Code No: 115AE **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, March - 2017
ELECTRICAL MACHINES – III
(Electrical and Electronics Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) What is the role of damper winding in (i) alternator and (ii) synchronous motor? [2]
b) What is an armature reaction? Explain its effect on the terminal voltage of an alternator at unity power factor load? [3]
c) Define voltage regulation. [2]
d) Compare between E.M.F. method and Potier Method. [3]
e) Why alternators are operated in parallel? [2]
f) Define sub transient, transient and steady state reactance's of AC generators? [3]
g) What could be the reasons if a 3-phase synchronous motor fails to start? [2]
h) What are the effects of increase in excitation of a synchronous motor? [3]
i) Can AC series motor be started on no-load? Explain. [2]
j) Explain the principle of working of 1-ϕ shaded pole I.M. [3]

PART - B

(50 Marks)

2.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.
b) An 8-pole, 3-phase, 60^0 spread, double layer winding has 72 coils in 72 slots. The coils are short-pitched by two slots. Calculate the winding factor for the fundamental and third harmonic. [5+5]

OR

3.a) Discuss the differences between distributed and concentrated windings of synchronous machines?
b) Determine the frequency of a 8 pole alternator rotating at 400 R.P.M. If the number of poles is doubled, then what will be its new frequency? [6+4]

4.a) Explain synchronous impedance method to determine voltage regulation of an alternator.
b) A 3-phase, star connected salient pole synchronous generator is driven at a speed near synchronous speed with the field circuit open and the stator is supplied from a balanced 3-phase supply. Voltmeter connected across the line gave minimum and maximum readings of 1196 V and 1217 V. The armature current fluctuated between 170 A and 225 A. Find the direct and quadrature axis reactance per phase. Neglect armature resistances. [6+4]

OR

5.a) Discuss in brief about the two-reaction analysis of a salient-pole synchronous machine

b) A synchronous generator has $X_d = 0.75$ pu and $X_q = 0.5$ pu. It is supplying full-load at rated voltage at 0.8 lagging power factor. Draw the phasor diagram and compute the excitation emf. [6+4]

6.a) Derive expression for synchronizing torque when two alternators are connected in parallel.

b) Two identical 2MVA alternators operate in parallel. The governor of first machine is such that the frequency droops uniformly from 50Hz on no-load to 47.5 Hz on full-load. The corresponding uniform speed droop of the second machine is 50Hz to 48Hz. How will they share a load of 3MW? [5+5]

OR

7.a) What is an infinite bus? State the characteristics of an infinite bus. What are the operating characteristics of an alternator connected to an infinite bus?

b) Describe the factors which affect the sharing of load between two alternators operating in parallel. [6+4]

8.a) Why synchronous motor is not self starting? Explain the methods of starting of synchronous motor.

b) A 500v, 6-pole, 3-phase, 50Hz, star-connected synchronous motor has a resistance and synchronous reactance of 0.3Ω and 3Ω per phase respectively. The open circuit voltage is 600V. If the friction and core losses total 1kw, calculate the line current and power factor when the motor output is 100hp. [6+4]

OR

9.a) Explain hunting of synchronous machines and methods of its prevention.

b) A 3-phase, 415V, 6-pole, 50Hz, star-connected synchronous motor has emf of 520V (L-L). The stator winding has a synchronous reactance of 2ohms per phase and the motor develop a torque of 220N-m. The motor is operating at 415V, 50Hz bus (i) calculate the current drawn from the supply and it's power factor (ii) draw the phasor diagram showing all the relevant quantities. [5+5]

10.a) Write a short notes on double revolving field theory?

b) A universal series motor has a resistance of 30Ω and an inductance of 0.5H. When connected to a 250V DC supply and loaded to take 0.8A,it runs at 2000rpm. Estimate its speed and power factor when connected to a 250V, 50Hz ac supply and loaded to take the same current. [5+5]

OR

11.a) 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.

b) A 250W, 230V, 50Hz capacitor start motor has the following constants for the main and auxiliary windings: main winding, Zm=(4.5+3.7i)Ω. Auxiliary winding Za=(9.5+3.5i)Ω. Determine the value of the starting capacitor that will place the main and auxiliary winding currents in quadrature at starting. [5+5]

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