***Ramgarhia Polytechnic College, Phagwara***



***Electronics & Communication Engineering Department***

Head of Department: Er. Simranjit Singh

Name of the Faulty: Er. Vishal Verma

Discipline: ECE

Semester: 3rd

Subject: Electrical Machine

Lesson Plan Duration: 16 Weeks

**RATIONALE**

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications

**Learning Outcomes**

 After undergoing this course, the students will be able to:

1. Describe star delta 3-phase connections
2. Explain phase, line voltages and current relationships in 3-phase power supply.
3. Demonstrate the concept of single phase transformers.
4. Measure the power and power factor in 3 phase load
5. Determine the efficiency of a single phase transformer
6. Apply the working principle of rotating electrical machines
7. Demonstrate the working of DC, AC and single phase fractional kilowatt motors.
8. Connect and run a DC shunt motor with supply through a 3 point starter

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| PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
| CO |
| CO1 |  |  |  |  |  |  |  |
| CO2 |  |  |  |  |  |  |  |
| CO3 |  |  |  |  |  |  |  |
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| CO8 |  |  |  |  |  |  |  |
| CO9 |  |  |  |  |  |  |  |

**Syllabus**

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| --- | --- | --- |
| Units | Details | Hours |
| 1. | Three Phase Supply – Advantage of three-phase system over single-phase system. - Star Delta connections - Relation between phase and line voltage and current in a three phase system - Power and power factor in three-phase system and their measurements by one, two and three wattmeter methods. | (06 hrs) |
| 2. | Transformers Principle of operation and constructional details of single phase transformer - Voltage Regulation of a transformer (No Derivation) - Losses in a transformer - Efficiency, condition for maximum efficiency and all day efficiency - CTs and PTs (Current transformer and potential transformer) - CVT (Constant Voltage Transformer) | (10 hrs) |
| 3. | Introduction to Rotating Electrical Machines - E.M.F induced in a coil rotating in a magnetic field. - Definition of motor and generator - Basic principle of a generator and a motor - Torque due to alignment of two magnetic fields and the concept of Torque angle - Basic Electromagnetic laws (Faraday’s laws of Electromagnetic Induction) | (10 hrs) |
| 4. | DC Machines - Principle of working of d.c motors and d.c generator, their constructional details - Function of the commutator for motoring and generating action - Factors determining the speed of a DC motor - Different types of excitation - Characteristics of different types of DC machines - Starting of DC motors and starters - Application of DC machines | (14 hrs) |
| 5. | A.C. Motors - Revolving magnetic field produced by poly phase supply - Brief introduction about three phase induction motors, its principle of operation - Principle and working of Synchronous Machines - Application of Synchronous Machines | (12 hrs) |
| 6. | Single Phase Fractional Kilowatt Motors - Introduction - Principle of operation of single phase motors - Types of single phase induction motors and their constructional details - Single phase synchronous motors – reluctance motor ( hysteresis motor) - Introduction to Commutator type single-phase motors - Introduction to servo- motors and stepper motors - Concept of micro-motors. | (12 hrs)  |

**Reference Books:**

1) Electrical Machine by SK Bhattacharya, Tata McGraw Hill Education Pvt Ltd, New Delhi

2) Electrical Machines by Nagrath and Kothari, Tata McGraw Hill Education Pvt Ltd, New Delhi

 3) Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi

4) Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar

 5) Electrical Engineering by JB Gupta, SK Kataria & Sons, New Delhi

6) Electrical Machines by DR Arora, Ishan Publications, Ambala city

7) Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi

**Delivery/Instructional Methodologies**

|  |  |
| --- | --- |
| Sr.No. | Description |
| 1. | Chalk and Talk |
| 2. | PowerPoint Presentation |

**Assessment Methodologies**

|  |  |  |
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| Sr. No. | Description | Type |
| 1. | Student Assignment | Direct |
| 2. | Test | Direct |
| 3. | Board Examination | Direct |
| 4. | Student Feedback | Direct |

**Gaps in the syllabus - to meet industry/profession requirements**

|  |  |  |  |
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| S.NO. | DESCRIPTION | PROPOSED ACTIONS | PO MAPPING |
|  | N/A | N/A | N/A |

**Topics beyond syllabus/advanced topics**

|  |  |  |
| --- | --- | --- |
| Units | Details | Hours |
| N/A | N/A | N/A |

**Web Source References**

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| --- | --- |
| Sr. No. | URL |
| 1. | https://nptel.ac.in/ |

**Lesson Plan**

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| --- | --- | --- |
| Week | Theory | Practical |
| Lecture Day |  | Practical Day |  |
| 1st | 1st | Advantage of three-phase system over single-phase system | 1. | 1)To measure power and power factors in 3 Phase load by two wattmeter method (GP1) |
| 2nd | Star Delta connections |
| 3rd | Relation between phase and line voltage and current in a three phase system |
| 4th |
| 2nd | 5th | Power and power factor in three-phase system and their measurements by one, two and three wattmeter methods. | 2. | 1)To measure power and power factors in 3 Phase load by two wattmeter method (GP2) |
| 6th |
| 7th | Principle of operation and constructional details of single phase transformer |
| 8th |
| 3rd | 9th | 3. | 2. To determine the efficiency of a single phase transformer from the data obtained through open circuit and short circuit test |
| 10th | Voltage Regulation of a transformer (No Derivation) |
| 11th |
| 12th | Losses in a transformer |
| 4th | 13th | 4. | 2. To determine the efficiency of a single phase transformer from the data obtained through open circuit and short circuit test(GP2) |
| 14th | Efficiency, condition for maximum efficiency and all day efficiency - CTs and PTs (Current transformer and potential transformer) |
| 15th |
| 5th | 17th | Introduction to Rotating Electrical Machines | 5. | 3. To measure power and power factor of a single phase induction motor(GP1) |
| 18th | E.M.F induced in a coil rotating in a magnetic field |
| 19th | Definition of motor and generator |
| 20th |
| 6th | 21st | Basic principle of a generator and a motor | 6. | 3. To measure power and power factor of a single phase induction motor(GP2) |
| 22nd |
| 23rd | **REVISION** |
| 24th | **1st Sessional Test (Tentative)** |
| 7th | 25th | Torque due to alignment of two magnetic fields and the concept of torque angle | 7. | 4.To run a synchronous motor with a.c supply and to measure speed to verify the relation N=12O f/ P(GP1) |
| 26th | Basic Electromagnetic laws (Faraday’s laws of Electromagnetic Induction) |
| 27th | DC Machines - Principle of working of d.c motors and d.c generator, their constructional details |
| 28th |
| 8th | 29th | Function of the commutator for motoring and generating action | 8. | 4.To run a synchronous motor with a.c supply and to measure speed to verify the relation N=12O f/ P(GP2) |
| 30th |
| 31st | Factors determining the speed of a DC motor |
| 32nd |
| 9th | 33rd | Different types of excitation | 9. | 5.To make connections of starting and running winding of a single phase capacitor motor and to run it with the help a DOL starter and to measure its speed(GP1) |
| 34th |
| 35th | Characteristics of different types of DC machines |
| 36th |
| 10th | 37th | Starting of DC motors and starters  | 10. | 5.To make connections of starting and running winding of a single phase capacitor motor and to run it with the help a DOL starter and to measure its speed(GP2) |
| 38th |
| 39th | - Application of DC machines |  |  |
| 40th |
| 11th | 41st | A.C. Motors | 11. | 6.Study construction of a stepper and servomotor and to write their complete specifications.(GP1) |
| 42nd | Revolving magnetic field produced by poly phase supply |
| 43rd |
| 44th | **REVISION** |
| 12th | 45th | **PTM** | 12. | 6.Study construction of a stepper and servomotor and to write their complete specification(GP2) |
| 46th | **2nd Sessional Test (Tentative)** |
| 47th | Brief introduction about three phase induction motors, its principle of operation |
| 48th |
| 13th | 49th | Principle and working of Synchronous MachinesApplication of Synchronous Machines | 13. | **REVISION** |
| 50th |
| 51st |
| 52nd |
| 14th | 53rd | Single Phase Fractional Kilowatt Motors |  | **REVISION** |
| 54th | Principle of operation of single phase motors | 14 |
| 55th |
| 56th | Types of single phase induction motors and their constructional details |
| 15th | 57th | 15. | **REVISION** |
| 58th | Single phase synchronous motors – reluctance motor ( hysteresis motor) |
| 59th |
| 60th | Introduction to Commutator type single-phase motors - Introduction to servo- motors and stepper motors - Concept of micro-motors. |
| 16th | 61st | 16. | **REVISION** |
| 62nd | **PTM** |
| 63rd | **REVISION** |
| 64th | **3rd Sessional Test (Tentative)** |