University School of Automation and Robotics
GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY
East Delhi Campus, Surajmal Vihar
Delhi - 110092

Paper Code: ARI 210	**L**	**T/P**	**Credits**
Subject: Electrical Machines and Drives	3	-	3

Marking Scheme

1. Teachers Continuous Evaluation: 25 Marks
2. End Term Theory Examination: 75 Marks

INSTRUCTIONS TO PAPER SETTERS: **Maximum Marks : 75**

1. There should be 9 questions in the end term examination question paper
2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
3. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes:

CO1:	Ability of students to utilize concepts of abstract data types.
CO2:	Ability of students to design, implement, and analyze linear data structures, such as lists, queues, and stacks, according to the needs of different applications.
CO3:	Ability of students to design, implement, and analyze efficient tree structures to meet requirements such as searching, indexing, and sorting.
CO4:	Ability of students to practically implement knowledge gained for computing graph problems and implement efficient graph algorithms to solve them.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	3	3	3	3	1	-	-	3	1	2	3
CO2	3	3	3	3	3	1	-	-	3	1	2	3
CO3	3	3	3	3	3	1	-	-	3	1	2	3
CO4	3	3	3	3	3	1	-	-	3	1	2	3

UNIT I **[10]**

Fractional Horsepower Motors: Single Phase Induction Motor: Double revolving field theory, equivalent circuit, no load and blocked rotor tests, starting methods, split phase Induction motor- capacitor start, two value capacitor motor. Introduction and applications of single-phase AC series motor, universal motor, AC servo motor, stepper motor, permanent magnet AC motors.

Stepper Motors: Principle of operation, characteristics and analysis of variable reluctance, permanent magnet and hybrid stepper motors, torque equation, drive circuits and switching diagrams, Open-Loop Control of Stepper Motor, Microprocessor-Based Control of Stepper Motor.

UNIT II **[10]**

Switched Reluctance Motors: Construction, principle of operation, torque production, modes of operation, drive circuits, microprocessor-based control of SRM and sensor less control.

Prof. Ajay S. Singholi
Professor In-charge, USAR
Guru Gobind Singh Indraprastha University
(East Delhi Campus)
Surajmal Vihar, Delhi-110092

Permanent Magnet Machines: Construction, working principle, torque equation, equivalent circuit, performance characteristics and applications of permanent magnet brushed DC motors (PMBDC), PMBLDC Motors, permanent magnet synchronous motors, reluctance motors, synchronous reluctance motors. DC and AC tacho generators.
Special Electrical Machines: Construction, principle of operation, characteristics and analysis of fractional horse power universal motor, hysteresis motor. Construction, principle of operation of Linear Induction Motors and applications.

UNIT III **[10]**

Dynamics of Electric Drives: Types of loads, quadrant diagram of speed time characteristics, Basic and modified characteristics of dc and ac motors, equalization of load, steady state stability, calculation of time and energy loss, control of electric drives, modes of operation, speed control and drive classifications, closed loop control of drives, selection of motor power rating, class of duty, thermal considerations.

UNIT IV **[10]**

DC Motor Drives: DC motor speed control, Methods of armature control, field weakening, semiconductor-controlled drives, starting, braking, transient analysis, controlled rectifier fed dc drives, chopper-controlled dc drives.
Induction Motor Drives: Three phase induction motor starting, braking, transient analysis, speed control from stator and rotor sides, stator voltage control, variable frequency control from voltage sources and current sources, static rotor resistance control, slip power recovery, static Scherbius and static Kramer drive.

Textbooks:

1. Nagrath I. J., Kothari D. P. (2011). *Electric Machines*. McGraw-Hill Education. 3rd edition.
2. A Fitzgerald A., Kingsley C., Umans S. (2002). *Electric Machinery*. Tata McGraw Hill Education, 6th edition.
3. Venkatratnam K. (2014). *Special Electrical Machines*. Universities Press 2014

References Books:

1. Mohan N. (2012). *Electrical Machines and Drives*. Wiley India Publication
2. Sen P. C. (2002). *Principles of Electrical Machines and Power Electronics*. John Wiley.
3. E.G. Janardanan E. G. (2014). *Special Electrical Machines*. PHI, 2014.

Prof. Ajay S. Singholi
Professor In-charge, USAR
Guru Gobind Singh Indraprastha University
(East Delhi Campus)
Surajmal Vihar, Delhi-110092