UNIVERSITY OF ENGINEERING & MANAGEMENT,JAIPUR

Lecture-wise Plan

Subject Name: Electric Drives **Subject Code-EE701**
Year: 4th Year **Semester: Eight**

Module Number	Topics	Number of Lectures
1	**Electric Drive:**	**5L**
	1. Concept, classification, parts and advantages of electrical drives. .	1
	2. Types of Loads, Components of load toques, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion..	2
	3. Determination of moment of inertia, Steady state stability, Transient stability	1
	4. Multi quadrant operation of drives. Load equalization	1
2	**Motor power rating:**	**6L**
	1. Thermal model of motor for heating and cooling, classes of motor duty	2
	2. Determination of motor rating for continuous, short time and intermittent duty.	2
	3. Equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads	1
	4. Effect of load inertia & environmental factors	1
3.	**Stating of Electric Drives:**	**6L**
	1. Effect of starting on Power supply, motor and load	\2
	2. Methods of stating of electric motors. Acceleration time Energy relation during stating,	2
	3. Methods to reduce the Energy loss during starting	2
4	**Braking of Electric Drives:**	**2L**
	1. Types of braking, braking of DC motor, Induction motor and Synchronous motor, Energy loss during braking	2
5	**Dc Motor Drives:**	**6L**
	1. Modelling of DC motors**,** State space modelling, block diagram &Transfer function	2
	2. Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives	2
	3. Power factor, supply harmonics and ripple in motor current chopper controlled DC	2

	motor drives	
6	**Induction motor drives:**	**4L**
	1. Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme,	2
	2. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/hertz control, vector or filed oriented control	2
7	**Synchronous motor drives:**	**4L**
	1. Variable frequency control, Self Control	2
	2. Voltage source inverter fed synchronous motor drive, Vector control.	2
8	**Industrial application:**	**3L**
	1. Introduction to Solar and Battery Powered Drive,	1
	2. Stepper motor, Switched Reluctance motor Drive	1
	3. Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives	1
Total Number Of Hours = 36		

Assignment:

Module1 (Electric Drives)

1. Describe the four quadrant operation of electrical drives.
2. Determine the steady state and transient stability of electric drives
3. State the factors that can influence the choice of a motor to drive the load

Module 2 (Motor Power Rating)

1. Mention the Effect of load inertia & environmental factors on motor power rating

Module 3 (Starting of Electric Drives)

1. Discuss the different starting methods for different motors.

Module 4 (Braking of Electric Drives)

1. What is Braking? What are the different methods of braking of a Dc Motor.

Module 5 (Dc Motor Drive)

1. What is dynamic braking for dc motor?
2. Block diagram of the speed controller for speed control using armature voltage change
3. Describe Run-up of series D.C. motor with resistance in armature circuit.

Module 6 (Induction Motor Drive)

1. Define plugging of 3 phase induction motor
2. Give the types of braking used for 3 phase induction motor.
3. Define regenerative braking of 3 phase induction motor

Module 7 (Industrial Application)

1. How we can consider the drives for Textile mills, Steel rolling mills, Cement mills, Paper mills

UNIVERSITY OF ENGINEERING & MANAGEMENT,JAIPUR

Lecture-wise Plan

Subject Name: **Utilization Of Electric Power** Subject Code: **EE-702**

Year: **4th Year** Semester: **7th**

Module Number	Topics	Number of Lectures
1	**Chapter 1: Traction**	**10L**
	1. System of Traction Electrification.	1L
	2. Train movement & energy consumption (Speed-time curves, Crest speed, Average speed & Schedule speed).	4L
	3. Factors affecting energy consumption (Dead weight, Acceleration weight & Adhesion weight).	3L
	4. Protective devices.	2L
	Chapter 2: Electric Traction motor & their control	**10L**
	1. Starting, braking with special emphasis on power electronic controllers.	4L
	2. Current collector	1L
	3. Interference with telecommunication circuit..	3L
	4. A brief outline of linear Induction motor principle in Traction.	2L
2	**Chapter 3: Illumination**	**10L**
	1. Laws of illumination.	1L
	2. Polar curves.	1L
	3. Photometry.	1L
	4. Integrating sphere.	1L
	5. Types of Lamps: Conventional and Energy Efficient.	2L
	6. Basic principle of Light control.	1L
	7. Different lighting scheme & their design methods.	2L
	8. Flood and Street lighting.	1L
3	**Chapter 4: Heating**	**6L**
	1. Types of heating	1L
	2. Resistance heating, Induction heating.	2L
	3. Arc furnace.	1L
	4. Dielectric heating.	1L
	5. Microwave heating.	1L
	Chapter 5: Welding	**6L**
	1. Resistance welding, Arc welding.	1L

	2. Ultrasonic welding, Electron bean welding, Laser beam welding.	2L
	3. Requirement for good welding	1L
	4. Power supplies for different welding schemes	2L
Total Number Of Hours = 42L		

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Assignment:

Module-1(Traction & Electric Traction motor & their control):

1. Describe the topology of boost converter based speed control method of traction motor with suitable diagram and waveforms (DC motor).
2. Drive the expression of the tractive effort exerted by train wheel in terms of traction motor torque, gear ratio, wheel diameter and efficiency of transmission of power through gears with suitable diagram.
3. What is the effect of a train going up a gradient on the required tractive effort to be supplied by the traction motor? Also drive the expression of that tractive effort
4. An electric train has an average speed of 40kmph on a level track between stops 1.6Km apart at suburban locality. The run is to be approximated as a simple quadrilateral speed time curve. It is accelerated at 2.0 kmphps and achieves a maximum speed of 64kmph.The coasting and braking retardation of this run is 0.16 kmphps & 3.2 kmphps respectively. Draw the speed-time curve indicating duration of acceleration, coasting and breaking periods.

Module-2 (Illumination):

1. Differentiate between “illumination” and “luminous intensity”. Also write down the properties of good illumination
2. Describe stroboscopic effect. What are the methods that can be employed to minimize this effect?
3. Two points X and Y in a horizontal plane are needed to be illuminated. A light source with uniform intensity is installed directly 20m above the point X. If illumination at point X is five times greater than point Y, then how far is point Y from point X

Module-3 (Heating & Welding):

1. What are the important features of electric heating? What is the basic principle of induction heating?
2. Describe the applications of induction heating. Describe with the help of a neat sketch, the working of a vertical core type induction furnace and its various advantages.
3. Explain the following terms
   a. Resistance welding
   b. Ultrasonic welding

c. Laser welding

UNIVERSITY OF ENGINEERING & MANAGEMENT,JAIPUR

Lecture-wise Plan

Subject Name: Power System III **Subject Code-EE 703A**
Year: 4th YearSemester: Seventh

Module Number	Topics	Number of Lectures
1	**Introduction:**	**2L**
	1. Power Systems in Restructured Environment; Distributed and Dispersed Generation;	1
	2. Environment Aspects of Electric Power Generation.	1
2	**Economic operation:**	**8L**
	1. Generation Cost Curves; Economic Operation of Thermal System;	2
	2. Plant Scheduling, Transmission Loss and Penalty Factor,	3
	3. Hydro-Thermal Scheduling; Concept of Reserves and Constraints; Unit Commitment.	3
3.	**Automatic Generation Control:**	**6L**
	1. Concept of AVR , Exciter and VAR Control;	3
	2. Concept of ALFC co-operating processes, inter-process communication. Single Area Load Frequency Control; Two Area Load Frequency Control; Frequency Response.	3
4	**Compensation in power system:**	**10L**
	1. Reactive Power Sensitivity and Voltage Control.	2
	2. Load Compensation with Capacitor Banks	2
	3. Line Compensation with Reactors	2
	4. Shunt and Series Compensation	2
	5. Fixed Series Capacitors; Thyristor Controlled Series Capacitors; Introduction to SVC and STATCOM.	2
5	**Power system transients:**	**9L**
	1. Types of System Transients, Overvoltage in Transmission Lines	3
	2. Propagation of Surges and Travelling Waves	3
	3. Protection against Lightning and Surges	3
Total Number Of Hours = 35		

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Assignment:

Module-1:

1. On what parameters does the layout of (a) thermal power plant (b) hydel power plant depends?
2. What are the environmental aspect that influence the installation of a hydel power plant?

Module-2:

1. Let us consider a generating station that contains a total number of threegenerating units. The fuel costs of these units are given by

$$f_1 = \frac{0.8}{2} P_1^2 + 10P_1 + 25 \text{ Rs./h}$$

$$f_2 = \frac{0.7}{2} P_2^2 + 5P_2 + 20 \text{ Rs./h}$$

$$f_3 = \frac{0.95}{2} P_3^2 + 15P_3 + 35 \text{ Rs./h}$$

The generation limit sof the units are as follows:

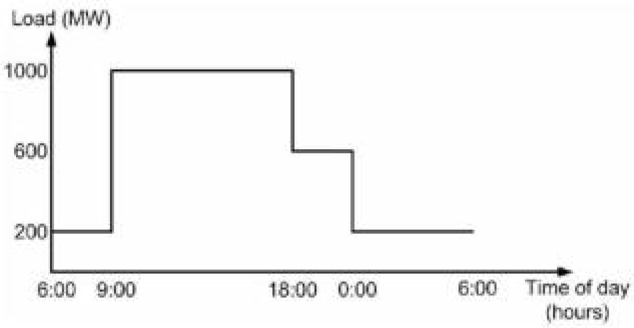
$$30 \text{ MW} \le P_1 \le 500 \text{ MW}$$

$$30 \text{ MW} \le P_2 \le 500 \text{ MW}$$

$$30 \text{ MW} \le P_3 \le 250 \text{ MW}$$

The total load that these units supply varies between 90 MW and 1250 MW. Assuming thatall the three units are operational all the time, compute the economic operating settings as the load changes.

2. Consider two generating plant with same fuel cost and generationlimits. These are given by



For a particular time of a year, the total load in a day varies as shown in the figure above. Also an additional cost of Rs. 5,000 is incurred by switching of a unit during the off peak hours andswitching it back on during the during the peak hours. Determine whether it is economical to have both units operational all the time.

Module-3:

1. Consider an interconnected 50-Hz power system that contains fourturbine-generator units rated 750 MW, 500 MW, 220 MW and 110 MW. The regulatingconstant of each unit is 0.05 per unit based on its own rating. Each unit is operating on 75%of its own rating when the load is suddenly dropped by 250 MW. We shall choose a commonbase of 500 MW and calculate the rise in frequency and drop in the mechanical power outputof each unit.

2. Consider a two-area power system in which area-1 generates a total of 2500 MW, while area-2 generates 2000 MW. Area-1 supplies 200 MW to area-2 through theinter-tie lines connected between the two areas. The bias constant of area-1 (b) is

875 MW/Hz and that of area-2 (b) is 700 MW/Hz. With the two areas operating in the steady state, the load of area-2 suddenly increases by 100 MW. It is desirable that area-2 absorbs itsown load change while not allowing the frequency to drift.

Module-4

1. Let us apply condition to maintain load voltage same as source voltage. Discuss the feasibility of injected voltage in series with the line to obtain load voltage same as source voltage.
2. Discuss transient operation of DVR.

Module -5

1. How does the propagation constant and characteristic impedance define the voltage and current behaviour in a transmission line, explain.
2. What is the relation between transmitted voltage and SWR?

UNIVERSITY OF ENGINEERING & MANAGEMENT,JAIPUR

Lecture-wise Plan

Subject Name:-Control system-III **Subject Code**:-EE703B

Year:4th Year **Semester: -**SEVENTH

Module	TOPICS	NO OF LECTURES
1	**Feedback Linearization**: Motivation, Input–Output Linearization, Full-State Linearization, State Feedback Control and Stabilization.	05
2	**Sliding Mode Control:** Overview of SMC, Motivating Examples, Stabilization of second order system; Advantages and disadvantages.	05
3	**Optimal control system:** Formulation of optimal control problem: Minimum time, minimum energy, minimum fuel problem, state regulator, output regulator & tracking problems. Calculus of variations: Constrained fixed point and variable point problems, Euler Lagrange equations. Problems with equality and inequality constraints. Engineering application, Lagrange, Mayer &Bolza problems, Pontryagin's maximum (minimum) principle. Multiple decision process in discrete and continuous time - The dynamic programming. Numerical solution of two point boundary value problems - the steepest descent method and the Fletcher - Powell Method.	20
	TOTAL HOUR REQUIRED=30	

ASSIGNMENTS:

MODULE 1:

1. Write short note on input output linearization
2. Write short note state feedback control

MODULE 2:

1. Explain sliding mode control.
2. Explain the stabilization methods of second order control system

MODULE 3:

1. Write a short note on optimal control methods.
2. Explain the significance of Lagrange equations
3. Write short notes on Mayer &Bolza problems, Pontryagin’s maximum (minimum) principle

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Lecture-wise Plan

Subject Name: Electric Machines III **Subject Code-EE 703C**

Year: 4th YearSemester: Seventh

Module Number	Topics	Number of Lectures
1	**Generalized theory of Electric Machine:**	**8L**
	1. The Primitive machine, Voltage equations of the Primitive machine	1
	1. Invariance of power,Transformation from a displaced brush axis	1
	2. Transformation from three phases to two phases	1
	3. Transformation from rotating axes to stationary axes	1
	4. Physical concepts of Park's transformations, Transformed impedance matrix	2
	5. Electrical torque, Restriction of the generalized theory of electrical machines	2
2	**DC Machine dynamics:**	**6L**
	1. Separately excited D.C. generators: steady state analysis,	2
	2. Separately excited DC machines transient analysis	2
	3. Transfer function & Block diagram.	2
3.	**AC Machine dynamics:**	**9L**
	1. Electrical transients in Synchronous machine, Expression for reactance and time constants.	3
	2. Dynamics of synchronous machine, Electro-mechanical equation- motor operation-generator operation - small oscillations, general equation for small oscillations- representation of oscillations in state variable form.	3
	3. Dynamics of Induction machine, Induction machine dynamics during starting and braking, acceleration time, Induction machine dynamics during normal operation, Equation of dynamical response of Induction motor.	**3**
4	**Space vectors and its application:**	**10L**
	1. Space Vectors and its application to the analysis of inductionmotors.,	2
	2. Principle, DQ flux-linkages model	2
	3. Space Phasor model derivation,	2
	4. Analytical solution of machine dynamics, Signal flow graph of the space modelled Induction motor,	2
	5. Control principle of Induction motor.	2

5	**AC motor behavior under asymmetrical voltage supply:**	**9L**
	1. Harmonic effects on Induction motor,	3
	2. Harmonic equivalent circuit and harmonic torque.	3
	3. Harmonic torque	3
Total Number Of Hours = 42		

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Assignment:

Module-1:

1. What is Krons' primitive machine? Derive the general voltage and torque equations of such a general machine considering d-q coils on stator and rotor members.
2. Derive the [G] matrix explaining each term.

Module-2:

1. A DC shunt generator is running steadily and develops a constant voltage at no load. The armature terminals are suddenly short circuited. Find the expression to show the nature of both field current and armature current with time, take the instant of short circuit at t=0. Draw the relevant curves.
2. Draw the curve for armature current with time for the above situation.

Module-3:

1. What are the various basic parameters of a synchronous machine ?A 3-phase, 50 Hz cylindrical-rotor synchronous machine has thefollowing parameters : Self-inductance for phase a = 3.15 mH. Armature leakage inductance = 0.35 mH. Calculate the mutual inductance between armature phases and its synchronous reactance.Deduce the necessary formula used.
2. Why it is important to investigate the transient behaviour of synchronous generator ?3 phase synchronous generator (salient-pole) without damper bars, is developing rated voltage at its terminals, when running at synchronous speed at no load. A three phase balanced shortcircuitsuddenly occurs at alternator terminals. If all the synchronous machine resistances and armature transformer voltages are neglected, develop expressions for the armature and field currents as a function of time.Derive the same for armature currents if armature transformervoltages are included.

Module-4

1. Explain with block diagram the universal vector decouplingcontrol of an induction motor using Rotor Field oriented control.
2. Using Space Phasor equations derive the expression of Sub transient inductance and Transient inductance of an inductionmotor. State the assumptions.

Module -5

1. Explain how the negative sequence and zero sequencereactances are measured experimentally.

2. Find the expression of current in the event of a sudden threephase short circuit in a 3 phase induction motor. Assume that thetransient begin on no load and the reference frame is attached tothe rotor.

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Lecture-wise Plan

Subject Name: **High Voltage Engineering** Subject Code: **EE-704A**

Year: **4th Year** Semester: **7th**

Module Number	Topics	Number of Lectures
1	**Breakdown phenomena:**	**13L**
	1. Breakdown of Gases:Mechanism of Break down of gases, Charge multiplication, Secondary emission	2L
	2. Townsend Theory, Streamer Theory, Paschen's Law	2L
	3. Determination of Minimum breakdown voltage,	1L
	4. Partial Discharge: definition and development in solid dielectric, Break Down of Solids: Intrinsic breakdown,	2L
	5. Electromechanical break down, Thermal breakdown, Streamer Breakdown	2L
	6. Breakdown of Liquid: Intrinsic Break down, Cavitation Theory, Suspended particle Theory	2L
	7. Breakdown in Vacuum: Non metallic electron emission mechanism	1L
	8. Clump mechanism, Effect of pressure on breakdown voltage	1L
2	**Generation of High Voltage**	**10L**
	1. Generation of high AC voltages: Testing transformer,Cascaded transformer	1L
	2. Series resonant circuit, single stage and multi stage	1L
	3. Advantages of Series Resonant Circuit in testing of cables	1L
	4. Generation of DC high voltage: Cockcroft Walton double	1L
	5. Multistage HVDC generation circuit	1L

	6. Electrostatic generator	1L
	7. Definition of Impulse Voltage as per Indian Standard Specification, Wave front and wave tail time	1L
	8. Generation of Impulse Voltage	1L
	9. Multistage Impulse generator	1L
	10. triggering of Impulse Generator	1L
3	**Measurement of High Voltage**	**5L**
	1. Sphere gap voltmeter, AC , DC and impulse high voltage measurement as per Indian Standard Specifications	2L
	2. Resistance and Capacitance Potential dividers	1L
	3. Peak voltmeters for measurement of high AC voltage in conjunction with capacitance dividers	1L
	4. Capacitance Voltage Transformer	1L
4	**Transient in power systems, High Voltage Testing:**	**7L**
	1. Lightning Phenomena, Electrification of cloud, Development of Lightning Stroke	1L
	2. Protection of Electrical Apparatus against over voltage, Lightning Arrestors, Valve Type, Metal Oxide arresters	2L
	3. Insulation Co ordination, Basic Insulation level. Basic Impulse level, Switching Impulse level	1L
	4. Volt time characteristics of protective devices, Determination of Basic Impulse level of substation equipment	1L
	5. High Voltage testing, Testing as per Indian Standard Specifications	1L
	6. Power frequency withstand, induced over voltage and impulse test on transformers	1L
Total Number Of Hours = 35L		

UNIVERSITY OF ENGINEERING & MANAGEMENT,JAIPUR

Lecture-wise Plan

Subject Name: **High Voltage Engineering** Subject Code: **EE-704A**
Year: **4th Year** Semester: **7th**

Assignment:

Module-1(Breakdown phenomena):

1. Define Townsend's first and second ionization coefficient , explain the Townsend's criterion for spark
2. State and explain Paschen's law?
3. Write short notes on corona discharge?
4. Explain clearly the streamer mechanism of spark, with suitable sketches
5. Classify various break down mechanisms occurring on liquid dielectrics and explain them briefly?
6. Explain the losses in dielectrics?
7. What is the significance of Townsend's first and second ionization coefficients?
8. How breakdown occurs in impure liquid dielectrics?
9. Describe thermal mechanism of breakdown in liquid dielectrics?
10. Write short notes on intrinsic breakdown in solid dielectrics?

Module-2 (Generation of High Voltage):

1. What is the Need for Generating High Voltages in Laboratory
2. Draw a neat sketch of impulse generator and indicate the significance of each parameter being used?
3. Derive an expression for voltage efficiency of a multistage impulse generator?
4. What are applications of High Voltages?
5. Explain and compare the performance of half wave rectifier and voltage doubler circuit?
6. Show that the voltage drop in a n stage Cockroft Walton voltage multiplier circuit is $\frac{I}{fC}[\frac{2n^3}{3} + \frac{n^2}{2} - \frac{n}{6}]$
7. How Van De Graph Generator works, explain with a schematic diagram?
8. A ten stage impulse generator has 0.350 µF condensers. The wave front and wave tail resistances are 70 Ω and 2500Ω respectively. If the load capacitance is 2.5nF, determine the wave front and wave tail times of the impulse wave?
9. Explain how Trigatron Gap is used for tripping control in impulse generator circuit?
10. What is ripple voltage? Show that the ripple voltage in a rectifier circuit depends upon the load current and circuit parameters?

Module-3(Measurement of High Voltage):

1. Explain sphere gap?
2. How atmospheric condition and nearby earth object influence the measurement of high voltage using sphere gap?
3. Describe the principle of electrostatic voltmeter?
4. How Chubb – Fortescue method is used for high voltage measurement
5. Write short notes on capacitive voltage divider.
6. Why capacitive voltage dividers are used instead resistive voltage dividers while measuring high voltage?
7. A generating voltmeter is required to measure voltage between 15 kV to 250 kV. If the indicating meter reads a minimum current of 2 µA and maximum of 35 µA,

determine the capacitance of the generating voltmeter. Assume that the speed of driving synchronous motor is 1500 rpm.

8. Explain how peak voltmeter is used for high voltage measurement?

Module-4(Transient in power systems, High Voltage Testing):

1. Describe the testing methods of line insulators?
2. Explain the methods for testing cables?
3. Explain the testing of circuit breakers?
4. Write short notes on Insulation Co-ordination?
5. Discuss the phenomenon of travelling wave over transmission line. Establish the relation between the V & I waves travelling over the transmission line & for their velocity of propagation.
6. Deduce the general expression for reflection & refraction coefficient of travelling wave?
7. What do you understand by surge test or impulse test? Explain in detail?
8. What is meant by making capacity of the circuit breaker?
9. Explain how lightening strokes are developed?
10. Describe volt time characteristics of protective devices?

UNIVERSITY OF ENGINEERING & MANAGEMENT,JAIPUR

Lecture-wise Plan

Subject Name: Power plant engineering **Subject Code-EE704B**
Year: 4th Year **Semester: Eight**

Module Number	Topics	Number of Lectures
1	**Introduction:**	**4L**
	1. Power and energy, sources of energy .	1
	2. Review of thermodynamic cycles related to power plants, fuels and combustion calculations.	1
	3. Load estimation, load curves, various terms and factors involved in power plant calculations	1
	4. Effect of variable load on power plant operation, Selection of power plant	1
2	**Power plant economics and selection:**	**3L**
	1. Effect of plant type on costs, rates, fixed elements, energy elements. customer elements and investor's profit; depreciation and replacement,	2
	2. Theory of rates. Economics of plant selection, other consideration plant selection	1
3.	**Steam power plant:**	**8L**
	1. General layout of steam power plant	1
	2. Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories	2
	3. Different systems such as coal handling system, pulverizes and coal burners, combustion system, draft, ash handling system, Dust collection system	2
	4. Feed water treatment and condenser and cooling towers and cooling ponds	1
	5. Turbine auxiliary systems such as governing, feed heating, reheating, flange heating and gland leakage.	1
	6. Operation and maintenance of steam power plant, heat balance and efficiency Site selection of a steam power plant	1
4	**Diesel power plant:**	**5L**
	1. General layout, Components of Diesel power plant	1
	2. Performance of diesel power plant, fuel system, lubrication system, air intake and admission system, super charging system, exhaust system	2

	3. Diesel plant operation and efficiency, heat balance, Site selection of diesel power plant	1
	4. Comparative study of diesel power plant with steam power plant	1
5	**Gas turbine power plant:**	**3L**
	1. Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, co generation	1
	2. Auxiliary systems such as fuel, controls and lubrication, operation and maintenance	1
	3. Combined cycle power plants, Site selection of gas turbine power plant	1
6	**Nuclear power plant:**	**8L**
	1. Principles of nuclear energy, Layout of nuclear power plant, Basic components of nuclear reactions	2
	2. Power station, Nuclear waste disposal, Site selection of nuclear power plants	1
	3. Hydroelectric station Hydrology, Principles of working, applications, site selection, classification and arrangements	1
	4. Hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, inter connected systems	2
	5. Non Conventional Power Plants Introduction to non-conventional power plants (Solar, wind, geothermal, tidal) etc.	1
7	**Electrical system:**	**4L**
	1. Generators and their cooling, transformers and their cooling.	2
	2. Instrumentation Purpose, classification, selection and application, recorders and their use, listing of various control rooms. Pollution due to power generation	2
Total Number Of Hours = 35		

Assignment:

Module 1 (Introduction)

1. What is load factor and Demand factor?
2. The peak load on a power plant is 60 MW. The loads having maximum demands of 30 MW,20 MW, 10 MW and 14 MW are connected to the power plant. The capacity of the power plant is 80 MW and the annual load factor is 0.60. Estimate (a) average load on the power plant, (b) the energy supplied per year, (c) the demand factor, (d) the diversity factor.

3. A power plant has the following annual factors; load factor =0.74, capacity factor =0.60, use factor =0.66, maximum demand is 60 MW. Estimate (a) the annual energy production, (b) the reserve capacity over and above the peak load, and (c) the hours during which the plant is not in service per year.

Module 2 (Power plant economic and selection)

1. What are the economic consideration for plant selection

Module 3 (Steam Power Plant)

1. A steam power plant with inlet steam to the h.p. turbine at 90 bar and 500 degree centigrade and condensation at 40 degree centigrade produces 500 MW. It has one stage of reheat optimally placed which raises the steam temperature back to 500°C. One closed feed water heater with drains cascaded back to the condenser receives bled steam at the reheat pressure, and the remaining steam is reheated and then expanded in the l.p. turbine. The h.p and l.p turbines have isentropic efficiencies of 92 percent and 90 percent, respectively. The isentropic efficiency of the pump is 7 percent, calculate (a) the mass flow rate of steam at turbine inlet in kg/s, (b) the cycle efficiency and (c) the cycle work ratio,Use TTD=-1.6°C.
2. An ideal steam power plant operates between 70 bar, 550°C and 0.075 bar. It has seven feed water heaters, Find the optimum pressure and temperature at which the heaters operate.
3. A textile factory requires 10t/h of steam for process heating at 3 bar saturated and 1000 kW of power, for which a back pressure turbine of 70 percent internal efficiency is to be used. Find the steam condition required at the inlet of the turbine.

Module 4(Diesel power plant)

1. A four-stroke CI engine of 3.5 litre capacity develops indicated power on average of 13.1 Kw/m^3 of free air induced per minute, while running at 3600 rpm and having a volumetric efficiency of 82 per cent, referred to free air conditions of 1.013 bar and 25°C. A blower driven mechanically from the engine is proposed to be installed for supercharging. It works through a pressure of 1.75 and has an isentropic efficiency of 70 per cent. Assume that at the end of the intake stroke the cylinders contain a volume of charge equal to the swept volume, at the pressure and temperature of the delivered air from the blower. Taking all mechanical efficiencies to be 80 per cent, estimate the net increase in brake power of the engine due to supercharging.
2. Following are the observations made for a 20 minute trail of a two stroke diesel engine.
   Net brake load = 680 N, mep =3.0 bar, N= 360 rpm, Fuel consumption =1.56 kg, cooling water =160 kg, water inlet temperature =32°C, Water outlet temperature =57°C, Air used/kg fuel =30 kg, Room Temperature =27°C, Exhaust gas temperature =310°C, Cylindrical dimensions =210 mm bore *290 mm stroke, brake diameter =1m, calorific value of fuel =44MJ/Kg, steam formed per kg fuel in the exhaust =1.3 kg, specific heat of steam in exhaust =2.093 KJ/KgK, Specific heat of dry exhaust gases =1.01 Kj/KgK.
   Calculate the indicated power and the brake power and make an energy balance of the engine.

Module 5 (Gas turbine power plant)

1. What are the elements of gas turbine power plant
2. What is combined cycle power plant

Module 6 (Nuclear Power plant)

1. The half- life of radium 226 (atomic mass =226.095) 1620 yrs. Compute (a) the decay constant, and (b) the initial activity of 1 g of radium 226.
2. A certain nucleus has a cross-section of 10 barns for 2200 m/s neutrons. Find the cross-section if the KE of the neutrons increases to 0.1 eV. The two neutrons energies are withi1/V Range of the nucleus.
3. Calculate the macroscopic capture cross-section of water of density 1g/cm^3. The microscopic capture cross-sections of hydrogen and oxygen are 0.332 barn and 0.0002 barn, respectively.

Module 7 (Electrical system)

1. What are the cooling procedure for transformer
2. Discuss about the pollution due to the power generation.

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Lecture-wise Plan

Subject Name: Power Generation Economics **Subject Code-EE704C**
Year: 4th Year **Semester: Eight**

Module Number	Topics	Number of Lectures
1	**Economics of Generation:**	**6L**
	1. Cost of power generation-Thermal, Hydro and Nuclear	2
	2. Types of Consumers in a distribution system-Domestic, Commercial, Industrial etc.	1
	3. Concept of load factor, plant capacity factor, plant use factor, diversity factor, demand factor	2
	4. Choice of size and number of generation units.	1
2	**Tariff:**	**6L**
	1. Block rate, flat rate, two part, maximum demand, power factor and three part tariffs.	2
	2. Subsidization and cross subsidization. Availability tariff of generation companies.	2
	3. Pool tariff of transmission companies, Availability based tariff (ABT)	2
3.	**Unit Commitment:**	**6L**
	1. Constraints in Unit Commitment, Spinning reserve	2
	2. Thermal unit constraints, Hydro constraints, Must run, Fuel constraints	2
	3. Unit commitment solution methods,	2
4	**Economic Dispatch**:	**10L**
	1. Transmission loss formulae and its application in economic load scheduling	3
	2. Computational methods in economic load scheduling.	4
	3. Active and reactive power optimization	3
5	**State Estimation and load forecasting in power system:**	**7L**
	1. Introduction, state estimation methods	3
	2. Concept of load forecasting	2
	3. Load forecasting technique and application in power system	2

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Lecture-wise Plan

Total Number Of Hours = 35		

Assignment:

Module 1(Economics of Generation)

1. Briefly Discuss about the types of consumers in distribution system
2. How we can choice the size of the unit for a generation system
3. What is plant factor and diversity factor

Module 2(Tariff)

1. Discuss about the different types of tariff in generation system
2. What is Availability based tariff (ABT)?
3. Explain-"Subsidization and cross subsidization"

Module 3 (Unit Commitment)

1. What are the Constraints in Unit Commitment,? What is Spinning reserve?
2. Discuss the different unit constraints for thermal and hydro generation system
3. What are the Unit commitment solution methods?

Module 4(Economic Dispatch)

1. How we can optimize the active and reactive power?
2. What are the Computational methods in economic load scheduling

Module 5 (State Estimation and load forecasting in power system)

1. Explain- " load forecasting"
2. What are the different Load forecasting techniques? What are the application of load forecasting techniques in power system
3. Discuss about the state estimation methods.

UNIVERSITY OF ENGINEERING & MANAGEMENT,JAIPUR

Lecture-wise Plan

Subject Name: **Renewable And Non-Concentional Energy** Subject Code: **EE704D**

Year: **4th Year** Semester: **7th**

Module Number	Topics	Number of Lectures
1	**Chapter 1: Introduction to Energy sources:**	**2L**
	1. Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements.	1
	2. Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.	1
	Chapter 2: Solar Energy:	**5L**
	1. Solar radiation -beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length.	1
	2. Flat plate collectors, concentrating collectors, Solar air heaters types, solar driers, storage of solar energy-thermal storage, solar pond, solar water heaters of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells.	2
	3. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems.	2
	Chapter 3: Wind Energy:	**6L**
	1. Principle of wind energy conversion; Basic components of wind energy conversion systems;	1
	2. Wind mill components, various types and their constructional features	2
	3. Design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic or cesacting on wind mill blades and estimation of power output; wind data and site selection considerations	3
2.	**Chapter 4: Energy from Biomass:**	**4L**
	1. Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages,	1
	2. Constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production	2
	3. Fuel properties of bio gas, utilization of biogas	1
	Chapter 5: Geothermal Energy:	**4L**
	1. Introduction, Basic definitions.	1
	2. Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock , magma.	2
	3. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.	1
	Chapter 6: Energy from Ocean:	**6L**
	1. Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India.	2
	2. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy	2

	3. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.	2
3.	**Chapter 7: Magneto Hydrodynamic power generation:**	**3L**
	1. Principle of MHD power generation, MHD system, Design problems and developments	2
	2. Gas conductivity, materials for MHD generators and future prospects.	1
4.	**Chapter 8: Hydrogen Energy:**	**3L**
	1. Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation	2
	2. Utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.	1
	Chapter 9: Fuel cell:	**3L**
	1. Introduction, Design principle and operation of fuel cell, Types of fuel cells	2
	2. conversion efficiency of fuel cell, application of fuel cells	1
Total Number Of Hours = 36L		

Shubhajit Pal
Faculty In-Charge

Prof. Aniruddh Mukherjee
HOD, EE Dept.

Assignment:

Module-1

1. Mention the different forms of energy.
2. What is Kyoto protocol and what are its implications for developed and developing countries.
3. Explain the different characteristics of PV system.
4. With a neat diagram, explain how wind energy can be converted into electrical energy.

Module-2

1. What is the prospect of geothermal energy?
2. What principles guide in the location of a geothermal power station?
3. Write a short note on Biodiesel

Module-3:

1. Write short notes on:
(a) Magneto hydrodynamic energy (b) Wave energy
2. Discuss the advantages and limitations of tidal energy.

Module-4:

1. What is fuel cell? Discuss different types of fuel cell. What are the advantages of fuel cell energy? Discuss on alkaline fuel cell and hydrogen fuel cell.
2. Discuss the various methods of hydrogen production.

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Lecture-wise Plan

Subject Name: Computer Network Subject Code-CS602
Year: 3rd Year Semester: Sixth

Module Number	Topics	Number of Lectures
1	**Data Communication Fundamentals:**	**10L**
	1. Layered Network Architecture; Data and Signal; Guided Transmission Media; Unguided Transmission Media; Transmission Impairments and Channel Capacity; Transmission of Digital Signal; Analog Data to Analog Signal; Digital Data to Analog Signal; Multiplexing of Signals: The telephone system and DSL technology; Cable MODEM and SONET	10
2	**Data Link control:**	**6L**
	1. Interfacing to the media and synchronization; Error Detection and Correction; Flow and Error control; Data Link Control.	10
3	**Switching Communication Networks:**	**8L**
	1. Circuit switching; Packet switching; Routing in packet switched networks; Congestion control in packet switched networks; X.25; Frame Relay; Asynchronous Transfer Mode Switching (ATM).	8
4	**Broadcast communication networks:**	**10L**
	1. Network Topology; Medium Access Control Techniques; IEEE CSMA/CD based LANs; IEEE Ring LANs; High Speed LANs – Token Ring Based; High Speed LANs – CSMA/CD based; Wireless LANs; Bluetooth; Cellular Telephone Networks; Satellite Networks.	10
5	**Internetworking:**	**6L**
	1. Internetworking Devices; Internet Protocols; TCP/IP; Transport and Application layer protocols. Network Security: Cryptography; Secured Communication; Firewalls.	6
Total Number Of Hours = 40		

Assignments:

Module-1:

1. Write down the functions of OSI Layers
2. What will be SNR value in case of noiseless channel?
3. Define Bandwidth? Create the relationship between Bit Rate and Baud Rate?
4. Write down the names of network impairments?
5. Write down the features and basic components of a computer network
6. What kind of topology is well suited for university or college environment?
7. Why we need layered architecture?
8. What will be the channel capacity of a noisy channel having SNR value= 20dB and Bandwidth=3 KHz?

Module-2:

1. What is the significance of sequence number in Stop & Wait ARQ protocol?
2. Discuss Stop & Wait ARQ with 010101 bit sequence?
3. In Selective-Repeat ARQ, sender window size > 2m–1." Is it correct? Justify.
4. Suppose a sender is using sliding window protocol of window size 15. What will be the window status for the following occurrence? Sender has sent packets 0 to 11 and has received NAK 6.
5. Define ALOHA? Differentiate between Pure and Slotted ALOHA.

Module-3:

1. Differentiate between circuit switching and packet switching.
2. Write short notes on the following topic:
   A. Frame Relay
   B. X.25
   C. ATM
3. Why packet switching is connection less?

Module-4:

1. Discuss CSMA/CA with the help of a flowchart.
2. Why CSMA/CD is not implemented in WLAN?
3. Describe 802.3 header formats. Why padding is required?
4. Describe Bluetooth Architecture.
5. Differentiate between Token Ring and Token Bus.

Module-5:

1. What is distance vector routing protocol? What is the difference between RIP and EGP?
2. Distinguish between gateway and bridge. What is transparent bridge?
3. A network has subnet mask 255.255.255.224 Determine the maximum or number of Host in this network. Also determine the broadcast address of this network.
4. Compare IPv4 and IPv6
5. What is the purpose of subnetting? Find the netid and the host id of the following IP address
   A. 192.167.78.1
   B. 10.10.10.10
   C. 189.32.1.34
6. What is CIDR? Define NAT with proper example?

7. Write the differences between ARP and RARP?
8. Write the differences between TCP and UDP?
9. Differentiate Leaky Bucket Algorithm from Token Bucket Algorithm.
10. Why IP address is 32 Bit? How we need so many addresses? Compare IP address, Mac Address, Port address and Socket address?
11. Define Count to infinity problem? Which routing algorithm faces this problem?
12. Write the short notes on the following
    A. DNS
    B. FTP
    C. EMAIL
    D. MIME
    E. POP3
    F. SMTP
13. How are ‘iterative query resolution and ‘recursive query resolution different from each other in the context of DNS?
14. What do you understand by data privacy? How can authentication, integrity and non-repudiation be implemented by Digital Signature?
15. Define Firewall? Discuss all types of Firewall.

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Lecture-wise Plan

Subject Name: Artificial Intelligence — Subject Code-EC705A

Year: 4th Year — Semester: Seventh

Module Number	Topics	Number of Lectures
1	**Introduction:**	**2L**
	Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.	
2	**Intelligent Agents**	**2L**
	Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.	
3	**Problem Solving**	**2L**
	Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	
4	**Search techniques**	**5L**
	Solving problems by searching: problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.	
5	**Heuristic search strategies**	**5L**
	Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems	
6	**Adversarial search**	**3L**
	Games, optimal decisions & strategies in games, the mini max search procedure, alpha-beta pruning, additional refinements, iterative deepening.	
7	**Knowledge & reasoning**	**3L**
	Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	

8	**Using predicate logic**	**2L**
	Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.	
9	**Representing knowledge using rules**	**3L**
	Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.	
10	**Probabilistic reasoning**	**4L**
	Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	
11	**Planning**	2L
	Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.	
12	**Natural Language processing**	**2L**
	Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.	
13	**Learning**	**2L**
	Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.	
14	**Expert Systems**	**2L**
	Representing and using domain knowledge, expert system shells, knowledge acquisition	
Total Number Of Hours = 39		

Faculty In-Charge

HOD, CSE Dept.

UNIVERSITY OF ENGINEERING & MANAGEMENT,JAIPUR

Lecture-wise Plan

Subject Name: Artificial Intelligence Subject Code-EC705A
Year: 4th Year Semester: Seventh

Assignments:

Module-I: Introduction

1. What do you mean by Artificial intelligence?
2. Explain Tic - Tac - Toe problem.

Module-II: Intelligent Agents

1. Explain nature of environment
2. Discuss the followings:
    - structure of agents
    - goal based agents
    - utility based agents
    - Learning agents

Module-III: Problem Solving

1. Explain how the problem as state space search has defined?
2. Define problem characteristics and issues in the design of search programs.

Module-IV: Search techniques

1. What do you mean by problem solving agents? searching for solutions
2. Explain depth limited search, bidirectional search.

Module-V: Heuristic search strategies

1. Explain Greedy best-first search
2. How Hill climbing search and simulated annealing search are different from each other?

Module-VI: Adversarial search

1. What do you mean by optimal decisions & strategies in games?
2. Explain the mini max search procedure, alpha-beta pruning.

Module-VII: Knowledge & reasoning

1. Explain different knowledge representation issues, representation & mapping.
2. Mention different approaches to knowledge representation. What are the issues in knowledge representation?

Module-VIII: Using predicate logic

1. How you represent simple facts in logic?
2. Explain ISA relationship, computable functions & predicates.

Module-IX: Representing knowledge using rules

1. Differentiate Procedural and declarative knowledge
2. Explain logic programming. What are the differences between forward and backward reasoning?

Module-X: Probabilistic reasoning

1. How you represent knowledge in an uncertain domain?
2. Explain the semantics of Bayesian networks. What do you mean by Dempster-Shafer theory?

Module-XI: Planning

1. Explain the components of a planning system. What is Goal stack planning?
2. What do you mean by Hierarchical planning?

Module-XII: Natural Language processing

1. Explain Syntactic processing in NLP.
2. What do you mean by semantic analysis?

Module-XIII: Learning

1. Explain the different forms of learning. What do you mean by inductive learning, learning decision trees, explanation based learning?
2. Differentiate neural net learning & genetic learning.

Module-XIV: Expert Systems

1. How do you representing and use domain knowledge?
2. Explain expert system shells, knowledge acquisition.

UNIVERSITY OF ENGINEERING & MANAGEMENT,JAIPUR

Lecture-wise Plan

Subject Name: Digital Communication **Subject Code-EE705C**

Year: 3rd Year **Semester: 7th**

Module Number	Topics	Number of Lectures
1	**Probability Theory and Random Processes:**	**6L**
	1. Conditional probability, communication example, joint probability, statistical independence, random variable continuous and discrete.	2
	2. cumulative distribution function, probability density function – Gaussian, Rayleigh and Rician, mean, variance	2
	3. Random process, stationary and ergodicprocesses, correlationcoefficient,covariance,auto correlationfunction anditsproperties,randombinary wave,power spectraldensity.	2
2	**Signal Vector Representation:**	**6L**
	1. Analogybetweensignalandvector, distinguishability ofsignal, orthogonalityandorthonormality,	1
	2. basisfunction,orthogonalsignalspace,message point,signalconstellation,geometric interpretationofsignals,likelihoodfunctions,Schwartz inequality,Gram-Schmidtorthogonalizationprocedure,	2
	3. response of thenoisysignalatthe receiver,maximumlikelihood decisionrule, decisionboundary,optimum correlationreceiver; probability of error, errorfunction,complementaryerror function,Type-IandType-IIerrors.	3
3	**Digital Data Transmission:**	**10L**
	1. Conceptofsampling,PulseAmplitudeModulation(PAM),interlacingandmultiplexingofsamples	1
	2. PulseCodeModulation(PCM),quantization, uniformandnon-uniformquantization,quantizationnoise,binaryencoding.	2
	3. A-Lawandμ-lawcompanding, differentialPCM,deltamodulationandAdaptivedeltamodulation	2
	4. Digital transmissioncomponents,source,multiplexer,linecoder,regenerativerepeater,conceptofline coding – polar/unipolar/bipolarNRZandRZ, Manchester,differentialencodingandtheirPSDs.	2
	5. pulse shaping, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction	3
4	**Digital Modulation Techniques:**	**14L**
	1. Typesof DigitalModulation,coherentand non-coherentBinaryModulationTechniques,basicdigitalcarrier modulation techniques:ASK,FSKandPSK 2. CoherentBinaryPhaseShiftKeying(BPSK),geometricalrepresentationofBPSKsignal;errorprobabilityofBPSK,generationanddetectionofBPSKSignal, power spectrumofBPSK..	1 2
	3. ConceptofM-aryCommunication,M-aryphaseshiftkeying,theaverageprobabilityofsymbolerrorforcoherentM-aryPSK,powerspectraofMPSK,Quadrature Phase ShiftKeying (QPSK), error probabilityof QPSKsignal, generationand detectionof QPSKsignals,power spectraof QPSKsignals,	2
	4. OffsetQuadrature Phaseshift Keying (OQPSK),CoherentFrequencyShiftKeying(FSK),BinaryFSK,errorprobabilityofBFSKsignals,generationanddetectionofCoherentBinaryFSKsignals,power	2

	spectraofBFSKsignal,	
	5. MinimumShiftKeying(MSK),signalconstellationofMSKwaveforms,errorprobabilityofMSKsignal,GaussianMinimumShiftKeying:GMSK	2
	6. basicconceptof OFDM	2
	7. constellation diagram,Someperformanceissuesfordifferentdigitalmodulationtechniques-ErrorVectorMagnitude(EVM),EyePatternandRelativeConstellationError(RCE),Conceptual ideaforVector SignalAnalyzer (VSA).	3
Total Number Of Hours = 36		

Faculty In-Charge HOD, ECE Dept.

Assignment:

Module-1(Probability Theory and Random Processes:):

1. **Inpulseamplitudemodulation(PAM),aPAMwordconsistsofasequence of pulses, where each pulse may take on a given number of amplitude levels. Suppose a PAM word is n pulses long and each pulse may take on m different levels.**
   (a) How many distinct PAM words are there? (b) IfeachPAMword,fourpulseslong,isequallylikelytooccurandeach pulsecanhaveoneofthreelevels, {0, 1, 2}, whatistheprobabilityofa PAM word occurring with exactly two pulses of level 2?
2. **In pulse code modulation (PCM), a PCM word consists of a sequence of binary digits (bits) of 1s and 0s.**
   (a) SupposethePCMwordlengthisnbitslong.Howmanydistinctwordsare there?
   (b) IfeachPCMword,threebitslong,isequallylikelytooccur,whatisthe probability of a word with exactly two 1s occurring? Solve this problem in two ways. First, consider all words in a sample space. Second, suppose each bit is equally likely.

3. Mention properties of Stochastic process.

Module-2 (Signal Vector Representation):

1. **State and explain grahmshcmidtorthogonalization procedure.**
2. **State orthonormality, othogonality and basis function.**

3. **Discuss about maximum likelihood rule for AWGN channel.**
4. **Discuss about matched filter for optimum detection.**

Module-3(Digital Data Transmission):

1. **What is companding? Why it is needed?**
2. **Explain uniform and non-uniform quantization?**
3. **What is Nyquist criterion for zero intersymbol interference?**
4. **What is the function of raised cosine function?**
5. **What are limitations of delta modulation?**
6. **What is quantization noise?**
7. **Given an input data: 010110, Represent it using the line codes.**

Module-4(Digital Modulation Techniques):

1. **What is the difference between MSK and QPSK?**
2. **With Proper equations and signal constellation explain the concept of Quadri phase shift Keying.**
3. **Explain the concept of OFDM.**
4. **Draw an eye diagram and mention the significance of its different parts.**

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Lecture-wise Plan

Subject Name:-Electric System Design **Subject Code**:- EE 705

Year: 4th Year **Semester: -**Seventh

Module No.	Topics	Number of Lectures(H)
1.	Unit 1	**3H**
	Standard symbols, extracts from IE regulations, useful information on transformers, DG sets, circuit breakers, degree of protection and IP code	1 H 2H
2.	Unit 2	**10H**
	Single line diagram using ETAP, power distribution, basic functions of LT/HT switchgear, protective relays, maintenance aspects	5H 5H
3.	Unit 3	**10H**
	Types of cables, relevant IS, short circuit current calculation of cables, **cable rating and sizing , temperature specifications, cable layout**	5H 5H
4.	**Unit 4**	**4H**
	Earthing extracts from IS 3043, electrical shocks, electrical fire hazards, protection of buildings as per IS 2309	2H 2H
5.	Unit 5	**8H**
	Illumination design as per the National Lighting Code book, Indoor design calculations including layout, outdoor lighting design and layout.	4H 4H
6.	Unit 6	**8H**
	Electrical installation design, testing of transformers, maintenance of electrical distribution systems	8H
TOTAL HOUR REQUIRED=43		

ASSIGNMENT:

1. **Design of earthing arrangement of 33 kV substation yard.**
2. **What is knee point voltage?**
3. **Calculate the bust duct size for a 1500kVA transformer secondary side with the busbar side short circuit rating 25.2 kA per second.**
4. **Draw a line diagram showing radial feeder with relay protections.**

Faculty In-Charge HOD, EE Dept.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR
Lab Manual

Title of Course: Electric Drives Lab **Course Code: EE 791**
L-T –P Scheme: 3P **Course Credits: 2**

Course Description & Objectives:

Objectives:
1. To learn and understand the characteristics of thysistor controlled DC Drive.
2. To provide an understanding of the design aspectof different types Chopper fed DC Drive.
3. To provide an efficient understanding ofperformance of single phase half controlled symmetrical and asymmetrical bridge converter.
4. To provide an efficient understanding Regenerative / Dynamic braking operation of AC motor.
5. To learn and understand the performance Study Regenerative / Dynamic braking operation for DC Motor.

Course Contents:
Exercises that must be done in this course are listed below:

Exercise No. 1: Study of thysistor controlled DC Drive.
Exercise No. 2: Study of Chopper fed DC Drive.
Exercise No. 3: Study of AC Single phase motor-speed control using TRIAC.
Exercise No. 4: PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software.
Exercise No. 5:VSI / CSI fed Induction motor Drive analysis using MATLAB/DSPICE/PSIM Software.
Exercise No. 6: Study of V/f control operation of 3F induction motor drive.
Exercise No. 7: Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.
Exercise No. 8: Study Regenerative / Dynamic braking operation for DC Motor - Study using software.
Exercise No. 9: Study Regenerative / Dynamic braking operation of AC motor - study using software.PC/PLC based AC/DC motor control operation.

TEXT BOOK:
Fundamental of Power Electronics with MATLAB, Randall Shaffer, Cengage Learning.
2. SPICE for Power electronics and electric power, M.H. Rashid & H.M. Rashid, Taylor & Francis.
3.Fundamental of Electrical Drives, G.K. Dubey, New Age International Publication.
4. Electric Drives, VedamSubrahmanyam, TMH
5. A first course on Electrical Drives, S.K. Pillai, , New Age International Publication.5. Modeling & Simulation using MATLAB-SIMILINK , S. Jain, Wiley India
6. MATLAB & SIMULINK for Engineers, A.K. Tyagi, Oxford University Press.

Recommended Systems/Software Requirements:
1. Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 64 MB RAM and 100 MB free disk space.
2. Matlab 32 bit or 64 bit 2009a/2009b. PowerSIM(PSM) 8, DSPICE
3. Testing kit for TRAIC,SCR,DUAL converter, Chopper, Inverter and converter circuit, Microcontroller train kit(PV59RD2V51),uc8051,128kb memory.
4. Chip burning kit.
5. Other accessories.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR
Lab Manual

Experiment No: 1 To obtain response offiringanglecontrolofthyristorbased DC drive connected to DC motor.

Apparatus: i. Controldesignand simulation tool kit

ii. ThyristorisedDC drive

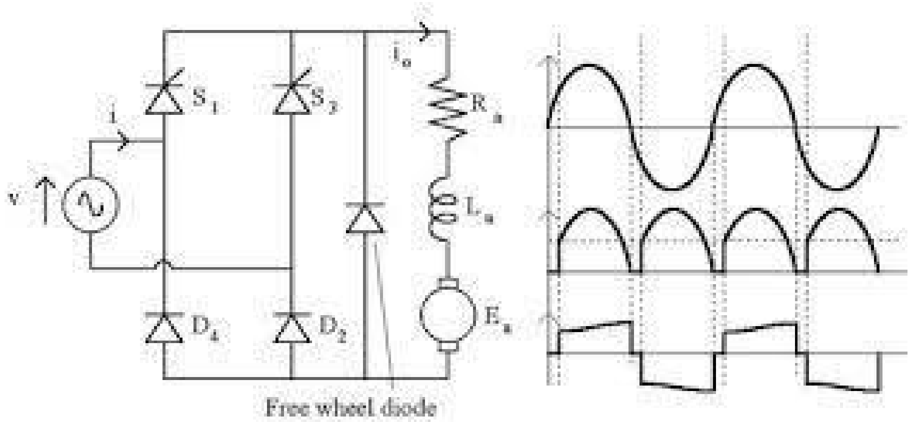
iii. DC motor

Specifications:

DC Drive	DC motor, DC generator
Thyristorized Bridge Rectifier:0-220VDC	Armature voltage: 220V DC
DiodeBridge Rectifier : 220V DC	Current: 2Amps
	Speed: 1500RPM
	Power: 0.5 HP

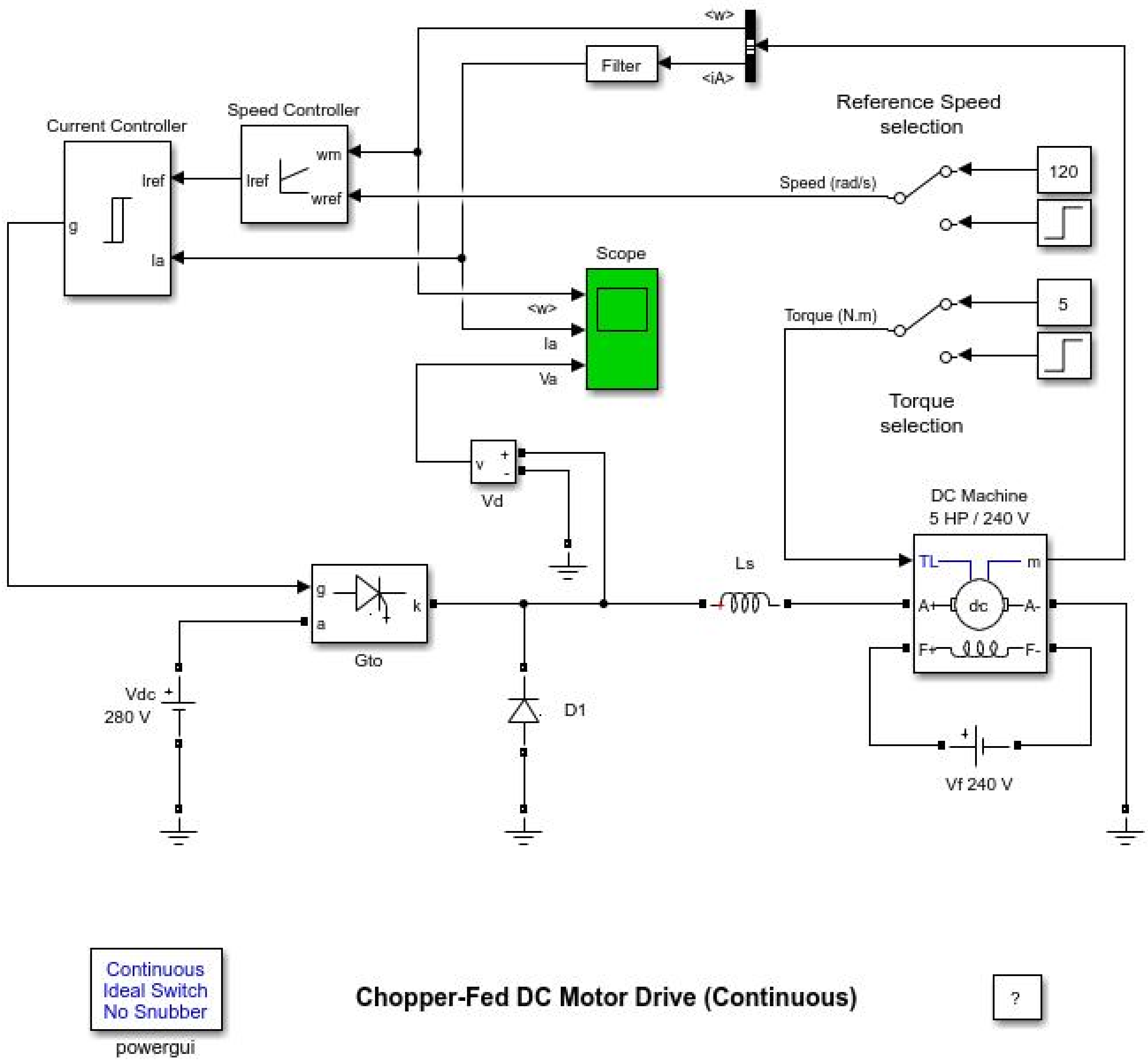
Theory:

Manyindustrialapplicationssuchassteel-rollingmills,papermillsandtractionsystemsetc,makeuseofcontrolled DC power.DC power isobtainedearlierfrom motor-generatorsets or bythyristor rectifiers. Theadventofthyristorshaschangedtheartofactodcconversion. Presentlyphasecontrolledactodcconvertersemployingthyristorsareextensivelyusedforchangingconstantacinputvoltagetocontrolleddcoutputvoltage.Hereathyristoristurnedoffasacsupplyvoltagereversebiasedit,providedanodecurrenthastofallentoalevelbelowtheholdingcurrent.Theturningofforcommutation,ofathyristorbysupplyvoltageiscallednaturalcommutationorlinecommutation.Phasecontrolledconceptisimplementedbygeneratingandtriggeringthyristorbyfiringpulseatdesiredfiringangle.Firingangleofthyristorismeasuredfromtheinstantitwouldstartconductingifitwerereplacedbyadiode.Firinganglemaybedefinedastheanglemeasuredfromtheinstant SCRgetsforwardbiasedtotheinstantitistriggered. Asinglephasesemi controlled converter is usedin this experiment to varyvoltageappliedto DCmotor.Semiconverterhasanadvantagesoffreewheelingactionispresentinsideconverteritself,whichimprovesp.f ofcircuit.


i
v
S 1
S 2
i a
R a
L a
E a
D 4
D 2
Free wheel diode

Exercise No. 2: Study of Chopper fed DC Drive.

Aim: Study the characteristics of DC motor fed with DC Chopper



Description

The DC motor is fed by the DC source through a chopper which consists of GTO thyristor and free-wheeling diode D1. The motor drives a mechanical load characterized by inertia J, friction coefficient B, and load torque TL.

The hysteresis current controller compares the sensed current with the reference and generates the trigger signal for the GTO thyristor to force the motor current to follow the reference. The speed control loop uses a proportional-integral controller which produces the reference for the current loop. Current and Voltage Measurement blocks provide signals for visualization purpose.

Simulation

Motor starting

Start the simulation. Observe the motor current, voltage, and speed during the starting on the scope. At the end of the simulation time (1.5 s), the system has reached its steady-state.

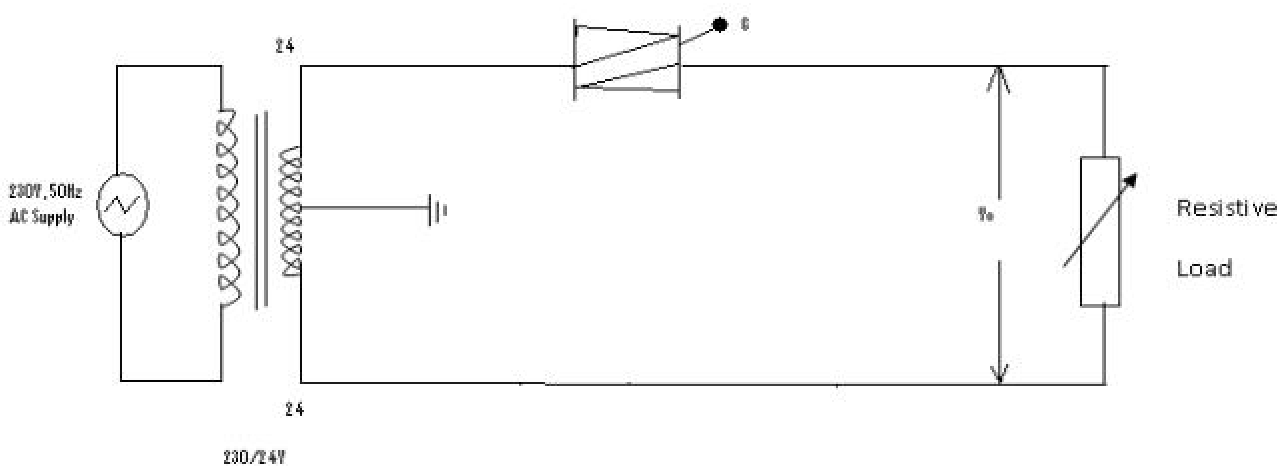
Response to a change in reference speed and load torque

The initial conditions state vector 'xInitial' to start with wm = 120 rad/s and TL = 5 N.m has been saved in the 'power_dcdrive_init.mat' file. This file is automatically loaded in your workspace when you start the simulation (see Model Properties). In order to use these initial conditions you have to enable them. Check the Simulation/Configuration Parameters menu , then select "Data Import/Export" and check "Initial state".

Now, double click the two Manual Switch blocks to switch from the constant "Ref. Speed (rad/s) " and "Torque (N.m)" blocks to the Step blocks. (Reference speed wref changed from 120 to 160 rad/s at t = 0.4 s and load torque changed from 5 to 25 N.m at t= 1.2s). Restart the simulation and observe the drive response to successive changes in speed reference and load torque.

Exercise No. 3: Study of AC Single phase motor-speed control using TRIAC.

Aim: Study of speed control of AC Motor using TRIAC



Circuit Diagram

Tabular Column:

S.No.	Firing Angle(α)	Output Voltage(Volts)	Time period(ms)
1			
2			
3			

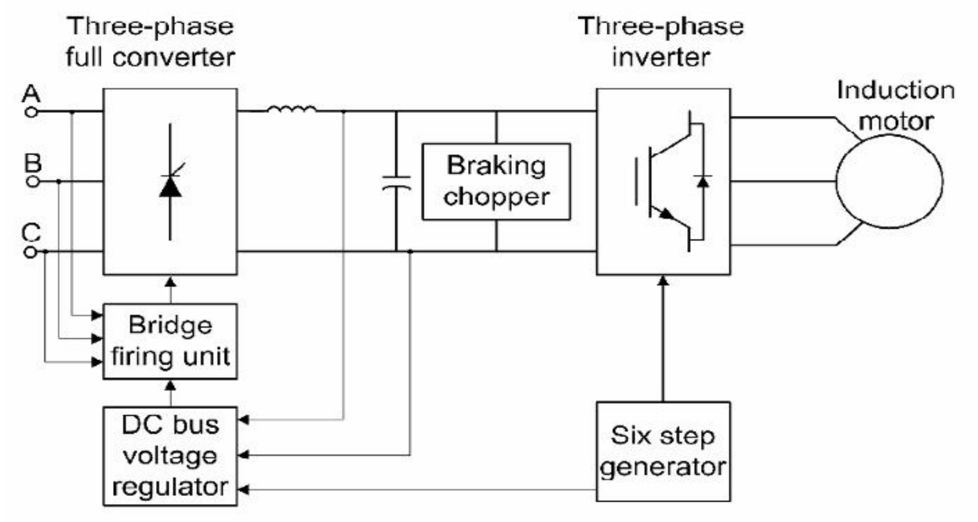
Exercise No. 4: PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software.

Aim: To study the six step Induction Motor drive using MATLAB

Introduction

The Six-Step VSI Induction Motor Drive block represents a classical open-loop Volts/Hz control, six-step or quasi-square wave drive for induction motors. The block obtains the stator supply frequency from the speed reference (neglecting the slip frequency). This frequency is used to compute the stator flux position necessary to generate the six-step pulses for the three-phase inverter. The block obtains the reference DC bus voltage, or stator input voltage, based on the Volts/Hz control, or constant stator flux strategy.

The main advantage of this drive compared to other scalar-controlled and vector-controlled drives is its implementation simplicity. However, as with most scalar-controlled drives, the dynamic response of this drive is slow due to the inherent coupling effect between the torque and flux that is present in the machine. In addition, this drive tends to be more unstable to change in motor speed compared to closed-loop speed-controlled drives.

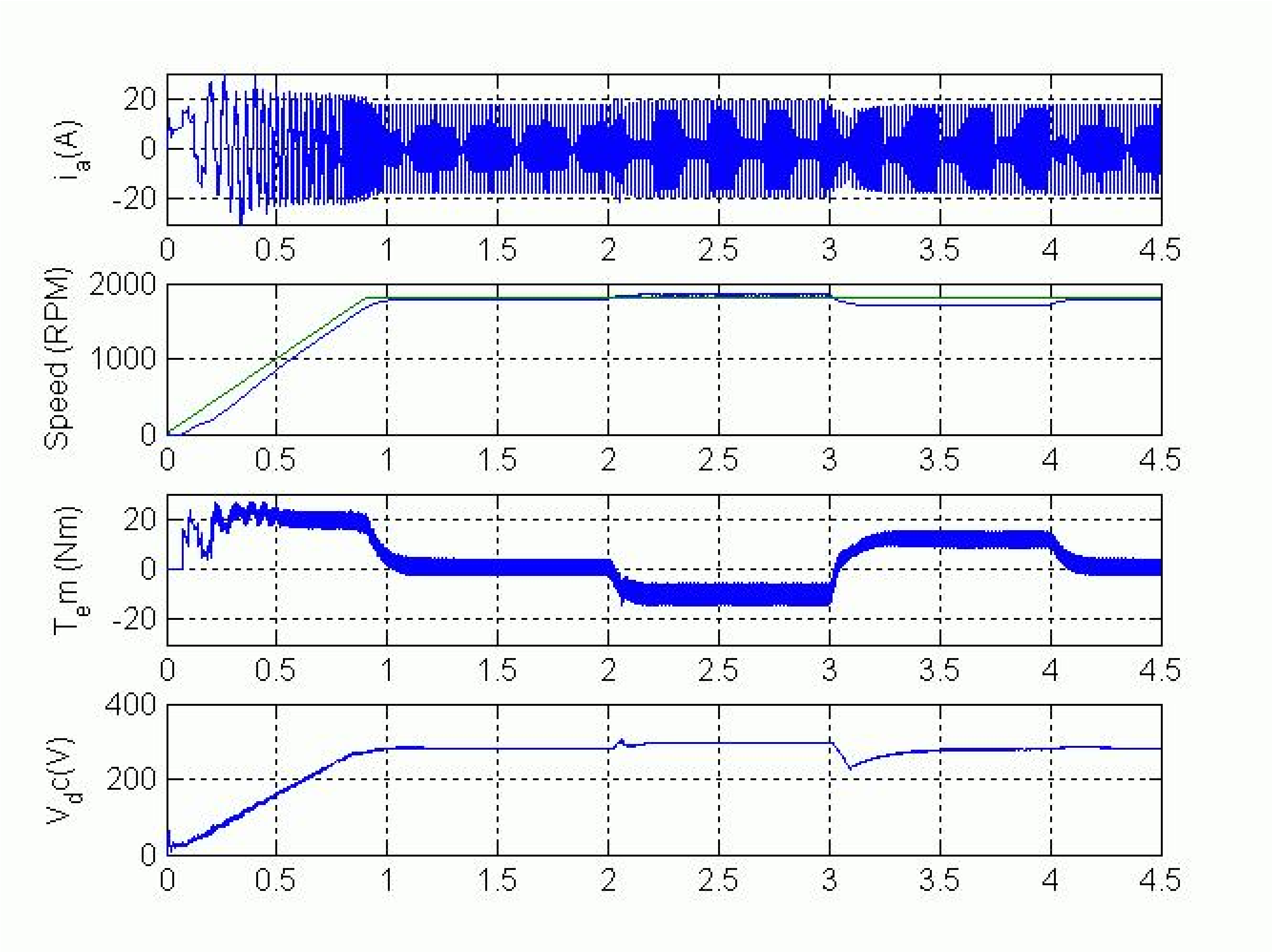


High-Level Schematic

A typical operation of the AC1 motor drive. A speed reference step from zero to 1800 rpm is applied at t = 0.

As shown in the following figure, the speed set point doesn't go instantaneously to 1800 rpm but follows the acceleration ramp (2000 rpm/s). The motor reaches steady state at t = 1.3 s. At t = 2 s, an accelerating torque is applied on the motor's shaft. You can observe a speed increase. Because the rotor speed is higher than the synchronous speed, the motor is working in the generator mode. The braking energy is transferred to the DC link and the bus voltage tends to increase. However, the over-voltage activates the braking chopper, which causes the voltage to decrease. In this example, the braking resistance is not big enough to avoid a voltage increase but the bus is maintained within tolerable limits. At t = 3 s, the torque applied to the motor's shaft steps from −11 N.m to +11 N.m. You can observe a DC voltage and speed drop at this point. The DC bus controller switches from braking to motoring mode. At t = 4 s, the load torque is removed completely.

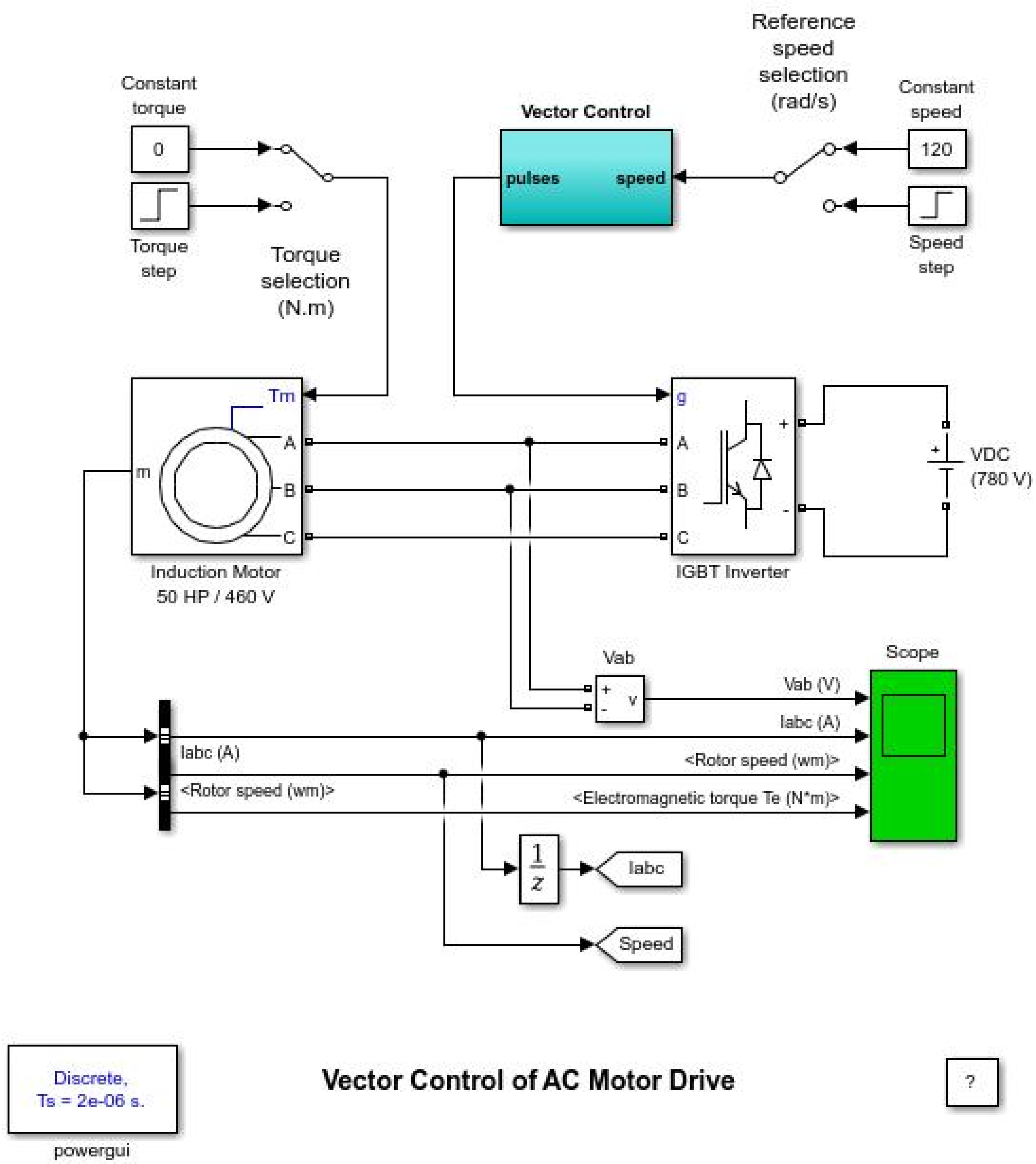
Lab Manual



i_a (A)
20
0
-20
Speed (RPM)
2000
1000
0
T_em (Nm)
20
0
-20
V_dc(V)
400
200
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5

Exercise No. 5:VSI / CSI fed Induction motor Drive analysis using MATLAB/DSPICE/PSIM Software.

Aim: Study of Induction Motor drive using Vector Control.



Description

The induction motor is fed by a current-controlled PWM inverter which is built using a Universal Bridge block. The motor drives a mechanical load characterized by inertia J, friction coefficient B, and load torque TL . The speed control loop uses a proportional-integral controller to produce the quadrature-axis current reference iq* which controls the motor torque. The motor flux is controlled by the direct-axis current reference id*. Block DQ-ABC is used to convert id* and iq* into current references ia*, ib*, and ic* for the current regulator. Current and Voltage Measurement blocks provide signals for visualization purpose. Motor current, speed, and torque signals are available at the output of the 'Asynchronous Machine' block.

Exercise No. 6: Study of V/f control operation of 3F induction motor drive.

Aim: Speed control of 3 phase Induction Motor using V/f method.

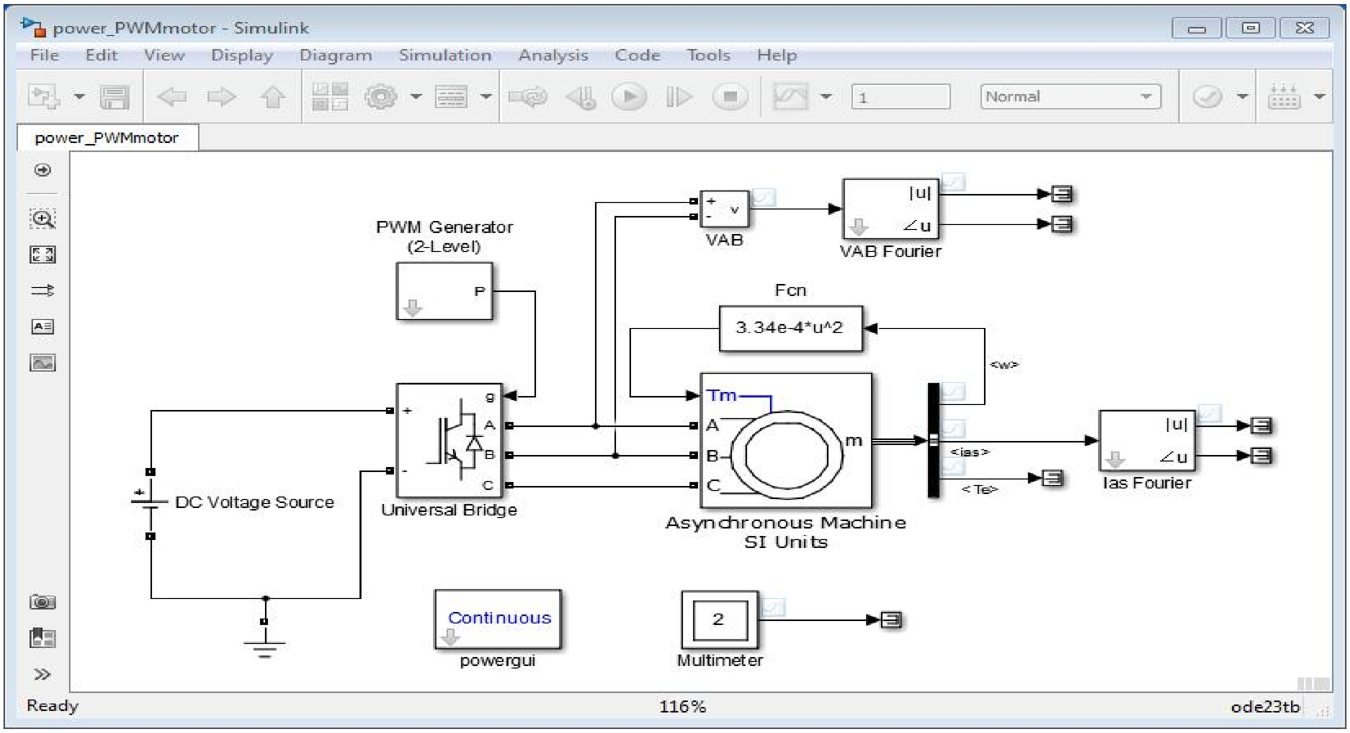
Variable speed control of AC electrical machines makes use of forced-commutated electronic switches such as IGBTs, MOSFETs, and GTOs. Asynchronous machines fed by *pulse width modulation* (PWM) voltage sourced converters (VSC) are nowadays gradually replacing the DC motors and thyristor bridges. With PWM, combined with modern control techniques such as field-oriented control or direct torque control, you can obtain the same flexibility in speed and torque control as with DC machines. This section shows how to build a simple open loop AC drive controlling an asynchronous machine.

The Machines library contains four of the most commonly used three-phase machines: simplified and complete synchronous machines, asynchronous machine, and permanent magnet synchronous machine. Each machine can be used either in generator or motor mode. Combined with linear and nonlinear elements such as transformers, lines, loads, breakers, etc., they can be used to simulate electromechanical transients in an electrical network. They can also be combined with power electronic devices to simulate drives.

The Power Electronics library contains blocks allowing you to simulate diodes, thyristors, GTO thyristors, MOSFETs, and IGBT devices. You could interconnect several blocks together to build a three-phase bridge. For example, an IGBT inverter bridge would require six IGBTs and six antiparallel diodes.

To facilitate implementation of bridges, the Universal Bridge block automatically performs these interconnections for you.

PWM Control of an Induction Motor



Exercise No. 7: Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.

Aim: To study the synchronous motor drive fed with PWM Inverter using MATLAB

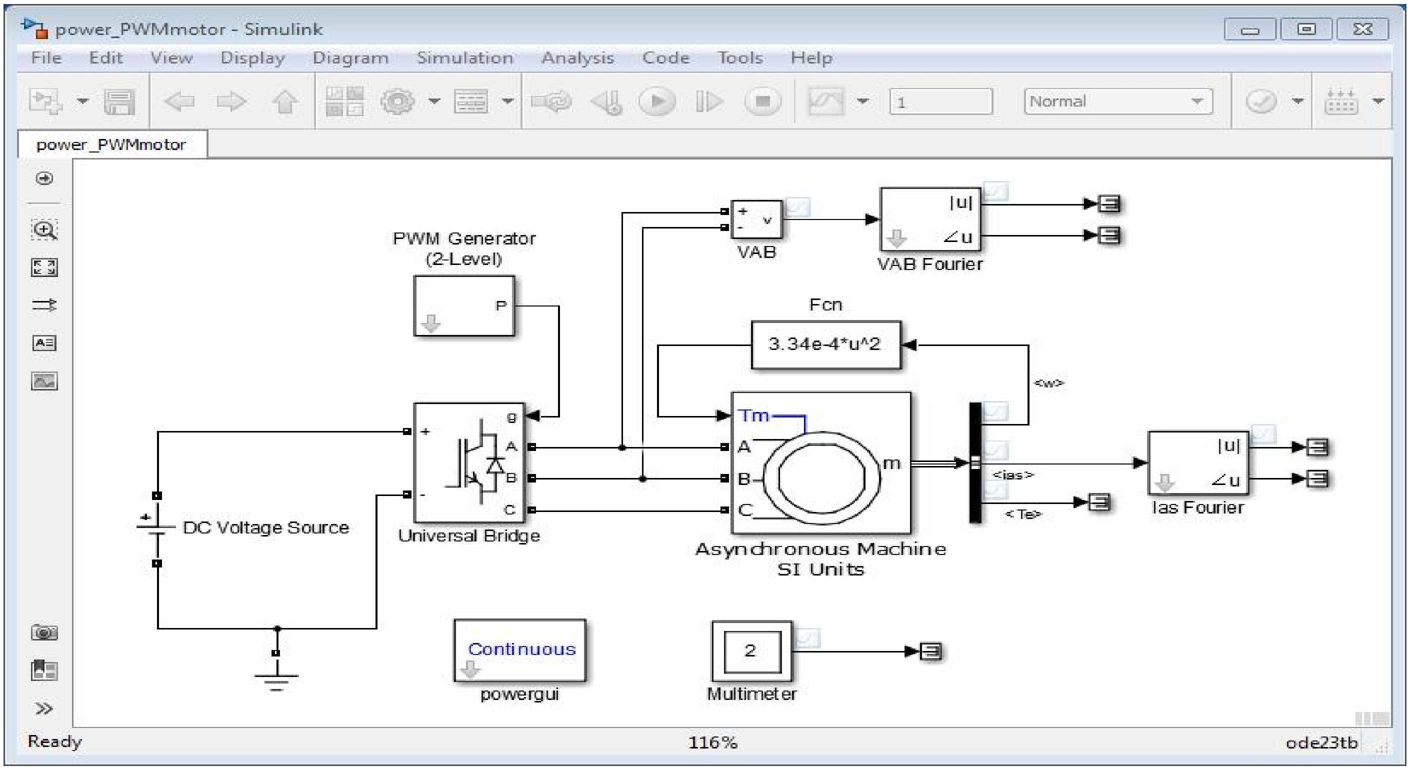
Variable speed control of AC electrical machines makes use of forced-commutated electronic switches such as IGBTs, MOSFETs, and GTOs. Asynchronous machines fed by *pulse width modulation* (PWM) voltage sourced converters (VSC) are nowadays gradually replacing the DC motors and thyristor bridges. With PWM, combined with modern control techniques such as field-oriented control or direct torque control, you can obtain the same flexibility in speed and torque control as with DC machines. This section shows how to build a simple open loop AC drive controlling an asynchronous machine. Chapter 4 will introduce you to a specialized library containing models of DC and AC drives. These "ready to use" models will enable you to simulate electric drive systems without the need to build those complex systems yourself.

The Machines library contains four of the most commonly used three-phase machines: simplified and complete synchronous machines, asynchronous machine, and permanent magnet synchronous machine. Each machine can be used either in generator or motor mode. Combined with linear and nonlinear elements such as transformers, lines, loads, breakers, etc., they can be used to simulate electromechanical transients in an electrical network. They can also be combined with power electronic devices to simulate drives.

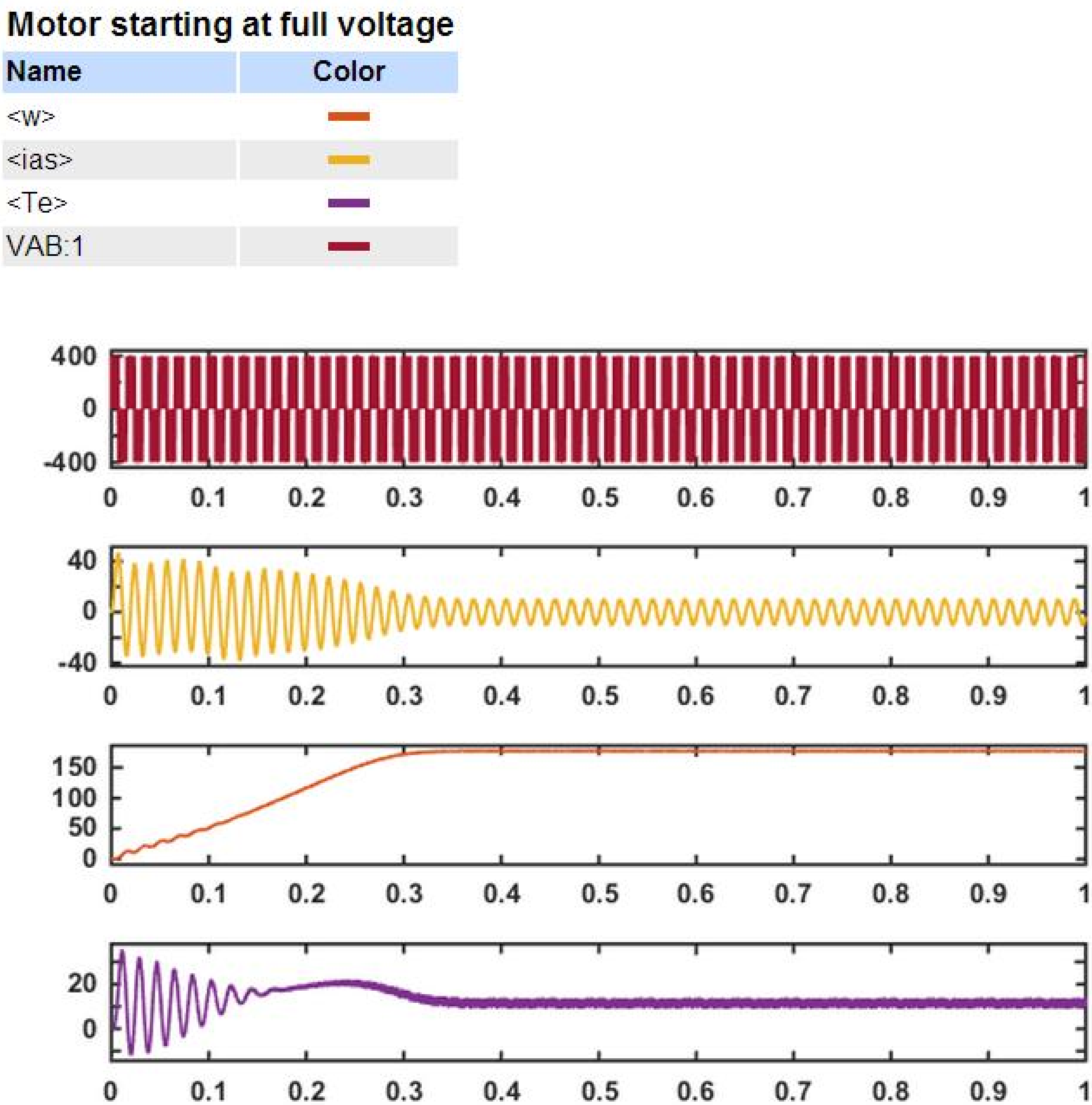
The Power Electronics library contains blocks allowing you to simulate diodes, thyristors, GTO thyristors, MOSFETs, and IGBT devices. You could interconnect several blocks together to build a three-phase bridge. For example, an IGBT inverter bridge would require six IGBTs and six antiparallel diodes.

To facilitate implementation of bridges, the Universal Bridge block automatically performs these interconnections for you.

PWM Control of an Induction Motor



PWM Motor Drive; Simulation Results for Motor Starting at Full Voltage


Motor starting at full voltage
Name
Color
<w>
<ias>
<Te>
VAB:1
400
0
-400
40
0
-40
150
100
50
0
20
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Exercise No. 8: Study Regenerative / Dynamic braking operation for DC Motor - Study using software.

Aim: Study the DC motor characteristics during regenerative braking using MATLAB

Introduction

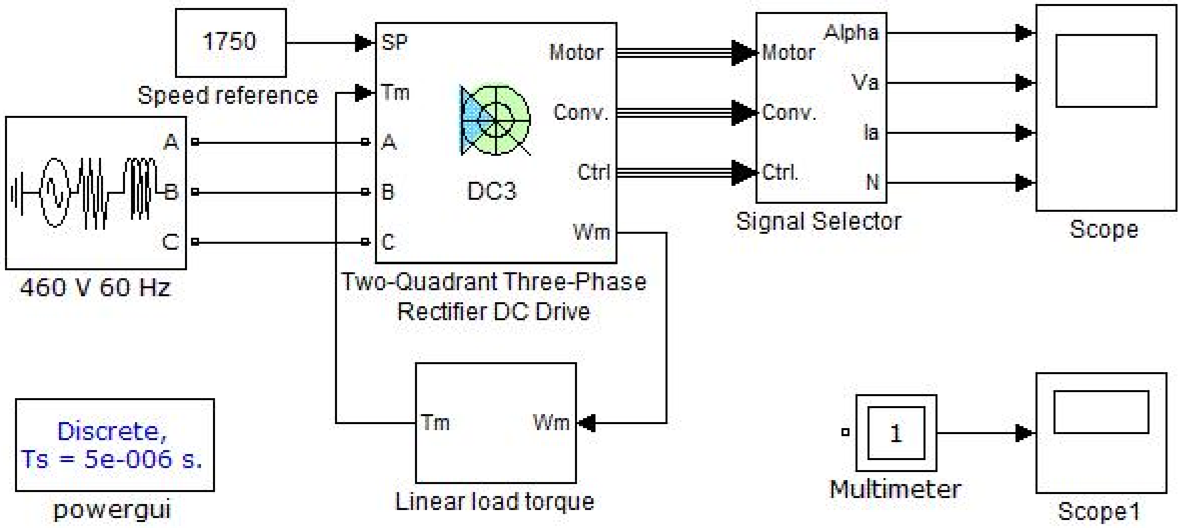
In this section, you will learn how to use the DC drive models of the Electric Drives library. First, we will specify the types of motor, converters, and controllers used in the seven DC drive models of the library, designated DC1 to DC7. These seven models are based on the DC brush motor in the Electric Drives library. As in any electric motor, the DC brush motor has two main parts, the stator (fixed) part and the rotor (movable) part. The DC brush motor also has two types of windings, the excitation or field winding and the armature winding. As its name implies, the field winding is used to produce a magnetic excitation field in the motor whereas the armature coils carry the induced motor current. Since the time constant (*L/R*) of the armature circuit is much smaller than that of the field winding, controlling speed by changing armature voltage is quicker than changing the field voltage. Therefore the excitation field is fed from a constant DC voltage source while the armature windings are fed by a variable DC source. The latter source is produced by a phase-controlled thyristor converter for the DC1 to DC4 models and by a transistor chopper for the DC5, DC6, and DC7 models. The thyristor converter is fed by a single-phase AC source in the cases of DC1 and DC2 and by a three-phase AC source in the cases of DC3 and DC4. Finally, the seven DC models can work in various sets of quadrants. All these possibilities are summarized in the following table.

DC Models

Model	Type of Converter	Operation Quadrants
DC1	Single-phase thyristor converter	I-II
DC2	Single-phase thyristor converter	I-II-III-IV
DC3	Three-phase thyristor converter	I-II
DC4	Three-phase thyristor converter	I-II-III-IV
DC5	Chopper	I
DC6	Chopper	I-II
DC7	Chopper	I-II-III-IV

Regenerative Braking

Operation in quadrants II and IV corresponds to forward and reverse braking, respectively. For the DC models of the Electric Drives library, this braking is regenerative, meaning that the kinetic energy of the motor-load system is converted to electric energy and returned to the power source. This bidirectional power flow is obtained by inverting the motor's connections when the current becomes null (DC1 and DC3) or by the use of a second converter (DC2 and DC4). Both methods allow inverting the motor current in order to create an electric torque opposite to the direction of motion. The chopper-fed DC drive models (DC5, DC6, DC7) produce regenerative braking in similar fashions.



This step-by-step example illustrates the use of the DC3 model with a 200 hp DC motor parameter set during speed regulation. The DC3 block models a two-quadrant three-phase thyristor converter drive. During this example, the motor will be connected to a load and driven to its 1750 rpm nominal speed.

Exercise No. 9: Study Regenerative / Dynamic braking operation of AC motor - study using software.PC/PLC based AC/DC motor control operation.

Aim: Study the characteristics of induction motor during dynamic braking using MATLAB

In this section, you will learn how to use the AC drive models of the Electric Drives library. First, we will specify the types of motors, converters, and controllers used in the six AC drive models of the library designated AC1 to AC6. The AC1, AC2, AC3, and AC4 models are based on the three-phase induction motor. This motor has a three-phase winding at the stator and a wound rotor or a squirrel-cage rotor. The squirrel-cage rotor consists of slots of conducting bars embedded in the rotor iron. The conducting bars are short-circuited together at each end of the rotor by conducting rings. The AC5 model is based on a wound rotor synchronous motor, and the AC6 model uses a permanent magnet synchronous motor. The models of these three types of motors are available in the Machines library. These AC motors are fed by a variable AC voltage and frequency produced by an inverter. The type of inverter used in the six AC drive models is a voltage source inverter (VSI) in the sense that this inverter is fed by a constant DC voltage. This constant voltage is provided by an uncontrolled diode rectifier and a capacitor (capacitive DC bus voltage).

Dynamic Braking

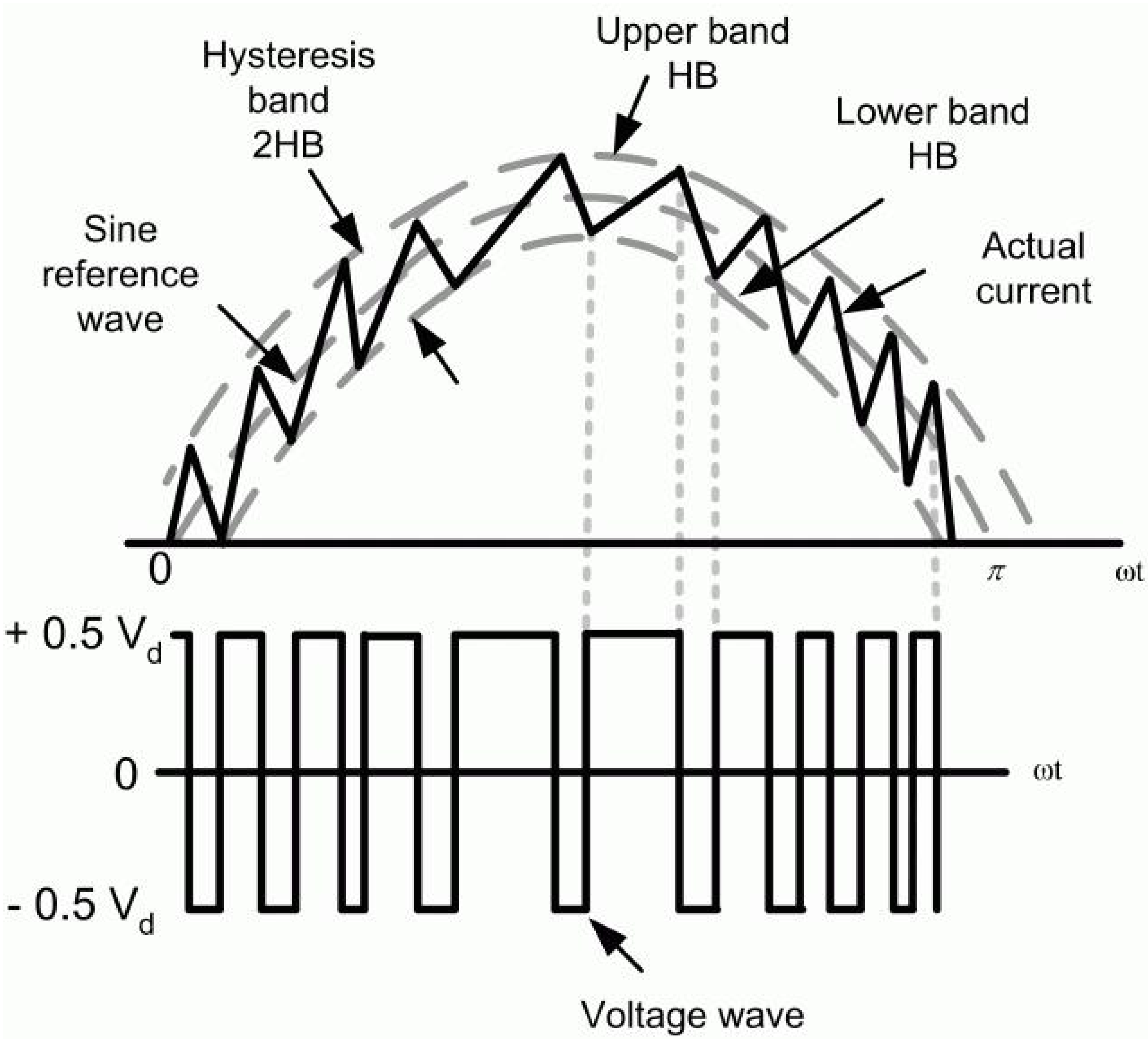
When the DC bus is provided by a diode rectifier, the drive doesn't have a bidirectional power flow capability and therefore cannot perform regenerative braking. In the AC1, AC2, AC3, AC4, and AC6 models, a braking resistor in series with a chopper ensures the braking of the motor-load system. This braking scheme is called dynamic braking. It is placed in parallel with the DC bus in order to prevent its voltage from increasing when the motor decelerates. With dynamic braking, the kinetic energy of the motor-load system is converted into heat dissipated in the braking resistor.

Modulation Techniques

The VSI inverters used in the AC drive models of the library are based on two types of modulation, hysteresis modulation and space vector pulse width modulation (PWM).

The hysteresis modulation is a feedback current control method where the motor current tracks the reference current within a hysteresis band. The following figure shows the operation principle of the hysteresis modulation. The controller generates the sinusoidal reference current of desired magnitude and frequency that is compared with the actual motor line current. If the current exceeds the upper limit of the hysteresis band, the upper switch of the inverter arm is turned off and the lower switch is turned on. As a result, the current starts to decay. If the current crosses the lower limit of the hysteresis band, the lower switch of the inverter arm is turned off and the upper switch is turned on. As a result, the current gets back into the hysteresis band. Hence, the actual current is forced to track the reference current within the hysteresis band.

Operation Principle of Hysteresis Modulation



The following figure shows the hysteresis current control modulation scheme, consisting of three hysteresis comparators, one for each phase. This type of closed-loop PWM is used in AC3 and AC5 models.

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Lab Manual

Title of Course: Electric System Design Lab
Course Code: EE 795
L-T-P scheme: 0-0-3 **Course Credit: 2**

Objectives:
1. To introduce the student fundamentals of Electrical System design and layout.
2. To learn the basics of line diagram.
3. To assimilate the design criteria and use it for a large scale design.

Learning Outcomes: The students will have a detailed knowledge of the concepts Electrical System and their co-ordination.

Course Contents:
Exercises that must be done in this course are listed below:
Exercise No.1:Study of residential house wiring using switches, fuse, lamps and energy meter.
Exercise No. 2: Study of different types of wiring
Exercise No. 3: Study of fluorescent lamp wiring.
Exercise No. 4: Measurement of electrical quantities.
Exercise No. 5: Study of ETAP.

Text Book:
1. Electric Power Distribution Handbook, G Ramamurthy, University Press, 2nd Edition.

Recommended Systems/Apparatus Requirements:
Laboratory Kits, Multimeters, Connecting wires, Watt Meters, PC.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR
Lab Manual

Exercise No.1:Study of residential house wiring using switches, fuse, lamps and energy meter.

Aim:

To implementresidential housewiringusingswitches, fuse,indicator, lamp and energymeter,

ApparatusRequired:

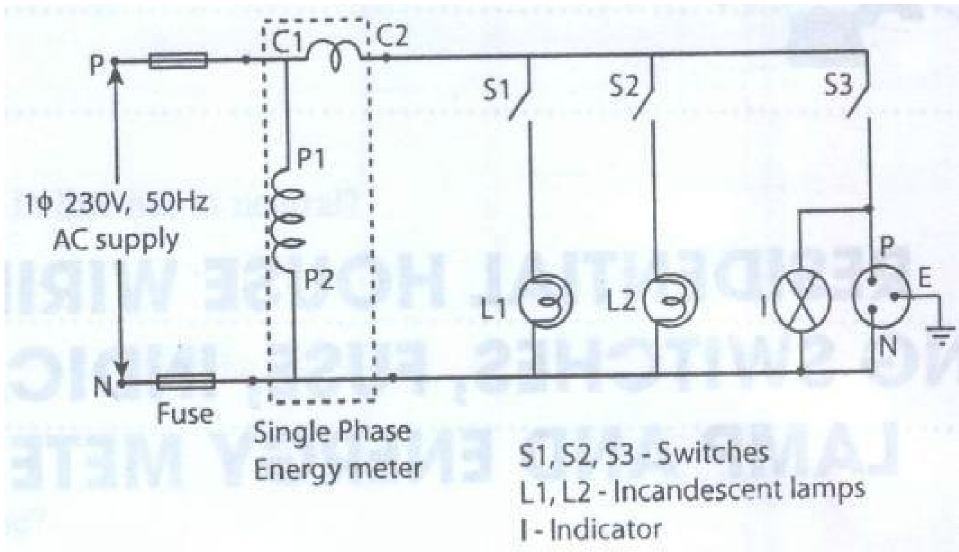
S.No.	Components equired	Range	Quantity
1	Switch	SPST	3 Nos.
2	Incandescentlamp	40W	2 Nos.
3	Lamp Holder	-	2 Nos.
4	Indicator	-	1 No
5	Socket	10A	1 No
6	Wires	-	As perrequired
7	EnergyMeter	1-phase, 300V, 16a, 750rev, 50Hz	1 No.

Tools required: Wiremans tool Kit-1 No.

Precautions:

1. Themetal coveringof allappliances areto be properlyearthed in order to avoidelectricalshockdueto leakage or failure of insulation.
2. Everyline has to be protectedbyafuseof suitableratingas per therequirement.
3. Handlewith carewhilegivingconnectionsand doingexperiments.

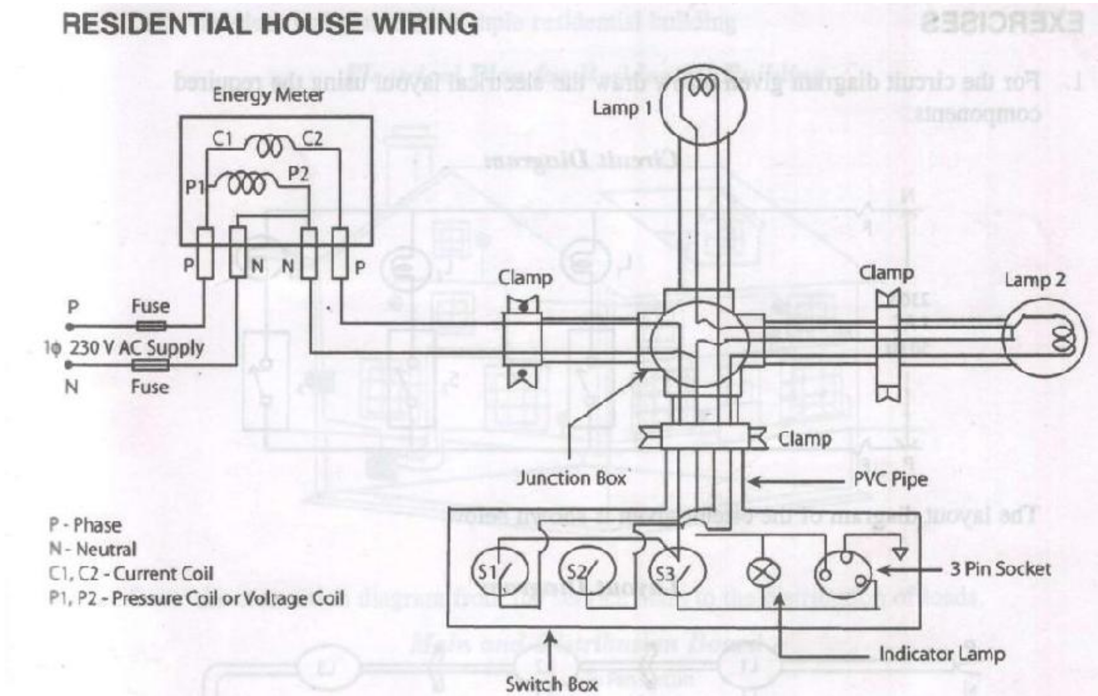
Circuit Diagram



Theory:

Conductors,switchesandotheraccessoriesshouldbeofpropercapableofcarryingthemaximum currentwhichwillflowthroughthem.Conductorsshouldbeofcopperoraluminum.Inpowercircuit,wiringshouldbedesignedfortheloadwhichitissupposedtocarrycurrent.Powersubcircuitsshouldbekeptseparatefromlightingandfansub-circuits.Wiringshouldbedoneonthedistributionsystemwithmainbranchdistributionboardsatconvenientcenters.Wringshouldbeneat,withgoodappearance.Wireshouldpassthroughapipeorbox,andshouldnottwistorcross.Theconductoriscarriedinarigidsteelconduitconformingtostandards orin a porcelain tube.

Aswitchisusedtomakeorbreaktheelectriccircuit.Itmustmakethecontactfinely.Under someabnormal conditions it must retain itsrigidityandkeep its alignment betweenswitchcontacts.The fuse arrangementismade tobreakthecircuitinthefaultoroverloadedconditions.Theenergymeterisusedtomeasuretheunits(kWh)consumedbytheloadshouldnottwistorcross.Theconductoriscarriedinarigidsteelconduitconformingtostandardsorinaporcelaintube.



Procedure:

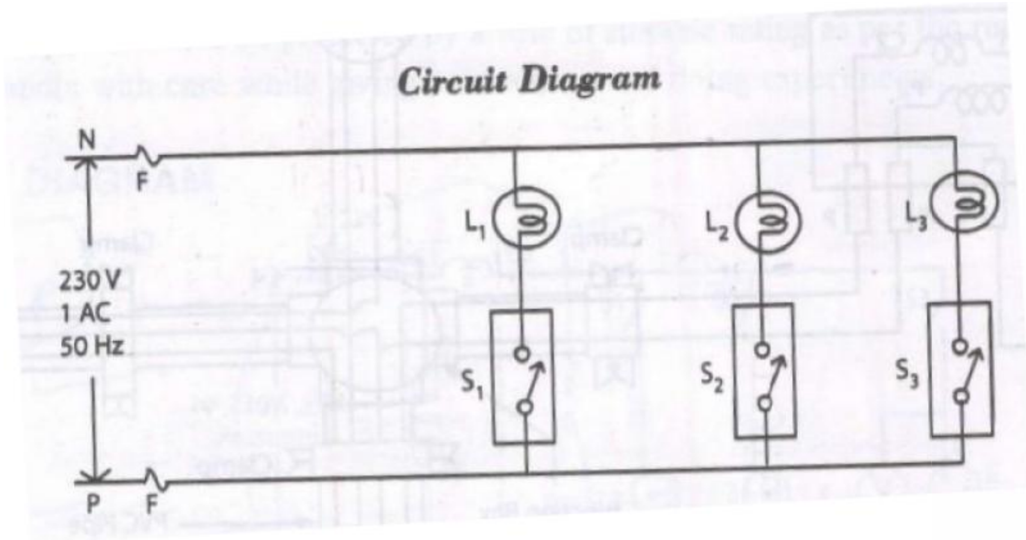
1. Studythegiven wiringdiagram.
2. Makethe location pointsforenergymeter, main witch box, Switchboard, and lamp.
3. Thelines forwiringon the wooden board.
4. Place the wiresalongwith theline and fix.
5. Fixthe bulb holder,switches,socket in marked positions on the woodenboard.
6. Connect theenergymeter and main switch boxin marked positions on the woodenboard.
7. Giveasupplyto thewires circuit.
8. Test theworkingof light and socket

Result:

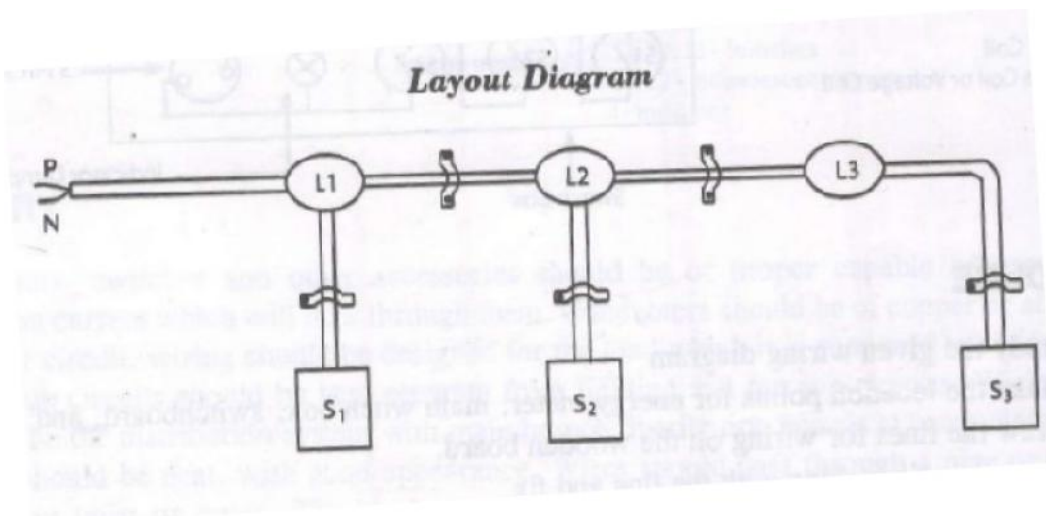
Thusthesimplehousewiringbyusingswitches,fuse,indicator,filamentlampsandenergymeter was studied.

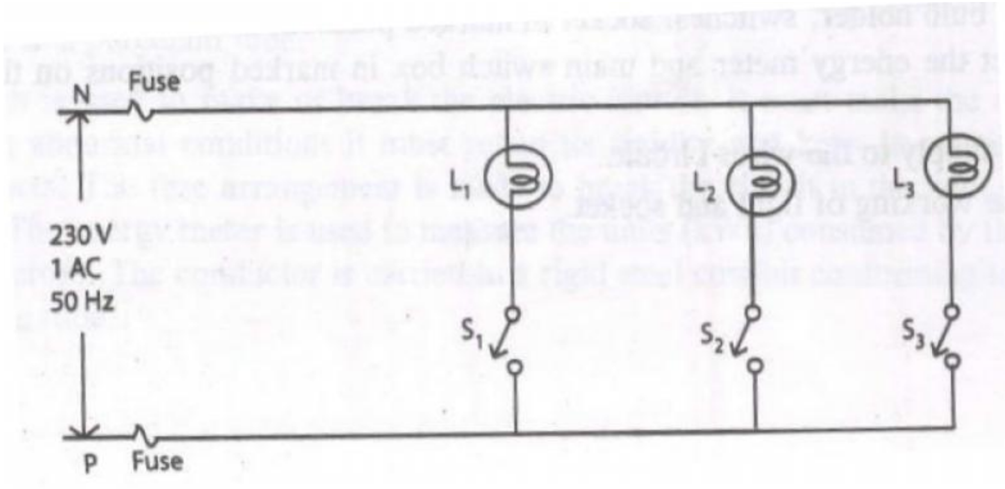
Exercises:

1. Forthe circuitdiagramgivenbelowdrawthe electricallayoutusing the requiredcomponents.

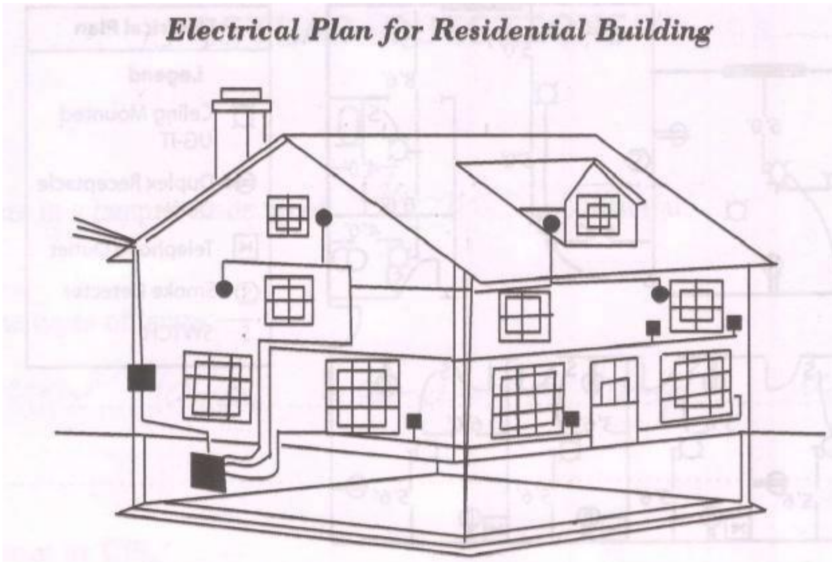


Thelayoutdiagram of the circuitgiven is shownbelow



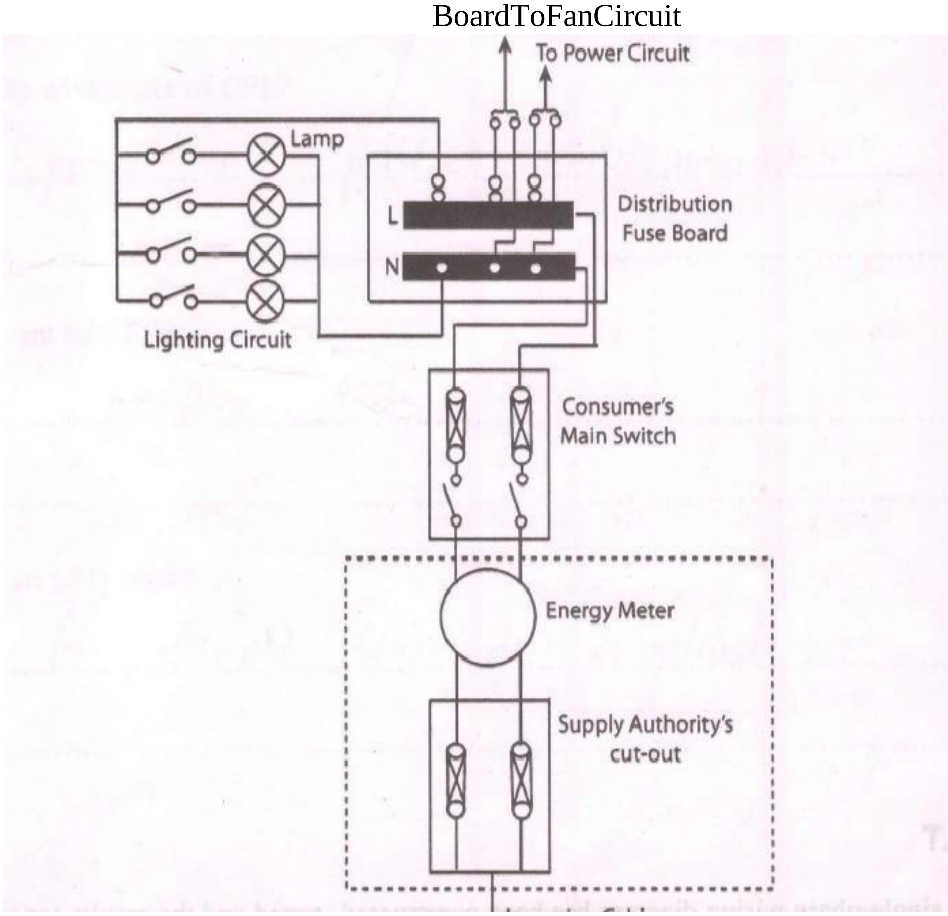

N
Fuse
L1
L2
L3
230 V
1 AC
50 Hz
S1
S2
S3
P
Fuse

2. Draw theelectricalplan forasample residential building



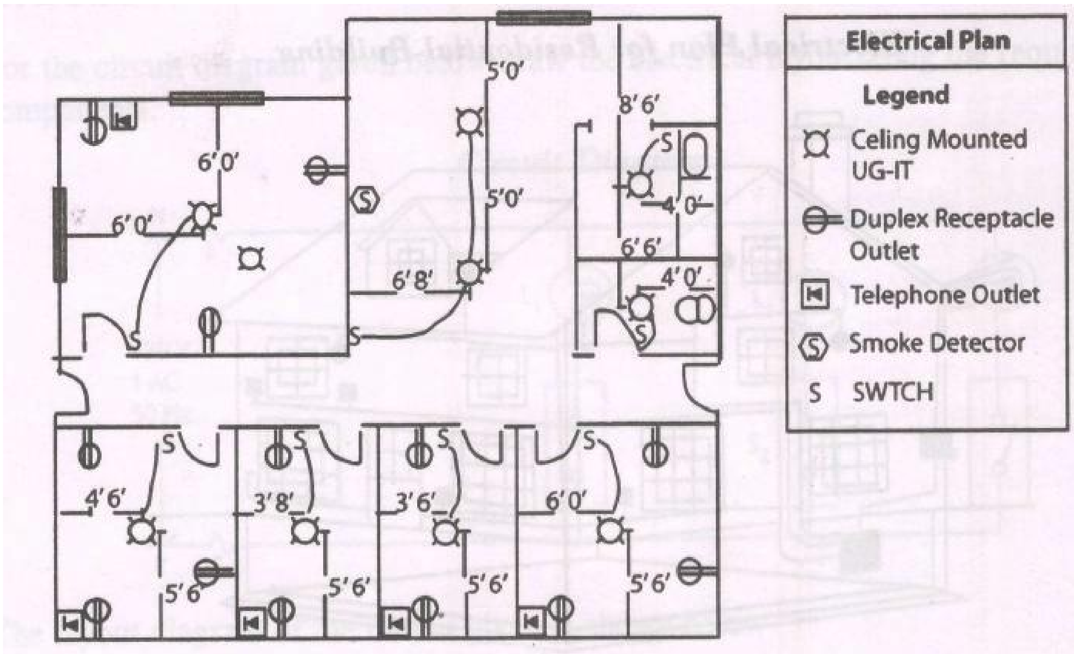
3. Draw theconnectiondiagramfrom the service main to the distribution of loads.

Main and Distribution
BoardToFanCircuit



IncomingCable

4. Electricallayout for residential building– A sample



5. Draw theelectrical layout foryourclassroom

Result:

Thus the single-phase wiringdiagram has been constructed, testedand theresultsare verified.

Exercise No. 2: Study of different types of wiring

Aim:

Tostudydifferenttypesofwiring and to preparethe following wiring:

(i) Staircase wiring
(ii) Fluorescentlamp wiring
(iii) Corridor wiring

ApparatusRequired:

S. No.	Fluorescent Lamp Wiring	StaircaseWiring	Corridor Wiring	Tools required
1	Fluorescent lamp with fitting	Twowayswitches	Switches	Screwdriver
2	Joint clips	Bulb,Bulbholder	Bulb,Bulbholder	Hammer
3	Wires	Clamps	Clamps	Cuttingpliers
4	Screws	Screws	Screws	Line tester
5	Switch board	Ceilingrose	Ceilingrose	
6	Choke	Switch board	Switch board	
7	Switches	Connectingwires	Connectingwires	

Types ofWiring

Therearevarious typesofwiringused in the residential and commercial buildings.Theyare

1. Cleat Wring
2. Batten Wiring
   (a) PVC Batten Wiring
   (b) TRS/CTSWiring
   (c) LeadSheath Wiring
3. CasingCappingWiring
   (a) Wood CasingCapping Wiring
   (b) PVC CasingCappingWiring
4. Conduit Wiring
   (a) Surface Conduit

WiringMetal Conduit
WiringPVC
ConduitWiring
(b) Concealed Conduit Wiring

1. Cleat Wiring:

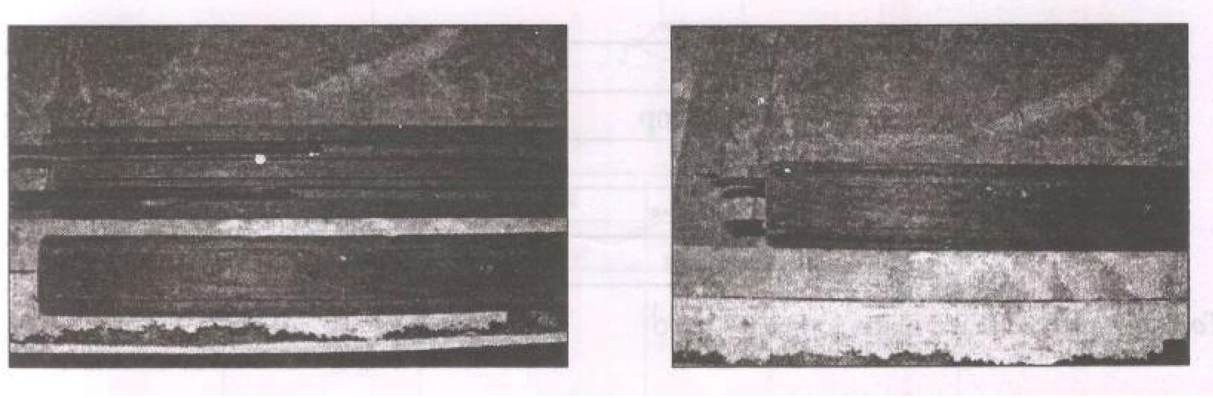
Cleatwiringisrecommendedonlyfortemporaryinstallations.Thecleatsaremadeinpainhavingbottomandtophalves.Thebottomhalfisgroovedtoreceivethewireandthetophalfisforcablegrip.Initiallythebottomandtopcleatsarefixedonthewalllooselyaccordingtothelayout.Thenthecableisdrawn,tensionedandthecleatsaretightenedbythescrew.Cleatsareofthreetypes,havingone,twoorthreegrooves,soastoreceiveone,twoorthreewires.ThissystemusesinsulatedCablessubprotectedinporcelaincleats.Thisisofwiring suitable onlyfortemporarywiringpurpose.Inlamporwetlocationthewireusedshouldbemoistureproofandaweatheringproof.

2. Batten Wiring

Toughrubber-Sheathed(T.R.S)orPVC–Sheathedcablesaresuitabletorunonteakwoodbattens.VarnishingofteakwoodbattenMethodofsecuringthebattensSuitabilityoftoughrubber-sheathedcable Suitabilityof PVC sheathedcable.

3. Wood Casing WiringSystem

Woodcasingwiringsystemshallnotbeusedindampplacesorinill-ventilatedplaces,unlesssuitableprecautionsaretaken.Thissystemofwiringissuitableforlowvoltageinstallation,Ithiswiring,cableslikevulcanizedrubber,insulatedcablesorplasticinsulatedcablesareuseandcarriedwithinthewoodcasingenclosures.Thewoodcasingwiringsystemshallnotbeuseindampplaces andin ill-ventilated places,unless suitable precautionsaretaken.



Material and Pattern ofCasing

Allcasingshallbeoffirstclass,seasonedteakwoodoranyotherapprovedhardwoodfreefromkno ts,shakes,sapsorother defects,withallthesidesplanedtoasmoothfinish,andallsideswellvarnished,bothinsideandoutsidewith pureshellacvarnish.Thecasingshallhaveagroovedbodywith a beaded or plain-molded cover as desired.

4. Tough rubber-Sheathed or PVCSheathed Wiring System

Wiringwithtoughrubbersheathedcablesissuitableforlowvoltageinstallationsandshallnotbeusedinplacesexposedtosunandrainnorindampplaces,unlesswiresaresheathedinprotective coveringagainst atmosphereand well protected to withstand dampness.

5. Metal-Sheathed Wiring System

Metal-sheathedwiringsystemissuitablefor1GWvoltageinstallations,andshallnotbeusedinsituationswhereacidsandalkalisarelikelytobepresent.Metal-sheathedwiringmaybeusedinplaces exposedto sun and rainprovided no joint of anydescription is exposed.

6. Conduit WiringSystem

Thisusesaconduitpipeforthemechanicalprotectionofwire.Inthissystemofwiring,wiresarecarriedthroughP.V.Cconduitpipeforgivingconvergingtopipesconduitpipehascertainadvantages likeit is moisture proofanddurable.

Exercise No. 3: Study of fluorescent lamp wiring.

Aim:

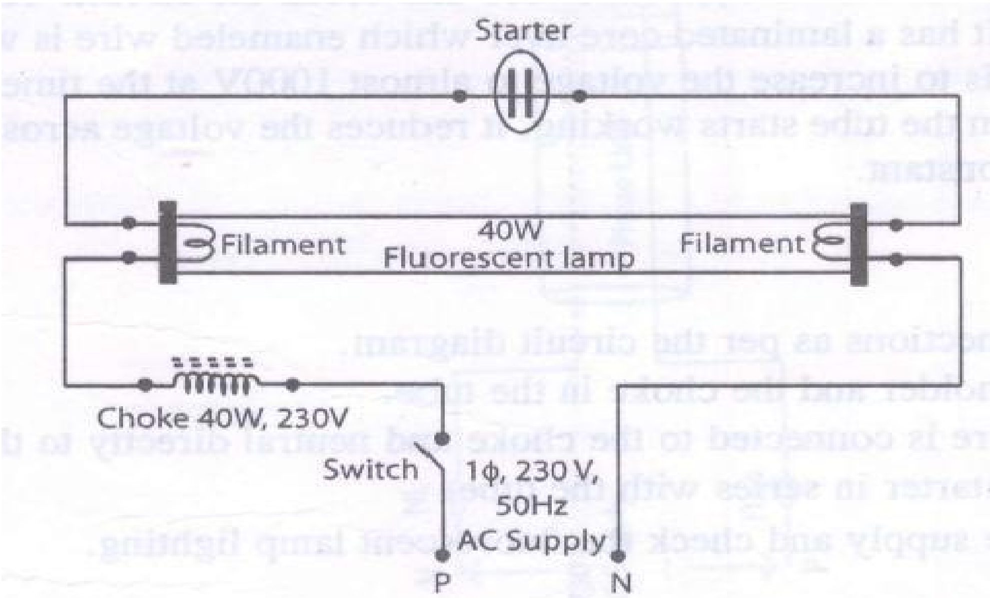
To make connections ofa fluorescentlamp wiringand to studythe accessories of the same.

ApparatusRequired:

S.No.	Components	Range/Type	Quantity
1	Fluorescentlamp fixture	4 ft	1
2	Fluorescentlamp	40W	1
3	Choke	40W, 230V	1
4	Starter	-	1
5	Connectingwires	-	As perrequired

Tools Required :Wiremans tool kit– 1

No.CircuitDiagram:



Theory:

1. Theelectrodeofthestarterwhichisenclosedinagasbulbfilledwithargongas,causedischarge in theargongas with consequentheating.

2. Due toheating,thebimetallicstripbendsandcausesinthestarter toclose.After this,thechoke, the filaments (tube ends) to tube and starter becomesconnected in series.
3. Whenthecurrentflowsthroughthetubeendfilamentstheheatisproduced.Duringtheprocessthe dischargeinthestartertubedisappearsandthecontactsinthestartermoveapart.
4. Whensuddenbreakinthecircuitoccurduetomovingapartofstarterterminals,thiscauses ahigh value ofe.m.f to be induced in thechoke.
5. AccordingtoLenz‟s,thedirectionofinducede.m.finthechokewilltrytoopposesthe fall of current in the circuit.
6. Thevoltagethusactingacrossthetubeendswillbehighenoughtocauseadischargetooccur in thegas inside thetube. Thus the startsgivinglight.
7. Thefluorescentlampisalowpressuremercurylampandisalongevacuatedtube.Itcontainsasmal lamountofmercuryandargongasat2.5mmpressure.Atthetimeofswitchinginthetubemercuryis intheformofsmalldrops.Therefore,tostartthetube,fillingupofargongasisnecessary.So,intheb eginning,argongasstartsburningattheendsofthetube;themercuryisheatedandcontrolsthecurr entandthetubestartsgivinglight.Ateachendofthetube,thereisatungstenelectrodewhichiscoate dwithfastelectronemittingmaterial.Insideofthetubeiscoatedwithphosphoraccordingtothetyp e of light.
8. Astarterhelpstostartthestartthetubeandbreakthecircuit.Thechokecoilisalsocalledblast.Ithasa laminatedcoreoverwhichenameledwireiswound.Thefunctionofthechokeistoincreasethevolt agetoalmost1000Vatthetimeofswitchingonthetubeandwhenthetubestartsworking,itreducest hevoltageacrossthetubeandkeepsthe currents constant.

Procedure:

1. Givethe connectionsasper thecircuitdiagram
2. Fixthe tubeholderand the choke in thetube.
3. Thephase wireis connected to the choke and neutral directlyto thetube.
4. Connect the starterin series with the tube.
5. Switch on thesupplyandcheck thefluorescent lamp lighting.

Result:

Thus the fluorescentlampcircuit is studiedandassembled.

Exercise No. 4: Measurement of electrical quantities.

Aim:

Tomeasuretheelectricalquantities–voltage,current,powerandtocalculatepowerfactorforRLCcircuit.

ApparatusRequired:

S.No.	Components	Range/Type	Quantity

1	Voltmeter	(0-300)V,MItype	1
2	Ammeter	(0-10)A,MItype	1
3	Wattmeter	300V, 10A,UPF/LPF	1
4	Autotransformer	1KVA,230/(0-270)V	1
5	Resistive, inductive &capacitiveload	-	1
6	Connectingwire	-	As perrequired

Theory:

Powerinanelectriccircuitcanbemeasuredusingawattmeter.Awattmeterconsistsoftwocoils,namelycurrentcoilandpressurecoilorpotentialcoil.ThecurrentcoilismarkedasMLandpressurecoilismarkedasCV.Thecurrentcoilmeasuresthequantitythatisproportionaltothecurrentinthecircuitandthepressuremeasuresquantitythatisproportionaltovoltageinthecircuit.Anammeterisconnectedinseriestothewattmetertomeasurethecurrent.Avoltmeterisconnectedinparalleltowattmetertomeasurevoltage.Thepowerfactorofthecircuitiscalculated usingtherelation givenbelow:

Formulae:

Actualpower = OR xmultiplicationfactor

Apparent power = VIwatts

Powerfactor, Cosφ = (Actual power)/ (Apparent power)

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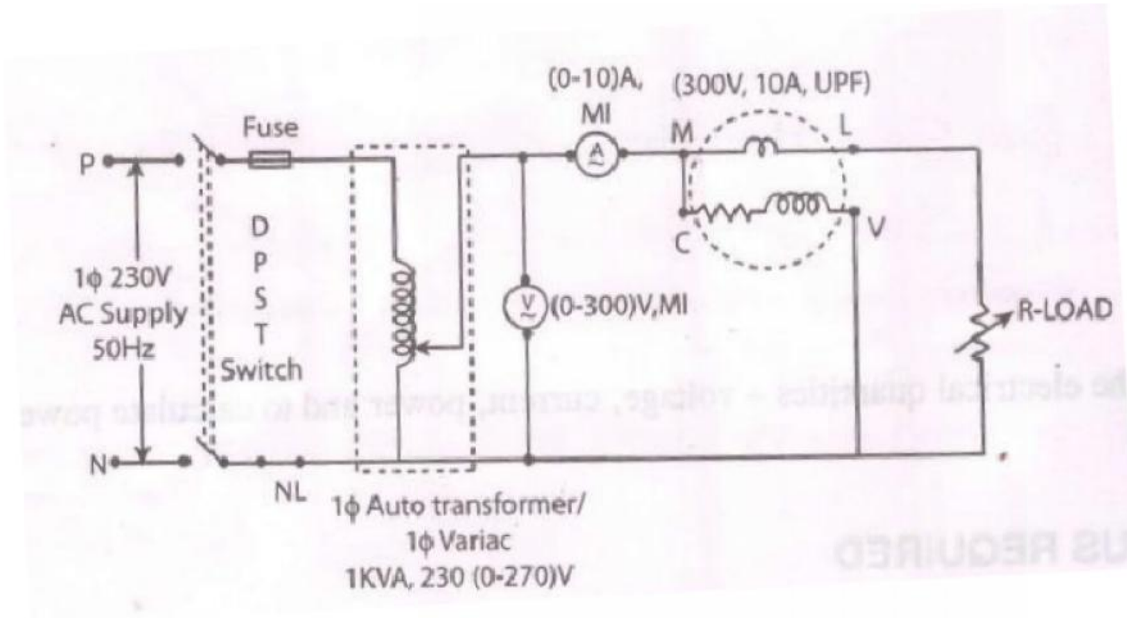
R-Load

Circuit Diagram



Procedure:

1. Connect the circuitas shown in the circuit diagram
2. Switch on thesupplyandvarythe autotransformer to build the rated voltage.
3. Varythe loadaccordingto current values are increases linearlyfor differentratings.
4. Notedown the ammeter,wattmeterreadings.Voltage will maintain constant.
5. Aftertakingall the reading, bringthe voltageback to minimum inthe autotransformer.
6. Switch off thepower supply. Removetheconnections.
7. Calculate thepower factorbythegivenformula.

Tabulation

S.No.	Voltage(V)	Current(A)	Wattmeter		PowerFactor
			ObsReading	Act. Reading	

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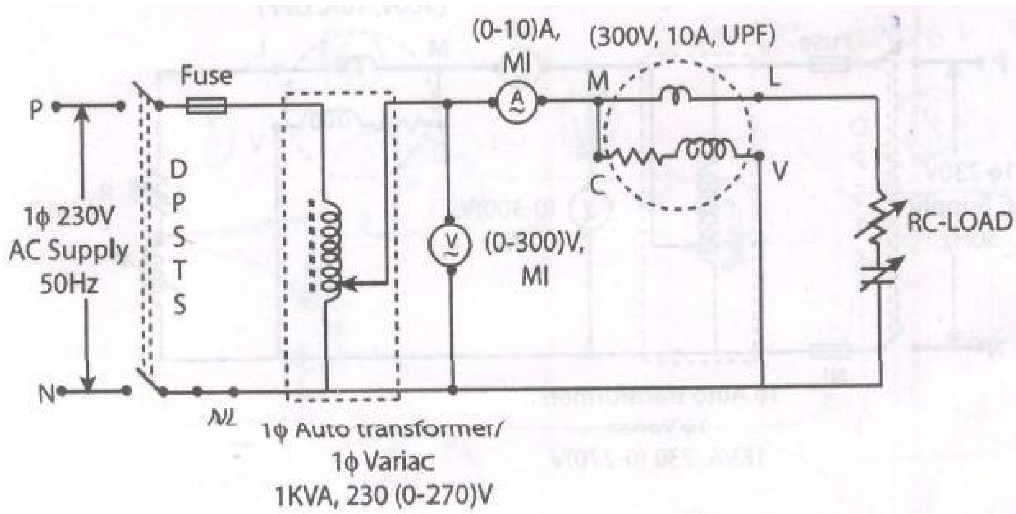
RC –

LoadCircuit

Diagram



Procedure

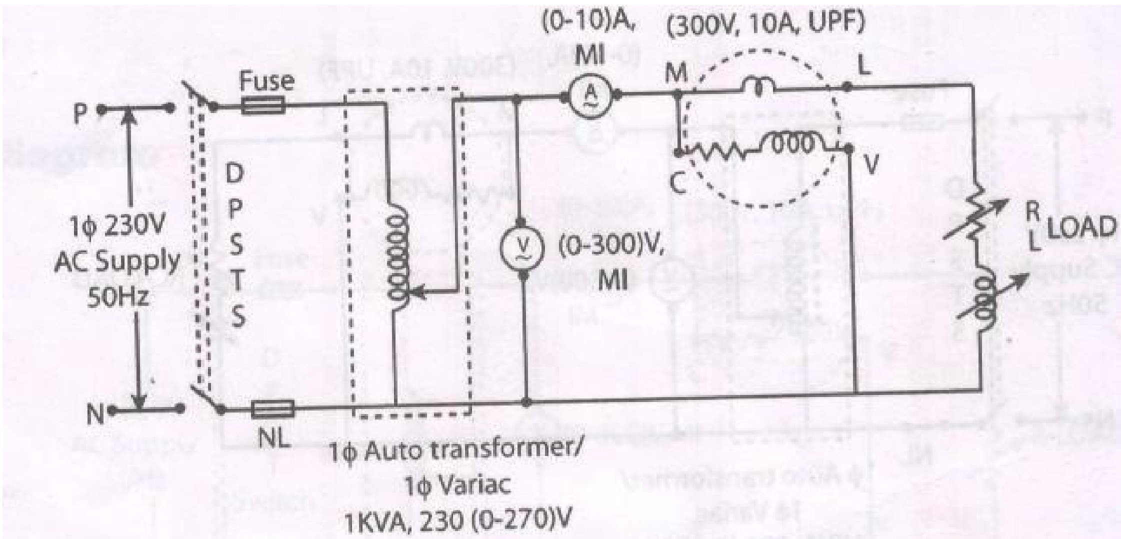
1. Connect the circuitas shown in the circuit diagram.
2. Switch on thesupplyandvarythe autotransformer to build the rated voltage.
3. Observethereadingofammeter,voltmeterandwattmeterfor various loadvalues.
4. Varythe loadaccordingto currentreadings.Voltage is maintain constant.
5. Aftertakingall the reading, bringthe voltageback to minimum inthe autotransformer.
6. Switch off thepower supply.
7. Calculate thepower factorbythegivenformula

Tabulation

S.No.	Voltage(V)	Current(A)	Wattmeter		PowerFactor
			ObsReading	Act. Reading	

RC-LoadCircuit

Diagram



Procedure:

1. Connect the circuitas shown in the circuit diagram
2. Switch on thesupplyandvarythe autotransformer to build the rated voltage.
3. Observethereadingofammeter,voltmeterandwattmeterfor various loadvalues.
4. Varythe loadaccordingto currentreadings.Voltage is maintain constant.
5. Aftertakingall the reading, bringthe voltageback to minimum inthe autotransformer.
6. Switch off thepower supply.
7. Calculate thepower factorbythegivenformula.

Tabulation

S.No.	Voltage(V)	Current(A)	Wattmeter		PowerFactor
			ObsReading	Act. Reading	

Result:

Thustheelectricalquantities–voltage,currentandpoweraremeasuredforRLCloadandcorrespondingpower factoris calculated.

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Exercise No. 5: Study of ETAP.

Aim: To study Electrical Power System design tool and use it for various design calculations and estimate.

Studies shall be performed using the latest version of approved software:
ETAP (Developed by ETAP / Operation Technology, Inc.)
Approved equal C. Software Program Requirements
Software shall comply with IEEE 399, IEEE 141, IEEE 242, IEEE 1015, IEEE 1584.

To gather and tabulate the following input data to support the power systems study:
1. Product Data for overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Maximum fault contribution or Impedance of utility service entrance
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following: a. Circuit-breaker and fuse-current ratings and types b. Generator kilovolt amperes, size, voltage, and source impedance c. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length d. Motor horsepower and code letter designation according to NEMA MG 1
4. Data sheets to supplement electrical distribution system diagram, crossreferenced with tag numbers on diagram, showing the following: a. Special load considerations, including starting inrush currents and frequent starting and stopping b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve d. Generator thermal-damage curve e. Ratings, types, and settings of utility company's overcurrent protective devices f. Special overcurrent protective device settings or types stipulated by utility company g. Time-current-characteristic curves of devices indicated to be coordinated.
Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical B. Software shall have the ability to utilize typical data such as %Z, X/R ratios for transformers, etc. in case these values cannot be ascertained from existing documentation and/or field data collection. C. Various system operating configurations of the system including status of switching devices and load status (continuous, intermittent, spare), etc. shall be modeled as part of the project database using a configuration management tool. D. Study related scenarios including data revisions, engineering properties, study solution parameters & network topology shall be setup. In the event of system changes, these scenarios may be utilized by Company at a later date to re-run the studies.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR
Course Description

Title of Course: Seminar on Industrial Training **Course Code: EE781**
L-T –P Scheme: 0-0-3 **Course Credits: 2**

Course Description & Objectives:

1. **Understand** the history of medical research and bioethics related to the HeLa cells. Understand the diverse social and economic, racial and gender contexts within which Henrietta Lacks lived and died. Understand the themes of this seminar. Appreciate the legacy and implications of these medical, ethical and social understandings on today's society.

2. **Identify**, understand and discuss current, real-world issues.

3. **Distinguish** and **integrate** differing forms of knowledge and academic disciplinary approaches (e.g., humanities and sciences) with that of the student's own academic discipline (e.g., in agriculture, architecture, art, business, economics, education, engineering, natural resources, etc.). And apply a **multidisciplinary strategy** to address current, real-world **issues**.

4. Improve oral and written **communication** skills.

5. Explore an appreciation of the **self** in relation to its larger diverse social and academic contexts.

6. Apply principles of **ethics** and **respect** in interaction with others.

Course Outcomes:

After the completion of this course, the student should be able to:

1. **Learn and integrate.** ***Through independent learning and collaborative study, attain, use, and develop knowledge*** *in the arts, humanities, sciences, and social sciences, with disciplinary specialization and the ability to integrate information across disciplines.*

2. *Use multiple thinking strategies to* ***examine real-world issues****,* ***explore creative avenues of expression****,* ***solve problems, and make consequential decisions***

3. **Learn and integrate.** Communicate**.** *Acquire, articulate, create and convey intended meaning using* ***verbal*** *and* ***non-verbal method of communication*** *that demonstrates respect and understanding in a complex society.*

4. *Use multiple thinking strategies to examine* ***real-world issues****,* ***explore creative avenues of expression****,* ***solve problems, and make consequential decisions.***

5. **Clarify purpose and perspective.** *Explore* ***one's life purpose and meaning*** *through transformational experiences that foster an understanding of* ***self****,* ***relationships****, and* ***diverse global perspectives****.*

6. **ractice citizenship.** *Apply principles of* ***ethical*** *leadership*, ***collaborative engagement****,* ***socially responsible behavior***, ***respect for diversity*** *in an interdependent world, and a service-oriented commitment to advance and sustain local and* ***global communities****.*

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR
Course Description

Title of Course: Project Part- I **Course Code: EE782**
L-T –P Scheme: 6P **Course Credits: 4**

Project: an activity where the participants have some degree of *choice* in the outcome. The result is complete and functional, that is, it has a beginning, middle and end. Usually, it spans multiple lab periods and requires work outside scheduled lab periods. Since there are choices in implementation, *design* is inherently a component of a project. A project is inherently different from an *analysis* or *exercise*, in which the solution has a predictable form. Projects span a wide variety of possibilities: design and build, identify a system, do a forensic analysis, evaluate a product or assess some environmental situation.

Program Objective 1
Graduates shall make their way to the society with proper scientific and technical knowledge in mechanical engineering.

Program Objective 2
Graduates shall work in design and analysis of mechanical systems with strong fundamentals and methods of synthesis.

Program Objective 3
Graduates shall adapt to the rapidly changing environment in the areas of mechanical engineering and scale new heights in their profession through lifelong learning.

Program Objective 4
Graduates shall excel in career by their ability to work and communicate effectively as a team member and/or leader to complete the task with minimal resources, meeting deadlines.

Program Outcomes:

1. Ability to apply knowledge of mathematics, science and mechanical engineering fundamentals for solving problems.
2. Ability to Identify, formulate and analyze mechanical engineering problems arriving at meaningful conclusions involving mathematical inferences.
3. Ability to design and develop mechanical components and processes to meet desired needs considering public health, safety, cultural, social, and environmental aspects.
4. Ability to understand and investigate complex mechanical engineering problems experimentally.
5. Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.
6. Ability to understand the effect of mechanical engineering solutions on legal, cultural, social, public health and safety aspects./li>

7. Ability to develop sustainable solutions and understand their impact on society and environment.
8. Ability to apply ethical principles to engineering practices and professional responsibilities.
9. Ability to function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10. Ability to comprehend, design documentation, write effective reports, make effective presentations to the engineering community and society at large.
11. Ability to apply knowledge of engineering and management principles to lead teams and manage projects in multidisciplinary environments.
12. Ability to engage in independent and life-long learning in the broad context of technological changes and advancements.