

SEMESTER: S5
AC MACHINES LAB

Course Code	PCEEL507	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	PCEET402	Course Type	Lab

Course Objectives:

1. Provide practical experience in operation and testing of synchronous and induction machines

Expt. No.	Experiments
PART A – INDUCTION MACHINES	
1	<p>Load test on a 3-phase squirrel-cage induction motor (CO1)</p> <p>Objectives:</p> <ol style="list-style-type: none"> Start the motor using star-delta starter / auto-transformer starter Determine the performance characteristics
2	<p>Load test on a 3-phase slip-ring induction motor (CO1)</p> <p>Objectives:</p> <ol style="list-style-type: none"> Start the motor using rotor resistance starter / auto-transformer starter Determine the performance characteristics
3	<p>No-load and blocked-rotor tests on a 3-phase squirrel-cage induction motor (CO1)</p> <p>Objectives:</p> <ol style="list-style-type: none"> Determine the equivalent circuit parameters Predetermine its performance at rated speed from equivalent circuit Predetermine its performance on full-load from circle diagram
4	<p>No-load and blocked-rotor tests on 3-phase pole-changing induction motor (CO1)</p> <p>Objectives:</p> <ol style="list-style-type: none"> Conduct no-load and blocked-rotor tests in two different pole configurations (example 4 pole and 8 pole) Predetermine its performance on full-load from circle diagrams in both cases

	OR
	Load test on 3-phase pole-changing induction motor (CO1) Objectives: a) Conduct load tests in two different pole configurations (example 4 pole and 8 pole) b) Determine the performance characteristics
5	Variation of starting torque with rotor resistance in 3-phase slip-ring induction motor (CO1) Objectives: a) Plot the variation of starting torque against rotor resistance b) Determine the external rotor resistance for which maximum starting torque is obtained
6	Brake test on 1-phase induction motor (CO6) Objectives: Plot the performance characteristics
7	No-load and blocked-rotor tests on 1-phase induction motor (CO6) Objectives: a) Determine the equivalent circuit b) Predetermine the efficiency on full-load from equivalent circuit
8	3-phase induction machine working as motor and generator (CO2) Objectives: Determine the performance of 3-phase induction machine working as motor and generator
9	Speed control of 3-phase squirrel-cage induction motor using V/f technique (CO3) Objectives: Perform the speed control of a 3-phase squirrel-cage induction motor by varying supply voltage and frequency
PART B –SYNCHRONOUS MACHINES	
10	Voltage regulation of 3-phase synchronous generator by EMF and MMF method (CO4) Objectives: a) Conduct OC and SC tests. b) Predetermine the full-load voltage regulation at different power factors.

11	Voltage regulation of 3-phase synchronous generator by direct loading (CO4) Objectives: a) Determine the voltage regulation at full-load or half full-load at any power factor. b) Compare the voltage regulation with emf method.
12	Voltage regulation of 3-phase synchronous generator by Potier method (CO4) Objectives: a) Conduct OC, SC and ZPFC tests. b) Predetermine the full-load voltage regulation at different power factors.
13	V curves and Inverted V curves of synchronous machines (CO5) Objectives: a) Synchronise the 3-phase alternator using dark lamp or bright lamp method b) Plot the V curves and inverted V curves of synchronous motor on no-load and half/full load. c) Plot the V curves and inverted V curves of synchronous generator on half/full load.
14	Slip test on 3-phase salient-pole synchronous machines (CO4) Objectives: a) Determine direct-axis and quadrature-axis synchronous reactances b) Predetermine the full-load voltage regulation at different power factors c) Predetermine the excitation and reluctance power with 120% excitation voltage and hence plot the power angle characteristics
NOTE: A minimum of TWELVE experiments are mandatory out of the fourteen listed.	

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- *Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.*
- *Endorsement by External Examiner: The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Analyze the performance of 3-phase squirrel cage and slip ring induction motor at different loads.	K3
CO2	Analyze the performance of line excited induction machine working in motoring and generating modes	K3
CO3	Apply V/f control techniques for the speed control of 3-phase induction motors	K3
CO4	Determine the voltage regulation of 3-phase cylindrical rotor type and salient pole type synchronous generators	K3
CO5	Construct V and inverter V curves of synchronous machines at constant load.	K3
CO6	Compute the efficiency of single-phase induction motor at a specified load.	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		2					3	2		3
CO2	3	2		2					3	2		3
CO3	3	2		2					3	2		3
CO4	3	2		2					3	2		3
CO5	3	2		2					3	2		3
CO6	3	2		2					3	2		3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Electrical Machinery	P.S. Bimbhra	Khanna Publishers	7 th edition 2021
2	Electric Machines	D P Kothari & I J Nagrath	Tata McGraw Hill	5 th edition 2017

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (7 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping (6 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (5 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. Procedure/Preliminary Work/Design/Algorithm (10 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. Conduct of Experiment/Execution of Work/Programming (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted