USN											Course Code		2	1	E	E	4	4

Fourth Semester B.E. Degree Examinations, Sep/Oct 2023
ELECTRICAL MACHINES-II

Duration: 3 hrs **Max. Marks: 100**

Note: *1. Answer any* **FIVE** *full questions, choosing* **ONE** *full question from each module.*
  2. Missing data, if any, may be suitably assumed

Q. No		*Question*	*Marks*	*(RBTL:CO: PI)*

MODULE – 1

1.	a.	What is back emf? What is its significance?	06	(2 :1: 1.3.1)
	b.	Describe the power flow diagram of a DC motor. Derive the condition for maximum efficiency of a DC Machine.	06	(2 :1: 1.3.1)
	c.	The armature winding of a 4-pole, 250V D.C. shunt motor is lap connected. There are 120 slots each slot containing 8 conductors. The flux per pole is 20mWb and current taken by the motor is 25A. The resistance of armature and field circuit are 0.1Ω and 125 Ω respectively. If the rotational losses are 810W. Find i) back emf ii) gross torque iii) useful torque iv) Electrical, mechanical and commercial efficiencies.	08	(3 :1: 1.3.1)

OR

2.	a.	What is the necessity of starter for a DC motor? Explain the construction and working of 3-point starter. Also compare 3-point and 4-point starter.	06	(2 :1: 1.3.1)
	b.	Discuss the speed control methods of DC shunt motor.	06	(2 :3: 1.3.1)
	c.	A 200V, DC shunt motor takes 27A at rated voltage and runs at 800 rpm. Its field resistance is 100 Ohm. If an additional resistance of 20 Ohm is inserted in the armature circuit, compute the motor speed and line current in case load torque varies as square of the speed.	08	(3 :3: 1.3.1)

MODULE – 2

3.	a.	Explain Swinburne's test. State its merits and demerits.	06	(2 :2: 1.3.1)
	b.	Discuss the Torque-Slip characteristics of 3-Ø induction motor indicating different operating regions.	06	(2 :2: 1.3.1)
	c	The Hopkinson's test on two shunt machines gave the following test results at full load: Line voltage=220V; current taken from supply excluding field currents= 40A; motor armature current=200A; field currents are 6A and 7A. Calculate the efficiency of the machine working as a generator. The armature resistance of each machine is 0.05Ω.	08	(3 :2: 1.3.1)

OR

4.	a.	Derive an expression for running torque. Also obtain the condition for maximum running torque	06	(2 :2: 1.3.1)
	b.	Explain the field test on DC series motor.	06	(2 :2: 1.3.1)
	c	A 440V, 4-pole,3-Ø,50Hz, star connected induction motor has full load speed of 1425rpm. The rotor has an impedance of (0.4+j4) Ω/ph. and rotor to stator ratio is 0.8. Calculate full load torque, full load copper loss, max. torque and the speed at which it occurs and starting current.	08	(3 :3: 1.3.1)

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator**)

MODULE – 3

5. **a.** Explain the operation of 3-Ø induction motor with phasor diagram. **06** (2 :2: 1.3.1)

b. Obtain the exact and approximate equivalent circuit diagrams. **06** (2 :2: 1.3.1)

c A 25kW, 4 pole, 3-Ø, 50Hz Induction motor is running at 1440 rpm, supplying full load. The mechanical losses are 850W and stator losses are 1.7 times the rotor copper losses on full load. Calculate a) Gross mechanical power developed b) rotor copper loss c) rotor resistance per phase if the rotor current per phase is 65A, d) the full load efficiency. **08** (3 :2: 1.3.1)

OR

6. **a.** Draw and explain the Power flow diagram of 3-Ø induction motor. **06** (2 :3: 1.3.1)

b. Explain the operation of induction generator with block diagram. **06** (2 :3: 1.3.1)

c A 415V, 29.84kW, 3-phase, 50Hz, delta connected Induction motor gave the following test data: **08** (3 :3: 1.3.1)
No load test: 415V, 21A, 1250W
Blocked rotor test: 100V, 45A, 2730W
Construct the circle diagram and determine full load current and power factor, max. torque, max. output and efficiency.

MODULE – 4

7. **a.** Why starter is necessary for a 3-Ø induction motor. Explain the construction and operation of star-delta starter. **08** (2 :4: 1.3.1)

b. Discuss the different speed control methods of 3-Ø induction motor. **06** (2:3: 1.3.1)

c Explain the construction, operation, characteristics and applications of 1-phase capacitor start induction run motor. **06** (2 :4: 1.3.1)

OR

8. **a.** Explain double revolving field theory of 1-phase Induction motor with torque-speed characteristics. **08** (2 :4: 1.3.1)

b. Explain the construction, operation, characteristics and applications of universal motor. **06** (2 :4: 1.3.1)

c Explain the construction, operation, characteristics and applications of shaded pole motor. **06** (2 :4: 1.3.1)

MODULE – 5

9. **a.** Why synchronous motor is not self-starting? Explain the different starting methods of synchronous motor. **06** (2 :5: 1.3.1)

b. Analyze the operation of synchronous motor under variable excitation at constant load with vector diagrams? Also draw V- and inverted –V curves. **08** (2 :5: 1.3.1)

c What is hunting? Explain the causes and effects of hunting, and how it is prevented. **06** (2 :5: 1.3.1)

OR

10. **a.** Describe the construction, operation, characteristics and applications of servomotor. **08** (2 :4: 1.3.1)

b. Write a note on stepper motor. **06** (2 :4: 1.3.1)

c Describe the construction and operation of switched reluctance motor. **06** (2 :4: 1.3.1)

** ** ** **