## DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
### SCHEME OF INSTRUCTIONS AND EXAMINATIONS
#### (FIRST YEAR)

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Instruction period / week</th>
<th>Total Period / year</th>
<th>Scheme of Examination</th>
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<tr>
<td></td>
<td></td>
<td>Theory</td>
<td>Practical /Tutorial</td>
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<tr>
<td>EE-101</td>
<td>English</td>
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<td>EE-102</td>
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<td>EE-103</td>
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<td>EE-104</td>
<td>Engineering Chemistry &amp; Environmental Studies</td>
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<td>EE-105</td>
<td>Electrical Engineering Materials</td>
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<td>EE-106</td>
<td>Basic Electrical Engineering</td>
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**PRACTICAL:**

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<td>Engineering Drawing</td>
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<tr>
<td>EE-108</td>
<td>108-Basic Electrical &amp; Electronics Laboratory Practice</td>
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<td>EE-109</td>
<td>109-A Physics Laboratory Practice</td>
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<td>109-B Chemistry Laboratory Practice</td>
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<td>EE-110</td>
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**TOTAL:**

|                      |                      |                      | 1260                | 280                   | 720             | 1000            |
ELECTRICAL ENGINEERING MATERIALS

Subject Title : Electrical Engineering Materials
Subject Code : EE-105
Periods/Week : 03
Periods/Year : 90

TIME SCHEDULE

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<thead>
<tr>
<th>Sl. No.</th>
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<th>Weightage</th>
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<th>Essay questions</th>
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<td>Di-electric Materials</td>
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<tr>
<td>7.</td>
<td>Batteries</td>
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<tr>
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OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Comprehend the Conducting Materials
1.1 State the properties of conducting materials
1.2 Define the terms (a) Hardening (b) Annealing and explain the effects of these on copper regarding Electrical and Mechanical properties.
1.3 State the main requirements of Low Resistivity Materials and High Resistivity materials. List some examples.
1.4 Mention the Properties & Applications of Copper and Aluminium
1.5 Distinguish between Copper and Aluminium.
1.6 Mention the properties & applications of ACSR Conductors and AAAC.
1.7 State the requirements of High Resistive Materials.
1.8 State the types of High Resistive Materials.
1.9 List the properties & Applications of High Resistive Materials.
   i) Manganin
   ii) Eureka
   iii) Constantan
   iv) Nichrome
   v) Tungsten
   vi) Platinum
vii) Mercury and 
viii) Carbon 

1.10 List the colour codes of the resistors as per BIS.

2.0 **Understand the Semi conducting Materials**
2.1 Understand Semi-conducting materials.
2.2 Draw energy level diagrams of conductors, insulators and semi- 
Conductors.
2.3 Classify Semi-conducting materials.
2.4 Define Intrinsic and Extrinsic Semi-conductors.
2.5 Distinguish between Intrinsic and Extrinsic semi-conductors.
2.6 Explain the formation of P and N type semi-conductors.
2.7 Distinguish between P and N type semi-conductors.

3.0 **Comprehend the Insulating Materials**
3.1 State the important electrical properties of Insulating materials. 
(a) Insulating resistance (b) Volume and Surface resistance
3.2 Explain factors affecting insulating resistance.
3.3 Classify Insulating materials on the basis of temperature 
 i.e (Y, A, E, B, F, H and C class)
3.4 State the classification of insulating materials.
3.5 Mention the properties & applications of Impregnated paper, Wood, 
Cardboard, Asbestos, Mica, Ceramics and Glass.
3.6 Explain Thermoplastic & Thermosetting resins with examples.
3.7 Explain the properties & applications of PVC
3.8 State the effects of the following on P.V.C 
(a) Filler (b) Stabilizer (c) Plasticizer (d) Additives.
3.9 State the Properties and application of following gasses 
a) Air (b) Nitrogen (c) Hydrogen (d) Sulphur – Hexafluoride (SF₆).

4.0 **Know the Di-electric materials**
4.1 Give the Permittivity of commonly used di-electric materials
 i) Air
 ii) Bakelite
 iii) Glass
 iv) Mica
 v) Paper
 vi) Porcelain
 vii) Transformer oil
4.2 Explain Polarisation.
4.3 Explain Dielectric Loss.
4.4 State the application of Dielectrics.
4.5 List the colour codes of the capacitors as per BIS.

5.0 **Know the Magnetic Materials**
5.1 Classify the Magnetic Material as: 
(i) Ferro (ii) Para (iii) Dia-Magnetic materials with examples
5.2 Explain the Soft & Hard Magnetic materials with examples.
5.3 Draw B-H. Curves and Hysteresis loop and Explain.
5.4 Explain Hysteresis loss and State Steinmetz equation (No-Problems)
5.5 Explain Eddy Current Losses
State Curie point

6.0 Understand the Special Purpose Materials

6.1 State the various protective materials Lead, Paints, Steel Tapes.
6.2 Explain the thermo couple materials.
6.3 State the Bi-metals
6.4 State the soldering materials
6.5 Define fuse and state the different types of materials used for fuse.
6.6 Explain the process of Galvanising and Impregnation
6.7 State the use of Enamel coated copper wires (thin, medium and thick).
6.8 State the importance of Nano Materials.

7.0 Comprehend the Batteries

7.1 Classify cells as primary and secondary cells.
7.2 Compare primary and secondary cells.
7.3 Name the types of storage cells as lead acid, Nickel iron and Nickel Cadmium
7.4 Explain the parts of lead acid battery.
7.5 Write chemical reactions during charging and discharging of lead acid battery.
7.6 List indications of fully charged lead acid battery.
7.7 Explain parts of Nickel – iron cells
7.8 Write chemical reactions during charging and discharging of Nickel – iron cell.
7.9 State applications of (a) Lead acid battery (b) Nickel iron cell (c) Nickel Cadmium battery.
7.10 Compare Lead acid cell with Nickel iron cell.
7.11 Explain charging of batteries by Constant current method and Constant Voltage method.
7.12 State precautions to be taken during charging & discharging of batteries.
7.13 Explain trickle charging
7.14 State capacity of a battery and factors affecting capacity.
7.15 State Ampere-hour efficiency and Watt-hour efficiency of battery
7.16 Solve problems on the Ampere – Hour Efficiency and Watt – Hour Efficiency
7.17 Define maintenance free battery
7.18 Differentiate between maintenance free batteries and lead-acid batteries
7.19 Explain the construction and working of maintenance free batteries
7.20 State the applications of maintenance free batteries.

8.0 Know the UPS and SMPS

8.1 List the types of disturbances in commercial power supply.
8.2 List the devices used to suppress spikes in supply voltages.
8.3 Classify UPS
8.4 Draw the block diagram of an off-line UPS.
8.5 Draw the block diagram of on-line UPS.
8.6 List the storage batteries used in UPS.
8.7 List the advantages of SMPS.
8.8 Explain SMPS with block diagram.
8.9 Draw the circuit of SMPS using SMPS IC (TL497).
COURSE CONTENT

1. Conducting Materials

2. Semi conducting Materials
   Semi-conductors - Intrinsic and extrinsic semi- conductors-‘P’ and ‘N’ type Materials

3. Insulating Materials
   Properties -Insulation resistance - Factors effecting Insulation resistance - Classification of Insulation materials - Properties – Applications.

4. Di- electric materials
   Permittivity of di - electric materials- Polarisation - Dielectric Loss – Application of Dielectrics – Colour codes.

5. Magnetic Materials

6. Special Purpose Materials

7. Batteries
   Primary cell and Secondary cells-Lead acid, Nickel iron and Nickel - cadmium-Chemical reactions during charging and discharging – Charging of Batteries- Constant current method and constant voltage method-Trickle charging - Capacity of Battery - Ampere-hour efficiency and watt-hour efficiency - Maintenance free batteries

8. U.P.S
   Commercial power supply-Disturbances and Spikes in supply voltages- UPS – SMPS

REFERENCES

1. Electronic Components -Dr. K.Padmanabham
2. Electronic Components -D.V.Prasad
5. Materials science for Electrical and Electronic Engineers – Ian P.Jones (Oxford Publications)
BASIC ELECTRICAL ENGINEERING

Subject Title : Basic Electrical Engineering
Subject Code : EE-106
Periods/Week : 05
Periods/Year : 150

TIME SCHEDULE

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<tr>
<th>Sl. No.</th>
<th>Major Topics</th>
<th>Periods</th>
<th>Weightage</th>
<th>Short questions</th>
<th>Essay questions</th>
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<tr>
<td>1.</td>
<td>Electric Current-Ohm’s law, Resistance.</td>
<td>35</td>
<td>26</td>
<td>02</td>
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<tr>
<td>2.</td>
<td>Work, Power and Energy</td>
<td>10</td>
<td>13</td>
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<td>3.</td>
<td>Heating effects of electric Current</td>
<td>15</td>
<td>13</td>
<td>01</td>
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<td>4.</td>
<td>Magnetic effects of Electric current</td>
<td>30</td>
<td>16</td>
<td>02</td>
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<td>5.</td>
<td>Electromagnetic Induction</td>
<td>35</td>
<td>26</td>
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<td>Electrostatics</td>
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OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Comprehend the basic Principles of Electricity
1.1 Distinguish between conductor, insulator and semi-conductor with respect to valence electrons.
1.2 State and explain Ohm’s Law.
1.3 List the limitations of Ohms Law.
1.4 Explain the concept of Resistance to flow of electrons.
1.5 Define the terms specific resistance, conductance and conductivity.
1.6 Deduce the relation \( R = \frac{\rho l}{a} \)
1.7 Solve simple problems based on the Ohm’s Law & \( R = \frac{\rho l}{a} \).
1.8 State the effect of Alloynig on Resistivity.
1.9 Explain the effects of temperature on resistance
1.10 Develop the expression for resistance at any temperature as \( R_t = R_o \left(1 + \alpha_o t\right) \)
1.11 Define temperature co-efficient of resistance and give its unit.
1.12 Develop the formula for co-efficient of resistance at any temperature as \( \alpha_t = \alpha_o \left(1 + \alpha_o t\right) \)
1.13 Solve problems based on the \( R_t = R_o \left(1 + \alpha_o t\right) \) & \( \alpha_t = \alpha_o \left(1 + \alpha_o t\right) \).
1.14 Explain equivalent resistance of a network, develop the expressions for equivalent Resistance with simple series and parallel connections.
1.15 Solve problems on equivalent resistance in the case of series-parallel networks.
1.16 Solve problems on division of current when Two Resistors are connected in parallel.
2.0 **Explain the concept of work, power & energy**
2.1 State the S.I. System of units for work, power and energy
2.2 Express work, power and energy in Electrical, Mechanical and Thermal Units.
2.3 Define efficiency.
2.4 Calculate electricity bill for domestic consumers.
2.5 Solve problems on work, power and energy in Electrical, Mechanical and Thermal units.

3.0 **Appreciate the Heating effects of Electric Current**
3.1 Explain the Mechanical equivalent of heat.
3.2 State the heat produced due to flow of current.
3.3 Explain the practical applications of heat produced due to Electric current in metal Filament lamps, Electric kettle, Electric cooker, Electric Iron, Space heaters, Geyser,Infrared lamp.
3.4 Define thermal efficiency.
3.5 Solve problems on the above.

4.0 **Appreciate the magnetic effects of Electric Current**
4.1 Draw the lines of force around a magnetic.
4.2 Explain the concept of field lines around current carrying conductors
4.3 State Right hand thumb rule.
4.4 Plot the field pattern due to
   a) Straight current carrying conductor
   b) Solenoid and
   c) Toroid.
4.5 Explain Work law and its applications.
4.6 State Laplace law (Biot-Savart’s Law)
4.7 Give expressions for field strength (No derivation)
   a) At Centre of a circular conductor
   b) At any point on the axis of a circular conductor
   c) Around a Straight conductor
   d) On the axis of a solenoid
4.8 Explain the Mechanical force on a current carrying Conductor in a Magnetic field.
4.9 Derive an expression for magnitude of the force on a conductor in a magnetic field.
4.10 State the Fleming’s left hand rule
4.11 Derive an expression for the force between two parallel current carrying conductors.
4.12 State the nature of the force with different directions of the currents
4.13 Define ampere
4.14 Solve problems on the above.
4.15 Define magnetizing force, permeability, flux and Reluctance
4.16 Derive the concept of the Magnetic circuits
4.17 Solve problems on simple magnetic circuits
4.18 Compare magnetic circuit with electric circuit.
4.19 State Magnetic leakage co-efficient.

5.0 **Explain Electro Magnetic Induction**
5.1 State Faraday’s laws of electro - magnetic induction.
5.2 Explain dynamically and statically induced E.M.F.
5.3 State Lenz’s law and explain Fleming’s right hand rule.
5.4 Explain the concept of self and mutual inductance.
5.5 Derive expressions for self and mutual inductance.
5.6 State co-efficient of coupling.
5.7 Explain the total inductance with series connections with reference to direction of flux.
5.8 Develop an expression for energy stored in a magnetic field.
5.9 Develop an expression for energy stored per unit volume
5.10 Develop an expression for lifting power of a magnet.
5.11 Solve problems on the above.

6.0 Comprehend Electric Charge and Electrostatic Field
6.1 State Coulomb’s law of electrostatics and define unit charge
6.2 Define absolute and relative permittivity.
6.3 Solve problems on the above
6.4 Explain electrostatic field.
6.5 Plot electrostatic field due to
   a) Isolated positive charges
   b) Isolated negative charge
   c) Unlike charges side by side
   d) Like charges side by side
6.6 State electric flux, electric flux density and field intensity.
6.7 Compare electrostatic and magnetic circuits.
6.8 State Gauss theorem.
6.9 Explain electric potential and potential difference.
6.10 Explain di-electric strength and di-electric constant
6.11 Define capacitance and state its unit.
6.12 Derive the formula for capacitance of a capacitor.
6.13 State different types of capacitors
6.14 Give uses of different capacitors
6.15 Explain equivalent capacitance of
   a) Capacitors connected in series;
   b) Capacitors connected in parallel
6.16 Derive an expression for energy stored in a capacitor
6.17 Solve problems on the above

COURSE CONTENT

1. Electric Current - Ohm's Law - Resistance
   Conductor, Insulator, semi-Conductor - Electric Potential – Ohm’s law – Resistance –
   Specific Resistance – Conductivity – Temperature coefficient of Resistance – Resistance
   in series, parallel and series - parallel combinations

2. Work, Power & Energy
   Units of work, power and energy. – Conversion of Units-Efficiency

3. Heating Effects of Electrical Current
   Mechanical Equivalent of Heat - Heat produced due to flow of current in resistance-
   applications

4. Magnetic Effects of Electric Current
   Lines of force - Field pattern due to long straight current carrying conductor-Field pattern
   of solenoid and Toroid -Work Law and its applications -Biot Savart Law(Laplace Law) -
   Field strength at centre and any point on the axis of a circular current carrying conductor-
   Field Strength around a straight current carrying conductor- Field strength on the axis of a
   solenoid-Mechanical force on a current carrying conductor in magnetic field - Direction of

5. Electro Magnetic Induction
Faraday’s laws - Dynamically and statically induced E.M.F - Lenz’s Law & Fleming’s right hand rule - Self and mutual inductance - Co-efficient of coupling - Inductances in series - Energy stored in a magnetic field - Energy stored per unit volume - Lifting power of magnet.

6. Electrostatics
Atom, ion, positive and Negative charges - Laws of Electrostatics – coulomb - Permittivity - Electrostatic induction - Electrostatic field - lines of force - Comparison of electrostatic and magnetic lines of force - Strength of electric field - Flux density - Gauss theorem - Electric potential - potential difference - Dielectric strength - Dielectric constant - Capacitance - Capacitor - types - Capacitors in series and parallel - Energy stored in a capacitor.

REFERENCES
1. Electrical Technology Vol.I by B.L. Theraja
3. Electrical Technology by Hughes
## ENGINEERING DRAWING

**Subject Title**: Engineering Drawing  
**Subject Code**: EE – 107  
**Periods/Week**: 06  
**Periods Per Year**: 180  

### TIME SCHEDULE

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<th>Periods</th>
<th>Weightage</th>
<th>Short Questions</th>
<th>Essay Questions</th>
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<td>Importance of Engineering Drawing</td>
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<td>03</td>
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The Course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation.

Pre-Requisite: Clear visualization and sound pictorial intelligence

### OBJECTIVES

Upon completion of this subject the student shall be able to

1. Understand the basic concepts of Engineering Drawing
   1.1 State the importance of drawing as an engineering communication medium.
   1.2 State the necessity of I.S. Code of practice for Engineering Drawing.
   1.3 Explain the linkages between Engineering drawing and other subjects of study in diploma course.
2.0 **Use of Engineering Drawing Instruments** *(No. of drawing plates: 01)*

2.1 Select the correct instruments and draw lines of different orientation.
2.2 Select the correct instruments and draw small and large Circles.
2.3 Select the correct instruments for measuring distances on the drawing.
2.4 Use correct grade of pencil for different types of lines, thickness and given function.
2.5 Select and use appropriate scales for a given application.
2.6 Identify different drawing sheet sizes as per I.S. and Standard Lay-outs.
2.7 Prepare Title block as per I.S. Specifications.
2.8 Identify the steps to be taken to keep the drawing clean and tidy.

**Drawing Plate 1**: (Having two exercises)

3.0 **Write Free Hand Lettering and Numbers** *(No. of drawing plates: 01)*

3.1 Write titles using sloping lettering and numerals as per B.I.S (Bureau of Indian standards)
3.2 Write titles using vertical lettering and numerals as per B.I.S.
3.3 Select suitable sizes of lettering for different layouts and applications.
3.4 Practice the use of lettering stencils.

**Drawing plate 2**: (Having 5 to 6 exercises)

4.0 **Understand Dimensioning Practice** *(No. of drawing plates: 01)*

4.1 State the need of dimensioning the drawing according to accepted standard.
4.2 Define “Dimensioning”.
4.3 Identify notations of Dimensioning used in dimensioned drawing.
4.4 Identify the system of placement of dimensions in the given dimensioned drawing.
4.5 Dimension a given drawing using standard notations and desired system of dimensioning.
4.6 Dimension standard features applying necessary rules.
4.7 Arrange dimensions in a desired method given in a drawing.
4.8 Identify the departures if any made in the given dimensioned drawing with reference to SP-46-1988, and dimension the same correctly.

**Drawing Plate 3**: (Having 08 to10 exercises)

5.0 **Apply Principles of Geometric Constructions** *(No. of drawing plates: 03)*

5.1 Divide a given line into desired number of equal parts internally.
5.2 Draw tangent lines and arcs.
5.3 General method to construct any polygon.
5.4 Introduction to conics
5.5 Construction of ellipse, parabola and hyperbola by general method
5.5 Construct ellipse by concentric circles method
5.6 Construct parabola by rectangle method, rectangular hyperbola, involute, cycloid and helix from the given data.
5.7 State the applications of the above constructions in engineering practice.

**Drawing Plate -4**: Draw one plate having problems up to construction polygon
Drawing Plate -5: Draw one plate having problems of construction of conics
Drawing Plate -6: Draw one plate having problems of construction of involute, cycloid and helix

6.0 **Apply Principles of Projection of points, lines, planes & solids**
(No. of Drawing Plate: 03)

6.1 Visualize the objects
6.2 Introduction to I-angle and III-angle projections
6.3 Draw the projection of a point with respect to reference planes (HP & VP)
6.4 Draw the projections of straight lines with respect to two references Planes (up to lines parallel to one plane and inclined to other plane)
6.5 Draw the projections of planes (up to planes perpendicular to one plane and inclined to other plane)
6.6 Draw the projections of solids (up to axis of solids parallel to one plane and inclined to other plane)

Drawing Plate -7: Draw one plate having problems up to projection of points and Lines (15 exercises)
Drawing Plate -8: Draw one plate having problems of projection of planes (6 exercises)
Drawing Plate -9&10: Draw Two plates having problems of projection of solids (total 10 exercises)

7.0 **Understand the need for auxiliary views**

7.1 State the need of Auxiliary views for a given engineering drawing.
7.2 Draw the auxiliary views of a given engineering component
7.3 Differentiate between auxiliary view and apparent view

Drawing plate No.11: (Having 4 exercises)

8.0 **Appreciate the need of Sectional Views**

8.1 Explain the need to draw sectional views.
8.2 Select the section plane for a given component to reveal maximum information.
8.3 Explain the positions of section plane with reference planes
8.4 Differentiate between true shape and apparent shape of section
8.5 Draw sectional views and true sections of regular solids discussed in 6.0
8.6 Apply principles of hatching.

Drawing Plate – 12: Draw one plate having problems of section of solids
(6 exercises)

9.0 **Apply principles of orthographic projection** (No. of plates: 04)

9.1 Explain the principles of orthographic projection with simple sketches.
9.2 Prepare an Engineering drawing of a given simple engineering part in first angle projection.
9.3 Draw the orthographic view of an object from its pictorial drawing.
9.4 Draw the minimum number of views needed to represent a given object fully.

Drawing Plate 13: (Having 10 to 12 exercises)
10.0 Prepare pictorial drawings
   10.1 State the need of pictorial drawings.
   10.2 Differentiate between isometric scale and true scale.
   10.3 Prepare Isometric views for the given orthographic drawings.

Drawing plate 14: (Having 10 to 12 exercises)

11.0 Interpret Development of surfaces of different solids
   11.1 State the need for preparing development drawing.
   11.2 Prepare development of simple engineering objects using parallel line
        and radial line method.
   11.3 Prepare development of surface of engineering components like trays, funnel, 90°
        elbow & rectangular duct.

Drawing plate No. 15: (Having 10 exercises)
<table>
<thead>
<tr>
<th>S.No</th>
<th>List of Practical</th>
<th>Key Competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Importance of Engineering Drawing</td>
<td>• Explain the linkages between Engineering drawing and other subjects of study in Diploma course.</td>
</tr>
<tr>
<td>2.</td>
<td>Engineering Drawing Instruments</td>
<td>• Select the correct instruments to draw various entities in different orientation</td>
</tr>
<tr>
<td>3.</td>
<td>Free hand lettering &amp; Numbering</td>
<td>• Write titles using sloping and vertical lettering and numerals as per B.I.S (Bureau of Indian standards)</td>
</tr>
<tr>
<td>4.</td>
<td>Dimensioning Practice</td>
<td>• Dimension a given drawing using standard notations and desired system of dimensioning</td>
</tr>
<tr>
<td>5.</td>
<td>Geometrical construction</td>
<td>• Construct ellipse, parabola, rectangular hyperbola, involute, cycloid and helix from the given data.</td>
</tr>
<tr>
<td>6.</td>
<td>Projection of points, Lines, Planes &amp; Solids</td>
<td>• Draw the projection of a point, straight lines, planes &amp; solids with respect to reference planes (HP &amp; VP)</td>
</tr>
<tr>
<td>7.</td>
<td>Auxiliary views</td>
<td>• Draw the auxiliary views of a given Engineering component</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Differentiate between Auxiliary view and apparent view</td>
</tr>
<tr>
<td>8.</td>
<td>Sectional views</td>
<td>• Differentiate between true shape and apparent shape of section</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use conventional representation of Engineering materials as per latest B.I.S. Code.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Apply principles of hatching.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Draw simple sections of regular solids</td>
</tr>
<tr>
<td>9.</td>
<td>Orthographic Projection</td>
<td>• Draw the minimum number of views needed to represent a given object fully</td>
</tr>
<tr>
<td>10.</td>
<td>Pictorial drawing</td>
<td>• Differentiate between isometric scale and true scale.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Draw the isometric views of given objects.</td>
</tr>
<tr>
<td>11.</td>
<td>Development of surfaces</td>
<td>• Prepare development of Surface of Engineering components like trays, funnel, 90° elbow &amp; rectangular duct.</td>
</tr>
</tbody>
</table>
COURSE CONTENT

NOTE

1. I.S. / B.S Latest Specification should invariably be followed in all the topics.
2. A-3 Size Drawing Sheets are to be used for all Drawing Practice Exercises.

1.0 The importance of Engineering Drawing

2.0 Engineering drawing Instruments
Classifications: Basic Tools, tools for drawing straight lines, tools for curved lines, tools for measuring distances and special tools like mini drafter & drafting machine – Mentioning of names under each classification and their brief description - Scales: Recommended scales reduced & enlarged -Lines: Types of lines, selection of line thickness - Selection of Pencils - Sheet Sizes: A0, A1, A2, A3, A4, A5, Layout of drawing sheets in respect of A0, A1, A3 sizes, Sizes of the Title block and its contents - Care and maintenance of Drawing Sheet, Drawing plate: Lay out of sheet – as per SP-46-1988 to a suitable scale. Simple Exercises on the use of Drawing Instruments. Importance of Title Block.

3.0 Free hand lettering & numbering
Importance of lettering – Types of lettering - Guide Lines for Lettering Recommended sizes of letters & numbers - Advantages of single stroke or simple style of lettering - Use of lettering stencils

4.0 Dimensioning practice
Purpose of engineering Drawing, need of I.S.I code in dimensioning - Shape description of an Engineering object - Definition of Dimensioning size description - Location of features, surface finish, fully dimensioned Drawing - Notations or tools of dimensioning, dimension line extension line, leader line, arrows, symbols, number and notes, rules to be observed in the use of above tools - Placing dimensions: Aligned system and unidirectional system (SP-46-1988) - Arrangement of dimensions Chain, parallel, combined progressive, and dimensioning by co-ordinate methods - The rules for dimensioning standard, features “Circles (holes) arcs, angles, tapers, chamfers, and dimension of narrow spaces.

5.0 Geometric Construction
Division of a line: to divide a straight line into given number of equal parts internally examples in engineering application. Construction of tangent lines: to draw tangent lines touching circles internally and externally. Construction of tangent arcs
i) To draw tangent arc of given radius to touch two lines inclined at given angle (acute, right and obtuse angles).
ii) Tangent arc of given radius touching a circle or an arc and a given line.
iii) Tangent arcs of radius R, touching two given circles internally and externally.
Construction of polygon: construction of any regular polygon of given side length using general method
Conical Curves: Explanation of Ellipse, Parabola, Hyperbola, as sections of a double cone and a loci of a moving point, Eccentricity of above curves – Their Engg. application viz. Projectiles, reflectors, P-V Diagram of a Hyperbolic process, Construction of any conic section of given eccentricity by general method Construction of ellipse by concentric circles method Construction of parabola by rectangle method Construction of rectangular hyperbola
General Curves: Involute, Cycloid and Helix, explanations as locus of a moving point, their engineering application, viz, Gear tooth profile, screw threads, springs etc. – their construction

6.0 Projection of points, lines and planes & solids
Projecting a point on two planes of projection -Projecting a point on three planes of projection -Projection of straight line.  
(a) Parallel to both the planes.
(b) Perpendicular to one of the planes.
(c) inclined to one plane and parallel to other planes
Projection of regular planes
(a) Plane perpendicular to HP and parallel to VP and vice versa.
(c) Plane perpendicular to HP and inclined to VP and vice versa.
Projection of regular solids
(a) Axis perpendicular to one of the planes
(b) Axis parallel to VP and inclined to HP and vice versa.

7.0 Auxiliary views
Need for drawing auxiliary views -Explanation of the basic principles of drawing an auxiliary views explanation of reference plane and auxiliary plane - Partial auxiliary view.

8.0 Sectional views
Need for drawing sectional views – what is a sectional view - Location of cutting plane – Purpose of cutting plane line – Selection of cutting plane to give maximum information (vertical and offset planes) - Hatching – Section of regular solids inclined to one plane and parallel to other plane

9.0 Orthographic Projections
Meaning of orthographic projection -Using a viewing box and a model – Number of views obtained on the six faces of the box, - Legible sketches of only 3 views for describing object -Concept of front view, top view, and side view sketching these views for a number of engg objects -Explanation of first angle projection. – Positioning of three views in First angle projection - Projection of points as a means of locating the corners of the surfaces of an object – Use of miter line in drawing a third view when other two views are given -Method of representing hidden lines -Selection of minimum number of views to describe an object fully.
10.0 **Pictorial Drawings**
Brief description of different types of pictorial drawing viz., Isometric, oblique, and perspective and their use - Isometric drawings: Iso axis, angle between them, meaning of visual distortion in dimensions - Need for an isometric scale, difference between Isometric scale, and ordinary scale difference between Isometric view and Isometric projection - Isometric and non-Isometric lines - Isometric drawing of common features like rectangles, circular shapes, non-isometric lines - Use of box and offset methods

11.0 **Development of Surfaces**
Need for preparing development of surface with reference to sheet metal work - Concept of true length of a line with reference to its orthographic projection when the line is (i) parallel to the plane of projection (ii) inclined to one principal and parallel to the other - Development of simple solids like cubes, prisms, cylinders, cones, pyramid (sketches only) - Types of development: Parallel line and radial line development - Procedure of drawing development, drawings of trays funnels, 90° elbow pipes and rectangular ducts.

**REFERENCES**

- Engineering Drawing by Basant Agarwal & C.M Agarwal - (McGraw-hill)
- Engineering Drawing by N.D.Bhatt.
BASIC ELECTRICAL & ELECTRONICS LABORATORY PRACTICE

Subject Title : Basic Electrical & Electronics Laboratory Practice
Subject Code : EE-108
Periods/Week : 06
Periods/Year : 180

TIME SCHEDULE

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Major Topics</th>
<th>No. of Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Wiring tools and Accessories</td>
<td>15</td>
</tr>
<tr>
<td>2.</td>
<td>Electrical Wiring Joints</td>
<td>21</td>
</tr>
<tr>
<td>3.</td>
<td>Lamp Circuits</td>
<td>33</td>
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<td>4.</td>
<td>Soldering Practice</td>
<td>15</td>
</tr>
<tr>
<td>5.</td>
<td>AC and DC circuits</td>
<td>21</td>
</tr>
<tr>
<td>6.</td>
<td>Resistance Measurement</td>
<td>21</td>
</tr>
<tr>
<td>7.</td>
<td>Capacitance Measurement</td>
<td>21</td>
</tr>
<tr>
<td>8.</td>
<td>Battery voltage measurement</td>
<td>15</td>
</tr>
<tr>
<td>9.</td>
<td>Piping and Thread cutting skills</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>180</strong></td>
</tr>
</tbody>
</table>

OBJECTIVES

Upon completion of the practice the student shall be able to

1.0  **Work with the Wiring Tools and Accessories**
1.1  Study the following electrical wiring tools with respect to sizes, shape, purpose, speed and use etc.
   1. Screw drivers
   2. Pliers
   3. Drilling machines & Drilling Bits.
   4. Rawl plug jumper, and poker
   5. Voltage/line tester
   6. Splicers (insulation remover)
   7. Standard Wire gauge
1.2  Study different types of Electrical Wiring accessories with respect to sizes, shape, purpose, and Use etc.
   1. Switches
   2. Ceiling roses
   3. Lamp holders and adopters
   4. Sockets
   5. Plug
   6. Fuses
1.3  Study different types of main switches (DP mains, ICDP, ICTP) with respect to rating, Purpose and Use etc.
1.4  Study of 2-pole and 3-pole MCB’s with respect to rating, purpose, And Use etc.
1.5  Study different types of wires and cables (1/18,3/20,7/20) with respect to sizes, rating, Purpose and Use etc.
2.0 Prepare Electrical Wiring Joints
2.1 Prepare straight joint/Married joint
2.2 Prepare T joint
2.3 Prepare Western union joint
2.4 Prepare pigtail joint

3.0 Practice Lamp Circuits
3.1 Make a circuit with One lamp controlled by one switch with PVC surface conduit system
3.2 Make a circuit with Two lamps controlled by two switches with PVC surface conduit system
3.3 Make a circuit with One lamp controlled by one switch and provision of 2/3-pin socket.
3.4 Make a circuit for Stair case wiring
3.5 Make a circuit for Godown wiring
3.6 Make a circuit for Electrical bell connection.

4.0 Practice Soldering
4.1 Get familiarised to use of various soldering tools and components
4.2 Solder simple electronic circuits with P.C.B

5.0 Demonstrate difference between AC and DC.
5.1 Demonstrate unidirectional current flow with 12 V battery
5.2 Determine polarity using a Voltmeter/LED
5.3 Demonstrate reversal of current using battery and DPDT switch
5.4 Make an Electromagnet and testing it on a DC power supply
5.5 Demonstrate AC using a Low voltage Transformer
5.6 Practice Series and parallel connection of lamps
5.7 Practice Bright and Dim light arrangement (using a series lamp/using a Diode)

6.0 Practice Resistance measurement
6.1 Identify different types of resistors
6.2 Calculate Resistance by its colour code
6.3 Measuring the resistance using multimeter
6.4 Connecting resistors in series and parallel and measuring the resistance using multimeter
6.5 Practice Rheostat connections

7.0 Practice Capacitor measurement
7.1 Identify different types of capacitors
7.2 Find the value/specifications of capacitor from Value printed and Color code
7.3 Demonstrate that capacitor can hold charge, charging and discharging require a specific time.
7.4 Investigate the effect of connecting capacitors in series and parallel
7.5 Testing the capacitor Using multimeter,

8.0 Practice Battery voltage measurement
8.1 Measurement of Battery Voltage using Voltmeter and Multimeter
8.2 Connecting batteries in series and parallel and observing the output voltage using Voltmeter and DMM
8.3 Measurement of current supplied by Battery using ammeter and Multimeter with rheostat as load

9.0 Develop Piping and Thread cutting skills
9.1 Cut a metal conduit, G.I. pipe and solid using hack saw
9.2 Practice Thread cutting G.I. pipe metal conduit and solid rod using Die set
9.3 Practice Internal thread cutting using Tap set reamers
9.4 Practice Thread Cleaning
9.5 Make a hexagonal nut from a round rod
9.6 Practice Thread cutting PVC pipe metal conduit using Die set.
9.7 Practice Internal thread cutting using Tap set reamers

SKILLS

Upon completion of the Wiring practice, the student shall be able to

1.0 Handle the different wiring a) tools and accessories b) select switches, and MCB’s c) Identify wires and cables as per the requirements of the load.
1.1 Identify the size and specifications of the various tools used in the electrical wiring.
1.2 Develop the skill of handling of the following electrical wiring tools.
   • Screw drivers
   • Pliers
   • Electrical Drilling machine
   • Rawl jumper
   • Line tester
   • Insulation remover (splicer)
1.3 Understand the usage of the standard wire gauge.
1.4 Identify the types, size and specifications of the following electrical wiring accessories.
   • Switches
   • Ceiling roses
   • Lamp holders
   • Tube light holders
   • Plug socket
   • Plug pins
   • Adopters
1.5 Understand the importance of the rewireble fuse and the various sizes of fuses.
1.6 Identify the type, size and specifications of DP mains, ICDP and ICTP.
1.7 Identify the various types of MCB’s, their ratings and installation.
1.8 Identify the type, size and specifications of the different type of wires, cables and find the ampere rating of 1/18, 3/20, 7/20,... wires and cables and the equivalent sq.mm. ratings.

2.0 To Prepare the electrical wiring joints and practice various types of joints for different types of wires and cables.
2.1 To prepare a Straight joint/Married joint using a 7/20 Al. Cable
   a) Identify the size of the cable.
   b) Handle the cutter, electrician Knife, for the wire jointing work.
   c) Perform splicing of insulation properly.
d) Insert the leads of the two wires properly as per the sketches.
e) Perform a firm straight joint/Married joint.

2.2 To prepare a T joint using a 7/20 Al. Cable
a) Identify the size of the cable.
b) Handle the cutter, electrician Knife, for the wire jointing work.
c) Perform splicing of insulation properly.
d) Insert the leads of the wires properly as per the sketches.
e) Perform a firm T joint.

2.3 To prepare a Western union joint using a single strand Al. Cable
a) Identify the size of the cable.
b) Handle the cutter, electrician Knife, for the wire jointing work.
c) Perform splicing of insulation properly.
d) Insert the leads of the wires properly as per the sketches.
e) Perform a firm western union joint.

2.4 To prepare a pig tail joint using a single strand Cu. Cable
a) Identify the size of the cable.
b) Handle the cutter, electrician Knife, for the wire jointing work.
c) Perform splicing of insulation properly.
d) Insert the leads of the wires properly as per the sketches.
e) Perform a firm pig tail joint.

3.0 To connect Lamp Circuits with PVC surface conduit wiring system
3.1 To control one lamp by one 1-way switch with PVC surface conduit wiring System

a) Draw wiring diagram.
b) Identify the size of cable, PVC pipe, type of 1-way switch and lamp holder.
c) Read the specifications of 1-way switch and lamp holder.
d) Fix the PVC pipe using saddles, junction boxes as per circuit diagram.
e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes.
f) Select colour and length of wire for phase and neutral.
g) Draw phase wire to the bottom point of the 1-way switch and neutral wire to the second point of lamp holder.
h) Draw wire from top point of the 1-way switch to the first point of lamp holder.
i) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
J) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of lamp holder.
K) Don’t touch the live terminals.

3.2 To control two lamps by two 1-way switches with PVC surface conduit Wiring system
a) Draw wiring diagram.
b) Identify the size of cable, PVC pipe, type of 1-way switch and lamp holder.
c) Read the specifications of 1-way switch and lamp holder

d) Fix the PVC pipe using saddles, junction boxes as per circuit diagram.

e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes.

f) Select colour and length of wire for phase and neutral.

g) Draw phase wire to the bottom point of the first 1-way switch and neutral wire to the second point of first lamp holder.

h) Draw wire from second point of first lamp holder to the second point of second lamp holder

i) Draw wire from bottom point of the first 1-way switch to the bottom point of the second 1-way switch.

j) Draw wire from top point of the first 1-way switch to the first point of First lamp holder.

k) Draw wire from top point of the second 1-way switch to the first point of Second lamp holder.

l) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.

m) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of lamp holder.

3.3 To control one lamp and 2/3 pin socket by two 1-way switches with PVC Surface conduit wiring system

a) Draw wiring diagram.

b) Identify the size of cable, PVC pipe, type of 1-way switch and lamp holder.

c) Read the specifications of 1-way switch and lamp holder.

d) Fix the PVC pipe using saddles, junction boxes as per circuit diagram.

e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes.

f) Select colour and length of wire for phase and neutral.

g) Draw phase wire to the bottom point of the first 1-way switch and neutral wire to the second point of lamp holder.

h) Draw wire from second point of lamp holder to the top point of 2/3 pin socket

i) Draw wire from bottom point of the first 1-way switch to the bottom point of the second 1-way switch.

j) Draw wire from top point of the second 1-way switch to the bottom point of 2/3 pin socket.

k) Draw wire from top point of the first 1-way switch to the first point of lamp holder.

l) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.

m) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of lamp holder.
3.4 To control one lamp from two different places by two 2-way switches with PVC surface conduit wiring system (Stair-case wiring)
   a) Draw wiring diagram
   b) Identify the size of cable, PVC pipe, type of 1-way switch and lamp holder.
   c) Read the specifications of 1-way switch and lamp holder
   d) Fix the PVC pipe using saddles, junction boxes as per circuit diagram.
   e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes.
   f) Select colour and length of wire for phase and neutral.
   g) Draw phase wire to the middle point of the first 2-way switch and neutral wire to the second point of lamp holder.
   h) Draw wire from bottom point of the first 2-way switch to the top point of the second 2-way switch.
   i) Draw wire from top point of the first 2-way switch to the bottom point of second 2-way switch.
   j) Draw wire from middle point of the second 2-way switch to the first point of lamp holder.
   k) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
   l) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of lamp holder.

3.5 To control three lamps by one 1-way switch and two 2-way switches with PVC surface conduit wiring system (Godown wiring scheme)
   a) Draw wiring diagram
   b) Identify the size of cable, PVC pipe, type of 1-way switch and lamp holder.
   c) Read the specifications of 1-way switch and lamp holder.
   d) Fix the PVC pipe using saddles, junction boxes as per circuit diagram.
   e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes.
   f) Select colour and length of wire for phase and neutral.
   g) Draw phase wire to the bottom point of the 1-way switch and neutral wire to the second point of first lamp holder.
   h) Draw wire from second point of first lamp holder to the second point of second lamp holder.
   i) Draw wire from second point of second lamp holder to the second point of third lamp holder.
   j) Draw wire from top point of the 1-way switch to the middle point of first 2-way switch.
   k) Draw wire from bottom point of the first 2-way switch to the middle point of second 2-way switch.
   l) Draw wire from bottom point of the second 2-way switch to the first point of third lamp holder.
   m) Draw wire from top point of the first 2-way switch to the first point of first lamp holder.
   n) Draw wire from top point of the second 2-way switch to the first point of second lamp holder.
   o) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
p) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of lamp holder.

3.6 To control Electrical Bell by one 1-way switch through ceiling rose with PVC surface conduit wiring system
   a) Draw wiring diagram.
   b) Identify the size of cable, PVC pipe, type of 1-way switch, ceiling rose and lamp holder.
   c) Read the specifications of 1-way switch and lamp holder.
   d) Fix the PVC pipe using saddles, junction boxes as per circuit diagram.
   e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes.
   f) Select colour and length of wire for phase and neutral.
   g) Draw phase wire to the bottom point of the 1-way switch and neutral wire to the second point of two plate ceiling rose.
   h) Draw wire from top point of the 1-way switch to the first point of two plate ceiling rose.
   i) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
   j) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of the lamp holder.

4.0 To perform soldering practice of simple electronic circuits with different Soldering tools
   a) Understand the importance of the soldering.
   b) Identify components for soldering.
   c) Identify different soldering tools.
   d) Proper use of Lead and Flux.
   e) Maintain proper temperature of soldering iron.
   f) Draw the circuit diagram of simple electronic circuit.
   g) Make proper Connections on PCB.

5.0 Demonstrate difference between AC and DC.
   a) Connect DC source across a resistor and measure V, I & W.
   b) Connect proper AC source across a coil and measure V, I, W & P.F.

6.0 Practice Resistance measurement
   a) Identify resistor based on the colour code.
   b) Measure resistance using multimeter.

7.0 Practice Capacitor measurement
   a) Identify capacitor based on the colour code.
   b) Measure the capacitance using multimeter.

8.0 Practice Battery voltage measurement
   a) By using a multimeter.
   b) By connecting Rheostats and ammeter.

9.0 Develop Piping and Thread cutting skills
   a) Identify the pipes to be joined.
   b) Perform thread cutting and thread cleaning.
<table>
<thead>
<tr>
<th>S.No</th>
<th>Experiment title</th>
<th>Key competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Handle the different wiring a) tools and accessories b) select switches, and MCB’s c) Identify wires and cables as per the requirements of the load.</td>
<td>a) Identify the size and specifications of various tools used for electrical wiring. b) Understand the usage of the standard wire gauge. c) Identify the type, size and specifications of DP mains, ICDP and ICTP, wires, cables and find the ampere rating of 1/18, 3/20, 7/20, wires and cables and the equivalent sq.mm. ratings.</td>
</tr>
<tr>
<td>2.1</td>
<td>To prepare a Straight joint/Married joint using a 7/20 Al. Cable</td>
<td>a) Identify the size of the cable b) Perform splicing of Insulation properly.</td>
</tr>
<tr>
<td>2.2</td>
<td>To prepare a T joint using a 7/20 Al. Cable</td>
<td>a) Insert the leads of the wires properly as per the sketches. b) Perform twisting of wires properly.</td>
</tr>
<tr>
<td>2.3</td>
<td>To prepare a Western union joint using a single strand Al. Cable</td>
<td>a) Perform overlap of two wires properly b) Perform twisting of binding wires properly</td>
</tr>
<tr>
<td>2.4</td>
<td>To prepare a pig tail joint using a single strand Cu. Cable</td>
<td>a) Place the wires in V-shape. b) Perform twisting of wires in clock wise direction.</td>
</tr>
<tr>
<td>3.1</td>
<td>To control one lamp by one 1-way switch with PVC surface conduit wiring system</td>
<td>a) Identify the size of cable, PVC pipe, type of 1-way switch and lamp holder. b) Draw wiring diagram. c) Make Connections as per Wiring Diagram d) Don’t touch live terminals</td>
</tr>
<tr>
<td>3.2</td>
<td>To control two lamps by two 1-way switches with PVC surface conduit wiring system</td>
<td>a) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes. b) Select colour and length of wire for phase and neutral c) Switch on the supply after making of the connections</td>
</tr>
<tr>
<td>3.3</td>
<td>To control one lamp and 2/3 pin socket by two 1-way switches with PVC surface conduit wiring system</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td></td>
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</table>
|     | a) Connect 2/3 pin socket properly with respect to phase, neutral and earth. 
|     | b) Connect phase wire through switches. |
| 3.4 | Stair-case wiring |
|     | a) Select two 2-way switches 
|     | b) Connect 2-way switches properly. 
|     | c) Test with 1-phase, 230V, 50 Hz supply to the circuit connected through ICDP switch. |
| 3.5 | Godown wiring scheme |
|     | a) Make proper connections 
|     | b) Importance of first switch connection 
|     | c) Observe sequence of operation of switches 
|     | d) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of lamp holder |
| 3.6 | To control Electrical Bell |
|     | a) Connect the bell through ceiling rose properly. 
|     | b) Make ceiling rose connections properly |
| 4.0 | Soldering Practice Of Simple Electronic Circuit |
|     | a) Proper use of Lead and Flux 
|     | b) Maintain proper temperature of soldering iron. |
| 5.0 | Demonstrate difference between AC and DC |
|     | a) Connect DC source and measure V & I 
|     | b) Connect proper AC source and measure V & I 
|     | c) Make inferences. |
| 6.0 | Practice Resistance measurement |
|     | a) Identifying resistor based on the colour code. 
|     | b) Measuring resistance using multimeter. |
| 7.0 | Practice Capacitor measurement |
|     | a) Identifying capacitor based on the colour code. 
|     | b) Handling multimeter. |
| 8.0 | Practice Battery voltage measurement |
|     | a) Handling multimeter 
|     | b) Handling Rheostats |
| 9.0 | Develop Piping and Thread cutting skills |
|     | a) Identify the size of the rods to be joined. 
|     | b) Perform thread cutting as per the order 
|     | c) perform thread Cleaning |
COURSE CONTENT

1.0 Wiring Tools And Accessories
Study the following electrical wiring tools with respect to sizes, shape, purpose, speed and Use of Screw drivers- Pliers- Drilling machines & Drilling Bits- Rawl plug jumper, and poker-Voltage/line tester- Splicers (insulation remover)- Standard Wire gauge- Study different types of Electrical Wiring accessories- Switches- Ceiling roses- Lamp holders and adopters-Sockets- Plugs- Fuses- Study different types of main switches (DP mains, ICDP, ICTP) Study of MCB’s-Study different types of wires and cables (1/18,3/20,7/20)

2.0 Electrical Wiring Joints
Prepare straight joint/ Married joint- T joint- Western union joint-Pigtail joint.

3.0 Lamp Circuits
One lamp controlled by one switch with PVC surface conduit system-Two lamps controlled by two switches with PVC surface conduit system- One lamp controlled by one switch and provision of 2/3-pin socket-Stair case wiring- Godown wiring- Electrical bell connection

4.0 Soldering Practice
Familiarization and use of various soldering tools and components -Solder simple electronic circuits with P.C.B

5.0 Demonstrate difference between A.C. and D.C.
Measuring Power across a resistor and coil using DC and AC supply respectively.

6.0 Practice Resistance measurement
Identify resistance using colour code-measure resistance Ohmmeter and multimeter.

7.0 Practice Capacitor measurement
Identify capacitance using colour code-measure resistance Ohmmeter and multimeter.

8.0 Practice Battery voltage measurement
Measure Battery voltage using multimeter.

9.0 Develop Piping and Thread cutting skills
Develop Piping and Thread cutting on a PVC pipe and GI pipe.

Reference
1. Electrical work shop By R.P.Singh
2. Experiments in Basic Electrical Engineering by S.K.Bhattacharya , Rastogi- NAI.
<table>
<thead>
<tr>
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<td>DC Machines</td>
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**PRACTICAL**:

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**TOTAL**: 24 18 630 280 720 1000

**D.C. MACHINES**

- **Subject Title**: D.C. Machines
- **Subject Code**: EE-302
- **Periods/Week**: 04
- **Periods/Semester**: 60

**TIME SCHEDULE**

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<th>Weightage</th>
<th>Short Questions</th>
<th>Essay Questions</th>
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I-28
1. **Fundamentals of D.C Generators**
   14  29  03  02

2. **Armature Reaction and Characteristics of D.C Generators.**
   16  26  02  02

3. **Fundamentals of D.C Motors**
   12  26  02  02

4. **Speed Control and Starters for D.C Motors**
   10  16  02  01

5. **Characteristics and Testing of D.C Motors**
   8   13  01  01

**TOTAL**  60  110  10  08

**OBJECTIVES**

Upon completion of the study of the course the student shall be able to

1.0 **Study the Fundamentals of D.C Generators**
   1.1 State the method of dynamically induced E.M.F.
   1.2 State Fleming’s right hand rule.
   1.3 Explain electromechanical energy conversion.
   1.4 Explain the working of simple loop generator.
   1.5 Understand the conversion of AC to DC by commutator.
   1.6 Explain the working of D.C generator.
   1.7 State the functions of each part of D.C generator.
   1.8 List various materials used for each part of DC Generator.
   1.9 List the types of windings -- (i) Lap (ii) Wave.(Single layer only).
   1.10 Define Pole pitch, Y_b, Y_f, Y_R in terms of armature slots.
   1.11 Compare Lap and Wave windings in different aspects.
   1.12 Classify DC generators based on excitation.
   1.13 Derive the E.M.F equation of D.C generator in terms of \( \phi, Z, N, P \) and \( A \).
   1.14 Draw the equivalent circuits of various DC generators and write voltage and current equations and solve simple problems.
   1.15 State the various losses incurred in the D.C Generator.
   1.16 Explain power stages in D.C. Generator.
   1.17 Define the mechanical, electrical and overall efficiencies of DC Generator.
   1.18 Derive the condition for maximum efficiency of DC generator.
   1.19 Solve Problems on efficiencies.

2.0 **Comprehend the Armature Reaction and Characteristics of D.C Generator.**
   2.1 State and explain the Armature reaction with sketches.
   2.2 Explain the phenomenon of Demagnetization & Cross magnetization.
   2.3 Derive the formula for \( AT_d, AT_c / Pole \).
   2.4 Solve simple problems on \( AT_d, AT_c / Pole \)
   2.5 State and explain Commutation.
   2.6 List the different methods of improving commutation.
   2.7 Explain the interpole method of improving commutation.
2.8 Draw and explain O.C.C, Internal and External characteristics of
(i) Separately excited (ii) Shunt
(iii) Series (iv) Compound generators.
2.9 Determine the critical field resistance and critical speed of DC
generators from O.C.C.
2.10 State the conditions for Buildup of E.M.F of DC generator.
2.11 State the Conditions for parallel operation of generators. (NoProblems)
2.12 Understand the use of Equalizer ring in parallel Operation.
2.13 List the applications of D.C generators.

3.0 Study the Fundamentals of D.C Motors
3.1 Appreciate the usage of the DC machine as a generator and DC motor.
3.2 State Fleming’s left hand rule.
3.3 Explain the working of D.C motor.
3.4 Explain the significance of back E.M.F and its formula.
3.5 Classify DC motors.
3.6 Draw the equivalent circuits of DC motors and Write the back E.M.F equations.
3.7 Solve Problems on Back E.M.F.
3.8 Define Torque and Derive the Torque equation of D.C motor.
3.9 Develop the formulae for armature torque (T_a), shaft torque (T_sh) and loss torque.
3.10 State the different losses in D.C motors and explain power stages in D.C.
motor.
3.11 Solve Problems on the above.
3.12 Explain and plot the electrical and mechanical characteristics of D.C. Shunt, Series and compound motors.
3.13 List the applications of D.C motors.

4.0 Comprehend the Speed Control and Starters for D.C Motors
4.1 Explain the necessity of speed control of DC Motors.
4.2 List different types of Starters for DC motors.
4.3 Explain the different methods of speed Control (Flux, Armature and Voltage) for D.C shunt motors.
4.4 State the advantages and disadvantages of above methods.
4.5 Explain the different methods of speed control for series motors
4.6 Explain the necessity of starter.
4.7 Explain 3-point starter with neat sketch.
4.8 Explain 4-point starter with neat sketch.

5.0 Appreciate the Characteristics and Testing of D.C Motors
5.1 Describe the direct and indirect methods of testing D.C. motors.
5.2 List different tests of D.C. motors.
5.3 Explain the method of conducting brake test on different types of D.C motors.
5.4 Explain the method of conducting Swinburne’s test.
5.5 Solve Problems on the above.
COURSE CONTENT

1. Fundamentals of D.C Generators


3. Fundamentals of D.C Motors
   Usage of a DC machine as a generator and a motor-Fleming’s left hand rule - working of D.C motors – classification - significance of back E.M.F- Write the formulas for back E.M.F for different D.C motors-Problems on E.M.F equation – torque-Torque equation of Dc motor - Armature torque (T_a) , shaft torque (T_sh) and loss torque - Different losses - electrical and mechanical characteristics of D.C Shunt, Series and compound motors. Applications of D.C motors.

4. Speed Control and Starters for D.C Motors
   Necessity of speed control- Direct and Indirect methods of speed control-different methods (Flux, Armature and Voltage) of speed controls for D.C shunt motors-State the advantages and disadvantages of above methods-different methods of speed control for series motors- problems -necessity of starter- 3-point starter, 4-point starter,.

5. Characteristics and Testing of D.C Motors
   Performance curves- brake test on different types of D.C motors-Swinburne’s test-problems.

REFERENCES
2. Electrical Technology - Vol –II by B.L. Theraja - S.Chand&co.
3. Electrical machines by P.S. Bhimbhra
4. Electrical Machines by M.V.Deshpande
5. Electric Machines by D.P.Kothari, J.Nagarath – TMH

ELECTRICAL CIRCUITS

Subject Title : Electrical Circuits
Subject code : EE-303
Periods/Week : 04
Periods/semester : 60

TIME SCHEDULE

I-31
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<td>Network Theorems</td>
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<td>Single phase A.C. circuits</td>
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**OBJECTIVES**

Upon the completion of the course the student shall be able to

1.0  **Understand Kirchoff’s laws and star delta Transformations.**

1.1  Differentiate between active and passive circuits.

1.2  Explain junction, branch and loop in circuits.

1.3  Understand the insufficiency of Ohm’s law to solve complex circuits.

1.4  State Kirchoff’s current law and voltage law.

1.5  Solve problems by applying KVL and KCL

1.6  Explain star and delta circuits

1.7  Explain the concept of circuit transformation and equivalent circuits

1.8  Develop transformation formulae for star- delta transformations

1.9  Solve problems on the above

2.0  **Understand Network Theorems**

2.1  Explain ideal voltage source & ideal current source

2.2  Explain Source transformation technique

2.3  State Super position theorem.

2.4  State Thevenin’s theorem.

2.5  State Norton’s theorem

2.6  State maximum power transfer theorem.

   (All the theorems with reference to D.C only)

2.7  Solve simple problems on the above theorems

3.0  **Comprehend the relationship between quantities connected with alternating current**

3.1  Explain simple loop generator concept

3.2  State the relationship between $\theta_m$ & $\theta_e$

3.3  State the relation between poles, speed and frequency

3.4  Define the instantaneous value, maximum value, frequency, time period, Average value, R.M.S value, form factor and peak factor.

3.5  Calculate the above for different alternating waveforms viz. half, full wave rectified sine, triangular and square wave forms.

3.6  Explain the term phase and phase difference

3.7  Understand j operator & Convert polar quantities to rectangular quantities and Vice-versa.
4.0 Comprehend the single phase A.C. Series circuits
4.1 Define the terms resistance, inductance and capacitance
4.2 Derive relationship between voltage and current in pure resistive, inductive and capacitive circuits
4.3 Calculate the impedance, current, phase angle, power and power factor in R-L, R-C, L-C & R-L-C series circuits.
4.4 Solve Problems on Series Circuits
4.5 Define Resonance in series circuits derive resonant frequency.
4.6 Define Q-factor and explain importance of Q-factor.
4.8 Solve simple problems on Series Resonance.

5.0 Comprehend the single phase A.C. Parallel Circuits
5.1 Solve Parallel Circuits by
   a) Vector method
   b) Admittance method
   c) J-notation method
5.2 Solve Problems on above (a) and (c) (No admittance method).
5.3 State condition for resonance in parallel circuits.

6.0 Understand Poly Phase Circuits
6.1 Define the term ‘Poly Phase’.
6.2 Explain the methods of generation of 2 phase and 3 phase emfs.
6.3 Write the expressions for Poly phase emfs and represent them by phasor diagram.
6.4 Understand the concept of phase sequence.
6.5 Derive the relation between line and phase values of current and voltage in 3 phase star and delta circuits.
6.6 Derive the equation for power in 3 phase circuit.
6.7 Solve numerical examples in balanced loads.
6.8 Derive the formulae for measurement of 3 phase power by using two watt meters.
6.9 Calculate the power factor of the load by the above method.
6.10 State the advantages of 3 phase system over single phase system.
6.11 Solve simple problems on the above

COURSE CONTENT
1. Kirchhoff’s Laws and Star - Delta Transformation
Active and Passive circuits - Junction, branch and loop in circuits - Insufficiency of Ohm’s law to solve complex circuits, Kirchhoff’s laws - Star - Delta configurations, star-delta transformations.

2. Network Theorems
Ideal Voltage, Ideal current source - Source transformation technique - Super position theorem - Thevenin’s Theorem - Norton’s Theorem - Maximum power transfer theorem with reference to D.C. - Problems on the above.

3. Fundamentals of A.C.
Simple loop Generator – Relation between $\theta_m$ & $\theta_e$ - Relation between poles, speed and frequency - Definition of Alternating quantity, cycle, period, frequency, amplitude,
instantaneous value and angular velocity - Average value - effective value/R.M.S value definitions and derivations - calculations of these values for half wave rectified sine wave, full wave rectified Sine wave, Triangular and Square wave forms-form factor- peak factor - Representation of alternating quantities by equation, graphs and phasor diagrams - Phase and phase difference – Understanding of `J` notation for alternating quantities ,transformation from polar to rectangle notations and Vice-versa

4.Single phase A.C. Series Circuits
Resistance, inductance and capacitance as circuit elements - concept of reactance, resistive, purely inductive and purely capacitive circuits - Derivation of voltage , current, power relations including phase relationships, wave forms and phasor diagrams - R-L, R-C , L-C & R-L-C series circuits - Derivation of relation between voltage, current, impedance, power including wave forms and phasor diagrams. Impedance triangle, phase angle, power factor, active and reactive components of current and power in above circuits – Definition of Resonance in series circuits and expression for resonant frequency- Q-factor-Importance of Q- factor- Problems on series circuits and series resonance.

5.Single phase A.C. Parallel Circuits
Simple Parallel circuits - solution by vector method and by `J` notation – problems - Resonant circuit – Condition for resonance in parallel circuit.

6.Poly phase circuits
Definition of Poly phase - Generation of 2 phase and 3 phase EMF’s - Location of coils for obtaining required phase difference - Representation of 2 phase,3 phase EMF’s by equations, graphs and phasors - phase sequence - Current in neutral in 2 phase and 3 phase system - Method of connection – star and delta - phasor diagram showing relation between phase and line quantities, Relation between phase and Line values of voltages and currents -power equation - Problems on 3 phase balanced circuits – Measurement of 3 phase power by two wattmeter and power factor in balanced circuits - Effect of Load power factor on wattmeter readings – Problems - Advantages of poly-phase systems over single-phase systems.

REFERENCES
4. Introduction to Electrical Engg. By V.K.Mehta
5. Electrical Technology by Hughes.
6. Problems in Electrical Engg. By Parker Smith
7. Engineering Circuit analysis By William Hayt and JackE,kemmerly-TMH
8. Electrical Circuits by A.Chakrabarthy- Dhanapat Rai and Sons
9. Network and Systems by D. Roy Chowdary- New age international publishers
11. Network Analysis by Vanvalkanburg, PHI.
12. Electrical Circuits by Joseph Edminister- Schaum series
14. Electric circuits by Mahmood Nahvi, Joseph A Edminister-TMH.
ELECTRICAL & ELECTRONIC MEASURING INSTRUMENTS

Subject Title : Electrical & Electronic Measuring Instruments
Subject Code : EE - 304
Periods/Week : 04
Periods/ Semester : 60

TIME SCHEDULE

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OBJECTIVES

Upon the completion of the course the student shall be able to

1.0 Comprehend the Basics of measuring instruments.
1.1 List the important electrical quantities to be measured, state their units and state the names of the instruments to measure them.

1.2 Classify instruments on the basis of construction and output as analog (electromechanical and analog electronic) and digital instruments.

1.3 Classify the electromechanical instruments according to Principle of Working.

1.4 Classify instruments (on the basis of method of measuring the value) as absolute and secondary instruments and Distinguish between them.

1.5 State the types of secondary instruments (indicating, integrating and recording instruments) and explain them with examples.

1.6 State the purpose and methods of obtaining deflecting, controlling and damping torques in indicating instruments.

1.7 State the definitions of the following important concepts related to measuring Instruments a) accuracy b) precision c)error d)resolution e)sensitivity

1.8 Classify the errors according to the source of the error (gross, systematic and random errors)

2.0 Explain the construction and working of different electromechanical Measuring instruments.

2.1 Describe the construction and working of Permanent Magnet Moving Coil Instrument. (Voltmeter/Ammeter).

2.2 List the errors commonly occurring in moving coil instruments and state their remedies.

2.3 State the advantages and disadvantages of M.C Instruments.

2.4 State the applications of M.C Instruments

2.5 Describe the construction and working of Moving Iron (Voltmeter / Ammeter) Attraction type and Repulsion type meters.

2.6 List the errors commonly occurring in M.I. Instruments.

2.7 State the advantages and disadvantages of M.I. Instruments.

2.8 Compare M.C. and M.I. instruments.

2.9 Describe the method of extending the range of moving coil ammeter with the help of shunt.

2.9.1 Describe the method of extending the range of moving coil voltmeter with the help of Multiplier.

2.11 Solve the problems on Shunts and Multipliers used for moving coil instruments.

2.12 Describe the working principle, construction and working of a dynamometer type instrument (ammeter, Voltmeter and wattmeter).

2.13 Draw the circuit diagram for measuring power with wattmeter in Single – Phase circuit.

2.14 List the common errors in the Dynamometer Instruments.
2.15 List the advantages and disadvantages of dynamometer instruments.
2.16 State the need for instrument transformers (CT and PT).
2.17 List the applications of CT and PT.
2.18 State the precaution when using CT.
2.19 Draw the circuit diagram for measuring power with wattmeter in Single – Phase circuit in conjunction with instrument transformers.
2.20 Explain the principle, construction and working of a 1-phase induction type Energy meter.
2.21 State Meter Constant
2.22 State the common errors and their remedies in 1- phase energy meter
2.23 Describe construction and connections of a 3-phase energy meter.
2.24 Explain the construction and working of Weston synchroscope.

3.0 **Explain the methods of measurement of resistance.**
3.1 Classify the resistance into Low , Medium and High Values giving examples for each.
3.2 List the methods of measurement of resistance (Low, Medium and High Values)
3.3 Draw the circuit diagram of basic Ohm-meter.
3.4 Explain the working of basic Ohm-meter.
3.5 Describe the two types of Ohm-meters (series and shunt).
3.6 Distinguish between shunt and series Ohm-meters circuits.
3.7 Describe the construction and working of Megger.
3.8 Explain the method of measurement of earth resistance using Earth Megger. (Construction and Working of Earth Megger is not required).
3.9 State the working principle of basic Potentiometer.
3.10 Describe the Construction and working of basic Potentiometer with a legible sketch.
3.11 Explain the measurement of unknown resistance using Potentiometer.
3.12 List the applications of Potentiometer.

4.0 **Explain the concept of Transducers and Sensors**
4.1 Define Transducer
4.2 Explain the need of Transducers in Measurement systems
4.3 Explain the Classification of Transducers
4.4 Explain the factors influencing the choice of Transducer
4.5 State applications of Transducers.
4.6 Explain the use of Thermocouple for the measurement of temperature.
4.7 Explain the measurement of temperature using Thermister in a Bridge circuit.
4.8 State the working principle and use of strain gauge.
4.9 Explain the construction, working and use of LVDT.
4.10 Explain the concept of Sensor and list the applications of sensors.
4.11 Explain Semiconductor sensors.

5.0 **Understand the working of Electronic & Digital instruments**
5.1 List the basic components of analog electronic Instruments.
5.2 List a few analog electronic Instruments.
5.3 Explain the working of Rectifier type voltmeter and ammeter.
5.4 List the basic components of Digital (Digital electronic) instruments.
5.5 List the advantages of Digital Instruments over Analog Instruments.
5.6 List the types of digital Voltmeters.
5.7 State the specifications of digital voltmeter.
5.8 Explain the Working of Digital Multimeter and state its specifications.
5.9 Explain the Working of Single Phase Digital Energy meter with block diagram.
5.10 Explain the Working of Three Phase Digital Energy meter with block diagram.
5.11 Explain the Working of Digital frequency meter with block diagram.
5.12 State the uses of Tong tester (clamp meter).

COURSE CONTENT

1. Basics of Measuring instruments:
List of important electrical quantities to be measured, their units and the names of the instruments to measure them- Classification of instruments - different types of torques (Deflection ,Controlling and Damping torques) in the indicating instruments-definitions of accuracy ,precision ,error, resolution and sensitivity-types of error.

2. Electromechanical Measuring Instruments:

3. Measurement of resistance:

4. Transducers and Sensors:
Definition of transducer-need of transducer-Classsification of Transducers - Factor influencing while its selection -Applications of Transducers –Thermocouple- Thermister - working principle and use of StrainGauge- construction, working and use of LVDT- Basic Concept of Sensors and its applications –Semiconductor sensors .

5. Electronic & Digital Instruments :
phase digital energy meter with block diagram-- working of three phase digital energy meter with block diagram- Working of Digital frequency meter with block diagram-use of tong tester(clamp meter).

References:
5. Modern Electronic Equipment – by Khandpur
7. Electrical measurements by Harris

ELECTRONICS - I

Subject Title : Electronics - I
Subject code : EE-305
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Major Topics</th>
<th>Periods</th>
<th>Weightage of Marks</th>
<th>Short Questions</th>
<th>Essay Questions</th>
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<tbody>
<tr>
<td>1.</td>
<td>Passive Components</td>
<td>08</td>
<td>20</td>
<td>02</td>
<td>01</td>
</tr>
<tr>
<td>2.</td>
<td>Semi Conductor devices</td>
<td>12</td>
<td>16</td>
<td>01</td>
<td>01</td>
</tr>
<tr>
<td>3.</td>
<td>Power supplies</td>
<td>08</td>
<td>20</td>
<td>02</td>
<td>01</td>
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<tr>
<td>4.</td>
<td>Special devices</td>
<td>12</td>
<td>32</td>
<td>02</td>
<td>02</td>
</tr>
<tr>
<td>5.</td>
<td>Introduction to Amplifiers</td>
<td>10</td>
<td>20</td>
<td>02</td>
<td>01</td>
</tr>
<tr>
<td>6.</td>
<td>Small Signal Amplifiers.</td>
<td>10</td>
<td>28</td>
<td>01</td>
<td>02</td>
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<td>Total</td>
<td></td>
<td>60</td>
<td>136</td>
<td>10</td>
<td>08</td>
</tr>
</tbody>
</table>

OBJECTIVES
Upon the completion of the course the student shall be able to
1.0 Comprehend Passive Components (Resistors, Capacitors and Inductors)
1.1 Define resistance.
1.2 State the properties of resistance.
1.3 Identify the value of resistance using colour codes
1.4 List the specifications of resistors.
1.5 Classify the resistors based on function and composition
1.6 List the types of resistors based on composition
1.7 Compare the features of carbon and wire wound potentiometers
1.8 Define Capacitance.
1.9 List the specifications of capacitor
1.10 List the factors affecting the value of capacitance.
1.11 List the types of capacitors.
1.12 List the applications of capacitors.
1.13 Define Self Inductance, Mutual Inductance and Co-efficient of coupling.
1.14 List the types of Inductors and Transformers used in electronic circuits.
1.15 Explain the loss of Inductors and Transformers
1.16 List different types of core materials used at different frequencies

2.0 Comprehend the Semi-Conductor Devices
2.1 State the electrical characteristics of
   a) insulators
   b) conductors and
   c) semi-conductors
2.2 Distinguish between intrinsic and extrinsic semi-conductors
2.3 Distinguish between P and N type semi-conductors.
2.4 Explain the working of PN Junction diode with no bias, forward bias and reverse bias
2.5 Explain the operation of Zener diode.
2.6 Draw the characteristics of Zener diode.
2.7 Explain formation of PNP and NPN transistors
2.8 State the different transistor configurations
2.9 Sketch the characteristics of CB, CE configurations.
2.10 Compare the performance characteristics of CB and CE configurations.
2.11 List the manufacturer specifications of PN junction diode, Zener diode and Transistor.

3.0 Explain the working Principle of Power supply circuits
3.1 Draw the half wave, full wave, and bridge rectifier circuits using P.N. junction diodes.
3.2 Explain the working principle of half wave, full wave and bridge rectifier with waveforms.
3.3 State the need for filter.
3.4 List the different types of filters.
3.5 Explain the function of Zener diode as regulator in a power supply.
3.6 Explain the function of voltage regulated power supply.

4.0 Describe the Performance of Special Devices
4.1 Explain the construction, working of special devices: UJT, FET, LEDs, LCD, SCR, Solar cell, opto-coupler, photo diode and photo transistor.
4.2 Sketch the characteristics of above devices
4.3 Mention the applications of the special devices

5.0 **Explain the principle of Working of Amplifiers.**
5.1 Explain the operation of transistor as an amplifier.
5.2 State the necessity of proper biasing for amplifier action.
5.3 Explain different biasing methods such as collector to base bias, potential divider bias.
5.4 Determine the operating point on the set of characteristics.
5.5 List the causes for instability of bias in transistor amplifier.

6.0 **Understand the Principle of Working of Small Signal Amplifiers.**
6.1 Classify amplifiers on the basis of frequency, function, type of load, period of conduction and number of stages.
6.2 Draw the circuit of RC coupled, Transformer coupled CE amplifier circuit and state the function of each component.
6.3 Draw the frequency response characteristics of each circuit, indicate the gain band width, upper cut-off and lower cut-off frequencies.
6.4 Explain the necessity of cascading of amplifiers.
6.5 Define `gain` in terms of decibel and `band width`.

**COURSE CONTENTS**

1. **Electronic Components**
   Different types of resistors, Colour code, specifications, uses of resistors-Different types of capacitors, specifications, Colour code, uses-Specifications for inductors and transformers- different types of chokes and transformers.

2. **Semi-conductor Devices**
   Insulators- Semi-conductors-conductor materials- Intrinsic and extrinsic semi-conductors, `P` and `n` type materials, PN Junction, forward and reverse bias-Zener diode, Zener diode characteristics - formation of PNP and NPN transistors-Transistor configurations- CB, CE - Input and output characteristics of CB,CE - comparison of CB,CE, configurations.

3. **Power supplies**
   Half - wave, Full wave and bridge rectifiers. types of Filters, Voltage regulated power supply using Zener Diode,

4. **Special Devices**
   UJT, FET, LED, LCD, SCR, Solar cell, Optocoupler, Photo diode, Photo transistor-characteristics and their applications.

5. **Introduction to Amplifiers**
   Principles of Operation- Biasing and stabilization technique-Operating point and Load line Characteristics.

6. **Small Signal Amplifiers**
Classification of Amplifiers, Coupling methods, Frequency Response of R.C coupled, transformer coupled and Cascade Amplifiers and their applications.

REFERENCES
Principles of Electronics by V.K. Mehta, S Chand& Co.
Basic Electronics and Linear circuits by Bhargava, TMH Publishers
Electronic Principle by Malvino
Electronic devices and circuits by Mathur, Chada & Kulashrestha
Industrial Electronics by G.K. Mithal
Applied Electronics by G.K. Mithal

GENERAL MECHANICAL ENGINEERING

Subject Title : General Mechanical Engineering
Subject code : EE-306
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Major Topics</th>
<th>Periods</th>
<th>Weightage of Marks</th>
<th>Short Questions</th>
<th>Essay Questions</th>
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<tbody>
<tr>
<td>1.</td>
<td>Simple Stresses and Strains</td>
<td>14</td>
<td>26</td>
<td>2</td>
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<td>2.</td>
<td>Torsion in Shafts</td>
<td>10</td>
<td>16</td>
<td>2</td>
<td>1</td>
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<td>3.</td>
<td>I.C. Engines</td>
<td>12</td>
<td>26</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>Boilers and Turbines</td>
<td>12</td>
<td>16</td>
<td>2</td>
<td>1</td>
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<tr>
<td>5.</td>
<td>Pumps and Lubricants</td>
<td>12</td>
<td>26</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Total</td>
<td></td>
<td>60</td>
<td>110</td>
<td>10</td>
<td>08</td>
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</tbody>
</table>

OBJECTIVES
Upon completion of the course the student shall be able to

1.0 Understand the meaning of stress and strain
1.1 Define the terms: stress and strain
1.2 Identify the different types of stresses and strains
1.3 Define Hooke’s law
1.4 Define moduli of elasticity
1.5 Draw typical stress-strain curve for an M.S. Specimen under tension
1.6 Define factor of safety
1.7 Define Poisson’s ratio
1.8 State the relationship between elastic constants.
1.9 Calculate the dimensional changes in the bodies of uniform cross section subjected to tensile and compressive forces

2.0 Appreciate the theory of torsion
2.1 Know the function of shafts.
2.2 Specify the standard sizes
2.3 Write down simple torsion equation
2.4 Design the size of solid shaft
   i) Strength point of view
   ii) Stiffness point of view

3.0 I.C.ENGINES
3.1 Know the constructional details of I.C.Engines
3.2 Define I.C. Engine
3.3 Identify the various parts of
   i) Diesel engine
   ii) Petrol engine
3.4 Explain the principle of 4-stroke diesel/petrol engine
3.5 Explain the principle of 2-stroke diesel/petrol engine
3.6 Distinguish between 4-stroke cycle and 2-stroke cycles
3.7 Distinguish between diesel engine and petrol engine
3.8 State the functions of components such as carburetor, fuel pumps and Governor.

4.0 BOILERS - TURBINES
4.1 Explain the function of a boiler
4.2 Compare fire tube boiler with water tube boiler
4.3 Draw the Sketch of Modern High Pressure boiler
4.4 Explain the working of above boiler
4.5 Identify the necessity of mountings such as
   1) water level indicator
   2) Pressure gauge
   3) Stop valve
   4) Feed check valve
   5) safety valve
   6) Fusible plug
4.6 Mention the working principle of above with sketches.
4.7 Explain the principle of working of a steam turbine
4.8 Classify the turbine based on action of steam
4.9 Compare impulse turbine with reaction turbine

5.0 Understand the working of centrifugal pumps.
5.1 Explain the principle of operation of centrifugal pump
5.2 Explain the constructional details of centrifugal pump.
5.3 Know the method of improving the delivery head by multistage
5.4 Appreciate the importance of priming of centrifugal pumps.
5.5 Explain the principle of operation of reversible turbine pump and jet pump
5.6 Explain the function of bearing
5.7 Classify the bearings
5.8 Explain with a line sketch the journal and collar bearings
5.9 List and explain anti friction bearing
5.10 know the application of ball and roller bearings
5.11 State the specifications of ball and roller bearings
5.12 State the purpose of lubrication
5.13 State the properties of a lubricant
5.14 List the types of lubricants with examples
5.15 Know the application of lubricants.

COURSE CONTENT
1. Simple stress and strains
Definitions of Tensile stress, Compressive stress, Shear stress, Linear strain, lateral strain and, Poisson’s ratio, elastic limit, statement of Hook’s law, stress-strain diagram with salient features for ductile materials under tensile stress. Elastic moduli, Definition and explanation of Young’s modulus, Modulus of rigidity, Bulk modulus, Working stress, Ultimate stress, Factor of safety. Simple problems on tensile and compressive stress and strains in uniform and varying cross section bar (tapering sections omitted), Relationship between Young’s modulus, rigidity modulus and bulk modulus (without proof) problems thereon

2. Torsion in shafts
Function of shafts, standard shaft sizes, Torsion equation, Design the size of the solid shaft (i) strength point of view and stiffness point of view.

Four stroke and two stroke petrol and diesel engines, petrol engine for 4 stroke/2 stroke, diesel engine for 4 stroke/2 stroke, Comparison between petrol and diesel engine, Functions of carburetor, fuel injection pump, governor, Classification of boilers fire tube-water tube Sketch and description of modern boiler and mention various mountings used.

4. Boilers and Turbines
   Working principle of Steam turbine- classification on the basis of steam-Comparison between impulse and reaction turbines.
5. Pumps - Introduction
   Centrifugal pumps- Single stage, Lubricants - examples and their applications

Note: 1. This subject is to be taught by Mechanical faculty
       2. Paper setting and paper evaluation is also to be done by Mechanical Faculty.

REFERENCES
1. Strength of materials by Ramamrutham
2. Strength of materials by Surender Singh
3. Strength of materials by S.B.Junarker
4. Hydraulic Machinery by Jagadishalal
5. Strength of Materials by R.S. Kurmi
CIRCUITS AND MEASUREMENTS LABORATORY PRACTICE

Subject Title : Circuits and Measurements Laboratory Practice
Subject Code  : EE-307
Periods/Week  : 06
Periods/Year  : 90

TIME SCHEDULE

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Major Topics</th>
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<tbody>
<tr>
<td>1</td>
<td>Techniques of using statistical tools and drawing and use of Graphs.</td>
<td>01</td>
</tr>
<tr>
<td>2</td>
<td>Network Laws &amp; Theorems</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Calibration of meters</td>
<td>05</td>
</tr>
<tr>
<td>4</td>
<td>1 - Ø A.C Circuit Parameters</td>
<td>05</td>
</tr>
<tr>
<td>5</td>
<td>Measurement of Power</td>
<td>07</td>
</tr>
<tr>
<td>6</td>
<td>Report on observations in Industrial visit</td>
<td>02</td>
</tr>
<tr>
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<td>TOTAL</td>
<td>30</td>
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</tbody>
</table>

OBJECTIVES( LIST OF EXPERIMENTS )

I Techniques of using statistical tools and drawing and use of Graphs
1. Techniques and rules of drawing graphs

II Network Laws & Theorems
1. Verification of Ohm’s Law
2. Verification of the limitations of Ohm’s law
3. Verification of Kirchoff’s current Law
4. Verification of Kirchoff’s Voltage law
5. Verification of Super position theorem
6. Verification of Thevenins theorem

III Calibration of meters
1. Calibration of Dynamometer type of wattmeter
2. Calibration of single phase Energy meter

IV 1 - Ø A.C Circuit Parameters
1. Determination of Q-factor and Power factor of an Inductive coil
2. Determination of Idle & Energy components of current in a single phase Inductive circuit

V Measurement of Power
1. Measurement of power in 1 -Ø circuit by 3-Voltmeter method
2. Measurement of power in 1 -Ø circuit by 3-Ammeter method
3. Measurement of power in 3 -Ø balanced circuit by 2-Wattmeter method

VI Report on observations in Industrial visits
1. Visit MRT division Electricity Department to understand the testing and repair of various Measuring instruments.
2. Visit any Electrical / Electronic Measuring Instrument manufacturing industry to observe and understand construction and working of various meters.

SKILLS

General Competencies required by the student for all Electrical laboratory Practices
Every student has to bring insulated tool kit and follow the general safety precautions throughout the lab sessions
1. Whenever handling/using a meter check for ‘zero’ position of the pointer and adjust for ‘zero’ position if there is any deviation

Competencies required to be achieved by the student for conducting the experiments:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Experiment title</th>
<th>Key competency</th>
<th>Competencies Required for all the experiments</th>
</tr>
</thead>
<tbody>
<tr>
<td>I)</td>
<td>Techniques of using statistical tools and drawing and use of Graphs</td>
<td>1.Analyzing trend of the graph 2. Correlate trend of the graph with the relation between the parameters</td>
<td>1. Following the international standards 2. Proper selection of X &amp; Y parameters 3. Choosing proper scale</td>
</tr>
<tr>
<td>I I) Network Laws &amp; Theorems</td>
<td></td>
<td></td>
<td>1. Draw the relevant circuit diagram 2. Select proper supply and load and note down their ratings 3. Select proper meters with proper ranges depending on the ratings of supply and load</td>
</tr>
<tr>
<td>1</td>
<td>Verification of Ohm's law</td>
<td>1.Calculate V/I for all sets of readings and compare with actual value of resistance 2. Draw the graph for V V/s. I 3. Comment on the results from both graph and computations.</td>
<td></td>
</tr>
</tbody>
</table>
| 2 | Verification of Limitations of Ohms law | 1. Calculate $V/I$ for all sets of readings and compare with actual value of resistance  
2. Draw the graph for $V$ vs. $I$  
3. Comment on the results from both graph and computations. | 4. Select proper wires and make connections as per circuit diagram  
5. Ensure that all the meters are connected with proper polarity  
6. Perform the experiment by carefully following the experimental procedure and precautions  
7. Observe the readings without any scope for errors and tabulate |
|---|---|---|---|
| 3 | Verification of super position theorem | 1. Note the following values  
$I_1 = \_\_\_\_\_ A$ when both the voltage sources are acting together  
$I_1' = \_\_\_\_\_ A$ when the first voltage source is acting alone  
$I_1'' = \_\_\_\_\_ A$ when the other voltage source is acting alone  
Check if $I_1 + I_1'' \sim I_1' + I_1'' \neq I$  
2. Comment on the result | |
| 4 | Verification of Kirchoff’s current Law (KCL) | 1. Note $I_p, I_q, \ldots$ as incoming currents and $I_x, I_y, \ldots$ as outgoing currents.  
2. Check for $\sum I_p \sim \sum I_x$ or $\sum I_p \neq \sum I_x$  
3. Comment on the result | |
| 5 | Verification of Kirchoff’s Voltage Law (KVL) | 1. Note $V_p, V_q, \ldots$ as rising voltages and $V_x, V_y, \ldots$ as drooping voltages.  
2. Check for $\sum V_p \sim \sum V_x$ or $\sum V_p \neq \sum V_x$  
3. Comment on the result | |
| 6 | Verification of Thevinin’s Theorem | 1. Compare Voltage, Current & Resistance of both cases.  
2. Comment on the result | |
<p>| III | Calibration of meters | 1. Short M &amp; C terminals of wattmeter and connect for |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| **1** | **Calibration of Dynamometer type Wattmeter** | proper Current range.  
1. Calculate Multiplication factor and \( W=M \cdot F \cdot W_R \)  
2. Calculate \( P=V_L \times I_L \)  
3. Calculate \( Error=P-W \)  
4. Draw graph between \( W \) and \( % \) Error  
5. Comment on the result |
| **IV ) 1 -Ø A.C Circuit Parameters** | 1. Calculate \( Z=V/I \);  
1. \( \sin \theta = \sin(\cos^{-1}(p.f)) \);  
2. \( X_L=Z \sin \theta \); \( L=(X_L/(2\pi f)) \);  
3. \( R=Z\cos \theta \)  
4. Find out the supply frequency  
5. \( Q \)-factor= \( X_L/R \)  
6. Variation of Inductance to change the load. |
| **1** | **Determination of Q-factor and Power Factor of a coil** | 1. Calculate \( I_x=I_L \cos \theta \) and \( I_y=I_L \sin \theta \);  
2. \( \sin \theta = \sin(\cos^{-1}(p.f)) \);  
3. Variation of resistance to obtain different loads |
| **2** | **Measurement of Idle & Energy components in a 1-Ø Inductive circuit** | 1. Calculate \( I_x=I_L \cos \theta \) and \( I_y=I_L \sin \theta \);  
1. \( \sin \theta = \sin(\cos^{-1}(p.f)) \);  
2. Variation of resistance to obtain different loads |
| **V ) Measurement of Power** | Calculate the value of Power \( P = (V_S^2-V_1^2-V_2^2)/2R \)  
\( \cos \theta = (V_S^2-V_1^2-V_2^2)/2V_1V_2 \) |
| **1** | **Measurement of Power and Power factor in 1 - Ø inductive circuit by 3 Voltmeter method** | 1. Calculate \( I_x=I_L \cos \theta \) and \( I_y=I_L \sin \theta \);  
2. \( \sin \theta = \sin(\cos^{-1}(p.f)) \);  
3. Variation of resistance to obtain different loads |
| **2** | **Measurement of power and Power factor in 1 - Ø inductive circuit by 3 Ammeter method** | Calculate the value of Power \( P = R(l_s^2-l_1^2-l_2^2)/2 \)  
\( \cos \theta = (l_s^2-l_1^2-l_2^2)/2l_1l_2 \) |
| **3** | **Measurement of power in 3- Ø circuit using the two wattmeter method** | 1. Short M & C Terminals of wattmeters and connect for proper current coil range |
2. Find out the M.F of Wattmeter
3. Reversing wattmeter terminals for negative readings (Lead values)
4. Calculate $P = W_1 + W_2$
   \[
   \cos \theta = \frac{\cos^{-1}\left[\frac{\sqrt{3}(W_1 - W_2)}{W_1 + W_2}\right]}{}
   \]

COURSE CONTENT
(I) Techniques of using statistical tools and drawing and use of Graphs
   Techniques and rules of drawing graphs

(II) Network Laws & Theorems
   Ohm’s Law - limitations of Ohm’s law - Verification of Ohms Law - Kirchoff’s current Law - Kirchoff’s Voltage law - Super position theorem - Thevenins theorem

(III) Calibration of meters
   Dynamometer type of wattmeter - Single phase Energy meter

(IV) 1 - $\Theta$ A.C Circuit Parameters
   Q-factor and Power factor of an Inductive coil - Idle & Energy components of current in a single phase Inductive circuit

(V) Measurement of Power
   1 - $\Theta$ circuit by 3-Voltmeter method - 1 - $\Theta$ circuit by 3-Ammeter method - 3 - $\Theta$ balanced circuit by 2-Wattmeter method

(VI) Report on Industrial Visit
   Visit to MRT division of Electricity Department – Electrical / Electronic measuring instruments manufacturing industry
ELECTRICAL WORKSHOP PRACTICE

Subject Title : Electrical Workshop Practice
Subject Code  : EE-308
Periods/Week  : 03
Periods/Year  : 45

TIME SCHEDULE

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Major Topics</th>
<th>No. of Periods</th>
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<tbody>
<tr>
<td>1.</td>
<td>Special Lamp Connections</td>
<td>12</td>
</tr>
<tr>
<td>2.</td>
<td>Wiring Practice for Power Loads</td>
<td>18</td>
</tr>
<tr>
<td>3.</td>
<td>Motor Connections</td>
<td>09</td>
</tr>
<tr>
<td>4.</td>
<td>Earthing</td>
<td>06</td>
</tr>
<tr>
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<td><strong>Total</strong></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Practice Special Lamp Circuits
1.1 Control two lamps by Series - Parallel connection using one 1-way switch & two 2-way switches with PVC surface conduit system
1.2 Control and practice the wiring for Fluorescent Lamp
1.3 Control and practice the wiring for Mercury Vapour Lamp

2.0 Perform Wiring for Power Loads
2.1 Control two sub-circuits through Energy meter, MCB’s and two 1-way switches.
2.2 Control 1.5 ton capacity A/C equipment by MCB and stabilizer.
2.3 Connect the Inverter to power supply through 2/3 pin socket and 1-way switch (Back up)
2.4 Connect Computer by main switch board with a miniature circuit breaker.
2.5 Connect and test the given Public Address System
2.6 Perform Wiring for Alarm circuit with Relay

3.0 Practice Motor connections
3.1 Prepare switch Board with DOL starter, MCB,1-phase Preventer and Pilot lamps for 3 phase Motor
3.2 Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor

4.0 Perform Earthing
4.1 Prepare Pipe Earthing.
4.2 Prepare Plate Earthing.
SKILLS
Upon completion of the Wiring practice, the student shall be able to

1.0 Practice Simple Lamp Circuits
1.1 Control two lamps by Series - Parallel connection using one 1-way switch & two 2-way switches with PVC surface conduit system
   a) Draw wiring diagram.
   b) Identify the size of cable, PVC pipe, type of 1-way & 2-way switches and lamp holder.
   c) Read the specifications of 1-way and 2-way switch and lamp holder.
   d) Fix the PVC pipe using saddles, junction boxes, gang boxes as per wiring diagram.
   e) Handle the screwdriver, electrician Knife, line tester to fix the PVC pipe using saddles, junction boxes and gang boxes.
   f) Select colour and length of wire for phase and neutral.
   g) Make connections as per wiring diagram.
   i) Draw wire through PVC pipe properly.
   j) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
   k) Observe glow intensity of lamps for series and parallel connections.
   l) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the bottom point of the 1-way switch and phase to the first point of lamp holder.
   m) Don’t touch the live terminals.

1.2 Control and practice the wiring for Fluorescent Lamp
   a) Draw wiring diagram.
   b) Identify the size of cable, type of 1-way switch, choke, starter and tube light side holder.
   c) Read the specifications of 1-way switch, choke and starter.
   d) Handle the screwdriver, electrician Knife and line tester properly.
   e) Select colour and length of wire for phase and neutral.
   f) Make connections as per wiring diagram.
   g) Connect top point of choke to phase wire and bottom point of the choke to tube light properly.
   h) Observe tube light glow when the starter in position and out of position.
   i) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
   j) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the first point of the choke and phase to the tube light right side holder.

1.3 Control and practice the wiring for Mercury Vapour Lamp
   a) Draw wiring diagram.
   b) Identify the size of cable, type of 1-way switch, choke, and M.V. lamp holder.
c) Read the specifications of Choke and M.V. lamp holder.

d) Handle the screw driver, electrician Knife and line tester properly.

f) Select colour and length of wire for phase and neutral.

g) Make connections as per wiring diagram.

h) Connect proper voltage terminal of choke to phase wire and neutral wire is connected to common terminal of choke.

i) Observe M.V. lamp glow after switch on the supply.

j) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.

k) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the second point of the choke and phase to the common point of choke.

2.0 Practice for Power Loads with PVC surface conduit wiring system

2.1 Control two Sub circuits through Energy meter, MCB’s and two 1-way switches

a) Draw wiring diagram.

b) Identify the size of cable, PVC pipe, type of 1-way switch, energy meter, MCB and lamp holder

c) Read the specifications of 1-way switch, energy meter, MCB and lamp holder.

d) Fix the PVC pipe using saddles, junction boxes, gang boxes as per wiring diagram.

e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles, junction boxes and gang boxes.

f) Select colour and length of wire for phase and neutral.

g) Make connections as per wiring diagram.

h) Draw wire through PVC pipe properly.

i) Draw wire of the phase to the first terminal of energy meter and neutral to the second terminal of the energy meter

j) Draw wire from energy meter to main MCB

k) Draw wire each sub circuit through each MCB

l) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.

m) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the first point of the Energy meter and phase to the second point of Energy meter.

2.2 Control 1.5 ton capacity window type A/C equipment by MCB and stabilizer.

a) Draw wiring diagram.

b) Identify the size of cable, PVC pipe, MCB, stabilizer, capacity of A/C and Socket

c) Read the specifications of MCB, stabilizer, capacity of A/C and Socket

d) Fix the PVC pipe using saddles, junction boxes, gang boxes as per wiring diagram.

e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles, junction boxes and gang boxes.
f) Select colour and length of wire for phase and neutral.
g) Make connections as per wiring diagram.
h) Draw wire through PVC pipe properly.
i) Connect supply to stabilizer through MCB
j) Select appropriate socket.
k) Make earth wire connections
l) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
m) Test with 1-phase, 230 V, 50 Hz supply to the circuit, neutral wire to the first point of the stabilizer and phase to the second point of stabilizer.

2.3 Connect the Inverter to power supply through 2/3 pin socket and 1-way switch

a) Draw wiring diagram.
b) Identify the size of cable, 1-way switch, PVC pipe, MCB, capacity of Inverter and Socket
c) Read the specifications of MCB, capacity of Inverter and Socket
d) Fix the PVC pipe using saddles, junction boxes, gang boxes as per wiring diagram.
e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles, junction boxes and gang boxes.
f) Select colour and length of wire for phase and neutral.
g) Make connections as per wiring diagram.
h) Draw wire through PVC pipe properly.
i) Connect supply to Inverter through MCB properly.
j) Select appropriate socket with switch control.
k) Make earth wire connections for required points.
l) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.

2.4 Connect Computer by main switch board with a miniature circuit breaker.

a) Draw wiring diagram.
b) Identify the size of cable, 1-way switch, PVC pipe, MCB and Sockets
c) Read the specifications of MCB and Sockets
d) Fix the PVC pipe using saddles, junction boxes, gang boxes as per wiring diagram.
e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles, junction boxes and gang boxes.
f) Select colour and length of wire for phase and neutral.
g) Make connections as per wiring diagram.
h) Draw wire through PVC pipe properly.
i) Connect supply to Computer through MCB properly.
j) Select appropriate sockets with 1-way switch control.
k) Make earth wire connections for required points.
l) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
m) Don’t touch the live terminals.

2.5 Connect and test the given Public Address System

a) Draw wiring diagram.
b) Identify the size of cable, 1-way switch, PVC pipe, amplifier, MCB, mouth piece and Speakers
c) Read the specifications of MCB, Amplifier, speakers and Socket
d) Fix the PVC pipe using saddles, junction boxes, gang boxes as per wiring diagram.
e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles, junction boxes and gang boxes.
f) Select colour and length of wire for phase and neutral.
g) Make connections as per wiring diagram.
h) Draw wire through PVC pipe properly.
i) Connect supply to amplifier through MCB properly.
j) Connect mouth piece to amplifier properly.
k) Connect speakers to amplifier properly.
l) Select appropriate sockets with 1-way switch control.
m) Make earth wire connections for require points.
n) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
o) Don’t touch the live terminals.

2.6 Wiring for Alarm circuit with Relay

a) Draw wiring diagram.
b) Identify the size of cable, 1-way switch, PVC pipe, push button switches Relay and alarm
c) Read the specifications of Relay and alarm.
d) Fix the PVC pipe using saddles, junction boxes as per wiring diagram.
e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles and junction boxes.
f) Select colour and length of wire for phase and neutral.
g) Make connections as per wiring diagram.
h) Draw wire through PVC pipe properly.
i) Connect 6V DC supply to relay terminals through push button switches.
j) Connect 240V AC supply to alarm.
k) Test with 1-phase, 230 V, 50 Hz supply to the circuit connected through ICDP switch.
o) Don’t touch the live terminals.

3.0 Practice Motor connections

3.1 Prepare switch Board with DOL starter, MCB,1- phase Preventer and Pilot lamps for 3-phase Motor

a) Draw wiring diagram.
b) Identify the size of cable, PVC pipe, DOL starter, MCB,1-phase preventer and lamp holder
c) Read the specifications of 1-way switch, DOL starter, MCB, 1-phase preventer and lamp holder.
d) Fix the PVC pipe using saddles, junction boxes as per wiring diagram.
e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles, junction boxes.
f) Select colour and length of wire for phase and neutral.
g) Make connections as per wiring diagram.
h) Draw wire through PVC pipe properly.
i) Draw wire of the 3-phase to the motor through DOL starter and 1-phase preventer.
j) Observe DOL starter and motor connections.
k) Test with 3-phase, 415 V, 50 Hz supply to the circuit connected through ICDP switch.
m) Test by changing any two phases of input supply.

3.2 Prepare switch Board with star-delta starter, MCB and Pilot lamps for 3-phase Motor
a) Draw wiring diagram.
b) Identify the size of cable, PVC pipe, star-delta starter, MCB and lamp holder
c) Read the specifications of 1-way switch, star-delta starter, MCB and lamp holder.
d) Fix the PVC pipe using saddles, junction boxes, as per wiring diagram.
e) Handle the screw driver, electrician Knife, line tester to fix the PVC pipe using saddles, junction boxes.
f) Select colour and length of wire for phase and neutral.
g) Make connections as per wiring diagram.
h) Draw wire through PVC pipe properly.
i) Draw wire of the 3-phase to the motor through star-delta starter.
j) Observe star-delta starter and motor connections.
k) Observe output terminals of star-delta starter (six)
k) Test with 3-phase, 415 V, 50 Hz supply to the circuit connected through ICDP switch.
m) Test by changing any two phases of input supply.

4.0 Prepare Earthing
4.1 Perform Pipe Earthing
a) Draw earthing diagram with specifications.
b) Identify the size of GI pipes, GI wire, reducing socket and funnel with wiremesh
d) Prepare the earth pit of 2.5 m below the surface of the ground.
e) Select suitable GI pipes and GI wire.
f) Draw GI wire to the earthing pipe fastened with bolts & nuts.
g) Fix the funnel with wire mesh at the top of GI pipe.
h) Pour sand, char coal and salt in alternate layers of about 15 cm around the earth pipe.
i) Test the earth resistance with Megger.
4.2 Perform Plate Earthing
a) Draw earthing diagram with specifications.
b) Identify the size of GI pipes, GI wire, GI Plate and funnel with wire mesh
d) Prepare the earth pit of 1.5 m below the surface of the ground.
f) Select suitable GI pipe GI plate / copper plate and GI wire.
g) Draw GI wire to the GI pipe fastened to GI plate / copper plate with bolts
   & nuts.
h) Fix the funnel with wire mesh at the top of GI pipe.
i) Pour sand, char coal and salt in alternate layers of about 15 cm around the earth pipe.
j) Test the earth resistance with Megger.

Key competencies to be achieved by the student

<table>
<thead>
<tr>
<th>S.No</th>
<th>Experiment title</th>
<th>Key competency</th>
</tr>
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<tbody>
<tr>
<td>1.1</td>
<td>Series-Parallel connection</td>
<td>a) Select colour and length of wire for phase and neutral.</td>
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<td>b) Make connections as per wiring diagram.</td>
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<td>c) Draw wire through PVC pipe properly</td>
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<td>d) Observe glow intensity of lamps for series and parallel</td>
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<td>connections</td>
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<td>1.2</td>
<td>Wiring practice of fluorescent lamp</td>
<td>a) Make connections as per wiring diagram.</td>
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<td></td>
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<td>b) Connect top point of choke to phase wire and bottom point</td>
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<td>of the choke to tube light properly</td>
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<td>c) Observe tube light glow when the starter in position and</td>
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<td>out of position</td>
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<td>1.3</td>
<td>Wiring practice of Mercury Vapour lamp</td>
<td>a) Connect proper voltage terminal of choke to phase</td>
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| 2.1 | Control two sub circuits through Energy meter, MCB's and two 1-way switches | a) Draw wire of the phase to the first terminal of energy meter and neutral to the second terminal of the energy meter  
b) Draw wire from energy meter to main MCB  
c) Draw wire each sub circuit through each MCB |
| 2.2 | Control 1.5 ton capacity window type A/C equipment by MCB and stabilizer | a) Connect supply to stabilizer through MCB  
b) Select appropriate socket.  
c) Make earth wire connections |
| 2.3 | Connect the inverter to power supply through 2/3 pin socket and 1-way switch | a) Connect supply to Inverter through MCB properly.  
b) Select appropriate socket.  
c) Make earth wire connections for require points |
| 2.4 | Connect computer by main switch board with a miniature circuit breaker. | a) Connect supply to Computer through MCB properly.  
b) Select appropriate sockets with 1-way switch control.  
c) Make earth wire connections for require points |
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</table>
| 2.5 | Connect and test the given public address system | a) Connect supply to amplifier through MCB properly.  
b) Connect mouth piece to amplifier properly.  
c) Connect speakers to amplifier properly. |
| 2.6 | Wiring for Alarm circuit with Relay | a) Connect 6V supply to relay terminals through push button switches.  
b) Connect 240V supply to alarm. |
| 3.1 | Prepare switch Board with DOL starter, MCB and Pilot lamps for 3 phase Motor | a) Draw wire of the 3-phase to the motor through DOL starter.  
b) Observe DOL starter and motor connections |
| 3.2 | Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor | a) Draw wire of the 3-phase to the motor through star-delta starter.  
b) Observe star-delta starter and motor connections.  
c) Observe output terminals of star-delta starter (six) |
| 4.1 | Prepare Pipe Earthing | a) Select suitable GI pipes and GI wire  
b) Prepare earth pit.  
c) Earth pipe must be in vertical position. |
| 4.2 | Prepare Plate Earthing | a) Select suitable GI plate /
COURSE CONTENT

1.0 Practice Special Lamp Circuits
   Series- Parallel connection -Fluorescent Lamp-Mercury Vapour Lamp

2.0 Wiring Practice for Power Loads
   Energy meter connection through MCB and two sub circuits - 1.5 ton capacity A/C equipment Connection-Inverter Connection- Computer Connection/Public address system Connection- Alarm circuit with Relay Connection

3.0 Practice Motor connections
   3-phase motor through DOL starter and MCB Connection- 3-phase motor through star-delta starter and MCB Connection- switch board with star delta starter, MCB, Pilot lamps for 3 phase motor

4.0 Practice Earthing
   Pipe Earthing – Plate Earthing.

REFERENCE
1. Electrical work shop By R.P.Singh
2. Electrical Design Estimating And Costing By K.B. RAINA & S.K.BHATTA CHARYA
3. Residential and Commercial Industrial Electrical systems Vol.2 by Joshi-TMH
4. Residential and Commercial Industrial Electrical systems Vol.3 by Joshi-TMH
5. Industrial Safety management by Deshmukh -TMH

DC MACHINES LABORATORY PRACTICE

Subject Title : DC Machines Laboratory Practice
Subject Code : EE-309
Periods/Week : 06
Periods/Semester : 90

TIME SCHEDULE
COURSE CONTENT
TESTING AND SPEED CONTROL OF DC MOTORS

1. Identify the terminals of the following DC Machines
   (a) DC Shunt motor
   (b) DC Series Motor
2. Identify the terminals of a Compound Motor.
3. Study the parts of DC 3 point starter, 4 point starter and Drum Controller Starter.
4. Obtain performance characteristics by conducting Brake Test on DC Shunt Motor
5. Obtain performance characteristics by conducting Brake Test on DC Series Motor.
6. Obtain performance characteristics by conducting Brake Test on DC Compound Motor.
7. Speed control of DC Shunt Motor by
   (a) Rheostatic control method
   (b) Field control method
8. Obtain the performance of a DC Shunt Motor by conducting Swinburne’s test.

CHARACTERISTICS OF DC GENERATORS

10 Obtain Internal and External characteristics of DC Shunt Generator.
11 Obtain Internal and External characteristics of DC Series Generator.
12. Obtain Internal and External characteristics of DC Compound Generator

OBJECTIVES:
Upon completion of the Practice, the student shall be able to

1.9 Identify the terminals of the following DC Machines (a) DC Shunt motor (b) DC Series Motor
1.10 Observe specifications of the motor on the name plate details

1.11 Identify the different terminals of a DC Shunt Motor.
1.12 Measure the resistance across the different terminals using multimeter.
1.13 Observe and record the different resistance values.
1.14 Identify the armature and shunt field resistance according to resistance values observed.
1.15 Identify the different terminals of a DC Series Motor.
1.16 Measure the resistance values across the different terminals using multimeter.
1.17 Observe and record the different resistance values.
1.18 Identify the armature and series field resistance according to resistance values observed.
2.0 Identify the terminals of a Compound Motor.
2.1 Observe specifications of the motor on the name plate details
2.2 Locate the different terminals of a DC Compound Motor.
2.3 Measure the resistance values across the different terminals with multimeter.
2.4 Observe and record the different resistance values
2.5 Identify the armature, series and shunt field resistance according to resistance values observed

3.0 Study the parts of DC 3 point starter, 4 point starter
3.1 Identify the terminals Line, Armature and Field (L-A-F) on the starter.
3.2 Locate NVR coil and OLR coils.
3.3 Know the purpose of NVR and OLR coils.

4.0 Obtain performance characteristics by conducting Brake Test on DC Shunt Motor.
4.1 Perform the test and note the readings of speed N, current I and spring balance readings for varying load on the motor upto rated current
4.2 Calculate the torque, input, output and efficiency
4.3 Draw performance curves of motor

5.0 Obtain performance characteristics by conducting Brake Test on DC Series Motor.
5.1 Perform the test and note the readings of speed N, current I and spring balance readings for varying load on the motor upto rated current
5.2 Calculate the torque, input, output and efficiency
5.3 Draw performance curves of motor

6.0 Obtain performance characteristics by conducting Brake Test on DC Compound Motor.
6.1 Perform the test and note the readings of speed N, current and spring balance readings for varying load on the motor upto rated current
6.2 Calculate the torque, input, output and efficiency.
6.3 Draw performance curves of motor

7.0 Speed control of DC Shunt Motor by (a) Rheostatic control (b) Field control
7.1 Perform the test and keep the rheostat is maximum position in armature so that minimum voltage is applied to armature
7.2 Record the readings of voltage by voltmeter and speed by tachometer
7.3 Observe the speed variation of the motor
7.4 Perform the test and keep the rheostat in minimum position in so that maximum current flows through the field and speed is minimum voltage is applied to armature
8.0 Obtain the performance of a DC Shunt Motor by conducting Swinburne’s test
8.1 Make the connections start the motor with the help of starter on no load at rated voltage
8.2 Adjust the speed regulator to get rated speed
8.3 Record the voltage and currents
8.4 Calculate the constant losses

9.0 Obtain OCC of a DC shunt Generator at rated speeds.
9.1 Draw the relevant circuit diagram for OCC test.
9.2 Select the proper DC supply voltage.
9.3 Choose the proper range of voltmeter, ammeter and rheostat.
9.4 Make the connections according to circuit diagram.
9.5 Ensure that all the instruments are connected in proper polarity.
9.6 Check the speed and maintain it constant by means of field regulator before taking every reading.
9.7 Observe and note the readings in a tabular form.
9.8 Draw the graph between \( I_f \) Vs \( E_g \).

10.0 Obtain Internal and External characteristics of DC Shunt Generator.
10.1 Perform the test
10.2 Adjust the armature resistance of the motor at minimum position and field resistance to a maximum position.
10.3 Start the motor by using 3-point starter.
10.4 Adjust the speed of the motor to its rated speed by using field rheostat.
10.5 Excite the generator to give the rated no-load terminal voltage with the help of field regulator.
10.6 Observe and note the readings of generated voltage and generator output current.
10.7 Close the load switch and gradually increase the load current by increasing the load.
10.8 Observe and note the readings in a tabular form.
10.9 Draw the graphs related to \( E_0 \) vs \( I \) and \( E \) vs \( I \) and \( V \) vs \( I \)

11.0 Obtain Internal and External characteristics of DC Series Generator.
11.1 Perform the test and adjust the armature resistance of the motor at minimum position and field resistance to a maximum position.
11.2 Start the motor by using 3-point starter.
11.3 Adjust the speed of the motor to its rated speed by using field regulator.
11.4 Excite the generator to give the rated no-load terminal voltage with the help of field regulator.
11.5 Observe and note the readings of generated voltage and generator output current.
11.6 Close the load switch and gradually increase the load current by increasing the load.
11.7 Observe and note the readings in a tabular form.
11.8 Draw the graphs related to \( E_0 \) vs I and E vs I and V vs I.

### 12.0 Obtain Internal and External characteristics of DC Compound Generator

12.1 Perform the test and note the readings of generated voltage and generator output current.
12.2 Close the load switch and gradually increase the load current by increasing the load.
12.3 Observe and note the readings in a tabular form.
12.4 Draw the graphs related to \( E_0 \) vs I and E vs I and V vs I.

#### Key competencies to be achieved by the student

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<td>1</td>
<td>Identify the terminals of the following DC Machines (a) DC Shunt motor (b) DC Series Motor</td>
<td>1. Locate the different terminals of a given Motor.</td>
<td>a) Measuring the resistance values across the different terminals with multimeter.</td>
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<td>2. Observe and record the different resistance values by multimeter</td>
<td>b) Identifying the armature and field winding resistances according to resistance values observed.</td>
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<tr>
<td>2</td>
<td>Identify the terminals of a Compound Motor.</td>
<td></td>
<td>a) Measuring the resistance values across the different terminals with multimeter.</td>
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<td></td>
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<td>b) Identifying the armature, series and shunt field resistance according to resistance values observed.</td>
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<tr>
<td>3</td>
<td>Study the parts of DC 3 point, 4 point starter..</td>
<td>1. Locate the Line, Armature, Field terminals of the starter (L-A-F)</td>
<td>a) Properly connecting Starter and motor terminals</td>
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<td>b) Properly start the motor.</td>
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<tr>
<td>4</td>
<td>Obtain OCC of a DC shunt Generator at rated speeds.</td>
<td>1. Draw the relevant circuit</td>
<td>a) Checking the speed and maintain it</td>
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<td>Draw the relevant circuit diagram</td>
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<td>Select the proper DC supply voltage</td>
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<td>3.</td>
<td>Choose the proper range of voltmeter, ammeter and rheostat.</td>
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<td>Make the connections according to circuit diagram.</td>
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<td>5.</td>
<td>Ensure that all the instruments are connected in proper polarity.</td>
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<td>b)</td>
<td>Drawing the graphs related to ( E_0 ) vs ( I ), ( E ) vs ( I ) and ( V ) vs ( I ).</td>
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<td>b)</td>
<td>Calculating Torque, Efficiency</td>
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<tr>
<td>10</td>
<td>Obtain performance characteristics by conducting Brake Test on DC Compound Motor.</td>
<td>3. Choose the proper range of voltmeter, ammeter and rheostat.</td>
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<td>4. Make the connections according to circuit diagram.</td>
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<td>Speed control of DC Shunt Motor by (a) Rheostatic control (b) Field control</td>
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<tr>
<td>12</td>
<td>Obtain the performance of a DC Shunt Motor by conducting Swinburne’s test</td>
<td>a) Record the speed, current and spring balance readings by varying the load on the motor upto rated load current.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>b) Calculate Torque, input, output and Efficiency</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>a) Keep the Rheostat connected to armature in maximum position in Rheostatic control method</td>
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<tr>
<td></td>
<td></td>
<td>b) Keep the Rheostat in field in minimum position in Field control method</td>
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<td></td>
<td></td>
<td>c) Observe the speed variation with respect to rated speed</td>
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<tr>
<td></td>
<td></td>
<td>a) To run the motor at rated speed on No load.</td>
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<tr>
<td></td>
<td></td>
<td>b) Calculate the constant losses</td>
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<tr>
<td></td>
<td></td>
<td>c) Calculate the efficiency at any desired load.</td>
<td></td>
</tr>
</tbody>
</table>

**REFERENCES**

2. Electrical Technology - Vol –II by B.L. Theraja - S.Chand&co.
3. Electrical machines by P.S. Bhimbhra
4. Electrical Machines by M.V.Deshpande
5. Electric Machines by D.P.Kothari, J.Nagarath – TMH
ELECTRONICS – I LABORATORY PRACTICE

Subject Title : Electronics – I Laboratory Practice
Subject Code : EE-310
Periods/Week : 03
Periods/Semester : 45

TIME SCHEDULE

<table>
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<td>3.</td>
<td>Filter Circuits</td>
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<td>4.</td>
<td>Regulated power supply</td>
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<td>5.</td>
<td>NPN Transistor</td>
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<td>6.</td>
<td>FET Characteristics</td>
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COURSE CONTENT

1.0 PLOT THE CHARACTERISTICS OF DIODE
1.1 To draw the forward & reverse characteristics of Silicon diode.
1.2 Determine Knee voltage.
1.3 Identify Cutoff, and Linear regions
1.4 Connect a 6V lamp in series with diode and test it on DC power supply
1.5 Using the CRO & Curve tracer to observe the Characteristics.
1.6 Heat the diode with a soldering Iron and observe the effect on reverse current

2.0 PLOT THE CHARACTERISTICS OF ZENER DIODE
2.1 To draw the forward & reverse characteristics of Zener diode and determine Breakdown Voltage
2.2 Connect resistance ladder circuit (3 resistors) and measure the voltages at the output by varying input voltage while Zener is reverse biased.

3.0 IMPLEMENT RECTIFIER CIRCUITS TO OBSERVE THE EFFECT OF FILTER
3.1 Implementing Half wave rectifier with and without filter
3.2 Implementing Full wave rectifier with and without filter
3.3 Implementing Bridge rectifier with and without filter
3.4 Implementing Voltage Doubler circuit
3.5 Connect a diode IN4007 in series with a 60W 230V Lamp and test it. (Record your observations)

4.0 PLOT THE REGULATION CHARACTERISTICS OF A POWER SUPPLY.
4.1 To build a Regulated power supply and draw the regulation characteristics
   i) using Zener diode   ii) using 3 Terminal +ve Regulator
4.2 Implement a −ve 3 Terminal Regulator and draw the regulation characteristics
4.3 Implement a Dual regulated power supply using both +ve and –ve 3 terminal regulators and draw the regulation characteristics.

4.4 Obtain a voltage above 30V using Dual RPS in the laboratory and measure them.

5.0 PLOT INPUT AND OUTPUT CHARACTERISTICS OF NPN TRANSISTOR

5.1 To draw Input and output characteristics of NPN Transistor and determine Beta of the transistor
   a) in CB configuration and b) in CE configuration

5.2 Turn on and turn off a relay using Transistor( BC148 as a switch.)

5.3 Connect a 6V lamp in series with BD139 and observe the effect of base current variation on lamp brightness.

5.4 Know the package and differences between BC148A, 148B, 148C and BF194 from the data sheets.

6.0 OBTAIN THE INPUT AND OUTPUT CHARACTERISTICS OF JFET

6.1 Drain the input and output characteristics of JFET and determine pinchoff voltage and transconductance.

6.2 Show that a FET can be used as a constant current source with appropriate bias.

6.3 Apply -2 volts to the gate circuit through resistors of value 10k, 100k and 1M separately and measure the output current and analyse.

OBJECTIVES

Upon completion of the Practice, the student shall be able to

1.0 PLOT THE CHARACTERISTICS OF DIODE

1.1 Identify the meters and equipment

1.2 Using DRB, DIB, DCB and measuring Voltage and current

1.3 Interpret diode datasheets and find the specifications of components used in the experiment

2.0 PLOT THE CHARACTERISTICS OF ZENER DIODE

2.1 Identification of meters and equipment

2.2 Using DRB, DIB, DCB measuring Voltage and current

2.3 Interpreting Zener diode datasheets and finding the specifications of components used in the experiment

3.0 IMPLEMENT RECTIFIER CIRCUITS TO OBSERVE THE EFFECT OF FILTER

3.1 Drawing the symbols of Transformer, Diode, Inductor and Capacitor

3.2 Reading the circuit Diagram

3.3 Identification of Diode terminals

3.4 Identification of meters and equipment

3.5 Using DRB, DIB, DCB and measuring Voltage and current.

3.6 Observing the polarity of capacitors.

3.7 Interpreting diode datasheets and finding the specifications of components used in the experiment.

4.0 PLOT THE REGULATION CHARACTERISTICS OF A POWER SUPPLY.

4.1 Drawing the symbols
4.2 Reading the circuit Diagram
4.3 Identification of Regulator terminals
4.4 Identification of meters and equipment
4.5 Using DRB, DIB, DCB and measuring Voltage and current.
4.6 Observing the polarity of capacitors.
4.7 Interpreting IC Regulator datasheets and finding the specifications of components used in the experiment.

5.0 PLOT INPUT AND OUTPUT CHARACTERISTICS OF NPN TRANSISTORS
5.1 Drawing the symbols of NPN transistor.
5.2 Reading the circuit Diagram
5.3 Identification of terminals
5.4 Identification of meters and equipment
5.5 Interpreting transistor datasheets and finding the specifications.

6.0 OBTAIN THE INPUT AND OUTPUT CHARACTERISTICS OF JFET
6.1 Drawing the symbols of FET
6.2 Reading the circuit Diagram
6.3 Identification of FET terminals
6.4 Identification of meters and equipment
6.5 Interpreting JFET datasheets and finding the specifications

<table>
<thead>
<tr>
<th>S.No</th>
<th>Experiment title</th>
<th>Key competency</th>
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</table>
| 1    | Plot the characterstics of diode | 1. assembling the circuit as per the circuit diagram  
2. Identification of Diode terminals by observation and also with DMM & Analogue MultiMete  
3. Drawing inference and writing the report |
| 2    | Plot the characterstics of zener diode | 1. Assembling the circuit as per the circuit diagram  
2. Identification of Zener Diode terminals by observation and with DMM &Analogue MultiMete  
3. Drawing inference and writing the report |
| 3    | Implement rectifier circuits to observe the effect of filter | 1. Assembling the circuit as per the circuit diagram  
2. Using the CRO to observe the waveforms  
3. Assess the Power supply performance in terms of ripple and % Regulation  
4. Drawing inference and writing the report |
<table>
<thead>
<tr>
<th>No.</th>
<th>Task</th>
<th>Details</th>
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| 4   | Plot the regulation characteristics of a power supply               | 1. Assembling the circuit as per the circuit diagram  
2. Identification of 3 terminal Regulator and its package & pin Configuration  
3. Finding the output voltage and type from the IC Regulator number |
| 5   | Plot input and output characteristics of NPN transistors            | 1. Drawing the symbols of NPN transistor.  
2. Reading the circuit Diagram  
3. Identification of transistor terminals  
4. Identification of meters and equipment  
5. Interpreting NPN transistor datasheets and finding the specifications |
| 6   | Obtain the input and output characteristics of JFET                | 1. Drawing the symbols of FET,  
2. Reading the circuit Diagram  
3. Identification of FET terminals  
4. Identification of meters and equipment  
5. Interpreting JFET datasheets and finding the specifications |

**REFERENCES**
2. Basic Electronics and Linear circuits by Bhargava, TMH Publishers
3. Electronic Principle by Malvino
4. Electronic devices and circuits by Mathur, Chada & Kulashrestha
5. Industrial Electronics by G.K. Mithal
6. Applied Electronics by G.K. Mithal
# DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
## SCHEME OF INSTRUCTIONS AND EXAMINATIONS
### IV Semester

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<tr>
<th>Subject Code</th>
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<th>Instruction period / week</th>
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### A.C MACHINES - I

**Subject Title**: A.C. MACHINES - I  
**Subject code**: EE-402  
**Periods/Week**: 05  
**Periods/semester**: 75

#### TIME SCHEDULE

<table>
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<th>Periods</th>
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<th>Short Questions</th>
<th>Essay Questions</th>
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<td>Single phase Transformers</td>
<td>35</td>
<td>52</td>
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<td>Three phase Transformers</td>
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<td>3.</td>
<td>Alternators</td>
<td>20</td>
<td>29</td>
<td>03</td>
<td>02</td>
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</table>
OBJECTIVES

Upon the completion of the course the student shall be able to

1.0 Understand the working of single phase transformer and 3 phase transformers

1.1 Define the word ‘Transformer’.
1.2 Explain the working of single-phase transformer.
1.3 Classify the transformers based on number of phases, construction and function.
1.4 Explain the constructional details of transformers.
1.5 State the purpose of each part of the transformer with sketch.
1.6 Distinguish between shell type and core type transformers.
1.7 Derive the E.M.F equation of a single power transformer.
1.8 Define ‘transformation’ ratio.
1.9 Draw Vector diagram for a transformer working on no load.
1.10 Calculate the core loss.
1.11 Explain the procedure for finding $R_o$ and $X_o$ from no load test.
1.12 Develop the vector diagram for a transformer on load for
   (a) Unity power factor
   (b) Lagging power factor
   (c) Leading power factor
1.13 State the effects of leakage reactance of primary and secondary windings.
1.14 Draw the equivalent circuit of a transformer by approximation.
1.15 Determine the equivalent circuit constants from no-load test and short circuit test data.
1.16 Derive the approximate equation for regulation for transformer.
1.17 Calculate regulation for
   (i) Unity power factor
   (ii) Lagging power factor
   (iii) Leading power factor
1.18 List out losses taking place in a transformer.
1.19 Derive the condition for maximum efficiency.
1.20 Solve simple numerical problems.
1.21 Explain the necessity of transformer rating is mentioned in KVA.
1.22 Calculate the all day efficiency given the load cycle.
1.23 Differentiate between distribution transformer and power transformer.
1.24 Explain the polarity test on single-phase transformer.
1.25 State the need for parallel operation of transformer.
1.26 Mention the conditions for paralleling and load sharing of transformers.

2.0 Understand Three Phase Transformers

2.1 State the advantages of 3 phase transformer over single phase transformer.
2.2 State the voltage relationships and applications of star-star, delta-star, star-delta and delta-delta connected transformer.
2.3 State the conditions for parallel operation of 3 phase transformer.
2.4 List the special transformers.
2.5 State the advantages and disadvantages of autotransformers (and its applications).
2.6 State the expression for saving of copper in auto transformer.
2.7 State the necessity of cooling of power transformers.
2.8 Explain the methods of cooling of power transformer.
2.9 Draw the sketch of a power transformer including the parts & explain their functions.
2.10 Explain the `on load' and `off load' tap changing.
2.11 Explain the procedure for tap changing for on load and no load tap changer.

3.0 Know the classification, construction, working and testing of alternators
3.1 Explain the Principle, Constructional and working of Alternators.
3.2 Classify the alternators based on rotor construction and explain them.
3.3 State the advantage of Stationary Armature.
3.4 List the main parts of alternator along with materials used.
3.5 State the effect of Chording and Distribution factor and derive expressions.
3.6 Derive EMF equation of an alternator taking into account distribution factor and pitch factor.
3.7 Solve simple problems on E.M.F equation.
3.8 State the need for an exciter.
3.9 List the various types of exciters (main, pilot and static).
3.10 Explain Armature Reaction of Alternator at different P.F’s.
3.11 State the reasons for voltage variations on Load.
3.12 Define the term synchronous impedance.
3.13 State the effects of synchronous impedance.
3.14 Draw the vector diagram for different power factors.
3.15 Define regulation of an alternator.
3.16 List the different methods of finding the regulation of alternator.
3.17 Calculate the regulation by synchronous impedance method.

4.0 Comprehend the procedure for voltage control and synchronisation
4.1 Explain the necessity for parallel operation of alternators.
4.2 State the conditions for synchronisation.
4.3 Explain the procedure of synchronisation by using lamp methods.
4.4 Explain the method for adjusting the loads shared by two alternators (or one alternator with infinite bus bar).
4.5 Explain Effect of change in input and excitation of an alternator connected to infinite bus.

COURSE CONTENT

1. Transformers
Classifications of transformers, Construction of transformers, Theory of an ideal transformer - emf equation derivation - Ratio of transformation and relation between turn ratio - Voltage ratio and current ratio, Transformer on no load - No load current
components and no load power factor - Transformer on load - Equivalent circuit of transformer - Equivalent circuit constants by transformation, Short circuits test - Regulation of transformer - definition and derivation of approximate equation for regulation based on vector diagram for lagging ,leading, unity power factor - determination of regulation from S.C. Test data , Losses in transformer -determination from O.C. and S.C. tests data- efficiency, condition for maximum efficiency – rating of transformer-All day efficiency definition - Calculation for a given load cycle- problems, Polarity test - Efficiency calculation, Parallel operation of single phase transformers - necessity - conditions for paralleling-load sharing of single phase transformers

2. Three phase transformer
Descriptive treatment of star-star, delta-delta, star-delta and delta-star, voltage current and phase relation for the above groups-conditions to be fulfilled for paralleling 3 phase transformer, open delta working of 3 phase transformers, Auto-transformers –expression for copper saving – applications, Necessity of cooling - Methods of cooling - Sketch of power transformer indicating parts and explain their functions - Tap changing gear - no load and on load tap changing procedure.

3. Alternators
Classification of low, medium and high speed alternators - Brief description of parts with sketches and function of each part, construction, Assembly - Exciter and pilot exciter – Stationary armature type construction – Advantages, Concentrated and distributed windings - short pitch and full pitch coils - Effect of chording and distribution factors - EMF equation - Derivation – Problems, Cause for variation of voltage on load - Resistance, leakage reactance - Armature reaction - Synchronous reactance and synchronous impedance concepts - phasor diagram for unity, lagging and leading power factor loads, Regulation - definition - derivation of relation between no load voltage and on load voltage for different power factors – Different methods of finding regulation- Calculation of regulation by synchronous impedance method,

4. Parallel operation of alternators
Necessity for parallel Operation - condition to be fulfilled for synchronisation, Synchronisation by lamp methods - Load sharing – simple problems-Effect of change in excitation and input of an alternator connected to infinite.

REFERENCES:
1. Electrical Technology - Vol –II by B.L. Theraja
2. AC machines by M.G Say
3. Electrical machines by P.S. Bhimbra, Khanna Publishers
6. Fundamentals of Electric machines - BR Gupta and Vandana singhal
POWER SYSTEMS – I

Subject Title : POWER SYSTEMS – I (GENERATION)
Subject Code : EE – 403
Periods / Week : 05
Periods / Semester : 75

TIME SCHEDULE

<table>
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<tr>
<th>Sl. No.</th>
<th>Major Topics</th>
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<th>Weightage of Marks</th>
<th>Short Questions</th>
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OBJECTIVES:
Upon completion of the course the student shall be able to

1.0 Appreciate the various sources of power generation.
   1.1 List the different sources of energy
   1.2 Classify the sources of energy into conventional and non-conventional types.
   1.3 State necessity of developing non-conventional methods of power generation.
   1.4 Explain the method of generating electrical energy from (i) Solar Power (ii) Tidal Power (iii) Wind Power (iv) Biomass (v) Geo-thermal power
1.5 State the relative merits and limitations of Conventional and Non-Conventional types of sources.
1.6 Appreciate the need of energy conservation and its methods.

2.0 Comprehend the working of thermal power station.
2.1 List the thermal power stations in A.P. with their location and their capacity.
2.2 Explain the general principle of working of thermal power stations.
2.3 List the requirements for setting up of Thermal Power Station.
2.4 Mention the requirement for site selection of thermal power plant.
2.4 Draw the detailed line diagram of a condensing type thermal power station.
2.5 Explain the principle of working of each component of thermal power station.
2.6 Describe the energy losses occurring in thermal power plant
2.7 State the methods to improve the efficiency of thermal power plant.
2.8 Define and mention the advantages of
   a) Pulverization
   b) Condensation
2.9 State the necessity of cooling towers in thermal power plant
2.10 List the types of cooling towers in thermal power plants.
2.7 List the controls used at i) Boilers, ii) Turbines, (iii) Alternators.
2.8 Comprehend the concept and need of Energy Auditing and list the methods.
2.10 Mention the causes of pollution and methods to control them.

3.0 Comprehend the working of hydroelectric power stations.
3.1 Comprehend the principle of working of Hydro power station.
3.2 List the requirements for setting up of Hydro Electric Power Station.
3.3 Mention the requirement and factors for site selection of Hydro Electric Power Plant.
3.4 Explain Hydrograph.
3.5 Derive waterpower equation and define various hydraulic terms used – Solve numerical problems.
3.6 Classify the H.E.P’s based upon head, duty, location and hydraulic considerations.
3.7 Explain with layout diagram working of i) High Head, ii) Medium Head, iii) Low Head Power Stations.
3.6 Specifically explain the need and working of
   i) Surge Tank, ii) Fore bay, iii) Spill gates.
3.8 List the main controls used at
   a) Head works    b) Turbine    c) Alternators.

4.0 Comprehend the working of Nuclear Power Stations.
4.1 Introduction to nuclear energy, fission and fusion reactions.
4.2 Appreciate merits and risks involved in using nuclear energy
4.3 Identify nuclear fuels and comprehend their properties.
4.3 Give specific examples of fission and fusion reactions with mass-energy balance.
4.5 Explain types of fission reactions and sustained chain reaction.
4.6 Explain use of moderator in nuclear reactions.
4.7 Explain types and working of reactors with merits and demerits.
4.8 Explain the working of a moderated type nuclear power station with a block diagram.
4.9 Explain the need and working of coolant, reflector and control rods.
4.10 Mention the materials used for coolant, reflector and control rods.
4.11 Explain the mechanism of power control by control rods.
4.12 Explain the measures to control radio activity.
4.13 List the main controls at the reactor.

5.0 Comprehend the power generation through Renewable Energy Sources
5.1 State the Renewable and Non-Renewable energy sources.
5.2 List Renewable and Non-Renewable energy sources.
5.3 State the amount of solar radiation reaching the earth’s surface.
5.4 State the principle of conversion of solar radiation into heat.
5.5 Explain the function of flat plate collector.
5.6 Explain the working principle of solar air heater with legible sketch
5.7 Identify different types of concentrating collectors.
5.8 Explain the working principle of concentrating collector (focusing type, parabolic trough collector).
5.9 State the different methods of storing solar energy.
5.10 State the principle of photo-voltaic conversion and applications.
5.11 Comprehend the solar photo-voltaic arrays.
5.12 State the working principle of solar cell.
5.13 Explain the energy conversion and current voltage characteristics of solar cell.
5.14 Appreciate the power available in the wind and the force caused by it on the blades.
5.15 State the collection of wind data and estimate the energy.
5.16 State the different considerations for site selection for installing wind mill.
5.17 Identify basic components of a wind mill.
5.18 Explain the construction details on the working principle of the wind mill.

6.0 Understand combined operation and economics of power stations.
6.1 Appreciate increase in use of electrical energy, its production and need for reliability.
6.2 Differentiate between isolated operation and integrated operation of power stations.
6.3 List the merits of integrated operation.
6.4 Comprehend the process of integrated operation and need for grid at various levels
6.5 List the voltage levels.
6.6 List the various charges and expenses in power station and classify them as fixed and running.
6.7 Define the terms a) load curve b) load factor
c) diversity factor  d) maximum demand.

6.8 Comprehend the cost of generation and effects of load factor and diversity factor on it
6.9 Solve numerical problems on the above.
6.10 Explain various types of consumer tariffs and compare them.
6.11 Solve numerical problems on the above.
6.12 Appreciate the effects of P.F. on electricity charges and mention the methods to improve it. Solve numerical problems.
6.13 Appreciate energy management.

COURSE CONTENT
1. Introduction
Different sources of energy - Conventional and Non-conventional sources - Need for Non-Conventional Energy based power generation - Methods of generation of energy from different sources of power such as Solar, Wind, Tidal, Bio-mass and Geo-Thermal - Merits and Limitations of Conventional and Non-conventional sources - Need for energy conservation and their methods.

2. Thermal Power Station
Thermal Power Station - Principle of working - Factors for selection of site. Block diagram of condensing type thermal power station - Thermal power station - Components and principles of working - Energy Losses and methods to improve the efficiency - pulverization, Condensation, Cooling towers and their types - Main controls at Boilers, Turbines and Alternators - Energy auditing of thermal power station - Causes of pollution and methods to control them.

3. Hydroelectric Power Stations
Hydro Electric Power Station - Factors for site selection and limitations in location and operation – Hydraulic terms used - Water power equation - Classification of hydroelectric power stations based on head, duty, location and hydraulic considerations - Layout diagram of High Head ii) Medium Head iii) Low Head Power Stations - Working of surge tank, fore bay, spill gates- Main controls of head works, turbines and alternators.

4. Nuclear Power Stations
Nuclear energy, fission and fusion reactions - Merits and risks in using nuclear energy. Nuclear fuels and their properties - Fission and fusion reactions with mass-energy balance, Fission reactions and sustained chain reaction - Moderator in nuclear reactions - Working of reactors with merits and demerits - Working of moderated type nuclear power station with a block diagram - Need and working of coolant, reflector, control rods – Materials used for them - Power control by control rods- measures to control radioactivity- main controls at the reactor.

5. Renewable Energy sources
Solar radiation - Principle of Conversion of solar radiation into heat - Function of flat plate collector - Working principle of Solar air heater - Different types of concentrating collectors and working of it-methods of storing solar energy - Principle of photo voltaic conversion - Applications-Solar photo voltaic arrays -

6. Combined Operation and economics of Power Stations
   Isolated operation and integrated operation of power stations - Their merits and limitations - Charges/Expenses involved in power station - Their classification as fixed and running - Load curve, load factor, diversity factor and maximum demand - Effects of load factor and diversity factor in power generation - Solve numerical problems. Consumer tariffs and their comparison - Effect of power factor on the electricity charges and methods to improve it - simple problems. - Energy management and conservation.

REFERENCES
1. Electrical Power by S.L.Uppal
2. Generation, Transmission and Utilisation by A.T.Starr
3. Electrical Power Systems by C.L.Wadhwa, New age international(P) limited
5. Electrical power plants by J B Guptha
6. Non conventional energy sources- G.D. Roy
8. Introduction to Non Conventional energy resources – Raja.
ELECTRICAL INSTALLATION AND ESTIMATION

Subject Title : ELECTRICAL INSTALLATION AND ESTIMATION  
Subject code : EE-404  
Periods/Week : 04  
Periods/Semester : 60

TIME SCHEDULE

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Major Topics</th>
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<th>Weightage of Marks</th>
<th>Short Questions</th>
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<td>3.</td>
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<td>4.</td>
<td>Departmental Test, REC and Electrical Act 2003,</td>
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OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Mention the use of wires and cables, Types of Installations and wiring Accessories.

1.1 Identify VIR, CTS, PVC, Lead Sheathed, Weather proof aluminium and copper wires.

1.2 Mention the uses of cables LV, HV, EHV and oil filled H types, SL, HSL and types of 3-phase cables.

1.3 Describe the use of standard wire gauge.

1.4 State the gauge of wire and number of strands in a multistrand and its current carrying capacity.

1.5 Explain (a) C.T.S system (b) T.R.S. system, (c) Surface conduit system (d) Concealed wiring system.

1.6 Identify Main Switches: a) Double pole iron clad (DPIC)  
                                b) Triple pole iron clad (TPIC)  
                                c) Triple pole iron clad with neutral link (TPICN)  
                                d) Distribution fuse board Ironclad  
                                e) MCB types with specifications, MCCB, ELCB and RCCB applications.
1.7 Mention the different types of fuses, fuse carrier materials used, ratings and their use.
   a) Rewirable fuses
   b) Open type fuses
   c) Kit kat type fuses
   d) Cartridge fuses

1.8 State the reasons for fire accidents in Electrical system.

1.9 Discuss the reasons for not using fuse in Neutral wire

1.10 Describe the procedure of first aid for shock treatment to an electrocuted person.

1.11 Mention the effects of shocks and electrocution.

2.0 Estimate Lighting and Power loads

2.1 Explain different types of service mains

2.2 Select the service main suited to the given situation

2.3 State the merits and demerits of different systems of interior wiring.

2.4 Select the type of wiring system suitable to the given situation

2.5 List out the electrical materials used in wiring and service mains.

2.6 List the schedule of rates used in preparing estimate

2.7 Estimate the material requirement for indoor wiring given the plan of a building.

2.8 Drawing the wiring layout for a big office building

2.9 Draw the wiring layout for a workshop/ Electrical Laboratory

2.10 Draw the wiring layout of a Big industry.

2.11 Draw wiring layout of a Big Hotel with lift arrangement

2.12 Draw the wiring layout and estimate the material required for a Residential Building with 2 bed room house.

2.13 Prepare layout and draw single line wiring diagrams as per standard practise for a given set of machines in a workshop.

2.14 Select type of wiring system and lighting requirements

2.15 Calculate the wire sizes for various circuits

2.16 Specify important materials used under given condition

2.17 Calculate the quantities of all materials required for the above.

2.18 Prepare the estimate of the complete installation as per standard practice

2.19 Select the type of wiring and service mains used for the irrigation pump set.

2.20 Specify the material used in the execution of the irrigation pump set installation.

2.21 Prepare an estimate for electrifying the irrigation pump set scheme

2.22 Prepare an estimation for submersible pump installation

3.0 Estimate the type of material and quantity required for OH Lines and Earthing

3.1 Calculate the total number of insulators required for the given scheme

3.2 Select the type of insulators to be used for over head lines.

3.3 Select the type size and number of cross arms required for the overhead line

3.4 Determine the size and total length of overhead conductor required for the line giving due consideration for the sag to be allowed

3.5 Estimate the quantity of all materials required for given 11 KV and 400 v overhead lines as per standard practice followed by NEC

3.6 Estimate the quantity of materials required for a pole and plinth mounted
transformer substation
3.7 Select supporting poles of suitable size and height to install a given transformer as per standard practice in NEC
3.8 Draw plinth and Pole Mounted transformer substation and estimate the quantity of materials required in each case.
3.9 Estimate the quantity of all the electrical accessories and components required for the given a) Pole mounted transformer b) Plinth mounted transformer including the operating mechanism as per standard practice in NEC
3.11 State the purpose of Earthing and types that are normally used.
3.12 Select the suitable type of Earthing for a given installation
3.13 Specify the different components used in electrical Earthing of a given installation
3.14 List the materials that are to be used in the earth pit surrounding the earth electrode
3.15 Prepare the estimate for pipe and plate Earthing

4.0 Departmental Test, REC and Electrical Act 2003
4.1 Write the departmental procedure for obtaining a service connection
4.2 Specify insulation resistance desirable for a given electrical installation
4.3 Specify the value of earth resistance to be maintained for a given electrical installations
4.4 Describe the test procedure for continuity of wiring in an electrical installation.
4.5 Explain the procedure for conducting insulation test of domestic wiring
4.6 Survey the load particulars in a village for a) Domestic b) industrial C) agricultural loads.
4.7 Calculate the capacity of a transformer required assuming suitable diversity factor
4.8 Determine the location point of transformer and calculate the tail end voltage regulations as per the practice in NEC.
4.9 Determine the economic feasibility of the scheme as per the standard norms fixed by REC to execute the scheme.
4.10 State major rules applicable to electrical installations as per Electrical act 2003
4.11 Write as per the Electrical act 2003, the rules and procedures to be adopted during execution of electrical installations.
   a) Domestic lighting & Power  b) Industrial
4.12 State the standards and code of practice followed by NEC in respect of electrical installations and OH lines of 11 KV and 400V pole mounted and Plinth mounted transformers.
4.13 State new I.E. Rules

COURSE CONTENT
1. Wiring Systems and Safety Procedures
   Introduction, size of wires, standard wires, types of wires, CTC, PVC, Lead sheathed VIR, weather proof wires, flexible wires different types of cable wires – Types and Installation of House Wiring Systems & Wirings Accessories : Methods of installing wiring, clips, screws - round blocks switch boards, sockets socket pins - CTS wiring - Installation of surface conduit wiring - Rigid conduits, flexible conduits - Conduit accessories - elbows bushings - reducers, conduit box saddles, PVC conduit wiring - Concealed wiring - Comparison of various wiring systems -- Distribution fuse boards -
Main switches – Different types of fuses and fuse carriers - Safety procedures - Electric shock and first aid, causes for fire hazards in Electrical installations

2. **Estimation of Lighting and power loads**

   Estimation of domestic lighting installation service main - types of wire - specification - quantity of materials required for service main – estimation and selection of interior wiring system suitable to a given building - number of circuits - calculation of length of wire and quantity of accessories required - estimates of materials for execution of the domestic wiring installation as per National Electrical act 2003. Power wiring installation Drawing wiring layout for a big office building, electrical laboratory, big industry, big hotel with lift arrangement and a residential building with 2 bed room house.- estimation and costing upto 20 kVA calculation of load current based on ratings of various equipment's to be installed - size of wire - length of wire number of circuits - quantity of accessories for execution of work as per standard practice.

   Irrigation pump installation - Estimation upto 10 HP service main - type- calculation of size and quantity of wire and other components required - Labour cost for erection - Type of starter and control panel - accessories quantity and estimation Estimate for the installation of submersible pump.

3. **Estimation of OH Lines and Earthing**

   Distribution lines of 11 kV and 400Volt OH lines - estimation only quantity of materials required for lines of length 1 km - of number of poles - Cross arms clamps - insulators - conductor length and size for a given power transmission Distribution transformer erection- Estimation of quantity of materials required for structures, isolators - HG fuse operating mechanism, isolators, lightening arrestors for pole mounted substation and plinth mounted substation Quantity estimation for materials required in electrical Earthing both for pipe earthling and plate Earthing suitable to the given equipment or transformer substation

4. **Departmental Tests and REC and Electrical Act 2003**

   Electrical installation testing - departmental procedure for testing before giving service connection - departmental procedure for obtaining service connection - desirable insulation resistance for domestic and power circuits - Tests for measuring insulation resistance - procedure for conducting insulation resistance test and continuity tests, earth continuity test.

   Design of rural electrification scheme - Load survey-determination of capacity of transformer - estimation of quantity of materials required for the erection of distribution lines and 11 kV feeder from a nearby 11 kV feeder - determining the economic feasibility of the scheme as per the procedure laid out in NEC, - Extracts from Indian Electricity rules 1956 and code of practice by NEC regarding - domestic power, agricultural industrial wiring installations, erection of 11 kV, 400 Volt distribution lines - pole mounted transformer – New I.E. Rules

**REFERENCES:**

   Electrical Wiring ,Estimating & costing by S.L.Uppal
   Electrical wiring, Estimating & costing by J.B.Gupta
   Electrical Drawing by Balbir Singh
   Electrical wiring by Arora
ELECTRONICS - II

Subject Title : ELECTRONICS-II
Subject code : EE-405
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

<table>
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<th>Weightage of Marks</th>
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<td>2</td>
<td>Oscillators</td>
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<td>Electronic instruments and Industrial application</td>
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<td>5</td>
<td>Introduction to I.C’s and UPS</td>
<td>10</td>
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</table>

OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Explain the principle of Working of Amplifiers.
   1.1 Explain the need for power amplifier
   1.2 Distinguish between voltage and power amplifier
   1.6 Explain the working principles of single tuned amplifier
   1.7 Define feedback, and feedback factor
   1.8 Draw the block Diagrams of Voltage Series and Shunt feedback amplifier.
   1.9 Explain the effect of feed back on gain, band width distortion, noise
   1.10 Explain the performance characteristics of emitter follower.
   1.11 List the applications of emitter follower.
   1.12 Explain the differences between degenerative and regenerative feedback.
   1.13 Draw the circuit and explain the operation of Differential Amplifier.
   1.14 List the characteristics of an Ideal Operational Amplifier.
   1.15 Explain the Operational Amplifier as summer, integrator, differentiator, scale change and invertors

2.0 Explain the principles of Oscillators.
2.1 Establish the conditions for oscillations
2.2 Classify different types of oscillators
2.3 Draw the circuit diagram of Hartley, Colpitts, Wean-bridge and crystal oscillators
2.4 Explain UJT relaxation oscillator.
2.6 Mention the different applications of oscillators

3.0 Appreciate the need for Modulation and Demodulation.
3.1 Define amplitude and frequency modulation
3.2 Sketch the waveforms of amplitude modulated and frequency modulated waves
3.4 Compare AM and FM systems

4.0 Comprehend the various Electronics Instruments and Industrial Applications
4.1 Sketch the CRT and indicate different parts.
4.2 Describe the functions of different parts of C.R.T.
4.3 Draw the block diagram of a simple CRO
4.4 State the functions of each stage.
4.5 State the necessity of time base voltage
4.6 List the applications of C.R.O.
4.8 List the advantage of electronic test meters over ordinary meters.
4.9 Describe the block diagram of Ramp type Digital Voltmeter and explain the working principle of each block
4.10 Draw and explain the block diagram of digital frequency meter.
4.11 Understand the digital multi meter and its applications.
4.12 Explain the working principle of function generator
4.13 State the need of timer.
4.14 Draw and explain the internal block diagram of IC 555
4.15 Draw the circuit of A stable Multivibrator using 555 IC.

5.0 Describe the Basics of ICs.
5.1 Distinguish between discrete circuits and integrated circuits
5.2 List the advantages of ICs and discrete circuits.
5.3 Categorise the I.C’s. and digital and liner I.C’s. on the basis of their application.
5.4 Categorise according to level of integration as SSI, MSI, LSI and VLSI.
5.5 Mention the area of applications of digital and linear I.C’s.

COURSE CONTENT
1. Amplifiers
   Power amplifier- Class A voltage amplifier - Class B-Push pull amplifier - complementary and symmetry Amplifiers- tuned voltage amplifier- Class C - RF amplifier -Negative feed back amplifier - differential amplifier- operation amplifier - specifications - applications as summer, integrator, differentiator, scale change and inverter.

2. Oscillators
   Principle of oscillator –operation of Hartley Colpitts, RC phase shift , crystal And Relaxation oscillators- Applications.
3. **Modulation and Detection**
   Principle of modulation - AM and FM-Linear collector modulation- Comparison between AM and FM-super heterodyne radio receiver.

4. **Electronic Instruments and Industrial Applications**

5. **Introduction to I.C.s**
   Introduction to I.C’s - Classification according to
   i) Applications.
   ii) Manufacturing techniques and,
   iii) List 6 types Packaging methods
   iv) Compare IC’s with discrete circuits.

**REFERENCES**
1. Industrial Electronics by G.K. Mithal
2. Electronic Instrumentation by David C. Cooper
3. Applied electronics by G.K.Mithal
4. Thyristor Engineering by M. Ramamurthy
5. Electronic Principles by Malvino
7. Principles of Electronics by V.K. Mehta
8. Electronic devices and circuits by Mathur,Chada & Kulakshetra
9. Electronic communication systems by George kennedy, TMH
10. Basic Electronics by Mandal –TMH.
Subject Title : Programming in ‘C’
Subject code : EE-406
Periods/Week : 04
Periods/Semester : 60

TIME SCHEDULE

<table>
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<tr>
<th>Sl. No</th>
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<td>2.</td>
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<td>3.</td>
<td>Arrays &amp; Strings</td>
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<td>User defined Functions</td>
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OBJECTIVES

Upon completion of the study of the subject the student shall be able

1.0 Comprehend the Basics of ‘C’ Programming
1.1 Know the Importance of ‘C’
1.2 Understand the basic structure of ‘C’ Programming
1.3 Know the Programming style with sample program
1.4 Execute a ‘C’ Program
1.5 Know about the character set
1.6 Know about constants, variables, keywords & identifiers
1.7 List various data types with examples
1.8 Explain different arithmetic operators, relational operators and logical operators with their precedence
1.9 Explain the assignment statements
1.10 Explain the increment & decrement operators
1.11 Identify the compound Assignment operators
1.12 Explain the I/P functions printf and scanf
1.13 Know various type conversion techniques

2.0 Understand various Decision & Loop Control Statements
2.1 State the Importance of conditional expressions
2.2 List and explain the various conditional statements
2.3 Explain the switch statement
2.4 List the different iterative loops and explain them (for, do, while statements)
2.5 Define nesting and implement with simple programs
2.6 Differentiate ‘break’ and ‘continue’ statements with programs
2.7 Mention about the null statements and comma operator

3.0 Know about the Arrays & Strings
3.1 Define 1-D and 2-D Arrays.
3.2 Know how to initialize above arrays and access array elements
3.3 Explain simple programs using arrays
3.4 Define ‘string’
3.5 Know how to declare and initialize string variables
3.6 Understand various string handling functions
3.7 Implement programs using string functions

4.0 **Understand the concept of User defined functions**
4.1 Define ‘function’
4.2 Understand the need for User defined function
4.3 Know the return values and their types
4.4 Write programs using function call technique
4.5 List the four storage classes supported by C
4.6 Discuss the importance of function proto types in programming
4.7 Differentiate local and external variables
4.8 Identify automatic and static variables and discuss them in detail
4.9 Write simple programs on above

5.0 **Understand Structures , Unions & Pointers**
5.1 Define a structure
5.2 Describe about structure variable
5.3 Explain initialization of structures
5.4 Know the accessing of members of a structure.
5.5 Illustrate concept of structure assignment
5.6 Explain how to find size of a structure.
5.7 Know passing of individual members of a structure to a function

5.8 Define a Union and Illustrate use of a union
5.6 Declare a pointer, assign a pointer, and initialize a pointer
5.7 Discuss pointer arithmetic.
5.8 Illustrate with example how pointer can be used to realize the effect of parameter passing by reference.
5.9 Illustrate with examples the relationship between arrays and pointers.
5.10 List various conditional and unconditional preprocessor directives

**COURSE CONTENT**

1. **Basics of ‘C’ Programming**
   Structure of a C programme, Programming rules, Character Set Keywords, Constants, Variables, Data types, Type conversion, Arithmetic, Logical, Relational operators and precedences – Assignment, Increment, Decrement operators, evaluation of expressions. I/P functions

2. **Decision and Loop control Statements**
   If, If-else, Nested If else, Break, Continue and Switch statements Loops:- For, While, Do-while, Nesting of Loops.
3. **Arrays and Strings**
   1 D Array declaration, Initialization, 2 D Array declaration, Initialization, Accessing of Array elements, Character Arrays declaration and Initialization of Strings, string handling functions

4. **User defined Functions**
   Function-Definition, Declaration, Return statement, passing parameters to function- Function calls, Storage classes of variables, Scope and visibility.

5. **Structures , Unions & Pointers** Structure features, Declaration and Initialization, Accessing of Structure members, Unions. Pointer declaration, Arithmetic operations and pointers, Pointers and Arrays, Various Preprocessor directives.

**REFERENCES**
1. Let us learn C, by Yashwant Kanetkar, BPB Publication, New Delhi
3. Programming In C by Samarjit Ghosh - PHI
4. Programming with ANSI and Turbo C by Kamthane, pearson Education
5. Programming In C by Gottfried (Schaum Series)

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**ELECTRICAL ENGINEERING DRAWING - I**

**Subject Title** : Electrical Engineering Drawing-1  
**Subject code** : EE-407  
**Periods/week** : 04  
**Periods/ Semester** : 60

**TIME SCHEDULE**

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<tr>
<td>2.</td>
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</table>
OBJECTIVES

Upon the completion of the course the student shall be able to

1.0 **Comprehend graphical symbols, view of fuses, Couplings and Bearings**
1.1 Draw standard symbols of electrical components and fixtures
1.2 Draw Sectional and end view of
   i) Rewirable fuse
   ii) Cartridge fuse
   iii) HRC fuse
1.3 Draw sectional elevation and end views of a flange coupling (protected type).
1.4 Draw sectional elevation and end views of Ball bearing and end plate.

2.0 **Draw the different views of DC machines**
2.1 Draw views, including sectional views of yoke and pole assembly
2.2 Draw sectional view of armature of DC machine
2.3 Draw sectional views of commutator of a DC Machine
2.4 Draw Sectional elevation and end view of a DC Machine
2.5 Draw the face plate of 3 point starter
2.6 Draw the face plate of 4 point starter

3.0 **Develop D.C.Windings**
3.1 Draw the developed winding diagram for Single Layer Lap connected D.C Machine
3.2 Draw the developed winding diagram for Single Layer Wave connected D.C Machine

4.0 **Draw the views of Transformers**
4.1 Draw different core sections of a Transformer.
4.2 Draw sectional views of a single-phase core type transformer from the given data
4.3 Draw sectional views of a 3 phase core type transformers from given data

5.0 **Draw the sketches of different electrical Earthing system.**
5.1 Draw the dimensioned sketch of
   a) Pipe Earthing
   b) Plate Earthing
5.2 Draw the dimensioned sketch of
   a) Transformer yard Earthing
   b) Sub-station Earthing

**COURSE CONTENTS**
1. **Graphical symbols, views of fuse, switches**
Graphical symbols as per ISI standards, Views of fuses, Rewirable fuse, Cartridge fuse, HRC fuse, Shaft coupling, Protected, Bearings, End plate with bearings
2. DC machine parts: (Assembled views in section)
Stator yoke and pole assembly, pole and field coil assembly main and interpoles,
Armature of a small DC machine, Commutator of DC machine, Face plate type 3 point
and 4 point starter,

3. D.C Winding
Single Layer Lap and Wave Windings - Winding tables- Ring diagram-Brush location –
Equalizer rings.

4. Transformers
Core sections, sectional views of single-phase core type, three phase core type
transformers.

5. Earthing systems
a) Pipe earthing, plate earthing
b) Transformer yard earthing
c) Substation earthing system.

REFERENCES
2. Electrical Engineering Drawing by Dargon.

A.C. MACHINES LABORATORY PRACTICE - I
Subject Title : A.C. Machines Laboratory Practice - I
Subject Code   : EE- 409
Periods/Week   : 06
Periods/Year(Sem) : 90

TIME SCHEDULE

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<th>No. of Periods</th>
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<tr>
<td>I.</td>
<td>Performance of single phase transformers</td>
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<tr>
<td>II.</td>
<td>Sumpner’s test and Scott connection</td>
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<td>III.</td>
<td>Parallel operation of transformers and oil testing kit</td>
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<td>Alternators</td>
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<tr>
<td>V.</td>
<td>Report on observations in Industrial visits</td>
<td>09</td>
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</table>

OBJECTIVES (LIST OF EXPERIMENTS)
Upon completion of the course the student shall be able to
I. Performance of single phase transformers.
   1. Conduct load test on 1-phase Transformer and obtain efficiency and regulation.
   3. Conduct O.C. and S.C. tests on 1-phase Transformer and find efficiency at various loads and p.f.s and find the load at which maximum efficiency occurs.
   4. Obtain the regulation of 1-phase Transformer by conducting S.C. test.
   5. Obtain the All-day efficiency of 1-phase Transformer for the given load cycle of 24 hours by conducting O.C. test (for iron loss) and S.C. test (for full load copper loss).

II. Sumpner's test and Scott connection.
   6. Obtain the efficiency and regulation of two similar 1-phase transformers by conducting sumpner's test.
   7. Conduct scott connection (T-connection) on transformers.

III. Parallel operation of transformers and oil testing kit
   8. Connect two identical 1-ph transformers in parallel and observe the load sharing.

IV. Alternators
   10. Conduct (direct) load test on Alternator and obtain voltage regulation.
   11. Obtain the regulation of Alternator by using synchronous impedance method.
   12. Synchronise the given Alternator with supply mains by using bright lamp method.

V. Report on observations in Industrial visits
   13. Understand the connections of 3-ph power transformers and their parallel operation in a 33/11 KV substation.
   14. Understand the functions of various equipment in the nearby Generating station.
   15. Understand the manufacturing and/or functioning of any nearby Solar installation.

SKILLS
At the end of each experiment the student shall be able to
1.0 Conduct load test on 1-phase Transformer and obtain efficiency and regulation.
   1.19 Draw the required circuit diagram.
   1.20 Identify the different terminals of the given 1-ph transformer.
   1.21 Interpret the name plate details.
   1.22 Select proper supply terminals.
1.23 Select proper range and type of meters.
1.24 Make connections as per circuit diagram.
1.25 Follow the instructions and increase the given load gradually and tabulate the observations.
1.26 Follow the precautions to be taken (ex: Check for loose and/or wrong connections if any and rectify).
1.27 Calculate efficiency and regulation at each load.
1.28 Draw the efficiency curve and locate the maximum efficiency point.

2.0 Conduct O.C. and S.C. tests on 1-phase Transformer and obtain equivalent circuit.

2.1 Draw the required circuit diagram.
   Identify the different terminals of the given 1-ph transformer.
2.2 Interpret the name plate details.
2.3 Select proper supply terminals.
2.4 Select proper range and type of meters.
2.5 Make connections as per circuit diagram.
2.6 Perform the O.C. test by giving required normal (rated) voltage and tabulate the readings.
2.7 Perform the S.C. test by giving required reduced voltage and tabulate the readings.
2.8 Follow Precautions to be taken.
2.9 Perform calculations and draw the equivalent circuit.

3.0 Conduct O.C. and S.C. tests on 1-phase Transformer and find efficiency at various loads and p.f.s and find the load at which maximum efficiency occurs.

3.1 Draw the required circuit diagram.
3.2 Identify the different terminals of the given 1-ph transformer.
3.3 Interpret the name plate details.
3.4 Select proper supply terminals.
3.5 Select proper range and type of meters.
3.6 Make connections as per circuit diagram.
3.7 Perform the O.C. test by giving required rated voltage and tabulate the readings.
3.8 Perform the S.C. test by giving required reduced voltage and tabulate the readings.
3.9 Follow the Precautions to be taken.
3.10 Perform calculations and draw the efficiency curve and locate the maximum efficiency point.

4.0 Obtain the regulation of 1-phase Transformer by conducting S.C. test

4.1 Draw the required circuit diagram.
4.2 Identify the different terminals of the given 1-ph transformer.
4.3 Interpret the name plate details.
4.4 Select proper supply terminals.
4.5 Select proper range and type of meters.
4.6 Make connections as per circuit diagram.
4.7 Perform the S.C. test by giving required reduced voltage and tabulate the readings.
4.8 Follow the Precautions to be taken.
4.8 Perform calculations.

5.0 Obtain the All-day efficiency of 1-ph Transformer for the given load cycle of 24 hours by conducting O.C.test(for iron loss) and S.C.test(for full load copper loss).
5.1. Draw the required circuit diagram and also note the given load cycle.
5.2. Identify the different terminals of the given 1-ph transformer.
5.3. Interpret the name plate details.
5.4. Select proper supply terminals.
5.5. Select proper range and type of meters.
5.6. Make connections as per circuit diagram.
5.7. Perform the O.C.test by giving required rated voltage and note iron loss.
5.8. Perform the S.C.test by giving required reduced voltage and note full load copper loss.
5.9. Follow the precautions to be taken.
5.10. Calculate the All-day efficiency.

6.0 Obtain the efficiency and regulation of two similar 1-phase transformers by conducting sumpner’s test.
6.1. Draw the required circuit diagram.
6.2. Identify the different terminals of 1-ph transformers.
6.3. Interpret the name plate details.
6.4. Select proper supply.
6.5. Select proper range and type of meters.
6.6. Make connections as per circuit diagram.
6.7. Follow the instructions and perform sumpner’s test by giving required rated voltage on primary side.
6.8. Check for series opposition (back to back) connection on secondary side.
6.9. Give required reduced voltage on secondary side.
6.10. Tabulate observations.
6.10. Follow the precautions to be taken.
6.11. Calculate efficiency and regulation.

7.0 Conduct scott connection( T- connection) on transformers.
7.1. Draw the required circuit diagram.
7.2. Identify main and teaser transformers and their terminals.
7.3. Interpret the name plate details.
7.4. Select proper supply.
7.5. Select proper range and type of meters.
7.6. Make connections as per circuit diagram
7.7. Follow the instructions and give the required 3-ph supply.
7.8. Take readings on both 3-ph and 2-ph side.
7.9. Follow the Precautions to be taken.
7.10. Interpret the readings and verify 3-ph to 2-ph transformation.

8.0 Connect two identical 1-ph transformers in parallel and observe the load sharing.
8.0. Draw the required circuit diagrams (main diagram and diagram for polarity test).
8.1. Identify the different terminals of 1-ph transformers.
8.2. Interpret the name plate details and labelling on transformers.
8.3. Select proper supply.
8.4 Select proper range and type of meters.
8.5 Conduct polarity test and ascertain the relative polarities of secondary windings.
8.6 Make connections as per circuit diagram.
8.7 Follow the instructions and give the required 1-ph supply.
8.8 Increase load gradually and tabulate observations.
8.9 Follow the Precautions to be taken.
8.10 Interpret the readings and the load sharing details.

9.0 Obtain the Dielectric Strength of transformer oil using oil testing kit.
9.1 Get acquaintance with the given oil testing kit.
9.2 Set the distance between electrodes for 1 c.m..
9.3 Pour carefully the required quantity of transformer oil in the oil chamber(cell).
9.4 Increase the voltage gradually up to flash point.
9.5 Note down the reading of the breakdown voltage.
9.6 Repeat the exercise three times (with a gap of 5 minutes each time) and take average to find the Dielectric Strength.

10.0 Conduct (direct) load test on Alternator and obtain voltage regulation.
10.1 Draw the required circuit diagram.
10.2 Identify the different terminals of 3-ph Alternator, exciter and prime mover.
10.3 Interpret the name plate details.
10.4 Select proper supply for prime mover and exciter.
10.5 Select proper range and type of meters.
10.6 Make connections as per circuit diagram.
10.7 Follow the instructions and increase the given load gradually and tabulate the observations.
10.8 Follow the precautions to be taken.
10.9 Calculate regulation at each load.

11.0 Obtain the regulation of Alternator by using synchronous impedance method.
11.1 Draw the required circuit diagram.
11.2 Identify the different terminals of 3-ph Alternator, exciter and prime mover.
11.3 Interpret the name plate details.
11.4 Select proper supply for prime mover and exciter.
11.5 Select proper range and type of meters.
11.6 Make connections for O.C.test.
11.7 Perform O.C.test and take readings.
11.8 Make connections for S.C.test.
11.9 Perform S.C.test and take readings.
11.10 Select proper supply for armature resistance test.
11.11 Make connections for armature resistance test.
11.12 Give required voltage, take readings and obtain armature resistance.
11.13 Calculate synchronous impedance and regulation.
12.0 Synchronise the given Alternator with supply mains by using bright lamp method

12.1 Draw the required circuit diagram.
12.2 Identify the different terminals of 3-ph Alternator, exciter and prime mover.
12.3 Interpret the name plate details.
12.4 Select proper supply for prime mover and exciter.
12.5 Select proper range and type of meters.
12.6 Make connections as per circuit diagram.
12.7 Give supply to prime mover.
12.8 Run the alternator at rated speed.
12.9 Give required field current.
12.10 Synchronise when all the conditions are satisfied.

Key competencies to be achieved by the student

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<tr>
<th>S.N o</th>
<th>Experiment title</th>
<th>Key competency</th>
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<td>1</td>
<td>Conduct load test on 1-phase Transformer and obtain efficiency and regulation.</td>
<td>§ Identify the different terminals of 1-ph transformer.</td>
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<td></td>
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<td>§ Select proper range and type of meters</td>
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<td>§ Make connections as per circuit diagram.</td>
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<tr>
<td></td>
<td></td>
<td>§ Increase the given load gradually and tabulate the observations.</td>
</tr>
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<td></td>
<td></td>
<td>§ Draw the efficiency curve and locate the maximum efficiency point.</td>
</tr>
<tr>
<td>2</td>
<td>Conduct O.C. and S.C. tests on 1-phase Transformer and obtain equivalent circuit.</td>
<td>§ Select proper range and type of meters</td>
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<tr>
<td></td>
<td></td>
<td>§ Make connections as per circuit diagram.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>§ Perform the O.C.test by giving required normal (rated) voltage.</td>
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<td></td>
<td></td>
<td>§ Perform the S.C.test by giving required reduced voltage.</td>
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<tr>
<td></td>
<td></td>
<td>§ Perform calculations and draw the equivalent circuit.</td>
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</tbody>
</table>
| 3 | Conduct O.C. and S.C. tests on 1-phase Transformer and find efficiency at various loads and p.f.s and find the load at which maximum efficiency occurs. | ➤ Make connections as per circuit diagram.  
➤ Perform the O.C.test by giving required normal (rated) voltage .  
➤ Perform the S.C.test by giving required reduced voltage.  
➤ Perform calculations and draw the efficiency curve and locate the maximum efficiency point. |
| 4 | Obtain the regulation of 1-phase Transformer by conducting S.C. test. | ➤ Make connections as per circuit diagram.  
➤ Perform the S.C. test by giving required reduced voltage.  
➤ Perform calculations and obtain regulation. |
| 5 | Obtain the All-day efficiency of 1-ph Transformer for the given load cycle of 24 hours by conducting O.C.test (for iron loss) and S.C.test (for full load copper loss). | ➤ Perform the O.C.test by giving required normal (rated) voltage .  
➤ Perform the S.C.test by giving required reduced voltage.  
➤ Calculate the All-day efficiency. |
| 6 | Obtain the efficiency and regulation of two similar 1-phase transformers by conducting sumner's test. | ➤ Follow the instructions and perform sumner’s test by giving required rated voltage on primary side.  
➤ Check for series opposition (back to back) connection on secondary side.  
➤ Give required reduced voltage on secondary side.  
➤ Calculate efficiency and regulation. |
| 7 | Conduct scott connection( T-connection) on transformers. | ➤ Follow the instructions and give the required 3-ph supply.  
➤ Take readings on both 3-ph and 2-ph side.  
➤ Interpret the readings and verify 3-ph to 2-ph transformation. |
<table>
<thead>
<tr>
<th></th>
<th>Connect two identical 1-ph transformers in parallel and observe the load sharing.</th>
<th>Draw the required circuit diagrams (main diagram and diagram for polarity test).&lt;br&gt;Interpret the name plate details and labelling on transformers.&lt;br&gt;Conduct polarity test and ascertain the relative polarities of secondary windings.&lt;br&gt;Increase load gradually and tabulate observations.&lt;br&gt;Interpret the readings and the load sharing details.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Obtain the Dielectric Strength of transformer oil using oil testing kit</td>
<td>Pour carefully the required quantity of transformer oil in the oil chamber.&lt;br&gt;Increase voltage gradually up to flash point.&lt;br&gt;Note down the reading of the breakdown voltage.</td>
</tr>
<tr>
<td>10</td>
<td>Conduct (direct) load test on Alternator and obtain voltage regulation.</td>
<td>Identify the different terminals of 3-ph Alternator, exciter and prime mover.&lt;br&gt;Select proper supply for prime mover and exciter.&lt;br&gt;Follow the instructions and increase the given load gradually and tabulate the observations.&lt;br&gt;Calculate regulation at each load.</td>
</tr>
<tr>
<td>11</td>
<td>Obtain the regulation of Alternator by using synchronous impedance method.</td>
<td>Select proper supply for prime mover and exciter.&lt;br&gt;Perform O.C.test and take readings.&lt;br&gt;Perform S.C.test and take readings.&lt;br&gt;Give required voltage, take readings and obtain armature resistance.</td>
</tr>
<tr>
<td>12</td>
<td>Synchronise the given Alternator with supply mains by using bright lamp method.</td>
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<td>--------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td></td>
<td>▪ Calculate synchronous impedance and regulation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Select proper supply for prime mover and exciter.</td>
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</tr>
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<td>▪ Make connections as per circuit diagram.</td>
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<td>▪ Run the alternator at rated speed.</td>
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<td>▪ Give required field current.</td>
<td></td>
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<tr>
<td></td>
<td>▪ Synchronise when all the conditions are satisfied.</td>
<td></td>
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</tbody>
</table>

**COURSE CONTENT**

1. **Performance of single phase transformers:**

2. **Sumpner's test and Scott connection:**
   Obtaining the efficiency and regulation of two similar 1-phase transformers by conducting sumpner's test - scott connection (T-connection) on transformers.

3. **Parallel operation of transformers and oil testing kit:**
   Connection of two 1-ph transformers in parallel and observing the load sharing-
   Testing the dielectric strength of transformer oil using oil testing kit.

4. **Alternators:**
   Load test on Alternator – obtaining the regulation of alternator by using synchronous impedance method – Synchronisation of the given Alternator with supply mains by using bright lamp method.

5. **Industrial visits:**
   Connections of 3-ph power transformers and their parallel operation in a 33/11 KV substation-functions of various equipment in the nearby Generating station- manufacturing and/or functioning of any nearby Solar installation.
ELECTRONICS –II LABORATORY PRACTICE

Subject Title : Electronics – II Laboratory Practice
Subject Code : EE-410
Periods/Week : 03
Periods/Semester : 45

TIME SCHEDULE

<table>
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<tr>
<th>S. No.</th>
<th>Major Topics</th>
<th>No. of Periods</th>
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<td>1.</td>
<td>RC coupled Amplifier Characteristics</td>
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<td>2.</td>
<td>Oscillators Characteristics</td>
<td>9</td>
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<tr>
<td>3.</td>
<td>Photo Electric Devices</td>
<td>9</td>
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<tr>
<td>4.</td>
<td>555 IC</td>
<td>15</td>
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<td>Total</td>
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</table>

COURSE CONTENT

1.0 OBTAIN THE CHARACTERSTICS OF A RC COUPLED AMPLIFIER
1.1 Plot the frequency response characteristics of a RC coupled Amplifier.
1.2 Calculate the gain, f1, f2 and band width from the response.
1.3 Observe the effect of connecting and disconnecting the emitter bypass capacitor on gain, and distortion.
1.4 Measure the voltage across Emitter Resistance using CRO, with and without emitter bypass capacitor Ce.
1.5 Measuring the output power using AC power meter

2.0 OBTAIN THE CHARACTERSTICS OF THE OSCILLATORS
2.1 To observe the output of a tuned circuit oscillator and identify the type from the components in the circuit
   a) Colpitt’s oscillator  b) Hartley oscillator
2.2 2.2 Observe the effect of varying the core of inductor
2.3 Observe the effect of using a crystal in the oscillator circuit

3.0 OBTAIN THE CHARACTERSTICS OF THE PHOTO ELECTRIC DEVICES
3.1 To plot the characteristics of a Photo diode.
3.2 To plot the characteristics of a Photo transistor
3.3 To plot the characteristics of a LDR.

4.0 FAMILIARIZE TO WORK WITH 555 IC.
4.1 To Implement Monostable multi vibrator
4.2 To Implement Astable multivibrator

OBJECTIVES:
Upon completion of the Practice, the student shall be able to
1.0 OBTAIN THE CHARACTERSTICS OF A RC COUPLED AMPLIFIER
1.1 Assembling the circuit as per the circuit diagram
1.2. Identifying the coupling and bypass capacitors (types, values)
1.3. Observing the 3db points
1.4. Observing the distortion (clipping) of signal on CRO and adjusting the input for distortionless output
1.5. Plot the output characteristics on semi log graph sheet and also on normal graph sheet.
1.6. Calculating the gain in db

2.0 OBTAIN THE CHARACTERSTICS OF THE OSCILLATORS
2.1 To observe the output of a tuned circuit oscillator and identify the type from the components in the circuit
   a) Colpitt’s oscillator  b) Hartley oscillator
2.2 Observe the effect of varying the core of inductor
2.3 Observe the effect of using a crystal in the oscillator circuit

3.0 OBTAIN THE CHARACTERSTICS OF THE PHOTO ELECTRIC DEVICES
3.1 To plot the characteristics of a Photo diode.
3.2 To plot the characteristics of a Photo transistor
3.3 To plot the characteristics of a LDR.

4.0 FAMILIARIZE TO WORK WITH 555 IC.
4.1 Familiarize with 555 pin configuration
4.2 Performing the experiment as per procedure’s
4.3 Observing wave forms on CRO.
4.4 Observing the effect of changing R, C component Values
4.5 Observe wave forms at Pins 2, 3 and 5
4.6 Observe the effect of applying a voltage to pin 5
4.7 Observe the effect of connecting pin 4 to ground.

**Key competencies to be achieved by the student**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Experiment title</th>
<th>Key competency</th>
</tr>
</thead>
</table>
| 1    | **Obtain the characteristics of a RC coupled amplifier** | 1. Assembling the circuit as per the circuit diagram  
2. Identifying the coupling and bypass capacitors (types, values)  
3. Observing the 3db points  
4. Observing the distortion (clipping) of signal on CRO and adjusting the input for distortionless output  
5. Plot the output characteristics on semi log graph sheet and also on normal graph sheet.  
6. Calculating the gain in db |
| 2    | **Obtain the characteristics of the Oscillators**     | 1. Observe the effect of varying the core of inductor  
2. Observe the effect of using a crystal in the oscillator circuit |
| 3    | **Obtain The Characteristics Of The Photo Electric Devices** | 1. To plot the characteristics of a Photo transistor  
2. To plot the characteristics of a LDR. |
| 4    | **Familiarize to work with 555 IC**                  | Draw Inference from the Observed waveforms b) use 555 for Square wave Oscillator/Clock and Voltage controlled Oscillator applications |

**REFERENCES**

2. Basic Electronics and Linear circuits by Bhargava, TMH Publishers
3. Electronic Principle by Malvino
4. Electronic devices and circuits by Mathur, Chada & Kulashrestha
5. Industrial Electronics by G.K. Mithal
6. Applied Electronics by G.K. Mithal
# DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING
## SCHEME OF INSTRUCTIONS AND EXAMINATIONS
### VI Semester

<table>
<thead>
<tr>
<th>Subject Code</th>
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<td>Industrial Automation</td>
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### PRACTICAL:

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<tr>
<td>EE-608</td>
<td>Digital Electronics &amp; Micro Controller Laboratory Practice</td>
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<tr>
<td>EE-609</td>
<td>Power Electronics &amp; PLC Laboratory Practice</td>
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| TOTAL | 24 | 18 | 630 | 280 | 720 | 1000 |

**INDUSTRIAL MANAGEMENT**

I-102
Subject Title : INDUSTRIAL MANAGEMENT
Subject Code : EE-601
Periods/Week : 04
Periods/semester : 60

TIME SCHEDULE

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<tr>
<th>Sl. No.</th>
<th>Major Topics</th>
<th>Periods</th>
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<td>Overview Of Business</td>
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OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Explain the basics of Business
1.1 Define Business
1.2 State the Types of Business (Service, Manufacturing, Trade)
1.3 Explain the business procedures in Engineering sector (Process industry, Textile industry, Chemical industry, Agro industry,)
1.4 State the need of Globalization.
1.5 List the Advantages & Disadvantages of globalization w.r.t. India.
1.6 Explain the importance of Intellectual Property Rights (I.P.R.)

2.0 Explain the Management Process:
2.1 Define Management.
2.2 Explain the concept of management
2.3 Explain the Different Levels of management
2.4 Explain Administration & management
2.5 State the principles of Scientific management by F.W.Taylor
2.6 State the principles of Management by Henry Fayol (14 principles)
2.7 List the Functions of Management
   a) Planning
   b) Organizing
2.8 Explain the four Functions of Management.
3.0 **Appreciate the need for Organizational Management**
3.1 Define Organization
3.2 List the Types of organization : a) Line b) Line & staff c) Functional d) Project
3.3 Explain the four types of organization.
3.4 Define departmentation.
3.5 Explain the following types of departmentations
   a) Centralized & Decentralized
   b) Authority & Responsibility
   c) Span of Control
3.6 Explain the Forms of ownership
   a) Proprietorship
   b) Partnership
   c) Joint stock
   d) Co-operative Society
   e) Govt. Sector

4.0 **Appreciate the need for Human Resource Management**
4.1 Define Personal Management.
4.2 Explain the functions of Personal Management
4.3 Define Staffing .
4.4 State the importance of HR Planning.
4.5 Explain the various Recruitment Procedures.
4.6 Explain the need for Training & Development .
4.7 State the various types of training procedures (Induction, Skill Enhancement etc)
4.8 State the different types of Leaderships,
4.9 Explain the Maslow’s Theory of Motivation
4.10 Explain the Causes of accident and the Safety precautions to be followed.
4.11 Explain the importance of various Acts – Factory Act, ESI Act, Workmen Compensation Act, Industrial Dispute Act etc.

5.0 **Explain the basics of Financial Management**
5.1 State the Objectives of Financial Management.
5.2 State the Functions of Financial Management.
5.3. State the necessity of Capital Generation & Management.
5.4 List the types of Capitals.
5.5 List the Sources of raising Capital.
5.6 Explain the Types of Budgets
   a) Production Budget (including Variance Report )
   b) Labour Budget.
5.7 Describe Profit & Loss Account (only concepts).
5.8 Describe the proforma of Balance Sheet.
5.4 Explain Excise Tax, Service Tax, Income Tax, VAT, Custom Duty.

6.0 **Explain the importance of Materials Management**
6.1 Define Inventory Management (No Numerical).
6.2 State the objectives of Inventory Management.
6.3 Explain ABC Analysis.
6.4 State Economic Order Quantity.
6.5 Describe the Graphical Representation of Economic Order Quantity.
6.6 State the objectives of Purchasing.
6.7 State the functions of Purchase Department.
6.8 Explain the steps involved in Purchasing.
6.9 State the Modern Techniques of Material Management.
6.10 Describe the JIT / SAP / ERP packages.

7.0 **Explain the importance of Project Management**
7.1 State the meaning of Project Management.
7.2 Describe the CPM & PERT Techniques of Project Management.
7.3 Identify the critical path and find the project duration.
7.4 Explain the concept of Break Even Analysis
7.5 Define Quality.
7.6 State the concept of Quality.
7.7 Describe the various Quality Management systems.
7.8 Explain the importance of Quality policy, Quality control, Quality Circle.
7.9 State the principles of Quality Assurance.
7.10 State the concepts of TQM, Kaizen 5’s and 6 sigma.
7.11 State the constituents of ISO 9000 series standards.

**Course contents :**

1.0 **Overview of Business:**
   Business - types of business in various sectors- service, manufacturing & trade-
   Industrial sectors – Engineering, process, Textile, Chemical, Agro industries –
   Globalization and effect of globalization – advantages and Disadvantages-
   Intellectual Property Rights (I.P.R.)

2.0 **Management process**
   Concept of management – levels of management – Scientific management – by
   FW Taylor – Principles of management- functions of management –
   Administration – management.

3.0 **Organization management**
   Organization – types of organization( line, line & staff, staff & project) –
   Departmentation – Classification (centralized, decentralized, Authority,
   Responsibility, and span of control – Forms of Ownership – Proprietorship –

4.0 **Human resource Management**
   Personal Management – Staffing – Introduction to HR planning – Recruitment
   procedures – Types of Trainings –Personal training – skill development training –
   Leaderships – types – Motivation – Maslows theory – Causes of accidents –
   safety precautions – Factory Act – Workmen compensation Act – Industrial
   disputes Act- ESI Act.

5.0 **Finance Management**
   of raising capital – Types of budgets – production budgets – labour budgets –

6.0 Material Management

7.0 Project Management
Introduction – CPM & PERT – concept of Break event Analysis – quality system - Definition of Quality , concept of Quality , Quality policy, Quality control, Quality Circle, Quality Assurance, Introduction to TQM- Kaizen 5’s and 6 sigma concepts, ISO 9000 series standards.

Text Books:
Industrial Engg & Management by Dr. O.P. Khanna :Dhanpath Rai & sons New Delhi
Business Administration & Management by Dr. S.C. Saxena & W.H. Newman & E.Kirby Warren
Sahitya Bhavan Agra
The process of Management by Andrew R. McGill
Prentice- Hall
Industrial Management by Rustom S. Davar
Khanna Publication
Industrial Organization & Management by Banga & Sharma
Khanna Publication
Industrial Management by Jhamb & Bokil
Everest Publication, Pune.
ELECTRIC TRACTION

Subject Title : ELECTRIC TRACTION
Subject Code : EE-602
Periods/Week : 04
Periods/semester : 60

TIME SCHEDULE

<table>
<thead>
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<th>Sl. No.</th>
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<th>Weightage of marks</th>
<th>Short questions</th>
<th>Essay questions</th>
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<td>Electric Traction - Properties</td>
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<td>42</td>
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<td>Traction system Equipment</td>
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<td>42</td>
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<td>Constituents of Supply systems in traction</td>
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</table>

OBJECTIVES
On completion of the course the student shall be able to

1.0 Explain the Properties of Electric Traction
1.1 Describe single-phase A.C. and Composite systems
1.2 List the types of services (main line, suburban, Metro and urban). Sketch the speed-time curves for the above services
1.3 State each stage of the speed-time curve with appropriate speeds.
1.4 State the importance of speed-time curves
1.5 Define Maximum speed, average speed and scheduled speed
1.6 List the factors affecting the scheduled speed
1.7 Sketch the simplified speed-time curves
1.8 Explain the practical importance of the above curves
1.9 Derive the expression for maximum speed, acceleration and retardation for Trapezoidal & Quadrilateral speed time curves.
1.10 Solve numerical examples on above speed time curves
1.11 Explain the tractive effort
1.12 Derive the expression for tractive effort for acceleration to overcome gravity pull and train resistance
1.13 Calculate the tractive effort under given conditions
1.14 Explain the mechanics of transfer of power from motor to driving wheel
1.15 Define `Coefficient of adhesion'
1.16 List the factors affecting the coefficient of adhesion
1.17 Solve problems on calculation of number of axels required.
1.18 State the methods of improving the coefficient of adhesion
1.19 Explain the term specific energy consumption
1.20 Derive the formulae for energy output of drive to
   i) Accelerate
   ii) To overcome friction
   iii) To overcome gradient
1.21 List the factors affecting specific energy consumption
1.22 Solve simple problems on specific energy calculation under given conditions.

2.0 Explain the function of the various Traction system Equipment
2.1 List the various Overhead Equipments (OHE).
2.2 State the Principles of Design of OHE like
   a) Composition of OHE.
   b) Height of Contact Wire.
   c) Contact Wire Gradient.
   d) Encumbrances.
   e) Span Length.
2.3 Explain Automatic Weight Tension and Temp. compensation.
2.4 Distinguish between Un insulated Overlaps and Insulated Overlaps
2.5 State the importance of Neutral Section.
2.6 State the importance of Section Insulator.
2.7 State the importance of an Isolator.
2.8 Describe the Polygonal OHE:
   a) Single Catenary Construction.
   b) Compound Catenary Construction.
   c) Switched Catenary Construction.
   d) Modified Y Compound Catenary.
2.9 State the effect of Speed on OHE.
2.10 Describe the need for OHE Supporting Structure.
2.11 List the different types of signal boards of OHE.
2.12 Describe the OHE Maintenance Schedule. (No Derivation and No Numerical)
2.13 State the important requirements of traction motor
2.14 Explain the suitability of different motors D.C, 1-φ A.C, 3-φ A.C., Composite & Kando systems for traction
2.15 Explain with neat sketch the control of traction motor by autotransformer method in single phase 25 kv system
2.16 Explain the purpose and material used for
   a) Catenary
   b) droppers
   c) trolley wires
   d) bow collector
   e) pantograph collector
2.17 State the need for Booster Transformer.

3.0 Explain the Constituents of Supply systems in traction
3.1 List the various constituents of Supply systems in traction Substations.
3.2 Describe the various constituents of Supply systems
   a) Feeding Posts.
   b) Feeding and Sectioning Arrangements.
   c) Sectioning and Paralleling Post.
   d) Sub sectioning and Paralleling Post.
   e) Sub sectioning Post.
   f) Elementary Section.
   g) Miscellaneous Equipments at Control Post or Switching Stations.
3.3 Describe the Major Equipment at traction Substation.
   a) Transformer.
   b) Circuit Breaker.
   c) Interrupter.
3.5 Describe the Protective System for AC Traction – Transformer Protection and 25 KV Centenary Protection.
3.6 Explain the importance of Location and Spacing of Substations.

Course contents

1. Electric Traction properties
   Single-phase A.C. and Composite systems - Types of services (main line, suburban, Metro and urban) - speed-time curves for the above services - importance of speed-time curves - Maximum speed, average speed and scheduled speed - Factors affecting the scheduled speed - Simplified speed-time curves & practical importance - Expression for maximum speed, acceleration and retardation for Trapezoidal & Quadrilateral speed time curves - numerical examples - tractive effort & derivation - Coefficient of adhesion - factors affecting the coefficient of adhesion - problems on calculation of number of axels required - methods of improving the coefficient of adhesion - specific energy consumption - factors affecting specific energy consumption - simple problems on specific energy calculation under given conditions.

2.0 Traction system Equipment
3.0 Constituents of Supply systems in traction


REFERENCE BOOKS

2. Electrical Motors applications and control by M.V.Deshpande
4. Electrical power by S.L.Uppal
5. Electrical power by J.B.Gupta
POWER SYSTEMS –III

Subject Title : POWER SYSTEMS-III (SWITCHGEAR AND PROTECTION)
Subject Code : EE – 603
Periods / Week : 04
Periods /Semester : 60

TIME SCHEDULE

<table>
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<th>Short questions</th>
<th>Essay questions</th>
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<td>1.</td>
<td>Switch Gear and Circuit Breakers</td>
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<td>16</td>
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<td>Fuses and Reactors</td>
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<td>Protective Relays</td>
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<td>21</td>
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<td>Protection of Alternators and Transformers</td>
<td>12</td>
<td>23</td>
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<td>Protection of Transmission Lines and feeders</td>
<td>11</td>
<td>21</td>
<td>2</td>
<td>1 ½</td>
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<td>6.</td>
<td>Lighting Arrestors and Neutral Grounding</td>
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<td>16</td>
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OBJECTIVES

On completion of the course the student shall be able to

1.0 Switch Gear and Circuit Breakers.
1.1 State the types of faults in power system and their effects.
1.2 Define switch gear and classify.
1.3 State the purpose of isolators, air break switches and knife switches.
1.4 State the classification of above switches, their uses and limitations.
1.5 Explain the phenomenon of arc, arc voltage, arc current and its effects.
1.6 State factors responsible for arc and methods of arc quenching.
1.7 Classify the circuit breakers based upon medium of arc quenching.
1.8 Describe the principle of B.O.C.B and its types.
1.9 Describe the working of each type of B.O.C.B.
1.10 Comprehend the principle of M.O.C.B and its working.
1.11 Compare B.O.C.B and M.O.C.B and understand their maintenance.
1.12 Explain properties of SF₆ gas and principle of SF₆ circuit breakers.
1.13 Explain the working of SF₆ CB.
1.14 Explain the principle and working of A.B.C.B.
1.15 Compare OCB, SF₆CB and A.B.C.B.

2.0 Fuses and Reactors
2.1 Comprehend fuse as protective device
2.2 List the various types of fuses.
2.3 Define the terms related to fuses i.e., Rated current, Fusing current, Fusing factor. Mention different fuse materials.
2.4 State the importance of current limiting reactors.
2.5 Comprehend the types of reactors and their construction.
2.6 Draw the scheme of reactor connections and compare them.
2.7 Understand the importance of short circuit KVA and Solve simple problems

3.0 Protective Relays.
3.1 State the basic requirements of relays.
3.2 State the important activities in relays.
3.3 Classify the relays based upon duty
   i) Principle of Operation  ii) Time of operation.
3.4 Explain the working of thermal relay, its uses, merits and demerits.
3.5 Describe the working of solenoid plunger and attracted armature relays – List their uses.
3.6 Describe the construction and working of induction type over current relay.
3.7 Describe the current setting, time setting and application of above relay.
3.8 Explain the principle of obtaining directional property in induction relays.
3.9 Describe the working of directional over current induction relay and mention its applications.
3.10 Explain the principle, construction, working and applications of impedance relay.
3.11 Explain distance relay and its uses.
3.12 Describe differential protection and its two types.

4.0 Protection of Alternator, Transformer.
4.1 List the probable faults in Alternator Stator and rotor and mention their bad effects.
4.2 Describe the scheme of protection against excessive heating of stator and rotor. Mention the causes of it.
4.3 Explain the differential protection for alternator stator.
4.4 Explain the earth fault protection for rotor.
4.5 Explain the split phase protection of alternator against inter-turn short circuits.
4.6 Explain the need and working of field suppression protection.
4.7 List the possible faults and their types in a transformer – Explain their bad effect.
4.8 List the precautions to be taken for applying differential protection to transformers.
4.9 Explain differential protection of transformer.
4.10 Explain Buchholz relay and its protection scheme for transformer.

5.0 Protection of Transmission Lines and feeders

I-112
5.1 Explain the different schemes of protection for single and duplicate bus bars.
5.2 Describe the transmission line protection and feeder protection.
5.3 Explain pilot wires and their effects.
5.4 Explain the protection of transmission lines using distance and impedance relays.
5.5 Explain the combined protection by using definite distance and time distance relays.
5.6 Explain protection of radial feeders using time graded fuses.
5.7 Explain protection of parallel feeders using directional relays.
5.8 Explain protection of ring main feeder using directional relays. Mention the relation between number of sections and minimum relay time.
5.9 Explain differential protection for parallel feeders of transmission lines.

6.0 Lightning Arrestors and Neutral Grounding.
   6.1 Define surge, its types, and causes for production.
   6.2 Explain the scheme of surge protection with diagram.
   6.3 Explain the types of lightning arrestors or surge diverters.
   6.4 Explain the construction, working and applications of following types of lightning arrestors.
      i) Rod gap ii) Sphere gap iii) Horn gap iv) Valve type v) Thyrite type
      iv) Lead oxide.
   6.5 Explain the necessity of neutral grounding and give its merits and demerits.
   6.6 Describe the different types of grounding the neutral and compare them.

COURSE CONTENT

1. Switch Gear and Circuit Breakers

2. Fuses and Reactors
   Fuse as protective device and different types of fuses based on rated current, fusing current, fusing factor – Current limiting reactors and their necessity. Types of reactors and their construction – Equation for short circuit KVA and solve problems.

3. Protective Relays.
   Requirements, activities of relays – Classifications based on duty, principle of operation and time of operation – Thermal, Solenoid plunger and attracted armature relays – Their uses
merits and demerits. Construction and working of induction type over current type relays – Directional Over current relay Principle, construction working of impedance, distance relay.

4. Protection of Alternators, Transformer


5. Protection of Transmission Lines and Feeders,


6. Lightning Arrestors and Neutral grounding

Need for Surge Protection and its methods – Various types of LA’s, Horn gap – Sphere Gap – Valve type, Thyrite type and Lead Oxide type, Necessity of neutral grounding, Its merits and demerits- Methods of Grounding the neutral.

Reference Books

1. Principle of Power systems - V.K. Mehta
2. Electrical power - S.L. Uppal
4. Electrical Power - JB Gupta
5. Electrical power Systems - CL Wadhwa
POWER ELECTRONICS

Subject Title : Power Electronics
Subject Code  : EE-604
Periods/Week  : 04
Periods/Semester : 60

TIME SCHEDULE

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<th>Weightage of marks</th>
<th>Short questions</th>
<th>Essay questions</th>
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<tr>
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<td>Power Electronic Devices</td>
<td>20</td>
<td>39</td>
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<td>Converters, AC Regulators &amp; Choppers</td>
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<td>26</td>
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<td>3</td>
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<td>Speed control of AC / DC Motors</td>
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OBJECTIVES

Upon completion of the course the student shall be able to

1.0 Understand the construction and working of Power Electronic Devices
   1.1 List different thyristor family devices.
   1.2 Sketch the ISI circuit symbols for each device.
   1.3 Describe constructional details & two transistor analysis of SCR.
   1.4 Draw & Explain the Volt – Ampere characteristics of SCR.
   1.5 Draw the Gate characteristics of SCR
   1.6 Mention the ratings of SCR.
   1.7 Explain the construction of GTO SCR
   1.8 Compare the characteristics of GTO SCR and SCR.
   1.9 Draw & Explain the Volt-ampere characteristics of Diac & Triac under forward / Reverse bias.
   1.10 State the different modes of Triac triggering.
   1.11 Distinguish between SUS, SBS, SCS & LASCR
   1.12 Draw & Explain SCR circuit triggered by UJT.
   1.13 Explain power control circuits Diacs, Triacs & SCR’s.
   1.14 Briefly explain the working of Reverse conducting thyristor (RCT), Asymmetrical SCR (ASCR), Power BJT, Insulated gate Bipolar transistor (IGBT), MOS-controlled thyristors (MCT) with characteristics.
1.15 Necessity of Commutation in SCR’s & Explain various methods of Commutation.
1.16 Describe the mechanism in protecting power devices.
1.17 Study of Manufacturer’s data sheet of power electronic devices.

2.0 Understand the working of converters AC regulators and Choppers.
2.1 Classify converters.
2.2 Explain the working of single-phase half wave fully controlled converter with Resistive and R-L loads.
2.3 Understand need of freewheeling diode.
2.4 Explain the working of single phase fully controlled converter with resistive and R-L loads.
2.5 Explain the working of three-phase half wave controlled converter with Resistive load.
2.6 Explain the working of three phase fully controlled converter with resistive load.
2.7 Explain the working of single phase AC regulator.
2.8 Explain the working principle of chopper.
2.9 Describe the control modes of chopper.
2.10 Explain the operation of chopper in all four quadrants.

3.0 Understand the Inverters and Cyclo-converters
3.1 Classify inverters.
3.2 Explain the working of series inverter.
3.3 Explain the working of parallel inverter.
3.4 Explain the working of single-phase bridge inverter.
3.5 Explain the working of three-phase inverter.
3.6 Explain the basic principle of Cyclo-converter.
3.7 Explain the working of single-phase centre tapped Cyclo-converter.
3.8 Applications of Cyclo-converter.

4.0 Understand speed control of DC / AC Motors
4.1 Mention the factors affecting the speed of DC Motors.
4.2 Describe speed control for DC Shunt motor using converter.
4.3 Describe speed control for DC Shunt motor using chopper.
4.4 List the factors affecting speed of the AC Motors.
4.5 Explain the speed control of Induction Motor by using AC voltage regulator.
4.6 Explain the speed control of induction motor by using converters and inverters (V/F control)

5.0 Understand the Applications of power electronic circuits
5.1 Draw and explain the Light dimmer circuit using DIAC and TRIAC.
5.2 Draw and explain the Burglar alarm circuit using SCR.
5.3 Draw and explain the Emergency lamp circuit using SCR.
5.4 Draw and explain the Battery charger circuit using SCR.
COURSE CONTENTS

1. **Power Electronic Devices**
   Types of power semiconductor devices – SCR, Triac, Power BJT, IGBT
   Construction, Working principle of all devices, symbol. Two transistor analogy for SCR – V-I & Gate characteristics, Forward break over voltage, latching current, holding current, turn on triggering time, turn off time - triggering of SCR using UJT - Necessity of Commutation- various methods of Commutation- protection of power devices.

2. **Converters AC Regulators & Choppers**
   Classification of converters, single phase half wave fully controlled converter, freewheeling diode, single phase fully controlled converter, three phase half wave, three phase full wave controlled converter, single phase ac regulator, choppers- modes of operation.

3. **Inverters&Cyclo-converters**

4. **Speed Control of DC/AC Motors**
   DC Motor control- Introduction-Speed control of DC shunt Motor by using converters and choppers
   AC Motor Controls: speed control of induction Motor by using AC voltage controllers - V/F control (Converters and invertors control).

5. **Application of Power Electronic Circuits**
   Light dimmer Circuit- Burglar alarm Circuit- Emergency lamp and Battery charger Circuit using SCR- Advantages of the above circuits.

**TEXT BOOKS**

2. Power Electronics – Devices, Circuits and applications PHI, New Delhi

**REFERENCES**

1. Industrial Electronics by Chute
2. Industrial Electronics by Mithal
4. Industrial Electronics by Berde
MICRO CONTROLLERS & APPLICATIONS

Subject title : Micro controllers & Applications
Subject code : EE- 605
Periods/week : 04
Periods/semester : 60

TIME SCHEDULE

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<th>No. of Periods</th>
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<th>Short Answer Questions</th>
<th>Essay Questions</th>
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<td>Micro processors &amp; Micro controllers</td>
<td>14</td>
<td>19</td>
<td>3</td>
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<tr>
<td>2</td>
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<td>19</td>
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OBJECTIVES
Upon completion of the course the student shall be able to

1.0 Differentiate between Micro processors & Micro controllers
1.1 Define the terms used in Micro processor literature.
1.2 Describe the Evolution of Micro processor.
1.3 Explain the basic fundamental blocks of Micro processor.
1.4 Explain the Micro processor-based system.
1.5 Distinguish between Micro, Mini and Large computers.
1.6 Describe the features of Intel 8085.
1.7 Explain the concept of Peripheral interfacing.
1.8 Draw the functional block diagram, interface with 8085 and write Command word of 8255, 8279 & 8237.
1.9 State RS-232 standards.
1.10 Explain the concept of Micro controllers.
1.11 Compare Embedded with External memory devices.
1.12 Differentiate between CISC and RISC processors.
1.13 Differentiate between Harvard and Von Neumann architectures.
1.14 List the three commonly used Commercial Microcontroller Device families.

2.0 Appreciate the Architecture of 8051
2.1 Draw the block diagram of a microcontroller and explain the function of each block.
2.2 Explain the features of micro controllers.
2.3 Draw the functional block diagram of 8051 microcontroller
2.4 Describe the register structure of 8051.
2.5 Explain the functions of various special function registers.
2.6 Draw the pin diagram of 8051 microcontroller and specify the purpose of each pin.
2.7 Describe internal memory, external memory and ports of 8051.
2.8 Describe counters & timers in 8051
2.9 Explain serial input/output of 8051
2.10 Explain interrupts in 8051.
2.11 Describe the four timer modes in 8051.

3.0 **Explain the Instruction set and Addressing modes of 8051**
3.1 State the need for an instruction set.
3.2 Describe the instruction format of 8051.
3.3 Explain fetch cycle, execution cycle and instruction cycle.
3.4 Distinguish between machine cycle and T-state.
3.5 Draw the timing diagram for memory write, memory read operations of 8051.
3.6 Define the terms machine language, assembly language, and mnemonics.
3.7 Give the difference between machine level and assembly level programming.
3.8 List the major groups in the instruction set along with examples.
3.9 Explain the terms operation code, operand and illustrate these terms by writing an instruction.
3.10 Explain the data manipulation functions data transfer, arithmetic, logic and branching.
3.11 Classify the 8051 instructions into one byte, two byte and three byte instructions.
3.12 Describe the five addressing modes of 8051.
3.13 Explain data transfer instructions of 8051.
3.14 Explain the arithmetic instructions and recognize the flags that are set or reset for given data conditions.
3.15 Explain the logic instructions and recognize the flags that are set or reset for given data conditions.
3.16 Illustrate the logic operations and explain their use in making, setting and resetting of individual bits.
3.17 Explain unconditional and conditional jump and how flags are used to change the sequence of program.

4.0 **Appreciate the Programming concepts of 8051**
4.1 List the various symbols used in drawing flow charts.
4.2 Draw flow charts for some simple problems.
4.3 Write programs in mnemonics to illustrate the application of data copy instructions and translate these mnemonics into hex codes.
4.4 Write programs of instructions to perform single byte, double byte and multi byte addition and subtraction.
4.5 Illustrate the application of jump instruction in the program.
4.6 Write a program using counter techniques.
4.7 Define a subroutine and explain its use.
4.8 Explain the sequence of program when subroutine is called and executed.
4.9 Explain how information is exchanged between the program counter and the stack and identify the stack pointer register when a subroutine is called.
4.10 Write program to perform Single byte & Multi byte addition.
4.11 Write program to sum up given ‘N’ numbers.
4.12 Write program to sum up given 1st ‘N’ natural numbers.
4.13 Write program to multiply two 8-bit numbers using ‘MUL’ instruction.
4.14 Write program to find biggest data value in given Data array.
4.15 Write program to convert a given ‘HEX’ number to ‘BCD’ number.

5.0 Appreciate the applications of 8051.
5.1 Explain the working of 8051 Microcontroller in Traffic light controller.
5.2 Explain the working of 8051 Microcontroller in Clock program using the kit.
5.3 Explain the working of 8051 Microcontroller as Dot matrix display interface.
5.4 Explain the working of 8051 Microcontroller as Printer interface.
5.5 Explain the working of 8051 Microcontroller in Stepper motor control.
5.6 Explain the working of 8051 Microcontroller as Keyboard interface.
5.7 Explain the working of 8051 Microcontroller as a Seven segment display interface.

COURSE CONTENTS

1.0 Micro processors & Micro controllers:
Terms used, History, interfacing, commercially used microcontrollers.

2.0 Architecture of 8051:
Block diagram of microcomputer, Block diagram of 8051, Pin out diagram of 8051, registers, timers, interrupts, modes of operation.

3.0 Instruction set and Addressing modes of 8051:
Instruction set of 8051, instruction format, fetch cycle, execution cycle, instruction cycle, machine cycle, timing diagrams, machine language, assembly language, classification of instructions, addressing modes - Groups of instructions, Opcode, operand.

4.0 Programming concepts of 8051:
Flow charts, Data transfer, subroutines, single and multi byte addition and subtraction, multiplication, conversion

5.0 Applications of 8051:
Traffic lights, clock program, dot matrix display interface, printer interface, stepper motor control, keyboard interface, seven-segment display interface.

TEXT BOOKS:

1. 8051 Micro controller by Mazidi and Mazidi.
2. 8051 Micro controller by Kenneth J.Ayala.
3. Programming customizing the 8051 Microcontroller by Myke Predko TMH

5. Micro Processors by Ramesh S Gaonkar

REFERENCE BOOKS:

1. Intel Microprocessors by Barry Brey, Prentice-Hall.
2. 0000 to 8085: Introduction to microprocessors for engineers and scientists by by Ghosh & Sridhar, Prentice-Hall.
3. Microcontrollers (Theory and applications)                        Ajay V Deshmukh- TMH
INDUSTRIAL AUTOMATION

Subject Title :  INDUSTRIAL AUTOMATION
Subject code  :  EE-606
Periods/Week  :  04
Periods/Semester :  60

TIME SCHEDULE

<table>
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<tr>
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<td>1.</td>
<td>Basic Concepts of Control Systems</td>
<td>10</td>
<td>21</td>
<td>02</td>
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<td>2.</td>
<td>Components of control systems</td>
<td>08</td>
<td>13</td>
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<td>Electrical Actuators and Controllers</td>
<td>12</td>
<td>26</td>
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<td>4.</td>
<td>Block Diagram Reduction Techniques</td>
<td>10</td>
<td>16</td>
<td>02</td>
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<td>Control Procedures in Control systems</td>
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<td>08</td>
<td>01</td>
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<td>6.</td>
<td>PLC and its applications</td>
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OBJECTIVES

Upon completion of the course the student shall be able to

3.0 Basic Concepts of Control Systems
1.1 Explain the importance of control engineering in day to day life and industry
1.2 State the concept of control systems like Automobile control system, Speed control of AC/DC motor, Water level Controller.
1.3 Define the following terms using the above ideas
   (i) Input of a control system
   (ii) Output of a Control system
   (iii) Control Elements
1.4 Explain the Open loop and Closed loop control systems with examples like water level controller, Temperature Controller etc
1.5 Describe how the temperature of a room is controlled with setup
1.6 State the need for feedback in a control system
1.7 Understand concepts of types of feedback
1.8 Draw a generalized block diagram of a feed back control system and give the terminology
1.9 Define transfer function and derive it
1.10 State the equivalence of physical system components into electrical system elements

4.0 Components of control systems

2.1 Explain the contact types (Normally open and Normally closed)
2.2 Describe AC and DC Solenoids
2.3 Explain the different Input devices-Push button, Selector switch, Photo electric, Level Control, Pressure sensing device
2.4 Explain the different output devices-contacts, valves, Pilot lamps
2.5 Explain the working of Electromagnetic relay and Reed Relay

3.0 Electrical Actuators and Controllers

3.1 Explain the working of Potentiometers and their use as error detector
3.2 State the working principle of AC & DC Servomotors
3.3 Explain the working of Synchros - transmitter, control transformer and their use as error detector
3.4 State the concept and purpose of a Tacho – generator

4.0 Block Diagram Reduction Techniques

4.1 Explain how a given system is characterized
4.2 Explain the use of transfer function in characterizing a system equation
4.3 State the properties, limitations of transfer functions of systems
4.4 Obtain the impulse response of a system
4.5 Convert the Electrical systems like R, L and C in Laplace transform domain
4.6 Solve simple problems to obtain the transfer function relating to Electrical systems
4.7 Solving simple problems on reduction of block diagram

5.0 Control Procedures in Control systems

5.1 Obtain the concepts on
   (i) Linear and Non-Linear control system
   (ii) Time Variant and Time invariant system
   (iii) Continuous data and sampled data system
   (iv) Digital Control system
5.2 Obtain the concepts of the following
   (i) P- Controller (ii) I- Controller
   (iii) PI Controller (iv) PD Controller
   (v) PID Controller

6.0 PLC and its applications

6.1 State the need of Automation
6.2 State the advantages and requirements of Automation
6.3 Define Programmable Logic Controller (PLC)
6.4 State the advantages of PLC
6.5 Explain the Block diagram of PLC-parts and their purpose
6.6 State the applications of PLC
6.7 Explain Ladder diagram
6.8 Explain contacts and coils-Normally open, Normally closed, Energised output, latched
   Output, branching
6.9 Draw ladder diagrams for AND, OR, NOT gates
6.10 Draw ladder diagrams for combination circuits using NAND,NOR, AND, OR and NOT
6.11 Explain Timers-T ON, T OFF and Retentive timer
6.12 Explain Counters-CTU, CTD
6.13 Draw ladder diagrams using Timers and counters
6.14 Explain PLC Instruction set
6.15 Explain ladder diagrams for following
   (i) DOL starter and STAR-DELTA starter
   (ii) Stair case lighting
   (iii) Traffic light control
   (iv) Temperature Controller
6.16 Briefly explain the Hardware and software used in following special control systems
   (i) Distributed Control system(DCS)
   (ii) SCADA

COURSE CONTENT

1.0 Basic Concepts of Control Systems
Basic concepts-Definition of open loop and closed loop system, examples with block diagrams. Terms used in the control systems-Types of feedback-Transfer function-Definition & derivation control systems- Equivalence of physical system components into electrical System elements

2.0 Components of control systems
Contact types-Normally open & Normally closed, Solenoids-AC/DC, Input devices-
   Push button, Selector switch, Photo electric, Level Control, Pressure sensing device, Output devices- contactors, valves, Pilot lamps, Relays-Electromagnetic and Reed Relay

3.0 Electrical Actuators and Controllers
Potentiometers -working principle, AC & DC Servomotors-working principle, working of Synchros - transmitter, control transformer, concept and purpose of a Tacho – generator

4.0 Block Diagram Reduction Techniques
Transfer function -Purpose and properties- limitations of transfer functions of systems-Impulse response of system-Conversion of Electrical systems like R, L and C in Laplace
transform domain- simple problems to obtain the transfer functions- Block diagram reduction
Technique-Solving Simple problems using reduction technique

5.0 Control Procedures in Control systems
Types of control systems-Time Variant/ Invariant systems, Continuous data and sampled data system, Linear and Non-Linear control system, Digital Control system-
Concept of controllers- P Controller, I Controller, PI Controller, PD Controller, PID Controller

6.0 PLC and its applications
PLC Definition-advantages-Block diagram-Ladder diagrams for AND, OR, NOT, NAND, NOR-Instruction set-Ladder diagram for DOL starter, Star-Delta Starter, Stair case lighting, Traffic light control, Temperature controller-Special control systems-DCS, SCADA

REFERENCE BOOKS
1. Control Systems by Nagarath & Gopal
2. Control systems by Ogata
3. Control of electrical Machines by S.K.Bhattacharya
4. Industrial control engineering by Jacob
5. Industrial automation and process control by Jon Sterenson
6. Programmable Logic controllers by John W.Webb
ELECTRICAL CAD AND PROJECT MANAGEMENT PRACTICE

Subject Title : Electrical CAD and Project Management Practice
Subject Code : EE-607
Periods/Week : 06
Periods/Year : 90 (30 sessions each of 3 periods duration)

TIME SCHEDULE

<table>
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<tr>
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<td>1.</td>
<td>Study the Auto cad screen, various tool bars menus</td>
<td>2</td>
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<tr>
<td>2.</td>
<td>Exercise on standard commands</td>
<td>1</td>
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<tr>
<td>3.</td>
<td>Exercise on 2D drawing commands</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Exercise on modify 2D commands</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>Exercise on dimensioning commands</td>
<td>1</td>
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<tr>
<td>6.</td>
<td>Exercise on formatting commands</td>
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<tr>
<td>7.</td>
<td>Exercise on Insert commands</td>
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<tr>
<td>8.</td>
<td>Exercise on view commands</td>
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<tr>
<td>9.</td>
<td>Exercise on isometric drawings in 2D</td>
<td>3</td>
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<tr>
<td>10.</td>
<td>Exercise on Electrical drawings</td>
<td>7</td>
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<tr>
<td>11.</td>
<td>Exercise on shading of 3D models</td>
<td>2</td>
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<tr>
<td>12.</td>
<td>Study of Project Management Software tools</td>
<td>3</td>
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<td>Practising of Project Management Software</td>
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<td>TOTAL SESSIONS</td>
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OBJECTIVES

Upon completion of the practice the student shall be able to

1.29 **Study the Auto cad screen components.**
   1.30 Study components in menu bar
   1.31 Customise and arrange tool bar
   1.32 Display the drawing created in the working area.
   1.33 Study user coordinate system(UCS)
   1.34 Increase or decrease layouts
   1.35 Give the inputs in the command bar
   1.36 Display name and purpose of the tools
   1.37 Study cross hair to locate the cursor
   1.38 Invoke the commands
   1.39 Getting started with AutoCAD

2.0 **Exercise on Standard commands.**
   2.1 Create a new file by NEW command
   2.2 Open a file by OPEN command
   2.3 Save a file by SAVE command
2.4 Close a file by CLOSE command
2.5 Delete the object or text using CUT command
2.6 Copy the object or text using COPY command
2.7 Paste entities copied by using PASTE command
2.8 Zoom an object by using ZOOM command.

3.0 Exercise on 2D drawing commands.
3.1 Draw a line using LINE command
3.2 Create a multiple parallel lines by using MLINE command
3.3 Create a poly line using POLYLINE command
3.4 Add arc segments to a poly line using ARC command
3.5 Draw a circle using CIRCLE command, with centre point and radius.
3.6 Draw a polygon using POLYGON command
3.7 Draw a helix using HELIX command
3.8 With plane tool draw a rectangular, Triangular and quadrilateral areas filled with a solid colour.
3.9 Draw a smooth curve to a series of points using SPLINE command
3.10 Draw a elliptical curve using ELLIPSE command
3.11 Divide a object into specified segments using DIV command
3.12 Insert a block into the current drawing using INSERT command
3.13 Fill an enclosed area or an object using HATCH command

4.9 Exercise on modify 2D commands
4.10 Create a mirror image of an entity using MIRROR command
4.11 Create multiple images of an entity using ARRAY command
4.12 Change the size of an object by using STRETCH command
4.13 Trim the edges of an object at the edges of another object using TRIM command
4.14 Break a line or an object between two points using BREAK command
4.15 Join two similar objects to form a single using JOINT command
4.16 Create a fillet round the edges of two arcs using FILLET command
4.17 Chamfer on lines which are crossed, radiating or unlimited long using CHAMFER command
4.18 Break a compound object into its component objects using EXPLODE command
4.10 Form a group of selected entities by using GROUP command

5.0 Exercise on dimensioning commands.
5.1 Create and modify quickly a series of dimensions using QDIM command
5.2 Practice LINEAR, ALIGNED, and COORDINATE dimensions
5.3 Indicate radii and diameters of arcs and circles using RADIUS or DIAMETER commands
5.4 Measure angle between two lines using ANGLUR dimension command
5.5 Measure length of arc using ARC LENGTH command
5.6 Create a base line dimension from a specified baseline using BASELINE command
5.7 Mark a centre of an arc or circle using CENTREMARK command

6.0 Exercise on formatting commands.
6.1 Create layers using LAYER command.
6.2 Control the visibility of objects and assigned properties to objects.
6.3 Practice the locking unlocking of layers.
6.4 Write a text to drawing, change font size and style.
6.5 Create a standard naming convention to a text styles, table styles, layer styles, dimension styles etc.

7.0 Exercise on insert commands.
7.1 Inserts blocks into current drawing file using INSERT command
7.2 Attach an image to a drawing image using ATTACH RASTER IMAGE command
7.3 Add an attribute to a drawing by defining it and save it by using DEFINE ATTRIBUTE
7.4 Define attribute by specifying the characteristics of the attribute, including its name, prompt and default values

8.11 Exercise on view commands.
8.12 Redraw or refresh a display by using REDRAW command
8.13 Regenerate or reproduce the current viewports of all entities by using Regen command
8.14 Show the orthographic views (side view, top view, front view) of any object
8.15 Show the isometric views of any object
8.16 Shade a given object with solid colour using SHADE command
8.17 Create a hidden line view of a model using HIDE command
8.7 Create wire frame model using WIRE FRAME command

9.7 Exercise on isometric drawings in 2D.
9.8 Look down the isometric view of a box from top or bottom and left or right corners like SW,NE isometric views
9.9 Create two dimensional isometric drawings by using Isometric SNAP and GRID
9.10 Visualise the boundary of drawing and distances between entities by using reference grid
9.11 Using set snap spacing ensure accuracy of drawing
9.12 Change the default axis colours, size of the crosshair display by using crosshair tab
9.13 Create an isometric circle on the current isometric plane using Ellipse Isocircle

10.0 Exercise on Electrical drawings
10.1 Draw electrical symbols
10.2 Draw core section of transformer
10.3 Draw electrical poles and towers
10.4 Draw pipe earthing with dimensions
10.5 Draw plate earthing with dimensions
10.6 Draw simple electronic circuits
10.7 Draw the views of electrical machines like dc and ac machines

11.0 Exercise on shading of 3D models
11.1 Draw and shade 3D models of box, pyramid, cone, cylinder, sphere
11.2 Create a torus
11.3 Revolve the 3D model

12.0 Understanding Project Management Software MS-Project / Primavera
12.1 State the features and applications of Project management software MS-Project / Primavera.
12.2 Understand the Various Menus used in MS-Project / Primavera Project Software.
13.0 Practices Project Management software MS-Project / Primavera

13.1 Study the components of input data.
13.2 Study the various commands to execute the given input data.
13.3 Prepare schedules for resource allocation.
13.4 Prepare modules for execution of projects.

Key competencies to be achieved by the student

<table>
<thead>
<tr>
<th>Sl. No.</th>
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<th>Competencies</th>
<th>Key competencies</th>
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<td>Study the Auto cad screen, various tool bars menus</td>
<td>• Study the Auto cad screen components.</td>
<td>• Study the Auto cad screen components.</td>
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<td>• Study components in menu bar</td>
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<td>• Customise and arrange tool bar</td>
<td>• Customise and arrange tool bar</td>
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<td>• Study user coordinate system(UCS)</td>
<td>• Study user coordinate system(UCS)</td>
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<td>• Give the inputs in the command bar</td>
<td>• Give the inputs in the command bar</td>
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<td>• Invoke the commands</td>
<td>• Invoke the commands</td>
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<td>2.</td>
<td>Exercise on standard commands</td>
<td>• Create a new file by NEW command</td>
<td>• Study Menu Commands thoroughly</td>
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<td>• Open a file by OPEN command</td>
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<td>• Save a file by SAVE command</td>
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<td>• Close a file by CLOSE command</td>
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<td>• Zoom an object by using ZOOM command.</td>
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<td>3.</td>
<td>Exercise on 2D drawing commands</td>
<td>• Draw a line using LINE command</td>
<td>• Study 2D Draw Commands thoroughly</td>
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<tr>
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<td></td>
<td>• Add arc segments to a poly line using ARC command</td>
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<td>• Draw a circle using CIRCLE command, with centre point and radius.</td>
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<td>• With plane tool draw a</td>
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|  | rectangular, Triangular and quadrilateral areas filled with a solid colour.  
|   | ▪ Draw a elliptical curve using ELLIPSE command  
|   | ▪ Divide a object into specified segments using DIV command  
|   | ▪ Insert a block into the current drawing using INSERT command  
|   | ▪ Fill an enclosed area or an object using HATCH command  
| 4 | Exercise on modify 2D commands  
|   | ▪ Create a mirror image of an entity using MIRROR command  
|   | ▪ Change the size of an object by using STRETCH command  
|   | ▪ Trim the edges of an object at the edges of another object using TRIM command  
|   | ▪ Break a line or an object between two points using BREAK command  
|   | ▪ Join two similar objects to form a single using JOINT command  
|   | ▪ Create a fillet round the edges of two arcs using FILLET command  
|   | ▪ Chamfer on lines which are crossed, radiating or unlimited long using CHAMFER command  
|   | ▪ Break a compound object into its component objects using EXPLODE command  
|   | ▪ Form a group of selected entities by using GROUP command  
|   | ▪ Study Edit Commands thoroughly  
| 5 | Exercise on dimensioning commands  
|   | ▪ Create and modify quickly a series of dimensions using QDIM command  
|   | ▪ Indicate radii and diameters of arcs and circles using RADIUS or DIAMETER commands  
|   | ▪ Measure angle between two lines using ANGLUR dimension command  
|   | ▪ Mark a centre of an arc or circle using CENTREMARK command  
|   | ▪ Practice Dimension Commands Thoroughly  |
| 6  | Exercise on formatting commands | Create layers using LAYER command.  
Control the visibility of objects and assigned properties to objects.  
Write a text to drawing, change font size and style. | Practice Formatting Commands Thoroughly |
|----|----------------------------------|----------------------------------------------------------------------------------|
| 7  | Exercise on insert commands     | Inserts blocks into current drawing file using INSERT command  
Define attribute by specifying the characteristics of the attribute, including its name, prompt and default values | Practice Insert Commands Thoroughly |
| 8  | Exercise on view commands       | Show the orthographic views (side view, top view, front view) of any object  
Show the isometric views of any object  
Shade a given object with solid colour using SHADE command  
Create a hidden line view of a model using HIDE command  
Create wire frame model using WIRE FRAME command | Practice View Commands Thoroughly |
| 9  | Exercise on isometric drawings in 2D | Look down the isometric view of a box from top or bottom and left or right corners like SW, NE isometric views  
Change the default axis colours, size of the crosshair display by using crosshair tab  
Create an isometric circle on the current isometric plane using Ellipse, Isocircle | Practice on Isometric drawings in 2D Thoroughly |
| 10 | Exercise on Electrical drawings | Draw electrical symbols  
Draw the views of electrical machines like dc and ac machines | Practice Commands Thoroughly |
| 11 | Exercise on shading of 3D models | - Draw and shade 3D models of box, pyramid, cone, cylinder, sphere  
- Revolve the 3D model | - Practice shading of 3D models Thoroughly |
| 12 | Study the Project Management Software MS-Project/Primavera | - Study the features and applications of Project management software MS-Project/Primavera.  
- Understand the Various Menus used in MS-Project Software MS/Primavera | - Understanding the Project Management software MS-Project / Primavera |
| 13 | Practicing on Project Management Software MS-Project/Primavera | - Understands the input data.  
- Understands various commands to execute the given input data.  
- Prepare schedules for resource allocation.  
- Prepare modules for execution of projects. | - Prepares and executes the Various Management projects |

**REFERENCES**

1. An introduction to Auto CAD – Dayanithi (NITTTR)
2. CAD Software by 4M CAD, Intelly CAD
3. Auto CAD-S.Vishal.
4. Project Management Practice softwares : MS-Project & Primavera
LIST OF EXPERIMENTS

1. (a) Identify the given digital ICs and draw the pin diagrams. (use TTL and CMOS ICs of AND, OR, NOT, NAND, NOR and XOR gates with two and three inputs)
   b) Realize basic gate functions using toggle switches and a bulb

1 (b). Verify the truth tables of AND, OR, NOT, NAND, NOR and XOR
   c) Measure threshold voltages resulting in change of a state of a NAND gate

2. Realize AND, OR, NOT, XOR functions using 2 input NAND and NOR TTL Gates
   b) From the data sheets find out CMOS Equivalent of above ICs
   c) Implement a 4bit complement generator using 7486 quad XOR IC

3. Realize a given Boolean function using TTL gates
   b) Realize a NOT gate using XOR gate
   c) b) Realize a simple comparator using XOR Gate
   c) Realize a clock circuit using 4093 CMOS Nand Gate, Resistor and capacitor and observe the waveform on CRO
   d) Interpret the specifications of 4093 IC from data sheets

4. Implement Half adder and full adder circuits using TTL gates and verify the truth tables.

5. a) Verify the function of 74138 decoder IC.
   b) Combine two 3 to 8 decoder to realize a 4 to 16 Decoder

6) Verify the function of 74148 Encoder
   b) Combine two 74148 Encoder
7) Verify the Function of Multiplexer (Using IC 74153) and De multiplexer IC 74154
   b) Implement the given function using IC 74153 and 74154

8. a) Verify the function of 4-bit magnitude comparator 7485IC.
   b) Verify the effect of giving different logic inputs to pins 2,3,4 of IC
   c) Realize a simple 2bit comparator using XOR Gate
9. a) Construct and verify the truth tables of NAND & NOR latches
   b) Realize a Bitable element with two NOT gates and a Feedback Resistor

10). a) Construct clocked RS FF using NAND gates and Verify its truth table.
    b) Verify the table of JK FF using 7476 IC.
    c) Construct D and T flip flops using 7476 and verify the truth tables.
    d) Verify the function of octal latch 74LS373

11. Port usage Driving LED, Sensing Switch, Driving Relay
    a) Port Usage driving LED (1 minute off / 1 minute off)
    b) Port Usage Sensing Switch (switch on LED on switch on)
    c) Port Usage driving Relay (1 minute off / 1 min on)

REFERENCE
Practicing of Digital Circuits by RP Jain

EXPT.NO:1

1.(a) Identify the given digital ICs and draw their pin diagrams. (use TTL and CMOS ICs of AND, OR, NOT, NAND, NOR and XOR gates with two and three inputs)
1 (b). Verify the truth tables of basic gates and universal gates.

Objectives:
1. Read the IC numbers.
2. Identify the importance of numbering on the ICs
3. Identify the no. of pins of each IC
4. Identify the type of IC package.
5. Draw the pin diagram of each IC from the data sheets
6. Identify the no. of gates present in each IC.
7. Identify the input and output pins
8. From the data sheets note down the important specifications.
9. Identify the power supply pins.
10. Observe the layout of a bread board.
11. Measure the output of the given dc power supply.
12. Read the logic diagram for Each Gate
13. Read the truth table of each gate.
14. Apply inputs as per the truth table and observe the outputs.
15. Identify basic gates and universal gates.
EXPT.NO:2

2. Verify NAND and NOR gates are universal gates.
   Objectives:
   1. Identify two input NAND and NOR gate ICs
   2. Mount the NAND and NOR ICs properly on bread board.
   3. Read the pin diagrams of ICs.
   4. Find the input pins, out pins, power supply pins.
   5. Read the circuit diagrams.
   6. Rig up the circuit diagrams one by one
   7. Apply different input combinations as per truth table and observe the corresponding outputs.
   8. Show that NAND and NOR are universal gates.

EXPT NO.3

3. Realize a given Boolean function after simplification and obtain its truth table.
   Objectives:
   1. Identify the no. of literals present in the given Boolean expression.
   2. Find the form of expression(SOP or POS)
   3. Simplify the Boolean expression
   4. Identify the logic gates required
   5. Find the sourcing and sinking characteristics of logic gates from the data sheets.
   6. Draw the logic diagram.
   7. Find the Required logic ICS.
   8. Rig up the circuit.
   9. Apply different input combinations as per truth table and note down the observations.

Expt.No.4

4. Construct half adder and full adder and verify the truth tables.
   Objectives:
   1. Identify the no. of inputs and outputs of half adder and full adder.
   2. Determine the truth tables of Half adder and full adder.
   3. Write Boolean expressions for the output variables from the truth tables.
   4. Simplify the Boolean expressions.
   5. Draw the logic diagrams of half adder and full adder.
   6. Identify the logic gates required.
   7. Rig up the circuits.
   8. Verify the truth tables of half adder and full adder by applying different input combinations.
   9. Show that construction of full adder using two half adders.
   10. Identify a 4-bit parallel adder IC

EXPT NO.5

5. Verify the function of 74138 decoder IC.
   Objectives:
1. Draw the pin diagram of 74138 IC from the data manual.
2. Identify the significance of numbering.
3. Identify the input and output pins.
4. Identify the enable pins.
5. Note down the active low and active high pins.
6. Read the truth table.
7. Read the logic diagram.
8. Rig up the circuit.
9. Apply the inputs to the enable inputs properly.
10. Check the effect of enable inputs.
11. Apply the inputs as per the truth table and observe the outputs.

EXPT NO.6

6. Verify the working of Multiplexer (Using IC 74153)

Objectives:
1. Draw the pin diagram of 74153 IC from the data manual.
2. Identify the input and output pins.
3. Identify the enable pins.
4. Note down the active low and active high pins.
5. Read the truth table.
6. Read the logic diagram.
7. Rig up the circuit.
8. Apply the inputs to the enable inputs properly.
9. Check the effect of enable inputs.
10. Apply different inputs as per the truth table and observe the outputs.
11. Find applications of MUX.
12. Identify different multiplexers.
13. Construct and test simple circuit using a multiplexer.

EXPT NO.7

7. Verify the functional table of 4-bit magnitude comparator 7485IC.

Objectives:
1. Determine the function of magnitude comparator.
2. Draw the pin diagram of 7485 IC from the data manual.
3. Identify the pins to which one 4-bit no. is to be applied.
4. Identify the pins to second 4-bit no. is to be applied.
5. Identify the output pins and note down their significance.
6. Identify the cascading pins and note down their significance.
7. Read the functional table of 7485 from the manual.
8. Observe the difference between functional table and truth table.
9. Rig up the circuit.
10. Apply the inputs and verify the functional table.
11. Connect two 7485 ICs in cascade and observe the working of 8-bit magnitude comparator.

EXPT NO.8

I-136
8. Construct and verify the truth tables of NAND & NOR latches

Objectives:
1. Identify the two input NAND and NOR ICs.
2. Draw the pin diagram of NAND and NOR ICs.
3. Mount the ICs on the bread board properly.
4. Read the logic diagram
5. Rig up the circuit diagram
6. Apply inputs as per truth table and observe the outputs.
7. Visualize a latch can store one bit of data.
8. Compare truth tables of NAND and NOR latches.
9. Observe the forbidden state in each latch.

EXPT.NO:9

a) Construct clocked RS FF using NAND gates and Verify its truth table.
b) Verify the table of JK FF using 7476 IC.
c) Construct D and T flip flops using 7476 and verify the truth tables.

Objectives:
1. Identify the required digital ICs on the digital trainer kit
2. Observe the clock circuitry on the trainer kits.
3. Draw the pin diagrams of required ICs from the data manual
4. Read the circuit diagrams
5. Construct clocked RS FF
6. Apply inputs and observe the outputs.
7. Observe the effect of clock
8. Identify the no. of FFs present in 7476 IC
9. Observe the preset and clear inputs of 7476
10. Apply the inputs and clock to the 7476 and verify the truth table
11. Observe the effect of Pr and CLR inputs of 7476.
13. Observe the outputs for the inputs as per the truth table.
14. Apply continuous clock to T flip flop and observe the output.

EXPT NO.10

Verify the function of octal latch 74LS373

Objectives:
1. Draw the pin diagram of 74373 IC from the data manual.
2. Identify the significance of numbering.
3. Identify the input and output pins
4. Identify the enable pins.
5. Note down the active low and active high pins.
6. Read the truth table.
7. Read the logic diagram.
8. Rig up the circuit
9. Apply the inputs to the enable inputs properly.
10. Apply the inputs as per the truth table and observe the outputs.
11. Check the effect of enable inputs.
EXPT NO.11

11. Port usage Driving LED, Sensing Switch, Driving Relay

1. Draw the practice diagrams
2. List the tools required
3. State the use of latch
4. List the different values of Resistors used for practice
5. State the use of IC 8255
6. List different LEDs
7. Identify the leads of LED
8. Check the working of switch using DMM
9. Check the continuity of Relay using DMM
10. Implementation of key de-bouncing (hardware)

Key Competencies achieved by the student

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Experiment Name</th>
<th>Key Competencies</th>
</tr>
</thead>
</table>
| 1.    | Identify the given digital ICs and draw their pin diagrams | 1. Reading the IC numbers.  
2. Drawing the pin diagram of each IC from the data sheets  
3. Identifying the no. of gates present in each IC.  
4. Observing the layout of a bread board.  
5. Identifying the power supply pins of IC.  
6. Observing how to place an IC on the bread board.  
7. Rigging up the circuit diagram  
8. Applying different combination of inputs as per truth table and observe the outputs.  
9. Observing how to remove an IC from the bread board using IC remover.  
10. Identifying the corresponding CMOS ICs. |
| 2.    | Verify NAND and NOR gates are universal gates. | 1. Reading the circuit diagrams.  
2. Rigging up the circuit diagram.  
3. Applying the inputs and observing the outputs. |
| 3.    | Realize a given Boolean function after simplification and obtain its truth table | 1. Reading the specifications of logic gates from the data sheets.  
2. Drawing the logic diagram  
3. Rigging up the logic diagram.  
4. Applying different input combinations as per truth table and note down the observations. |
| 4.    | Construct half adder and full adder and verify the truth | 1. Writing the Boolean expressions.  
2. Simplifying the Boolean expressions.  
3. Determining the logic gates required. |
<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Identifying the enable pins.</td>
<td></td>
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<tr>
<td>2.</td>
<td>Note down the active low and active high pins.</td>
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<tr>
<td>3.</td>
<td>Simplifying the Boolean expression.</td>
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<tr>
<td>4.</td>
<td>Checking the effect of enable inputs.</td>
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<tr>
<td>5.</td>
<td>Identifying the 4-bit parallel adder IC.</td>
<td>Rigging up the circuit.</td>
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<tr>
<td>6.</td>
<td>Verify the function of 74138 decoder IC.</td>
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<tr>
<td>7.</td>
<td>Verify the working of Multiplexer (Using IC 74153)</td>
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<tr>
<td>8.</td>
<td>Verify the functional table of 4-bit magnitude comparator 7485IC.</td>
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<tr>
<td>9.</td>
<td>Construct and verify the truth tables of NAND &amp; NOR latches</td>
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<tr>
<td>10.</td>
<td>Verify the function of octal latch 74LS373</td>
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</tbody>
</table>

Details:
- **Verify the function of 74138 decoder IC.**
  - Identify enable pins.
  - Note active low and active high pins.
  - Simplify the Boolean expression.
  - Check effect of enable inputs.
- **Verify the working of Multiplexer (Using IC 74153).**
  - Identify enable pins.
  - Note active low and active high pins.
  - Check effect of enable inputs.
  - Identify different multiplexers.
- **Verify the functional table of 4-bit magnitude comparator 7485IC.**
  - Identify pins to which one 4-bit number is applied.
  - Identify pins to which second 4-bit number is applied.
  - Identify output pins and note their significance.
  - Identify cascading pins and note their significance.
  - Connect two 7485 ICs in cascade and observe working of 8-bit magnitude comparator.
- **Construct and verify the truth tables of NAND & NOR latches.**
  - Apply inputs as per truth table and observe outputs.
  - Visualize latch can store one bit of data.
  - Compare truth tables of NAND and NOR latches.
  - Observe forbidden state in each latch.
- **Construct clocked RS FF using NAND gates and Verify its truth table.**
  - Observe effect of clock.
  - Identify number of FFs present in 7476 IC.
  - Observe preset and clear inputs of 7476.
  - Observe effect of Pr and CLR inputs of 7476.
  - Apply continuous clock to T flip flop and observe output.
- **Verify the function of octal latch 74LS373.**
  - Identify enable pins.
  - Note active low and active high pins.
  - Simplify Boolean expression.
|   |   | 4. Applying the inputs as per the truth table and observe the outputs.  
<table>
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<tr>
<th></th>
<th></th>
<th>5. Checking the effect of enable inputs.</th>
</tr>
</thead>
</table>
| 11. | Port usage: Driving LED, Sensing Switch, Driving Relay | 1. Identify leads of led with observation and use DMM  
2. Identify color of LED,  
3. Note R value for current limiting  
4. Note specifications of switch  
4. Note relay specifications  
5. Learn relay connections |
POWER ELECTRONICS AND PLC LABORATORY PRACTICE

Subject Title : Power Electronics and PLC Laboratory Practice
Subject Code : EE-609
Periods/Week : 03
Periods/Year : 45

TIME SCHEDULE

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Major Topics</th>
<th>No. of Periods</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Characteristics of different Power Electronic Devices</td>
<td>06</td>
</tr>
<tr>
<td>2.</td>
<td>Study the working of different Power Electronic circuits</td>
<td>06</td>
</tr>
<tr>
<td>3.</td>
<td>Speed control of the DC motor using the Power Electronic Devices</td>
<td>09</td>
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<tr>
<td>4.</td>
<td>Speed control of the single phase motor using SCR</td>
<td>03</td>
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<tr>
<td>5.</td>
<td>Execution of the different Ladder Diagrams</td>
<td>12</td>
</tr>
<tr>
<td>6.</td>
<td>Execution of the Ladder Diagrams with model applications</td>
<td>09</td>
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<td>Total</td>
<td>45</td>
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</tbody>
</table>

OBJECTIVES
Upon completion of the practice the student shall be able to

1.0 Plot the Characteristics of the different Power Electronic Devices
   (a) Plot the Characteristics of SCR
   (b) Plot the Characteristics of IGBT, GTO

2.0 Study the working of different Power Electronic circuits
   (c) Study of the working of single phase half wave converter
   (d) Study of the working of single phase full wave converter

3.0 Speed control of the DC motor using the Power Electronic Devices
   (e) Speed Control of DC motor using single phase full converter
   (f) Speed Control of DC motor using Chopper

4.0 Speed control of the 1-phase AC motor using the Power Electronic Devices
   (g) Speed Control of 1-phase AC motor using SCR

5.0 Execute the different Ladder Diagrams
   (h) Demonstrate PLC and Ladder diagram-Preparation, downloading and running
   (i) Execute Ladder diagrams for different Logical Gates
   (j) Execute Ladder diagrams using timers & counters

6.0 Execute the Ladder Diagrams with model applications
   (k) Execute Ladder diagrams with model applications (i) DOL starter (ii) Star-Delta starter
   (l) Execute Ladder diagrams with model applications (i) Stair case lighting (ii) Traffic light controller

SKILLS

1.40 Plot the characteristics of the different Power Electronic Devices

1.41 Identify the different Power electronic devices available in the laboratory like SCR, IGBT, GTO
1.42 Draw the symbols of the above devices.
1.43 Identify the different terminals.
1.44 Draw the necessary circuit diagram and identify the apparatus required
1.45 Make the connections of the circuit as per the circuit diagram of forward bias
1.46 Record the different values of voltage and current in forward bias
1.47 Change the connections of the circuit as per the circuit diagram of Reverse bias
1.48 Record the different values of voltage and current in forward bias
1.49 Plot the forward and reverse characteristics on a graph sheet
1.50 Repeat the experiment for other devices instead of SCR and plot the V-I characteristics.

2.0 **Study the Performance of the different Power Electronic Circuits**

2.1 Draw the circuit diagram for the single phase half wave converter
2.2 Identify the different components and apparatus required for the circuit
2.3 Make the necessary connections as per the circuit diagram with resistive load
2.4 Verify the waveforms in the CRO at different gate current pulses
2.5 Change the R- Load with R-L Load and observe the waveforms at different gate current pulses
2.6 Study the working of the single phase full wave converter with R –Load and R-L Load in similar way as above
2.7 Draw the circuit diagram for the single phase inverter using SCR’s
2.8 Identify the different components and apparatus required for the circuit
2.9 Make the necessary connections as per the circuit diagram
2.10 Verify the waveform in the CRO for different gate pulses

3.0 **Speed control of DC Motor using Power Electronic circuits**

3.1 Draw the circuit diagram for the speed control of the DC motor using the single phase full wave convertor
3.2 Identify the different apparatus required from the circuit diagram
3.3 Make the necessary connections according to the circuit
3.4 Note down the readings of the speed of the DC motor by changing the triggering angles
3.5 Draw the graph between Speed Vs Triggering Angles
3.6 Note down the readings of the speed of the DC motor by changing the duty cycle
3.5 Draw the graph between Speed Vs Duty cycle

4.0 **Speed control of single phase AC motor using SCR.**

4.1 Draw the circuit diagram for the speed control of the single phase AC motor using the Silicon controlled Rectifier
4.2 Identify the different apparatus required from the circuit
4.3 Make the necessary connections according to the given circuit diagram
4.4 Note down the readings of the speed of the DC motor by changing the triggering angles
4.5 Draw the graph between Speed Vs Triggering Angles

5.0 Execute different Ladder Diagrams
5.1 Identify the PLC trainer kit, the Personal Computer and Loaded PLC software
5.2 Observe the input and output ports of the PLC
5.3 Make the interfacing between the PC and the PLC.
5.4 Prepare the appropriate ladder diagrams for different logical gates(AND, OR, NOT, NOR, NAND)
5.5 Save the ladder diagram with relevant file names
5.6 Execute each ladder diagram program and check for errors
5.7 Rectify errors if any then save and again execute the program
5.8 Download the LD program into the PLC
5.9 Prepare simple ladder diagrams using “timers and counters” instructions
5.10 Execute ,Run and check the output logic for each program

6.0 Execute Ladder Diagrams with Model applications
6.1 Identify the different available model application kits in the lab
6.2 Draw the ladder diagrams for the DOL starter and star/delta starter
6.3 Prepare the ladder diagrams in the Computer ,save and execute the program
6.4 Make proper connections of the model application at the output port of PLC and downloading its relevant LD program in PLC
6.5 Run the LD program and observe the outputs with the model applications
6.6 Execute the Ladder diagrams for other model applications like “Stair case lighting and Traffic signal control model” in the same way as above

Key competencies to be achieved by the student

<table>
<thead>
<tr>
<th>S.No</th>
<th>Experiment title</th>
<th>Key competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plot the Characteristics of SCR</td>
<td>1. Perfection with terminal identification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Identification of relevant apparatus required</td>
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<td></td>
<td></td>
<td>3. Plot the V-I Characteristics exactly</td>
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<tr>
<td>2</td>
<td>Plot the Characteristics of IGBT, GTO</td>
<td>1. Identification of the terminals</td>
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<tr>
<td></td>
<td></td>
<td>2. Make the correct connections</td>
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<td></td>
<td></td>
<td>3. Obtaining the exact graph</td>
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<td></td>
<td>Description</td>
<td>Details</td>
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<tr>
<td>3</td>
<td>Study of the working of single phase half wave converter</td>
<td>1. Make the correct connections as per the circuit diagram with correct polarity</td>
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<tr>
<td></td>
<td></td>
<td>2. Adjusting the CRO probes in getting the wave form properly</td>
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<tr>
<td>4</td>
<td>Study of the working of single phase full wave converter</td>
<td>1. Make the correct connections as per the circuit diagram</td>
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<td></td>
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<td>2. Adjust the CRO probes to get the wave form properly</td>
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<td>3. Observe output for different loads</td>
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<td>4. Ability to show the waveform at required firing angle</td>
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<tr>
<td>5</td>
<td>Speed Control of DC motor using single phase full converter</td>
<td>1. Identify the meters and components required</td>
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<td>2. Make proper connections as per given circuit diagram</td>
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<td>3. Obtain the speed control of the motor, Ability to run motor at required speed</td>
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<tr>
<td>6</td>
<td>Speed Control of DC motor using Chopper</td>
<td>1. Identify the meters and components required</td>
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<td></td>
<td>2. Make proper connections as per given circuit diagram</td>
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<td></td>
<td>3. Obtain the speed control of the motor, Ability to run motor at required speed</td>
</tr>
<tr>
<td>7</td>
<td>Speed Control of single phase motor using SCR</td>
<td>1. Identify the meters and components required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Make proper connections as per given circuit diagram</td>
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<td>3. Obtain the required speed control of the motor and getting the proper graph</td>
</tr>
<tr>
<td>8</td>
<td>Demonstrate PLC and Ladder diagram-Preparation, downloading and</td>
<td>1. Proper Interface between PLC, PC</td>
</tr>
<tr>
<td>Course Content</td>
<td>Details</td>
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<tr>
<td><strong>COURSE CONTENT</strong></td>
<td></td>
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</tbody>
</table>
| **Plot the Characteristics of different Power Electronic Devices** | (a) Terminal Identification of SCR, IGBT, GTO  
(b) Circuit connections of above devices  
(c) Plot the Voltage-Current characteristics of above |
| **Study the working of different Power Electronic circuits** | (a) Working of the single phase half wave converter  
(b) Working of the single phase full wave converter  
(c) Working of single phase full wave inverter  
(d) Plot relevant graphs for above |
| **Speed Control of the DC motor using the Power Electronic Devices** | (a) DC motor speed control using the single phase full converter |
(b) DC motor speed control using chopper
(c) Plot relevant graphs

**Speed control of the single phase motor using SCR**
(a) Single phase AC motor speed control using SCR
(b) Plot graph

**Execute the different Ladder Diagrams**
(a) Identify PLC, PC
(b) Interface PC, PLC
(c) Ladder diagram preparations for different logic gates (AND, OR, NOT, NOR, NAND)
(d) Save, Execute and run the program

**Execute the Ladder Diagrams with model applications**
(a) Prepare Ladder diagrams for relevant Model applications as
   - DOL starter
   - Star-Delta Starter
   - Stair Case Lighting
   - Traffic Signal Control
(b) Interface the given model with PLC
(c) Run relevant ladder diagram and observe output logic
PROJECT WORK

Subject Title : Project Work
Subject Code : EE-610
Periods / Week : 06
Periods / Semester : 90

OBJECTIVES

Upon completion of the Project work the student shall be able to

1.0 Project work
1.1 Identifies different works to be carried out in the Project.
1.2 Collects data relevant to the project work.
1.3 Carries out need survey.
1.4 Selects the most efficient method from the available choices based on preliminary investigation.
1.5 Design the required elements of the project work as per standard practices.
1.6 Prepares the working modules / equipments required for the project work.
1.7 Estimates the cost of project, technological need, computer skills, materials and other equipments.
1.8 Prepares the plan and schedule of starting time and sequence of operations to be carried out at the various stages of the project work in detail.
1.9 Preparation of critical activities at the various stages of the project work.
1.10 Tests to be carried at various conditions with different electrical input parameter if required.
1.11 Implementation of project work and recording the results at various places.
1.12 Collects the necessary information to procure necessary finance, and equipment.
1.13 Preparation of the chart or model for each of the project.
1.14 Preparation of project report.

2.0 Report on observations in Industrial visits
2.1 Visit nearby Traction Sub-station / Loco shed and submit the report.

COURSE CONTENT

Project work is intended to provide training in the solution of various fields of engineering problems relating to

Rural Electrification Systems: Solar Lamps, Solar Cooker, Solar Water pumping systems etc.

Energy Saving Equipments: Replacing of Tungsten filament lamps with effective Implementation of LED, CFL Lamps at various applications.
Automobile Field: Solar Operated Vehicles, Battery Operated Vehicles, Remote Operated electrical Devices, Usage of advanced Tubular Batteries for improving the efficiency.

Energy Management Techniques: Energy auditing at various reputed Industries.


Power Devices: Inverter, SCR based applications, UPS and Automatic switching DG Sets etc.

Electric traction: Metro-line projects.

Industrial Visit nearby Power Station

Project work will also include the implementation of Innovative Ideas which improves the nation growth and preparation of the feasibility report for any one type of enterprise under self – employment schemes also.

Students shall be divided into groups of five each and shall be assigned a problem that calls for application of the knowledge he/she acquired in the course and also which involves some extra study of reference materials.

Problems

b) Wirings of existing system.
c) Industrial complex wiring designs.
d) Rural electrification supply Scheme.
e) Energy efficient management systems.
f) Power Saving systems.
g) Design of Substations.
h) Set up of a small enterprise under self employment scheme.

Every student should prepare a project report and submit the same for assessment. Every student puts his share to the work in all the operations of the project. The end examination in Project work shall consist of power point presentation and Viva-voce test to be assessed by a panel of examiners comprising of an External examiner, the Head of Section, and member of staff who guided the project as Internal examiner.

Scheme of assessment

1) Seminar - 20 Marks
2) Internal assessment - 20 Marks
3) Power point presentation, - 60 Marks
   Report & Viva-Voce(3x20) 
   
   Total Marks 100

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