Code: 20A02402T

R20

B.Tech II Year II Semester (R20) Regular & Supplementary Examinations April/May 2024

AC MACHINES

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1		Answer the following: (10 X 02 = 20 Marks)	
	(a)	Compare Concentrated and Distributed Windings.	2M
	(b)	Define Winding Factor.	2M
	(c)	Describe why an Induction Motor is called a 'rotating transformer'.	2M
	(d)	Why an induction motor will never run at its synchronous speed?	2M
	(e)	What are the advantages of salient pole type construction used for synchronous machines?	2M
	(f)	List the various methods to determine the Voltage Regulation.	2M
	(g)	Why a 3-phase synchronous motor will always run at Synchronous Speed?	2M
	(h)	How does a change of excitation affect its Power Factor?	2M
	(i)	Explain how the direction of a capacitor-start motor can be reversed.	2M
	(j)	What is the principle of Reluctance Motor?	2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2	(a)	Calculate the pitch factor for the under given winding: 36 stator slots, 4 poles and coil span 1 to 8.	4M
	(b)	What is the necessity of chording in the armature winding of a Synchronous Machine?	3M
	(c)	Summarize winding factors of an Alternator.	3M
		OR	
3	(a)	Differentiate single layer and double layer winding.	5M
	(b)	A 3-phase, 50 Hz, star-connected alternator with 2-BTL 4 Analyze CO2 layer winding is running at 600 rpm. It has 12 turns/coil, 4 slots/pole/phase and a coil-pitch of 10 slots. If the flux/pole is 0.035 Wb sinusoidally distributed, find the phase and line emf's induced. Assume that the total turns/phase are series connected.	5M
4		The test readings of a 3 phase 14.71 kW, 400 V, 50 Hz, star connected induction motor is given below: No load test : 400 V, 9 A, Cos ϕ = 0.2 Short Circuit Test: 200 V, 50 A, Cos ϕ = 0.4. From the Circle Diagram estimate: (i) Line current, (ii) Power Factor, (iii) Slip, (iv) Efficiency at full load. Also, evaluate the maximum power output.	10M
		OR	
5		Develop an equivalent circuit for three phase induction motor. State the difference between exact and approximate equivalent circuit.	10M

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6	(a)	Predict the full load voltage regulation of a 3-phase star connected, 1000 kVA, 11,000 V alternator has rated current of 52.5A. The ac resistance of the winding per phase is 0.45 Ω. The test results are given below: OC Test: field current = 12.5A, voltage between lines = 422 V SC Test: field current = 12.5A, line current = 52.5A (i) For 0.8 pf lagging and (ii) 0.8 pf leading.	5M
	(b)	Describe how the direct and quadrature-axis reactances of a salient-pole synchronous machine can be estimated by means of slip test.	5M
		OR	
7		Formulate clearly the ASA method of determining the regulation of an Alternator.	10M
8	(a)	A 3-phase star connected synchronous motor rated at 187 kVA, 2300 V, 47A, 50 Hz, 187.5 rpm has an effective resistance of 1.5 ohm and a synchronous reactance of 20 ohm per phase. Determine the internal power developed by the motor when it is operating at rated current and 0.8 power factor leading.	5M
	(b)	Derive the mechanical power developed per phase of a Synchronous Motor.	5M
		OR	
9		A 6600 V, 3 phase, star connected synchronous motor draws a full load current of 80A at 0.8pf leading. The armature resistance is 2.2 Ω and reactance of 22 Ω per phase. If the stray losses of the machine are 3200 W. Find (i) Induced Emf, (ii) Output power, (iii) Efficiency of the machine.	10M
10		Describe the construction and working principle of the following special machines: (i) Stepper motors, (ii) Shaded pole induction motor.	10M
		OR	
11		Explain briefly the determination of Steady state Equivalent Circuit parameters of Single Phase Induction Motor from No-load and Blocked Rotor Tests.	10M

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Code: 20A02402T **R20**

B.Tech II Year II Semester (R20) Regular & Supplementary Examinations August/September 2023

AC MACHINES

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Explain, why the field winding is placed on rotor, instead on stator of an alternator. 2M

(b) Give an expression for distribution factor in an alternator 2M

(c) Why should the rotor of a 3-phase induction motor rotate in the same direction as that of its rotating magnetic field? 2M

(d) Why is it not possible to run an induction motor on synchronous speed? 2M

(e) Differentiate between MMF and EMF methods of finding regulation of an alternator. 2M

(f) What will be the effect, if input to one alternator is changed in parallel operation? 2M

(g) What is a synchronous condenser? 2M

(h) How 'V' and 'Λ' curves of synchronous motor are defined? 2M

(i) Give classification of capacitor motors. 2M

(j) The full load slip of a single phase induction motor is higher than of corresponding 3 phase induction motor. Why? 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 (a) What is the importance of fractional slot windings in AC machines? Derive the expression for pitch factor. 5M

(b) Discuss the differences between distributed and concentrated windings of AC machine. 5M

OR

3 (a) Explain the following terms related 3-phase a.c. windings. 5M
(i) Single-layer and double-layer windings.
(ii) Full-pitch and short-pitch windings.

(b) A 4 pole 50hz, star connected alternator has 6 slots per pole per phase and a 2-layer winding with 4 conductors per slot. If the coil span is 150 find no load terminal emf if the flux per pole is 300 mWb. 5M

4 (a) Explain the operation of no-load and blocked rotor tests of the induction motor. 5M

(b) A 6-pole 50 Hz induction motor has a rotor resistance of 0.25 Ω and a maximum torque of 180 Nm While it runs at 860 rpm. Calculate: 5M
(i) The torque at 4.5% slip.
(ii) The resistance to be added to the rotor circuit to obtain the maximum torque starting.

OR

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5	(a)	Explain the construction details of wound rotor type induction motor.	5M
	(b)	A six pole alternator running at 900rpm s supplying power to a three phase 4-pole induction motor. If induction motor is running at 1250 rpm, determine the frequency of rotor current.	5M
6	(a)	What are the different methods for calculating voltage regulation? Discuss the MMF method of calculating voltage regulation.	5M
	(b)	Explain the two-reaction theory as applied to salient pole synchronous machine.	5M
		OR	
7	(a)	Write a short on: (i) ZPF Method (ii) ASA Method.	5M
	(b)	Two similar three phase y connected alternators are in parallel connection. Each machine has a synchronous reactance of 4.5 ohm per phase and very small resistance. The alternator is excited to generate 1910 V per phase. The machine has a phase displacement of 30°(electrical)relative to each other. Calculate (i) the circulating current (ii) the terminal voltage per phase (c) the power supplied from one machine to other.	5M
8	(a)	Draw phasor diagram of synchronous motor at different power factor.	5M
	(b)	Derive the expression for the maximum power developed by a synchronous motor.	5M
		OR	
9	(a)	Explain in detail about haunting and its suppression.	5M
	(b)	A salient-pole synchronous motor has X_d = 0.85pu and X_q = 0.55 pu. It is connected to bus bars of 1.0 pu voltage, while its excitation is adjusted to 1.2 pu. Calculate the maximum power output that the motor can supply without loss of synchronism. Compute the minimum pu excitation that is necessary for the machine to stay in synchronism while supplying the full-load torque.	5M
10	(a)	Draw and discuss about torque – speed curve of single-phase induction motor.	5M
	(b)	Explain about double revolving field theory in single-phase induction motor.	5M
		OR	
11	(a)	Draw the circuit diagram of a capacitor-start single phase induction motor and explain its working. Where this type of motor is commonly used.	5M
	(b)	Explain the principle of operation of stepper motor and BLDC motor.	5M

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