Code No: RT31024 **R13** SET - 1

III B. Tech I Semester Supplementary Examinations, May – 2016
ELECTRICAL MACHINES – III
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**
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PART –A

1	a)	Give the main difference between AC and DC motors. How are the AC single phase motors made self-starting?	[4M]
	b)	What is the role of damper winding in (i) synchronous generator and (ii) synchronous motor?	[4M]
	c)	What is armature reaction of a synchronous machine? What is its effect for an alternator for zero power factor lagging?	[4M]
	d)	Derive the value of distribution factor for a uniformly distributed 3-phase winding.	[4M]
	e)	What is meant by hunting in synchronous motors and how it can be avoided?	[3M]
	f)	What could be the reasons if a 3-phase synchronous motor fails to start?	[3M]

PART –B

2	a)	Name the motors best suited to drive the following loads. (i) A small portable drill (ii) A $\frac{3}{4}^{th}$ HP air compressor (iii) A vacuum cleaner (iv) A $\frac{1}{3}^{rd}$ HP centrifugal pump.	[4M]
	b)	A 2.5kW, 120V, 60Hz capacitor-start motor has the following impedances for the main and auxiliary windings (at starting): Z_{main}= 4.5 + j3.7 Ω, Z_{aux}= 4.5 + j3.7 Ω. Find the value of starting capacitance that will place the main and auxiliary windings currents in quadrature at starting.	[8M]
	c)	Why are high speeds often desirable in operation of universal motors? Name three ways in which the speed of a universal motor can be varied.	[4M]
3	a)	Derive the generalized expression for an induced e.m.f per phase in three phase alternator, when coils are not full pitch and concentrated in one slot.	[8M]
	b)	A 3-phase, 20-pole, 360 rpm, star connected alternator has a double-layer winding arranged in 180 slots. There are 6-conductors per slot. Find the emf induced per phase, if the flux per pole is 0.042 Wb. The coils are short-chorded by one slot.	[5M]
	c)	Discuss the advantages of rotating field type of alternators.	[3M]

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4 a) Explain clearly what is meant by synchronous impedance of an alternator and how it can be determined experimentally. How does the value of regulation as calculated by synchronous impedance method compared with that obtained from an actual load test and why? [10M]

b) O.C and S.C tests were performed on a 3-phase, 0.5MVA, 3.6kV, star- connected alternator. The results are given below. [6M]
O.C: I_f = 10A, V_{oc} = 3000V
S.C: I_f = 10A, I_{sc} = 150A
R_{aph} = 1 ohm. Calculate the percentage regulation for full load condition at 0.8pf leading.

5 a) A synchronous generator is connected to an infinite bus. Discuss the effect of changing the input at constant excitation with the help of phasor diagrams. [8M]

b) Two identical 3-phase alternators work in parallel and supply a total of 1500kW at 11 kV at a power factor of 0.867 lag. Each machine supplies half the total power. The synchronous reactance of each is 50Ω per phase and the resistance is 4Ω per phase. The field excitation of the first machine is so adjusted that its armature current is 50A lagging. Determine the armature current of the second alternator and the generated voltage of the first machine. [8M]

6 a) Derive an expression for the power developed per phase of a synchronous motor. [8M]

b) A 75kW, 400V, 4-pole, 3-phase, star connected synchronous motor has a resistance and reactance per phase of 0.04ohm and 0.4ohm respectively. Compute for full-load 0.8pf lead the open circuit emf per phase and gross mechanical power developed. Assume an efficiency of 92.5%. [8M]

7 a) Describe the construction and working of a synchronous induction motor. [10M]

b) Write a short note on the constant excitation circle. [6M]

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