

GOVT. POLYTECHNIC BALANGIR

Department of Electrical Engineering

LESSON PLAN: 2025-26

Name of the Faculty: Tapas Panigrahi

Subject: AC MACHINES AND SPECIAL ELECTRICAL MACHINES

Program: Diploma in Electrical Engineering

Semester: 4TH

Total Contact Hours: 45 Total

Marks: 100

Assessment: Progressive –30, End Term – 70

Credits: 3

**COURSE OBJECTIVES:**

After completion of the course, the students will be able to

- Explain the optimized working of the thermal power plant
- Describe the efficient operation of large hydropower plants.
- Describe the efficient operation micro hydropower plants.
- Select the adequate mix of power generation based on economic operation.

Unit 1:Three Phase Induction Motor(Total Classes-10)				
Class No.	Topic	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	Working of 3-phase IM	1.1 Working principle: production of rotating magnetic field, Synchronous speed, rotor speed and slip	Chalkboard definition writing, students repeat definitions	CO1
2	Construction of IM	1.2 Constructional details of 3 phase induction motors: Squirrel cage induction motor and Slip ring induction motor	Chalkboard definition and discussion and video clip	CO1
3	Different terms of related to rotor	1.3 Rotor quantities: frequency, induced emf, power factor at starting and running condition	Chalkboard definition and discussion and video clip	CO1
4	Torque-Slip characteristics	1.4 Characteristics of torque versus slip (speed), Torques: starting, full load and maximum with relations among them(numericals)	Group discussion and PPT slides	CO1
5	Phasor diagram of IM	1.5 Induction motor as a generalized transformer with phasor diagram	PPT slides, short video clip	CO1
6	4-quadrant operation of IM	1.6 Four quadrant operation, Power flow diagram(numericals)	students repeat definitions, discussion	CO1
7	Starter & need of starter	1.7 Starters: need and types: stator resistance, auto transformer, star delta, rotor resistance and soft starters	PPT slides, short video clip	CO1

8	Speed control of IM	1.8 Speed control methods: stator voltage, pole changing, rotor resistance and VVVF	PPT slides, short video clip	CO1
9	Application of IM	1.9 Motor selection for different applications as per the load torquespeed requirements	PPT slides, short video clip	CO1
10	Maintenance of 3-phase IM	1.10 Maintenance of three phase induction motors	PPT slides, short video clip	CO1

**Unit 2: Single phase Induction Motors (Total Classes-9)**

Class No.	Topic	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	Double field revolving theory	2.1 Double field revolving theory	Chalkboard definition writing, students repeat definition	CO2
2	Working of 1-phase IM	2.2 Principle of making single phase induction motors self-start	definitions, discussion	CO2
3	Construction of 1-phase IM	2.3 Construction and working of singlephase induction motors	students repeat definition	CO2
4	Different typed of 1-phase IM & their working	2.3.1 Resistance start induction run 2.3.2 Capacitor start induction run 2.3.3 Capacitor start capacitor run 2.3.4 Shaded pole	Class discussion and note making	CO2
5	Different typed of 1-phase IM & their working	2.3.5 Repulsion type 2.3.6 Series motor	PPT slide and presentation	CO2
6	Different typed of 1-phase IM & their working	2.3.7 Universal motor 2.3.8 Hysteresis motor	Class discussion and note making	CO2
7	Torque Slip characteristics of 1-phase IM	2.4 Torque-speed characteristics for all of the above motors.	PPT slide and presentation	CO2
8	Motor selection and application	2.5 Motor selection for different applications as per the load torquespeed requirements	PPT slide and presentation	CO2
9	Maintenance	2.6 Maintenance of single phase induction motors	PPT slide and presentation	CO2

**Unit 3: Three phase Alternators (Total Classes-9)**

Class No.	Topic	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	Principle of working of alternator	3.1 Principle of working, moving and stationary armatures	Chalkboard definition writing, students repeat definitions,	CO3



2	Constructional details of alternator	3.2 Constructional details: parts and their functions	Group discussion	CO3
3	Constructional details of alternator	3.2.1 Rotor constructions	Chalkboard definition writing	CO3
4	Constructional details of alternator	3.2.2 Windings: Single and Double layer	PPT slide and presentation	CO3
5	E.M.F. equation of an Alternator	3.3 E.M.F. equation of an Alternator with numerical by considering short pitch factor and distribution factor	PPT slide and presentation	CO3
6	Factors affecting the terminal voltage and Armature resistance of alternator	3.4.1 Factors affecting the terminal voltage of alternator 3.4.2 Armature resistance and leakage reactance drops.	PPT slide and presentation	CO3
7	Armature reaction of alternator	3.5 Armature reaction at various power factors and synchronous impedance	PPT slide and presentation	CO3
8	Voltage regulation	3.6 Voltage regulation: direct loading and synchronous impedance methods	PPT slide and presentation	CO3
9	Maintenance of alternators	3.7 Maintenance of alternators	PPT slide and presentation	CO3

**Unit 4: Synchronous Motors (Total Classes-09)**

Class No.	Topic	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	Principle of working of synchronous motor	4.1 Principle of working /operation, significance of load angle	Chalkboard definition writing, students repeat definitions,	CO4
2	Different torque of synchronous motor	4.2 Torques: starting torque, running torque, pull in torque, pull out torque	PPT slide and presentation	CO4
3	Effect of excitation on synchronous motor	4.3 Synchronous motor on load with constant excitation (numerical), effect of excitation at constant load (numerical).	PPT slide and presentation	CO4
4	Synchronous motor on load	4.3 Synchronous motor on load with constant excitation (numerical), effect of excitation at constant load (numerical).	PPT slide and presentation	CO4
5	V and inverted V curve	4.4 Curves and Inverted V-Curves	PPT slide and presentation	CO4
6	Hunting	4.5 Hunting and Phase swinging	PPT slide and presentation	CO4
7	Different starting methods	4.6 Methods of Starting of Synchronous Motor	PPT slide and presentation	CO4

8	Losses of synchronous motor	4.7 Losses in synchronous motors and efficiency (no numerical).	PPT slide and presentation	CO4
9	Application	4.8 Applications areas	PPT slide and presentation	CO4
<b>Unit 5: Fractional horse power (FHP) Motors (Total Classes-08)</b>				
CLASS NO	TOPIC	Subtopic (Elaborated)	Simple Teaching Aids/Activities	Course Objective
1	Fractional horse power (FHP) Motors	<b>5.1 Construction and working</b>	Chalkboard definition writing, students repeat definitions,	CO5
2	Fractional horse power (FHP) Motors	<b>5.1.1 Synchronous Reluctance Motor</b>	PPT slide and presentation	CO5
3	Fractional horse power (FHP) Motors	<b>5.1.2 Switched Reluctance Motor</b>	PPT slide and presentation	CO5
4	Fractional horse power (FHP) Motors	<b>5.1.3 BLDC</b>	PPT slide and presentation	CO5
5	Fractional horse power (FHP) Motors	<b>5.1.4 Permanent Magnet Synchronous Motors</b>	PPT slide presentation	CO5
6	Fractional horse power (FHP) Motors	<b>5.1.5 Stepper motors</b>	PPT slide presentation	CO5
7	Fractional horse power (FHP) Motors	<b>5.1.6 AC and DC servomotors</b>	PPT slide and presentation	CO5
8	Fractional horse power (FHP) Motors	<b>5.2 Torque speed characteristics of above motors</b> <b>5.3 Applications of above motors</b>	PPT slide and presentation	CO5

*Taras Paigrali*  
Signature of the Faculty

*S. S. S.*  
17/1/26  
Signature of the HOD  
Deptt. of Electrical Engg.  
Govt. Polytechnic  
Bolangir