Code No: 125AE **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 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.

Graph sheets are to be provided during the examination

PART –A

(25 Marks)

1.a) What happens to the value of synchronous reactance if air gap is increased? [2]
b) A 50Hz alternator has a flux of 0.1 Wb/pole, sinusoidally distributed. Calculate the rms value of the emf generated in one turn of the winding, which spans 3/4 of a pole pitch. [3]
c) Explain, why the field winding is placed on rotor, instead on stator of an alternator? [2]
d) What is synchronous reactance? [3]
e) Briefly explain the two main controls of an alternator. [2]
f) Give the condition for presence of no dc decaying component in the fault current of an alternator. [3]
g) Why synchronous motors are not self-staring? Explain. [2]
h) How are 'V' and 'Λ' curves of synchronous motor are defined? [3]
i) The full load slip of a single phase induction motor is higher than of corresponding 3 phase induction motor. Why? [2]
j) Give the working principle of universal motor. [3]

PART – B

(50 Marks)

2.a) What is armature reaction? With the help of neat diagrams explain its effect on main flux in synchronous machines.
b) Explain the following terms related 3-phase a.c. windings.
i) Single-layer and double-layer windings.
ii) Full-pitch and short-pitch windings.
iii) Integral slot and fractional slot windings. [5+5]

OR

3.a) Explain the experimental determination of synchronous impedance.
b) Derive the relation between speed, frequency and number of poles in an alternator. [5+5]

4. Derive an expression for finding regulation of salient - pole alternator using two reaction theory. Draw its Phasor diagram. [10]

OR

5.a) Discuss about experimental determination of X_d and X_q of salient pole alternator using slip test.

b) A 3- phase generator rated at 25 MVA, 13.8 kV is operating at normal terminal voltage and rated load at 0.8 pf lag. The direct axis synchronous reactance is 7.62Ω, Quadrature axis synchronous reactance is 4.57Ω and the armature resistance is 0.15Ω/ph. Determine the direct axis and quadrature axis components of armature current and internal induced voltage. Also find the regulation. [5+5]

6.a) Explain the step by step procedure for synchronization of an alternator to the infinite bus system.

b) Show that synchronizing power is essential for maintaining synchronism of two alternators running in parallel. Deduce the relevant expression for it. [5+5]

OR

7. Explain the effect of change in excitation and mechanical power input on the alternator performance. [10]

8.a) Why at any load, the power factor decreases and the armature current increases if the field current is varied above and below the normal excitation.

b) A 500V, 3-phase mesh connected motor has an excitation emf of 600V. The motor synchronous impedance is (0.4+j5) ohms while the wind age, friction andiron losses are 1200W. What maximum power output can it deliver? [5+5]

OR

9.a) Explain how a synchronous motor can be operated as synchronous condenser.

b) A synchronous motor has an equivalent armature reactance of 3.3Ω. The exciting current is adjusted to such a value that the open circuit emf is 950V. Find the p.f. at which the motor would operate when it takes 80kW from 800V supply line. [5+5]

10.a) Draw the slip-torque characteristics of all types of single phase induction motors and compare their merits and demerits.

b) Explain the working principle of split-phase and capacitor start single-phase induction motors. [5+5]

OR

11.a) Draw the equivalent circuit diagram of single-phase induction motor.

b) Explain the principle of operation of stepper motor and ac series motor. [5+5]

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