, input impedance, input offset current, output impedance open loop voltage gain, differential mode gain, common mode rejection ratio, slew rate. Properties of op-amp; pin diagram and functions of each pin of IC 741 (Nature of power supply required.) Inverting amplifier – circuit diagram and explanation, gain calculation. Non-inverting amplifier – circuit diagram and explanation and gain calculation.

Op amp as Comparator, adder, subtractor, integrator, differentiator unity gain buffer and scale changer. Function generator (square, triangular) Schmitt trigger.

## REFERENCE BOOKS

1. Electronic Principle / A.P. Malvino / Tata McGraw-Hill
  2. Electronic Devices & Circuits / Millman & Halkias / Tata McGraw-Hill
  3. Basic Electronics & Linear Circuits / Bhargava / Tata McGraw-Hill
  4. Electronic devices & Circuit Theory / Boylestad & Nashalsky / PHI
  5. Electronic Fundamentals & Applications / D. Chattopadhyay & P.C. Rakhshit / New Age International
  6. Electronic Components and Materials / Madhuri A Joshi / Wheeler Publishers
  7. Electronic Component / Padmanaban
  8. Electronic Component / Ramchander
  9. Electronic Measurement and system / R.G. Gupta / Tata McGraw-Hill
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## PROGRAMMING IN C LAB

Subject Code : DCS-304S

**Total Marks : 100, credit :2 , CPW :4**

List of experiments:

1. To do exercise on data type conversion, use of variable of different types.
2. To write simple program using expression, assignment statements and different types of operators.
3. **To write simple programs using control statements: if, switch, conditional operator, for, while, do-while, break and continue statements.**
4. Familiarity with formatted and unformatted console I / O with simple programs.
5. To write program using 1D and 2D arrays, sorting and matrix manipulation.
6. Write programs on function, using function prototype declaration, function definition, with or without arguments, returning value or no value, call by value and call by reference, recursive functions.
7. To write program using pointer (int, float and character type) using malloc and calloc functions, pointer to pointer, pointer to function.
8. To write program using structure, accessing structure elements, array of structure, passing structure to function and using structure pointers, using unions, accessing union elements, using structure and union in same function, to write programs on enunciated data type and familiarity with type definition.
9. To write program using different file function.
10. To write program using different macro definition, file inclusion and conditional compilation.
11. To write program using string function and math function.
12. To write program to find base memory use, to make caps lock on and to control the different keys on the keyboard.

## ANALOG ELECTRONICS LAB

Subject Code : DETC-308S

Total Marks : 100, credit :2 , CPW :4

### DETAIL COURSE CONTENT

1. To be familiar with the common assembly tools.
2. To be able to identify the following passive and active circuit elements: —  
Resistor, capacitor, inductor, transformer, relay, switches, batteries/cells, diode, transistors, SCR, DIAC, TRIAC, LED, LCD, photodiode, phototransistors, ICs etc.
3. To be familiar with the following basic instruments: —  
Multimeter, oscilloscope, power supply and function generator.
4. To practice soldering and desoldering.
5. To construct & test a battery eliminator and simple amplifier circuit on a Bread Board and Vero Board.

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## ELECTRICAL MACHINE LAB (GROUP-A)

Subject Code : DEE-304S

Total Marks : 100, credit :2 , CPW :4

### DETAIL COURSE CONTENT

#### 1. Introduction: 8 Pds.

Supply systems available

Identification of instruments before performing every expt.

Precautions.

#### 2. Experiments:

- a) Building up voltage in D.C. generator.
- b) Starting and Reversing of D.C. shunt motor.
- c) Speed control of D.C. shunt motor (both above & below normal)
- d) Swinburn's test and computation of eff of D.C. motor
- e) Determine equivalent circuit parameters of single-phase transformer by performing o.c. test & s.c test.
- f) Determine the regulation & efficiency of single-phase transformer by direct loading.
- g) Parallel operation of single-phase transformers -- determine the sharing of loads.
- h) Connect 3-phase transformer in  $\Delta$ - $\Delta$ ,  $y$ - $\Delta$ ,  $y$ - $y$  &  $\Delta$ - $y$  and to determine the relationship between line voltages & phase voltages.

### REFERENCE BOOKS

1. Electrical machines by S.K. Bhattacharya.
2. Electrical machines by M.V. Deshpande.
3. Electrical laboratory experiments by A.K. Chakraborty



## **NETWORK SYSTEM LAB**

**Subject Code : DEE-305S**  
**Total Marks : 100, credit :2 , CPW :4**

### **DETAIL COURSE CONTENT**

1. Verification of Different Network Theorem
  - a. Superposition theorem.
  - b. Thevenin's theorem.
  - c. Norton's theorem.
  - d. Max. Power transfer theorem.
  - e. Super Position Theorem
2. Study of I-phase series & parallel R-L-C circuit (Variation of p.f. to be shown) – Resonance
3. Determination of Q factor of Resonant circuit
4. Transient Performance of R-L and R-C series circuits.
5. Transient Performance of R-L -C series circuits at
  - (i) over damped
  - (ii) under damped
  - (iii) critically damped conditions
6. To find Short circuit admittance parameters and Open circuit impedance parameters of a circuit.

## **ELECTRICAL WORKSHOP – I**

**Subject Code : DEE-306S**  
**Total Marks : 100, credit :2 , CPW :4**

### **DETAIL COURSE CONTENT**

1. **General Shop Theory**
  - a) Assessment of general characteristics of Electrical wiring Installation as per I.S.  
Purposes, Supplies & structure  
External influences  
Compatibility and Maintainability
  - b) Protection for safety of electrical wiring installation as per I.S.
  - c) Protection against electric shock, thermal effect, over-current, over-voltage, under-voltage and against a measure of isolation and switching of electrical circuits.
2. **Exercises:**
  - a) Identification of diff. Windings of D.C. compound m/c.
  - b) Study of constructional features and windings of D.C. m/c
  - c) Study of D.C. motor starters
  - d) Formation of coils of armature winding.
  - e) Study of sodium vapour lamp, mercury vapour lamp, Compact fluorescent lamp and connections of these.
  - f) Study the connection of fire-alarm
  - g) Dismantling and assembling of a ceiling-fan/Table fan.
  - h) Dismantling and assembling of 1- $\Phi$  transformers. Coil connection of 1-phase transformer.
  - i) To test a battery for its charged and discharged condition and to make connections for charging

**Item Nos. d, e, g & h of 8 periods duration and the remaining of 4 periods duration.**

# **ELECTRICAL MEASUREMENT & MEASURING INSTRUMENTS LAB**

## **DETAIL COURSE CONTENT**

**Subject Code : DEE-307S**

**Total Marks : 100, credit :2 , CPW :4**

1. Introduction:  
Purpose of Lab experiments  
Identification of instruments before performing every expt.
2. Experiments:
  - i) Measurement of low resistance by Kelvin's Double Bridge method.
  - ii) Measurement of 3-phase power (both balance & unbalance) by using:
    - b. Two wattmeters
    - c. Three wattmeter
  - iii) Measurement of inductance by Maxwell / Owen's bridge.
  - iv) Determination of an unknown capacitance with the help of Schering Bridge network
  - v) Study of B-H curve.
  - vi) Connection of both 1-phase & 3-phase energy-meters to a single phase load and 3-phase load and measure energy.

**Each Experiment of 4 periods duration (considering the sub-part as one experiment).**

### **REFERENCE BOOKS**

1. Experiments on basic electrical engineering by S.K. Bhattacharya & K.M. Rastori.
2. Basic electrical engineering by Nagrath & Kothari
3. Electrical & Electronic instruments by A.K.Sawhney.
4. Experiments on electrical engineering by A.K.Chakraborty.

## **FOURTH SEMESTER**

### **ELECTRICAL MACHINES – II**

#### **DETAIL COURSE CONTENT**

**Subject Code : DEE-401**

**Total Marks : 100, credit :4, CPW :4**

#### **IST HALF**

##### **Alternator:**

Introduction:

Construction – brief description and functions of diff. Parts, viz.

Armature – (i) stationary armature – merits

(ii) Rotating armature demerits

Stator – Core, frame, slots

Rotor – (i) Cylindrical

(ii) Salient type

- Salient features, merits and applications.

Excitation system – (i) Brushless excitation system with circuit diagram

(ii) Static excitation system with diagram.

Armature winding – Single layer and multilayer, Concentrated and distributed, 1-phase and 3-phase (Concept only).

E.M.F. equation: Coil span factor and distribution factor (significance and mathematical expressions only – no deduction) - Problems.

No-load characteristics and Load Characteristics at various p.f.

Synchronous reactance (both for cylindrical & Salient pole m/c), Synchronous impedance, O.C. Test and S.C. Test.

Phasor diagrams of cylindrical rotor m/c at different p.f. loads.

Voltage regulation – sync. Imp. Method, -- problems. Short circuit ratio (SCR) – concept & significance only. Power characteristics of cylindrical rotor m/c - Synchr. Power & Torque

Effect of Load and excitation on:

(i) Isolated synchronous Gen

(ii) Synchronous gen or infinite bus

Parallel operation of alternators – advantages, synchronizing by using

(i) three lamps and (ii) Synchroscope

Load sharing between two alternators – problems.

##### **Synchronous Motor:**

Principle of steady state constant speed operation, Construction (in brief).

Methods of starting (brief discussion), hunting & damper winding.

Effect of variation of Load – Speed torque characteristics.

Graphical explanation of the effect of variation of excitation on armature current and p.f. (over and under excitation) – V curves & inverted V-curves.

Applications

## **SECOND HALF**

### **3-Phase Induction Motor**

Introduction & production of rotating magnetic field.

Types of motors with their construction (in brief)

Principle of operation, syn. Speed, rotor speed, slip, rotor current frequency – related problems.

Induction motor as transformer – similarities & dissimilarities, equivalent circuit, torque equ. Starting torque, running torque, max torque, slip torque characteristics. Effect of rotor rest on torque – related problems.

Cogging & crawling (simple idea)

Power stages in 3-phase induction motor and their relation, losses, efficiency – related problems.

Motor enclosures, size, rating and specification as per I.S Code.

Starters for both stop-ring and Squirrel cage induction motors, starting of squirrel cage motors with automatic Y- $\Delta$  starter (circuit diagram necessary).

Speed control by different methods.

Double cage rotor principle and applications.

Brief idea about braking of induction motors –

(i) plugging, (ii) rheostatic, (iii) Regenerative. – Advantages disadvantages of diff. Types.

Industrial applications.

### **Fractional H.P. Motors:**

Construction, principle of operation and applications of 1-ph Induction motor – split phase motors

1-phase Synchronous motors – Reluctance Motors

AC – series motor: Universal motors.

### **Ref. Books:**

1. Electrical Machines by S. K. Bhattacharya – TMH
2. Electrical Machines by M. Deshpande – Wheeler
3. Theory and Performance of Electrical Machines by J. B. Gupta – Kataria
4. Electrical Machine by Dr. P. K Mukherjee & S. Chakraborty
5. A. Text book of Electrical Technology – Vol-II by B. L. Thereja – S. Chand
6. Induction & Synchronous machines by K. Murgeshk Kumar – Vikas
7. Performance & Design of D. C. Machines by M.G. Say

# ELECTRICAL ENGINEERING MATERIALS

## DETAIL COURSE CONTENT

Subject Code : DEE-402

Total Marks : 100, credit :3, CPW :3

### IST HALF

Classification of electrical engineering materials, Properties of conductors, characteristics of a good conductor material, Commonly used conductor materials

Electrical and mechanical properties of conductor materials for O/H lines and U/G cable – Trade names of conductors used for O/H lines.

Conductor materials used for electric machine winding.

Properties and applications of important resistor materials.

Super conductivity

Semiconductors:

Types of semi conductors commonly used, Application of semiconductor materials.

Simple idea and applications of thermistors, photoconductive cells, photovoltaic cells, varistors, LCD, LDR and strain-gauges. Merits of semiconductor materials used in Electrical Industry.

Working principle and applications of Hall-Effect Generators and Piezo-electric materials.

Magnetic materials: Soft and hard magnetic materials.

Classification of magnetic materials according to relative permeability. Magnetisation curve, Hysteresis and hysteresis loop – hysteresis loss, magnetostriction

Effects of impurities on Ferromagnetic materials.

Low carbon electrical steel, properties of electrolytic and carbonyl steel.

Special purpose materials:

Properties and uses of materials for –

(i) fuse (ii) soldering, (iii) Contacts, (iv) Structures, (v) fluorescence.

Galvanisation, Annealing, Vulcanising and stranding.

Electrical carbon material–

characteristics of carbon brushes & graphite brushes.

### SECOND HALF

Dielectric Materials: Dielectric strength, Factors affecting dielectric strength, dielectric loss, dissipation factor, Dielectric strength and Relative permittivity.

Electrical Conduction through gaseous, liquid and solid dielectrics – Applications of dielectrics.

Some commercially available capacitors for specific situation.

Insulating Materials: Introduction, General properties of insulating materials according to structure composition and application –Effects of various factors on insulation resistance..

Electrical properties: Insulation resistance, volume resistance, surface resistance, Effects of various factors on insulation resistance.

Mechanical properties: Viscosity, porosity, solubility.

Thermal properties: Stability, melting point, flash point, volatility, thermal conductivity, Heat resistance.

Chemical properties: Resistance to external chemical effects, Hygroscopic, Ageing.

Temperature rating of insulation, Effect of moisture on insulation.

Table of General classification of insulating materials: Fibrous Insulating materials, Types - Impregnating, coating, filling and bonding materials

Broad classification of ceramics used in electrical engineering, Porcelain, Factors affecting ceramics.

Applications of Mica products and glass in electrical engineering.

Insulating Resins: Natural and synthetic resins, Thermoplastic resins, short description and applications of (i) Polyethylene resins, XLPE and PVC.

Thermosetting resins – types, short description and applications of silicon resins and epoxy resins. Chart for the insulating materials used in Transformers.

Electrical properties and applications of insulating varnishes – Types of varnishes, Coolants (Hydrogen cooling) in Electrical machinery – necessity.

Properties and applications of Hydrogen, SF6 and mineral oils in Electrical machines

P.I. value of insulating oils and significance

Ref. Books:

- 1) Electrical Engineering materials by N. Alagappan & NT Kumar (TTTI, Madras) of TMH publications.
- 2) Electrical Engineering materials by Dekkar of PHI publications.

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## **ELECTRICAL MEASUREMENT & CONTROL**

### **DETAIL COURSE CONTENT**

**Subject Code : DEE-403**

**Total Marks : 100, credit :4, CPW :4**

#### **IST HALF**

Measurement of Power/Energy & Industrial Metering:

Digital energy-meter -- description with relevant circuit diagram, use of C.T.& P.T. for measurement in high voltage 3 phase circuit.

Measurement of reactive & apparent power by Sampling Wattmeter, M.D.I (Max. Demand Indicator)—construction & Principle of operation of commonly used M.D.I. In industry, advantages & disadvantages.

Operation & Utility of Tri-vector meter.

Features of Digital Instruments and advantages & disadvantages of Digital instruments over analog instruments.

Brief idea of (i) Mech. Resonance type (ii) Electrical resonance type Frequency meter

Synchroscope: - Construction & working of Weston synchroscope.

Phase-sequence meter -- Principle of working of rotating type

C.R.O.—block diagram representation & operation, applications (observation & measurement of voltage, current, phase difference & frequency)-

Use of dual trace oscilloscope.

Function generator—working principle with block diagram

Elements of Servomechanism:

Servomotor(a.c & d.c), Synchro transmitter & receiver, Servo amplifier,—working principle of all in brief.

Study of layout of a complete servo system showing (i) Synchro transmitter & receiver,(ii) Phase sensitive rectifier,(iii) d.c.amplifier (iv) d.c.motor & (v) Gear box & load.

Stepper Motor—working principle

## **SECOND HALF**

### **Measurement of Non-electrical quantities :**

Concept of measurement using Transducers as input element., Active & Passive transducers—differences. Digital Transducers. (brief idea )

#### **Study of the following transducers**

Thermistor., Strain gauge., Thermocouple., LVDT., Tachogenerators ( a.c. & d.c.), Capacitive transducers—application for liquid level measurement., Seismic transducers.

Instrument Transformers: Introduction and utility of using Instrument transformers (in the light of measurement and protection purposes)

#### **CT**

Constructional details of (i) Bar CT, Ring C.T. (wound type) and (ii) CT used in HV installations—multicore-secondary C.T (iii) Direct Current C.T., Working principles, errors (concept only), Reduction of errors (Mention the various methods briefly). Accuracy class, Burden on CT, Specifications, Precautions in the use of CT

#### **PT or VT**

Types – Mention the names with comparative study in brief. (Electromagnetic VT, CVT and CCVT) – basic circuit diagram of CVT, Working principle, Errors (concept only), Accuracy class, Burdens, Specifications, Precautions.

Circuit diagram for the measurement of current, voltage and power in a 3-phase circuit.

Diff. Types of faults – consequences. Detection of Cable faults by Cable-Fault locating equipment.

### **CONTROL SYSTEM:**

General idea of an open loop & closed loop control system—block diagram representation, reduction of blocks, multi input systems, Transfer function representation.

Signal flow graph, stability concept—Routh's criteria, simple problems

Brief descriptions of On-off control System & Position Control System and their application.

#### **REF. BOOKS:--**

1. A course in electrical & electronic measuring instruments by A.K.Sawhney.
  2. Digital Instrumentation by Bouwens.
  3. Electrical & Electronic measurements. By W.H.Cooper.
  4. Electrical measurements & measuring instruments. By J.B.Gupta.
  5. Technics of Instrumentation by A.C.Srivastava.
  6. Control system for Technician by G.P.Bryan.
  7. Automatic Process Control by Eckman.
  8. Principles of Process Control by D. Patranabis.
  9. Theory & Applications of automatic control by B.C.Nakra.
- Transducers and Instrumentation by D.V.S. Murty.

# PRINCIPLES & APPLICATIONS OF DIGITAL ELECTRONICS

## DETAIL COURSE CONTENT

Subject Code : DETC-405

Total Marks : 100, credit :3, CPW :3

### IST HALF

#### **BASIC LOGIC GATES**

Symbolic representation and truth table for logic gates: BUFFER – NOT – OR – AND – NAND – NOR – XOR – X-NOR

#### **BOOLEAN ALGEBRA**

Boolean variables – Boolean function – Rules and laws of Boolean algebra – De Morgan's theorem

Max. term and min. term – Canonical form of equation – Simplification of Boolean expression

Karnaugh map technique – Don't care condition – Prime implicants – Canonical forms – Quine-McClusky method

Realization of Boolean expression with logic gates

#### **COMBINATIONAL LOGIC CIRCUITS**

ARITHMETIC CIRCUITS: Half adder – Full adder – Half subtractor – Full subtractor – Parallel and serial full adder (1's complement, 2's complement and 9's complement addition)

Design of circuits using universal gates

Code converter, encoder and decoder – Multiplexer & demultiplexer

Parity generator and checker – Comparator

#### **SEQUENTIAL LOGIC CIRCUITS**

Difference between combinational and sequential logic circuits – Triggering of sequential logic circuits

Difference between flip flop and latch – Construction of RS, D, JK, JK master slave, T flip flops using basic gates, preset and clear signal

COUNTERS: Asynchronous and synchronous counter – Ripple counter – Mod-N counter – Up-down counter – Ring counter – Johnson counter – Programmable counter – Applications

REGISTERS: Shift registers – Serial in serial out – Serial in parallel out – Parallel in serial out – Parallel in parallel out – Applications

### SECOND HALF

#### **MEMORY DEVICES**

MEMORY ADDRESSING: Read, Write and Read Only operations

MEMORY CELLS: ROM, PROM, EEROM, EPROM, CDROM

Static and dynamic RAM – Refreshing of dynamic RAM

Volatile and non-volatile memories, PLA, PAL, GAL, FPLA

#### **DATA CONVERTERS**

DIGITAL TO ANALOG CONVERTERS: Binary weighted resistor type – R-2R ladder type – Specifications and applications of DA converter

ANALOG TO DIGITAL CONVERTER: Comparator type – Successive approximation type – Dual slope AD converter – Specifications and applications of AD converter



## LOGIC FAMILIES

Comparative studies of different type of logic families like DTL, TTL, CMOS, and ECL etc. with the following characteristics: —

- logic levels,
- power dissipation,
- fan in and fan out,
- propagation delay, and,
- noise immunity.

Interfacing of Ics of different logic families – Logic hazards

## REFERENCE BOOKS

1. Digital Principles and Applications / Malvino & Leach / Tata McGraw-Hill
2. Modern Digital Electronics / Jain / Tata McGraw-Hill
3. Digital Electronics / Taub & Schilling / Tata McGraw-Hill
4. Digital Electronics / V. K. Puri / Tata McGraw-Hill
5. Digital Circuits and Design / S. Salivahnan & A. Arivazhgan / Vikash Publishing House
6. Digital Logic Applications and Design / Yarbrough / Vikash Publishing House
7. Digital Logic and Computer Design / Morris Mano / Prentice Hall of India, N. Delhi
8. Digital Technology / V. Kumar / New Age Publishers
9. Digital Circuits / D. Ray Chaudhuri / Eureka Publishers

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## COMMUNICATION SKILLS (JOB) LAB (DHU 400S)

Total Marks : 100, CPW : 4 , Credit : 2

### DETAIL COURSE CONTENT

#### Looking for a Job

Identifying Sources — Skimming Newspapers for Information

#### Job Interviews \*

Preparing for an interview — Responding Appropriately — Group Discussions — Using Language Effectively for Interaction

\* Mock interviews are to be arranged and to be conducted by any suitable person

#### At the Workplace

Communicating using the telephone

## TEACHING INSTRUCTIONS

There should be no difference between the teaching methodology of the lecture classes of the subject COMMUNICATION SKILLS (JOB) and those of the sessional classes of the subject COMMUNICATION SKILLS (JOB) LAB, since all the modules are practical oriented.

Things to be followed by the polytechnics for effective teaching of the subject: —

- (a) L R U C Room to be used for the classes;
- (b) English newspapers be made available on a regular basis to the students;
- (c) samples of different Application Forms be made available to the students.

## TEXT BOOK

ENGLISH SKILLS for Technical Students – TEACHERS’ HANDBOOK / West Bengal State Council of Technical Education in collaboration with THE BRITISH COUNCIL / Orient Longman

### ELECTRICAL ENGINEERING DRAWING

Subject Code : DEE-404S  
Total Marks : 100, credit :2, CPW :4

### DETAIL COURSE CONTENT

#### GROUP - A

PLATE NO.	CONTENTS
1.	Electrical & electronics symbols and danger notice plates as per i.s.s.
2.	HRC fuse & MCB
3.	Electromagnetic/solenoid type contactor
4.	Pin & shackle insulators upto 100v, profile of insulator thread.
5.	Schematic diagram of battery charging from d.c. motor-generator set and from a.c. source
6.	Horn gap and impulse gap l.a.
7.	Sectional view of XLPE and FRLS (fire retardant and low smoke) cables
8.	RCC and steel tubular poles, stays & struts, transposition, guard & safety device, vibration damper 220kv and 400 KV towers

#### GROUP - B

Plate number	Contents
1.	Single Line diagram of a 132KV/33KV outdoor sub-station with all switchgear equipments.
2.	Draw and study the schematic and wiring diagrams for the following using standard conventions: i) Motor Control Circuits—basic idea of contactor control circuit components. ii) Remote control operation of Induction motor with control circuits.
3.	Distribution system showing from 6.6 KV/415 V sub-station to Panel board – and Panel board to DB.
4.	Sectional view of Vacuum Circuit Breaker.
5.	Back panel connection diagram with voltmeter, ammeter, 3-phase energy meter, frequency meter, power factor meter using C.T & P.T.
6.	Connection diagram of single phase motor.
7.	Diagrams of induction type O/C relay (directional and non-directional), impedance relay and differential relay.
8.	Bucholz relay protection of transformer.
9.	Merz-Price differential protection of alternator.

#### REFERENCE BOOKS / CODES

1. Electrical Drawing by Narang.
2. National electric code—SP—30—1984
3. Code of practice for electrical wiring installation—IS—732—1989

4. Danger notice plate- IS: 2551-- 1982
  5. Carriers and bases in rewirable type fuses for voltages up to 650v—IS: 2086—1993
  6. Electrical Drawing by Surjit Singh.
  7. Electrical Engineering Drawing by S.K.Bhattercharya.
  8. Power Wiring Diagram by A.T.Dover.
  9. Electrical Engineering Design and Drawing by O.P. Soni.
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## ELECTRICAL MACHINE LAB

### ( GROUP – B )

#### DETAIL COURSE CONTENT

**Subject Code : DEE-405S**

**Total Marks : 100, credit :2, CPW :4**

1. Determination of phase sequence of 3-phase supply.
2. Determination of parameter of a 3-phase alternator.
3. Regulation of 3-phase alternator by Synch. Impedance method.
4. Load test of an alternator and determine % regulation at various loads with u.p.f. conditions.
5. Synchronisation of 3-phase alternator by:
  - a. three lamp method
  - b. Synchroscope
6. No-load tests on an Induction motor.
7. Blocked-rotor test on an Induction motor.
8. Speed control of Induction motor by
  - a. Frequency changing/ cascade method.
  - b. Pole-changing method.
9. Determination of the effect of rotor resistance on the torque-speed curves of an Induction motor.
10. Load test on Induction motor and determine torque, output, efficiency, p.f., etc.
11. Study the effect of capacitor on the starting and running of a single-phase Induction motor, both in starting and running condition and to determine the method of reversing the direction of rotation.
12. Measurement of slip of Induction motor by Stroboscopic method.

**Each experiment of 4 pd. duration except Experiment No. 5 & 8, which are of 8 pd. duration.**

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## **ELECTRICAL MEASUREMENT & CONTROL LAB**

**Subject Code : DEE-406S**  
**Total Marks : 100, credit :2, CPW :4**

### **DETAIL COURSE CONTENT**

**(At least 12 experiments to be completed)**

1. Observation of voltage, current, frequency and phase difference by CRO.
2. Oscilloscope observation of B-H loop.
3. Study of CT and PT and measurement of gain of CT and PT.
4. Calibration of 3-phase energy meter.
5. Measurement of strain by Strain-gauge and strain-gauge factor from concerned graph.
6. Measurement of non-electrical quantities using LVDT. (Plot displacement vs. electrical parameters graph.)
7. Study of position control system
8. Speed-control of D.C. servo-motor.
9. Finding the location of fault in UG cable using:
  - a. Cable-fault locator
  - b. Murrey-loop Test.
10. Measurement of dielectric strength of Transformer oil.
11. Study of thermocouple and temperature measurement by thermocouple.
12. Study of different Lissajous pattern and determination of phase and frequency of unknown waveform.
13. To be familiar with Function generator & frequency counter.
14. Study of Proximity switch.
15. Study of On-off control set up/ Closed loop set up for (i) Proportional, (ii) differential and (iii) Integral controller.

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## **ELECTRICAL WORKSHOP – II**

### **DETAIL COURSE CONTENT**

**Subject Code : DEE-407S**  
**Total Marks : 100, credit :2, CPW :4**

1. To study the constructional features and windings of 3-phase Induction motor.
2. To identify different windings of 3-phase Induction motor with its phase sequence i.e. starting and finishing of winding by lamp/voltmeter/galvanometer.
3. To study of A.C. motor winding by winding manual.
4. To study the consequences of single phasing.
5. To study the ELCB (Earth leakage circuit breaker) and to know the necessity of using ELCB.
6. Connection of 3-phase induction motor with DOL starter, star-delta starter, auto transformer starter and rheostatic starter.
7. Rewinding practice of the following:-
  - i) 6 volt d.c armature used in automobiles
  - ii) Motor used in Mixie.

8. Winding a relay coil for 6 volt or 12 volt operation.
9. Study the supply system from 6.6 KV / 400 volt substation to a Polytechnic college including all necessary electrical auxiliaries, meters and switches.
10. To study the principle of operation, construction, common faults with their remedies of the following home appliances:-
  - i) Resistance oven ii)Cooking range iii)Vacuum cleaner
  - iv) Food processor v)Portable drilling machine vi)Portable grinder
  - vii) Toaster viii)Hot plate geyser and ix) Voltage stabilizer.

## **D I G I T A L   E L E C T R O N I C S   L A B**

### **D E T A I L   C O U R S E   C O N T E N T**

**Subject Code : DETC-410S**  
**Total Marks : 100, credit :2, CPW :4**

1. To verify the truth table of NOT, OR, AND, NAND, NOR, XOR, X-NOR with TTL logic gates and CMOS logic gates.
  2. To realize different Boolean expressions with logic gates.
  3. To realize half-adder, full-adder, subtractor, parallel and serial full-adder.
  4. To design 1's complement, 2's complement and 9's complement adder-subtractor.
  5. To implement encoder, decoder, multiplexer and demultiplexer.
  6. To construct parity generator and checker & comparator.
  7. To verify the function of SR, D, JK and T Flip-flops.
  8. To construct binary synchronous and asynchronous counter.
  9. To design programmable up / down counter.
  10. To design controlled shift register and study their function.
  11. To study different memory Ics.
  12. To study DA and AD converters.
  13. To interface TTL and CMOS Ics.
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**DETAILED SYLLABI OF THE  
DIFFERENT SUBJECTS OFFERED IN  
FIFTH & SIXTH SEMESTERS**





## **FIFTH SEMESTER**

### **Industrial Management & Entrepreneurship Development** **Subject Code : DHU-501**

**a. Industrial Management (1<sup>st</sup> Half)      Total Marks : 50, credit :2, CPW :2**

#### **Introduction to Management Science**

Principles & functions of management — Contributions of F.W. Taylor, Henry Fayol, Max Weber in development of the theories of management science.

#### **Organisational Behaviour**

Objectives — Brief introduction to: Motivation– Perception – Leadership & Leadership Styles – Communication – Team Building – Work Culture.

#### **Human Resources Management**

Scope & Functions – Human Resources Planning – Selection & Recruitment – Training & Development – Performance Appraisal .

#### **Production & material Management**

Production Planning: Routing – Loading – Scheduling — Production Control: Expediting – Dispatching — Materials Handling Inventory Management Inventory Management —Productivity — Quality Management: Tools & Techniques – Quality Management System.:

#### **Financial Management**

Financial Ratios — Elements of Costing — Auditing

#### **Marketing & Sales Management**

Marketing of products & Services — Advertising & Sales Promotion — Consumer Behaviour

#### **REFERENCE BOOKS**

Essentials of Management / Kontz / McGraw-Hill of India

Organization & Behaviour / M. Banerjee / Allied Publishers

Human Behaviour at Work: Organizational Behaviour / Keith Davis & Newstrom / McGraw-Hill of India

Human Resources Management / Mirza Saiyatain / Tata McGraw-Hill

Production Management & Control / Nikhil Bharat / U.N. Dhar & Co.

Production Management / Keith Lockyer / ELBS

Marketing Management / Philip Kotler / Prentice Hall of India

Lectures on Management Accounting / Dr. B.K. Basu / Basusri Bookstall, Kolkata

An Insight into Auditing: A Multi-dimensional Approach / Dr. B.K. Basu / Basusri Bookstall, Kolkata

Business Strategies, Financial Management & Management Accounting / S.K. Poddar / The Association of Engineers (India)

**b. Entrepreneurship Development (2<sup>nd</sup> Half) Total Marks : 50, credit :2, CPW :2**

#### **Entrepreneurial Development**

Definition of entrepreneurship, Characteristics of entrepreneurship, Factors influencing entrepreneurship, Types and Functions of Entrepreneurs.

Need for promotion of entrepreneurship, Entrepreneurial Environment, Govt. policies for setting-up new small enterprises.

## **Planning a SSI**

What is planning, Types of planning, Importance of planning, Steps in planning, Steps for starting a small enterprise. , Commercial Banks and Financial Institutions.

## **Problems of Small Industries**

Power shortages, Project planning, Finance, Raw materials, Production constraints, Marketing, Personal constraints, Regulation, Entrepreneurial Motivation Training, Motivating factors of Entrepreneurs, Achievement Motivation, Institutions assisting entrepreneurs.

## **REFERENCE BOOKS**

Starting your own business, A step-by-step Blue print for the first-time Entrepreneur – Stephen C. Harper, McGraw-Hill

Harvard Business Review on Entrepreneurship – Harvard Business School Press.

Entrepreneurship Development in small scale – proceedings of National Seminar, DCSSI, New Delhi – Patel, V.G.

Entrepreneurship: Strategies & Resources – Abrams Grant Pass. Oregon: Oasis press.

The Business Planning Guide – David H Bangs, Upstart Publishing Company in Chicago.

Entrepreneurship Development in India – Dr. C.B. Gupta, Dr. N.P. Srinivasan, Sultan Chand & Sons.

Entrepreneurship – Madhurima Lall and Shikha Sahai, Excel Books.

## **POWER PLANT ENGINEERING**

### **Detail Course Contents:**

**Subject Code : DEE-501**

**Total Marks : 100, credit :3, CPW :(3 +1T)**

### **IST HALF**

Conventional sources of Energy – Fossil fuels, Hydroelectric and nuclear.

#### **Thermal Power Station:**

Site selection, Layout diagram showing various components including electrical equipments used, working of station – thermodynamic cycles.

Utilities of various components as shown in layout diagram, Methods of firing boilers fluidized bed combustion choice of pressure of steam generation and steam temperature, elementary idea of turbines, draught mechanism, problems and methods of dust collection, stream power plant efficiency – Problems.

#### **Hydro-electric Power Stations:**

Site Selection. Classification of hydroelectric power stations:

- (i) on the basis of availability of water run-off river type with/without pondage – pumped storage plants.
- (ii) on the basis of head available – low medium and high head.

Classification of turbines based on the principle of operation and head of water. Capacity calculations for hydropower, Layout of hydroelectric power plants of different heads and layout of proposed storage plant. Utilities of different components.

### **SECOND HALF**

#### **Nuclear Power Plants:**

Introduction, Site Selection, elements of nuclear power plant – nuclear reactor, fuels, moderators, coolants, control rods – general layout of nuclear power plant, classification of nuclear power plant – precautionary measures adopted in nuclear power plants, idea about some important plants in India.

Advantages and disadvantages of thermal, hydro & nuclear power stations in respect of site, initial & running cost, sources, simplicity, cleanliness, efficiency & maintenance.

Idea of Captive Power Plants.

Diesel Power Plant & Gas-turbine Plants:

General layout of both plants, merits & demerits, methods of improving output and performance.

Elementary idea about Major Electrical Equipments used in Power Stations:

Generators (turbo- and hydro-), exciters including brush-less excitation and static excitation system, Generator-transformer and unit-auxiliary transformer, Layout of auxiliary supply systems.

Brief idea about Elements of Instrumentation in power stations; Turbidity instruments, Interlocking & sequence control systems, Remote control & telemetry, electrical instrument, Data acquisition system, co-ordinated Master Control system (CMC).

Combined working of power plants: Advantages, Need for co-ordination.

Performance of power stations and Economic considerations: Significance & Definitions of Load factor, diversity-factor on cost of generation, Plant capacity factor ----- Problems.

Cost of generation and classifications Load curves.

Tariff – Block-rate, two-part and p.f. tariff. – problems.

Ref Books:

- 1) Generation of Electrical Energy by B. R. Gupta.
- 2) Power System by V. K. Mehta.
- 3) Power Plant Engineering by Nagrath & Kothari.
- 4) Power System by J.B. Gupta.
- 5) Generation of Electric Power by Wadhwa.

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## **TRANSMISSION & DISTRIBUTION OF POWER**

**Detail Course Contents:**

**Subject Code : DEE-502**

**Total Marks : 100, credit :4, CPW :4**

### **IST HALF**

#### Transmission System

Introduction, Layout of power system, selection of voltage for HT & LT lines – EHV & HV voltages in our country, Advantages of using high voltage for transmission, comparison between AC & DC systems of power transmission, comparison of cost of conductors (only results) ..

#### Constructional Features of Transmission & Distribution Lines

Main components of Overhead lines (names & functions only), types of supports – RCC/PCC poles, steel tower, comparison between single circuit and double circuit design, conductors – different types used in rural electrification, EHV lines (ACSR conductors), conception of ground wire – G.I. wire, skin effect and proximity effect (brief idea).

Types of insulators, selection, failure of insulators, creepage distance (definition & significance only), voltage distribution over a string of suspension insulators (for 3 insulators only), string efficiency (definition & significance), methods of improvement of string efficiency – problems.

#### Mechanical Features of Overhead lines

Sag of transmission line (definition & importance), sag with level and uneven supports (only idea with formula for calculation), effect of wind pressure, temperature and ice deposition – problems on

level supports, stringing chart and its uses. Spacing of conductors, length of span, Relevant I.E. Rules.

#### Electrical features of Overhead lines

Resistance, Inductance & Capacitance of 3-phase transmission lines. (only formula), corona-corona loss, factors influencing corona.

U.G. cable: Description of (i) PVC, (ii) PILC (iii) FRLS (Fire Retardant Low Smoke), (iv) XLPE cables & (v) Gas filled (SF6) cables, Cable Rating and De-rating factor, lying of cables (brief idea).  
Comparison between U.G. system and O.H. system.

### **SECOND HALF**

Performance of Transmission Lines: Classification, regulation and efficiency of lines (idea with formula only), performance of short transmission lines – related problems, bundle conductors, ABC (Aerial-bundled conductors), objectives of transposition of transmission lines, Ferranti Effect.

#### Power Factor Improvement

Using Static condenser and Synchronous condenser – related problems

#### Distribution System

Brief Idea about feeders, Distributors, service mains, radial system and ring-main system.

AC Distribution – primary & secondary distribution, typical layout diagrams – single phase and three phase, voltage drop calculation for AC single phase feeder.

#### Sub-stations

Introduction, Gas insulated sub-station, key-diagram of grid sub-station, line-diagram of an outdoor sub-station, layout of 33/11 kV distribution sub-station.

#### Extra High Voltage DC System of Transmission

Special features, advantages, modern trends – HVDC system in Indian scenario.

Regional Grid System (Conception only).

#### **Ref. Books:**

- 1) Generation, Transmission and Utilization of Electric Power – A.T. Starr.
- 2) Principles of Power Systems – V.K. Mehta.
- 3) A Course in Electric Power – J. B. Gupta.
- 4) Generation of Electrical Energy – B. R. Gupta.
- 5) Electrical Technology – H. Cotton.
- 6) Transmission & Distribution of Power – Tarlok Singh.
- 7) Electrical Power System -- C.L.Wadhwa.

## **INDUSTRIAL ELECTRONICS**

### **Detail Course Contents:**

**Subject Code : DETC-503**

**Total Marks : 100, credit :3, CPW :(3 +1T)**

### **IST HALF**

#### **POWER DEVICES:**

Principle of operation of power BJT and IGBT with output characteristics.

Switching characteristics of power diodes, power transistors; power MOSFET, IGBT, SCR.

Protection of power devices overload protection, fuse protection, circuit breakers, transient protection, Zener, metal oxide resistors, turn on and odd snubber and transient voltage suppressor.

Losses in power devices- on state losses, switching losses, losses in BJT, MOSFET and IGBT)

## **Switching & Timer Circuits**

Simple transistor timer using R-C as timing element.

Classification of multi-vibrators.

Astable multi-vibrators, monostable multi-vibrators, bistable multi-vibrators, circuits using discrete components. Explanation and study of pin out diagram.

Internal block diagram and operating of IC 555.

Application of IC 555 timer as –

Astable multi-vibrator, mathematical expression for  $t_H$  and  $t_L$ , frequency of oscillation and duty cycle.

Monostable – mathematical expression for duration of high pulse.

## **Opto-electronic Device.**

Brief Study and application of the following opto-electronic devices:

Photo conduction cells, Photo diodes, Photo transistor, Light emitting diode, Optical isolator  
LDR

## **SECOND HALF**

### **UNIUNCTION TRANSISTOR**

Construction, operation and characteristics of UJT – Equivalent circuit – UJT as relaxation oscillator – Field of applications

### **THYRISTOR**

Construction, operation and characteristics of SCR – Turn on and turn off mechanism – SCS, DIAC, TRIAC and their uses

### **INTEGRATED CIRCUITS**

Basic idea of ICs – Classifications: linear and digital ICs, SSI, MSI, LSI and VLSI – Field of applications.

### **PROGRAMMABLE LOGIC CONTROLLER**

Definition of programmable logic control system, advantages of PLCs.

Block diagram of PLC system.

Programming of PLCs, different methods

Ladder programming of simple systems like traffic light controller.

List of various PLCs different methods.

### **CONTROL OF DC AND AC MOTOR:**

SCR power supply for DC motor, speed regulation by armature voltage control.

Speed control of AC induction motor (variable voltage control)

Advantage of AC motor control DC motor.

### **SWITCH MODE POWER SUPPLY:**

Principle of operation of buck converter, boost converter and buck-boost converter.

Principle of operation of a PWM switching regulator using IC 3524

Advantage of AC motor control over DC motor.

### **A.C. POWER CONDITIONER CKTS**

Block schematic description of uninterrupted power supply.

Block diagram & brief study and CVT

### **BOOKS**

1. Power Electronics
2. Industrial Electronics & Control
3. Power Electronics
4. Power Electronics & Control
5. Industrial Electronics
6. Industrial Electronics
7. Power Electronics Converter  
Application and Design

### **AUTHORS**

- P.C. SEN  
S. K. Bhattacharya (TTTI)  
Singh & Kanchandani  
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### **PUBLISHERS**

- TMH  
Do  
Do  
PHI  
Dhanpat Rai  
PHI  
W.I.Ltd.

## **ELECTRICAL SYSTEM DESIGN & ESTIMATING**

### **DETAIL COURSE CONTENT**

**Subject Code : DEE-503S**

**Total Marks : 100, credit :2CPW :4**

- i) State the factors to be considered for good lighting and discuss some important factors in connection with lighting.
- ii) Design the lighting scheme for large auditorium, workshop etc.
- iii) Design the electrical installation of machines in small workshop.
- iv) Draw the layout/ single line diagram of lighting scheme and electrical installation of machines.
- v) Estimate the house wiring materials.
- vi) Estimate the lighting system of an auditorium, workshops etc.
- vii) Estimate the electrical installation of machines in small workshop.
- viii) Estimate service connections of a small residential complex.
- ix) Estimate for giving 3-phase over-head service connections to a residential building.
- x) List the precaution to be observed in different types of wiring system.
- xi) State the various cost elements involved in electrical installation

## **ELECTRICAL MACHINE DESIGN PRACTICE**

### **DETAIL COURSE CONTENTDETAIL COURSE CONTENT**

**Subject Code : DEE-504S**

**Total Marks : 100, credit :2 ,CPW :5**

- i) Design of single phase transformer.
- ii) Design of three phase transformer.
- iii) Design of three phase induction motor.
- iv) Design of single phase induction motor
- v) Design of armature winding of DC machine

## **POWER SYSTEM LABORATORY**

### **DETAIL COURSE CONTENT**

**Subject Code : DEE-505S**

**Total Marks : 100, credit :2 CPW :4**

1. To improve P.f. using static condenser.
2. To simulate A.C. distributor.
3. To study active and reactive power flow through transmission lines.
4. To study phase-angle controller.
5. To study the supply system from 6.6 KV/400V sub-station to a housing complex.
6. To study various system faults by D.C. network analyzer.
7. To study various types of turbine used in Power station.
8. To study different types of excitation system for alternator.
9. To study different kinds of insulators.

10. To study PILC, PVC, FRLS and XLPE cables.

11. To prepare a computer program of Electric Bill.

***N.B: Item nos. 3-10 will be done with the help of Slides/Models.***

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## **INDUSTRIAL ELECTRONICS LABORATORY**

### **DETAIL COURSE CONT**

**Subject Code : DETC-508S**

**Total Marks : 100, credit :2 CPW :4**

- Job 1.** To examine and note the function of the components of a controlled voltage regulator circuit (Transistorised) and determination of its regulation at different load currents.(Also to connect a current limiting circuit).
- Job 2.** To fabricate a voltage regulator circuit with IC723 on bread board system; develop the output voltage setting network and determination of voltage regulation of the system.
- Job 3.** To adjust offset null, setup the closed loop amplifier using IC741 op-amp also to determine: (a) dc gain (b) ac gain.
- Job 4.** To fabricate an op-amp integrator, determine its amplitude, phase relation with input, duration of output pulse compared to input for a square wave input.
- Job 5.** To fabricate an op-amp differentiator, determine its amplitude, phase relation with input duration of output pulse compared to input for a triangular input.
- Job 6.** To study (the waveforms and switching delays of device) the switching characteristics of MOSFET.
- Job 7.** To study (waveforms and variation of output voltage with pulse width)  
(a) Switching Power Supply- Buck converter and Boost converter.  
(b) PWM switching voltage regulator.
- Job 8.** Study of Uninterrupted Power Supply unit.
- Job 9.** Study of CVT.
- Job 10.** To fabricate with 555(a) astable multivibrator, determine duration of high pulse, low pulse and duty cycle (b) monostable multivibrator,determine the duration of high and low pulses triggered condition with different R-C values.(c)pulse width modulation, the variation of duration of high pulse with the various values of control voltage at control input terminal of 555.
- Job 11.** To control the full wave a/c load by changing the conduction of SCR by phase shift triggering, (b) changing the conduction triac (use diac as triggering device.)
- Job 12.** Speed control of D.C. series motor using SCR
- Job 13.** Speed control of Induction motor using SCR
- Job 14.** A Simple program for PLC

### **REFERENCE BOOKS**

- 1. Industrial Electronics- A test lab manual by Paul B.Zbar
- 2. Power Electronics Laboratory by O.P. Aurora.
- 3. Basic Electronics by Paul B.Zbar.
- 4. SCR manual- GEC Ltd.

## **SIXTH SEMESTER**

### **Professional Ethics & Values and Optimization Technique Subject Code: DHU -601**

#### **A. PROFESSIONAL ETHICS & VALUES (DHU-601) 1<sup>st</sup> half Total Marks: 50, Credit: 2 , CPW : 2**

#### **DETAIL COURSE CONTENT**

##### **Effects of Technological Growth:**

Rapid Technological growth and depletion of resources. Reports of the Club of Rome. Limits to growth; sustainable development. Energy Crisis; Renewable Energy Resources. Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations. Environmental Ethics. Appropriate Technology Movement of Schumacher: later developments. Technology and developing nations. Problems of Technology transfer. Technology assessment/ impact analysis; Industrial hazards and safety, safety regulations safety engineering. Politics and technology, authorization versus democratic control of technology; Human Operator in Engineering projects and industries. Problems of man machine interaction. Impact of assembly line and automation. Human centered Technology

##### **Ethics of Profession:**

Engineering profession: Ethical issues in engineering practice. Conflicts between business demands and professional ideals. Social and ethical Responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond. Case studies.

##### **Profession and Human Values :**

Value Crisis in contemporary society. Nature of values: Value Spectrum of a 'good' life  
Psychological values: Integrated personality; mental health. Societal values: The modern search for a 'good' society, justice, democracy, secularism, rule of law; values in Indian Constitution.  
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity  
Moral and ethical values: Nature of moral judgments; canons of ethics; Ethics of virtue; ethics of duty; ethics of responsibility. Work ethics, professional ethics.

##### **REFERENCE BOOKS:**

1. Blending the best of the East & West, Dr. Subir Chowdhury, EXCEL
2. Ethics & Mgmt. & Indian Ethos, Ghosh, VIKAS
3. Business Ethics, Pherwani, EPH
4. Ethics, Indian Ethos & Mgmt., Balachandran, Raja, Nair, Shroff Publishers
5. Business Ethics: concept and cases, Velasquez, Pearson

#### **OPTIMIZATION TECHNIQUE**

##### **b. Optimization Technique (2<sup>nd</sup> Half) (DHU 601)**

**2<sup>nd</sup> half, Total Marks: 50, Credit: 2 , CPW : 2**

Introduction to Operation Research & Optimization technique

##### **Linear Programming :**



Introduction to linear programming, Formulation, LPP in the standard form, LPP in canonical form, conversion of LPP in standard form to canonical form, procedure of solving LPP by graphical method.

### **Introduction to Simplex method, Simplex algorithm.**

Shortest

1. path **DJKstra** method.

### **Project Scheduling :**

Project scheduling by PERT/ CPM, Decisions and game theory,

**Classical optimization theory**, unconstrained External problem.

REFERENCE BOOKS :

## **ELECTRICAL INSTALLATION, SWITCHGEAR & PROTECTION**

**Subject Code : DEE-601**

**Total Marks : 100, credit :4, CPW :4**

### **IST HALF**

#### **First Half**

General guidelines for Installation: Location of site, planning & design of installation work, inspection before arrival of machine, procedure for inspection of an electric motor before installation, drying out of rotating m/c - necessities, steps in drying out, methods (in tabular form), measurement taken during drying out.

Earthing Installation: System Earthing and equipment Earthing, Reasons for Earthing of electrical equipment, various Earthing systems, concept of touch voltage and step voltage, factors affecting earth resistance, methods of reducing the earth resistance, measurement of earth resistance

General requirement of electric installation according to I.E. Rules: Rules 30-40, 43-51, 57, 61, 64, 68, 71. As per I.E. Rules type of Earthing required for supports of overhead lines.

Panel boards installation showing back connections with necessary instruments, starters, protection equipment, switches, etc. of

- (i) Motor generator set for battery charging and to supply various loads.
- (ii) Synchronization of two alternators.

Troubleshooting: Causes for failure of electrical equipment, classification of faults under - (i) Electrical, (ii) Mechanical, (iii) Magnetic.

Tools and instruments used for troubleshooting and repair viz., Megger, Bridge-Megger, Ohmmeter, Multimeter, Growler, Tong Tester, Phase sequence indicator, etc. (Very short description with field of use)

Use of troubleshooting charts.

Detection & Remedies of faults in - (i) D. C. M/C, (ii) Transformer, (iii) Induction Motor - causes of noise & vibration, (v) Circuit Breakers, (vi) Starters, (viii) OH & UG lines, (ix) Domestic & Industrial wiring. (All in tabular form)

Repair & Maintenance with Maintenance Schedule of:

- (i) D.C. machine

- (ii) Transformer
- (iii) Induction motor
- (iv) Switchgear & Substation: circuit breakers, isolating switches and HV fuses, reactors and bus bars.
- (v) Relays
- (vi) Brief account of maintenance of contactors.
- (vii) Storage Batteries- charging and discharging procedures to be mentioned.
- (viii) OH lines and Cables: Fault locations finding - identification of the nature of faults and corresponding steps, jointing. Elements of hotline working in EHV lines.

#### Electric Safety Regulations

I.E. Act and rules, Statutory Regulation for safety of persons and equipment, Understand Do's & Don'ts listed in IS for substation & overhead operations.

Procedure for rescuing a person who has received an electric shock – CPR (Cardio Pulmonary Resuscitation)

Causes of electrical fires - steps to deal with fire on electrical installations, class of fires, types of fire-extinguishers used - hand appliances comprising water, sand-bucket, and chemical extinguishers, e.g., Hose-reels, CO<sub>2</sub> extinguishers & chemical foam extinguishers.

## **SECOND HALF**

#### Faults in Generation, Transmission and Distribution:

Types and causes of Faults, effects of faults, current limiting reactors (only objective of use), short-circuit KVA calculations for symmetrical faults – problems.

#### Circuit Breakers:

Classification of circuit breakers, selection of circuit breakers, rating of circuit breakers – breaking capacity, making capacity, rated operating duty, rated voltage

Principle of Arc Extinction, Restriking voltage and recovery voltage.

Description and Principle of operations of: MOCB, ABCB, SF<sub>6</sub> and Vacuum circuit breakers.

Operating mechanisms of CB, elementary idea of Auto-reclosing.

Miniature Circuit Breakers – Description & Working of various components, principle of operation, specifications and applications.

RCCB (Residual Current Circuit Breaker) or ELCB (Earth Leakage Circuit Breaker): Need, working and applications with related I.E. rules.

#### Protection against over-voltages:

Protection of transmission lines from over-voltages – protective ratio, protective angle, reduction of tower-footing resistance.

Protection of Sub-Station & Power Stations from direct lightning Strokes.

Rod gap, Horn gap & MOA (Metal Oxide Arrester) – Description, Principle and applications.

Surge Absorbers and Surge Diverters (conception only).

Protective Relaying: Zones of protection, primary & back-up protection, Essential qualities of protection, classification of protective schemes, basic relay terminology.

CT & PT used in protection: Requirements, Brief idea about CVT and CCVT.

Simple idea of Electromagnetic relays, thermal relays, static relays (with merits and demerits), and Microprocessor based relays, Auxiliary switch, Flaps – conception only. Short description about the Techniques for the production of Time-delays

Different Scheme of Protection:

Over-current Protection: Time-current characteristics of definite time, instantaneous, inverse time and IDMT Relays, use of very inverse-type O/C relay and extremely inverse type O/C relay.

Time-setting, current-setting, PSM – problems.

O/C protective schemes: Time-graded system, current-graded system, combination of these two, Directional relay (idea).

Elementary idea about protection of parallel feeders and Ring-mains, Earth fault protection Scheme Brief explanations with block-diagram representations of inverse time static relay & directional static relay.

Distance Protection Scheme: Area of applications, types – Impedance relays.

Three zone of protection using impedance relay – directional units

Elementary idea with block diagram representations of Static Impedance relay using Comparator

Equipment Protection:

(i) Generator protection – Percentage differential stator protection, brief idea of: - rotor protection due to loss of excitation, protection against rotor overheating because of unbalance in load, over-speed protection, protection against motoring and field suppression.

(ii) Transformer protection - Percentage differential protection – problems, Buchholz Relay, rate of rise of pressure relay, over-fluxing protection, O/C protection.

(iii) Differential protection of Generator Transformer Unit.

### **Ref. Books:**

1. Electrical Maintenance and Repair by J.L.Watts.
2. Installation, fault location and maintenance by T.T.T.I. Bhopal.
3. Operation and maintenance of electrical equipment (Vol-I & II) by B.V.S Rao.
4. Plant installation and maintenance by R.G. Chakraborty.
5. Examples in electrical installation, maintenance and commissioning by B.K.Sinha and H.K.Prasad.
6. Installation, maintenance and commissioning of electrical equipments by Tarlok Singh.

- 1) J. P. Switchgear Handbook – J. P. Limited.
- 2) Power System Protection & Switchgear – B. Ram.
- 3) Switchgear & Protection – Deshpande.
- 4) Switchgear & Protection – Mason.
- 5) Switchgear and Protection – S.Rao.
- 6) Power System—V.K.Mehta.

## **MICROPROCESSOR AND ITS APPLICATIONS**

**Subject Code : DETC-604**

**Total Marks : 100, credit :3, CPW :(3 +1T)**

### **IST HALF**

#### **BASIC ARCHITECTURE OF 8-BIT MICROPROCESSOR**

Hardware features of intel-8085-functional blocks, bus structure, arithmetic logic unit, general purpose registers and special purpose registers, interrupts, serial input and output ports, pin descriptions.

#### **TIMINGS CYCLES OF 8085**

Machine cycle, opcode fetch cycle, execution cycle, instruction cycle.

**MICROPROCESSOR PROGRAMMING:**

Instruction set of Intel-8085- Move, arithmetic, Logic, branching and machine cycle instruction and their timing diagrams.

Different types of programming model. Simple programming of 8085

Addressing modes-Direct, indirect, immediate, register, indexed and relative mode of addressing.

Introducing to branch and subroutine.

**SECOND HALF**

**MEMORY ORGANIZATION:**

Address space partitioning, memory mapped I/O, I/O mapped I/O, serial, parallel, synchronous, asynchronous data transfer and direct memory access, Memory Interfacing considerations, Buffered System

**Interrupt** – hardware and Software & Vectored Interrupts

**Interfacing** – Serial and Parallel (8251, 8255)

**Interfacing** of A/D and D/A converters with 8085 microprocessor and simple programming.

**APPLICATIONS OF MICROPROCESSOR:**

Measurement of Voltage, Current, Frequency

Generation of square, triangular & Staircase Waveforms.

Over current/ under voltage relay

Zero crossing defection & phase sequence detection

Software for thyristor triggering.

Brief idea of DC Motor Controller (SCR Controlled). (Tachogenerator feedback with bang-bang Control Strategy only).

Hardware & Software for the following: - temperature monitoring and controller. (ON/OFF Controller only).

- 1. Stepper motor controller.

**BOOKS:**

- 1. Microprocessor Architectures and Applications Gaonkar
- 2. Microprocessors: Principles and A.K. Pal
- 3. Microprocessors and its applications Leventhal
- 4. Text of Microprocessor base experiments and Projects A.K. Mukhopadhaya
- 5. Microprocessors and its interfacing. B.RAM

**ELECTIVE PAPERS**

**(ONE OF THE OPTIONS OFFERED AS ELECTIVE )**

**CONTROL ENGINEERING**

**Subject Code : DEE-602/1**

**Total Marks : 100, credit :4, CPW :4**

**FIRST HALF:-**

Introduction to Control Systems: Classification of control systems, Examples of Feedback Control Systems, Properties of Control Systems: Stability, steady-state & transient errors, Errors and Error constants, System types. Time response of system: Transient & steady state response of second order system and ramp response of second order system. Control actions: Proportional, integral,

derivative, and their combinations. Case Studies: Performance analysis of position control & speed control of AC & DC Servo motors. Control systems analysis in frequency domain: Frequency Domain Specifications in open loop and closed loop systems and their significance. Stability of linear systems: Routh-Hurwitz criterion, Bode' Plot, Polar Plot, Nyquist criterion. Stability margins. Root locus.

Concept of state, state variable, state model. State variable formulation of control system, Relating transfer function with state model. Time response of state model of linear time-invariant system.

#### **SECOND HALF:-**

Introduction to Industrial Process Control. Modeling of Industrial process Control dynamics. Process Control terminology. Single loop control of standard first order process plants. Controller Implementation : Electronic, Analog, Pneumatic Controllers: P, P-I, P-D, P-I-D control, Controller tuning, Ziegler-Nichol's method. Examples and features of Level Control, Flow Control, Temperature Control, Feed-forward control, Ratio Control, Multi-loop and Cascade control System.

Introduction to Programmable Logic Control (PLC), its Features & Architecture, Ladder Diagram and Simple case Studies.

### **INDUSTRIAL INSTRUMENTATION**

**Subject Code : DEE-602/2**

**Total Marks : 100, credit :4, CPW :4**

**FIRST HALF: Transducers:** Active and Passive Transducers, Static and dynamic specification; Transducer for Position-Potentiometers. Different Types of Optical Encoders, Digital Encoders, Piezoelectric Sensor. Force Measurement by Elastic Transducer, force balance Transducer. **Pressure Measurement:** Direct and Indirect Methods, Capacitive and Resistive Type Pressure transducers, force balance Type Pressure Transducer, Bourdon tubes, Bellows; Pirani gauge. **Flow Measurement :** Principle, point velocity measurement, Hot wire anemometers, different flow meters, Gross Mass flow Measurement technique, Solid-flow Measurement technique, Head flow meters, Area flow meters, Magnetic flow meter, Measurement of airflow. Level Measurement using different types of Level Sensors. Humidity transducers, PH Measurement Technique. Nozzle/ Flapper System and its application for Current to Pressure Conversion. Control Valves and its characteristics, Valve positioners. **Actuators:** Electrical, Pneumatic and Hydraulic Actuators.

**SECOND HALF: Optical Sensors and their Signal Conditioning:** Photo detectors, Photovoltaic detectors, Photodiode detectors, Photo emissive detectors, Principles of Laser Sensor and its applications, Optical coupling and isolation.

**Digital Meters:** Readouts, LED, LCD, Display drivers, Digital frequency meters, Measurement of time period, Pulse width and frequency ratio, Digital Voltmeter, LCR meter.

**Microprocessor & Microcomputer based Instrumentation :** Signal Conditioning and Interfacing techniques for the measurement of different physical Parameters such as Voltage, Current, Frequency of an unknown signal, Phase Sequence of power supply system, Power factor, Temperature using different types of Temperature Sensors, Speed, Linear & Rotary Positions, Force, Pressure, Flow and Level etc.

Introduction to Programmable Logic Controller (PLC), its features & Architecture, Programming Technique, Programmable Ladder diagram for Sequential System, Simple Case studies.

# COMPUTER NETWORK

## DETAIL COURSE CONTENT

Subject Code : DEE-602/3

Total Marks : 100, credit :4, CPW :4

### FIRST HALF

#### NETWORK BASICS

Definition of computer network – Network components – Categories of networks – Classification of NETWORKS: LAN, MAN & WAN – Connection of networks – Application of Network System – General applications like ATM Banking etc with modern approach to Distributed Computing System – Mobile Computing System.

#### BASIC CONCEPT OF DATA COMMUNICATION

Signals – Different kind of analog and digital signals for communication – Wave Spectra – Mode of Signals: Simplex, duplex, half & full duplex – Resultant of superposition of signals – Application of Fourier Transformation.

Classification of COMMUNICATION CHANNEL: Guided media and unguided media – Characteristics of different TRANSMISSION MEDIA: Twisted Pair Cable, Coaxial Cable, Optical Fibre, Terrestrial Communication, Micro-waves – Short Wave Communication – Satellite Communication.

Encoding techniques – Modulation techniques – Application in modem.

Broadband and base band systems.

### SECOND HALF:

#### NETWORK STRUCTURES

Network topology.

CHANNEL SHARING TECHNIQUES: FDM – TDM – WDM – Inverse Multiplexing.

SWITCHING: Circuit Switching – Message Switching – Packet Switching.

Layered architecture of network system – Seven layer OSI model – Functions of each OSI layer – Other ISO structure – TCP / IP Layer Structure.

#### FLOW CONTROL & ERROR CONTROL

FLOW CONTROL: Congestion control – Necessity of flow control – Poll / select method – Stop and wait method – Sliding window method.

ERROR CONTROL: Error detection & correction – Types of error – Checksum – Forward error control – Automatic repeat request – Cyclic redundancy check.

Algorithms: Routing, Fixed and Adaptive

#### LOCAL AREA NETWORK:

Basic concepts.

IEEE 802 family of standards.

ETHERNET: CSMA / CD – Frame formats.

Token Bus – Token Ring – Frame Formats.

FDDI: Access method – Frame format.  
Hubs – Switches – Bridges – Transceivers – Repeaters.  
Wireless LAN.

**SWITCHGEAR & PROTECTION LABORATORY (SESSIONAL)**

**Subject Code : DEE-603S**

**Total Marks : 100, credit :2, CPW :4**

1. Study a HRC fuse.
2. Testing of Differential and o/c Relay by Relay testing kit.
3. Study of Transformer Differential Relay.
4. Draw the characteristics of thermal O/L relay.
5. Determine the inverse characteristics of Induction type – (i) O/C relay, (ii) E/F relay.
6. Study the MOCB, VCB, ABCB and SF6 CB using models and OHP.
7. To demonstrate the various parts of MCB.

**MICROPROCESSOR APPLICATION LAB (SESSIONAL)**

**Subject Code : DETC-607S**

**Total Marks : 100, credit :2, CPW :4**

1. Hands on practice and observation & study on 8085 microprocessor.
2. Execution of simple programs in assembly language of 8085 microprocessor.
3. Measurement of different physical parameters such as voltage, frequency, speed, temperature using 8085 microprocessor.
4. Generation of different waveform using 8085 based D/A converters.
5. Thyristor triggering using 8085 based system
6. Study of 8255 PPI at different modes.
7. Electromagnetic relay operation using 8085 based system.
8. Study of interfacing & execution of stepper motor using 8085 based system.

**Control Engineering Lab.**

**Subject Code : DEE-605S/1**

**Total Marks : 100, credit :4, CPW :4**

1. Experiments on Synchro Transmitter-Receiver System.
2. Torque – Speed Characteristics of DC & AC Servo Motors.
3. Study of DC & AC Position Control System using different Controller Algorithms.
4. Experiments on Level Control System using different Control Algorithms.
5. Experiments of Flow Control System using different Control Algorithms.
6. Experiments of Temperature Control System using different Control Algorithms
7. Experiments on Multi-loop Control System using different Control Algorithms.
8. Experiments on PLC by hands on practice of Programming using Ladder diagrams at different modes of Sequential Systems.

**Industrial Instrumentation Lab.**  
**Subject Code : DEE-605S/2**  
**Total Marks : 100, credit :4, CPW :4**

1. Measurement of Speed Using different Optical Encoders.
2. Detection of linear and Rotary Positions.
3. Measurement of Pressure using LVDT & Burdon Tube, CVDT.
4. Measurement of Level and Flow of a Fluid.
5. Experiments on Control Valve Characteristics.
6. Microcomputer based Measurement of Temperature, Phase Sequence, Pressure, Position & Speed etc.
7. Experiments on PLC by hands on practice of Programming using Ladder diagrams at different modes of Sequential Systems.

**COMPUTER NETWORK LAB**

**DETAIL COURSE CONTENT**

**Subject Code : DEE-605S/3**  
**Total Marks : 100, credit :4, CPW :4**

The laboratory works will be performed on the following areas:—

1. LAN card (MB and GB range) installation and cabling, demonstration on Hub, Switches and wireless LAN card.
2. Optical fibre based LAN- Transceiver, commissioning of optical fibre tools.

**REFERENCE BOOKS**

1. Data Communication and Networking / B.A. Forouzan / Tata McGraw-Hill
2. Communication Network / Leon, Garcia, Widjaja / Tata McGraw-Hill
3. Computer Network / Tanenbaum / Prentice Hall of India
4. Data Communications / F. Halsall / Pearson Edu.
5. Computer Network/ U. Black / Prentice Hall of India
6. Peter Norton's Introduction to Computer / P. Norton / Tata McGraw-Hill
7. Computer Network / Stallings / Prentice Hall of India
8. Local Area Network / Ahuja / Tata McGraw-Hill.
9. Computer Communication ISDN Systems / Dr. D.C. Agarwal
10. Elements of Computer Science & Engineering / Prof. A.K. Mukhopadhyay
11. Computer Networks Fundamentals and Applications / Rajesh, Easwarakumar & Balasubramanian



