4E4175

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4E4175
B.Tech. IV-Sem (Main & Back) Exam; June-July 2016
Electrical & Electronics Engineering
4EX5A Electrical Machines-II
Common with EE,EX

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks (Main & Back): 26

Min. Passing Marks (Old Back): 24

Instructions to Candidates:-

*Attempt any **five questions**, selecting **one question** from **each unit**. All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No.205)

1. NIL ____________ 2. NIL ____________

UNIT-I

Q.1 (a) Explain how rotating magnetic field is produced by three phase currents? [6+4+6=16]

(b) Explain the terms coil span factor and distribution factor in connection with three - phase armature winding, and derive the equations for

(i) Coil span factor

(ii) Distribution factor

OR

Q.1 (a) Explain what are the effects of distribution of winding and use of short- pitched coil. On the magnitude of generated voltage by ac armature winding. Write the equation of generated voltage, considering the effects of above.

(b) Find the no - load phase voltage of a star-connected, 3-phase, 6-pole alternator which runs at 1200 rpm, having flux per pole of 0.1 web Sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and coil is carded by one slot. [6+10=16]

UNIT-II

Q.2 (a) What is meant by slip in an induction motor? Why must slip be present for motor action? [2+6+8=16]

(b) Derive the equation for torque of 3-plase induction motor under running condition.

(c) A 6- pole, 50Hz, 3-phase induction motor running on full load develops a useful torque of 150 N-m at a rotor frequency of 1.5 Hz. Calculate the shaft power output. If the mechanical torque lost in friction be 10 N-M, determine

(i) Rotor copper loss

(ii) The input to motor

(c) Efficiency

OR

Q.2 (a) Why starter is necessary for starting induction motors? Briefly explain with diagram, the star-delta starter. [4]

(b) Explain cogging and crawling in 3-phase induction motor. [4]

(c) Write a short note "on Induction generator" [4]

(d) Explain the method of speed control of 3-phase induction motor by varying the rotor resistance. [4]

UNIT-III

Q.3 (a) Explain the double field revolving theory of single- phase induction motor and derive the equation for net torque developed in the motor, explain why this motor is not self starting. [6]

(b) Draw and explain the equivalent circuit of single-phase induction motor based upon double field revolving theory. [5]

(c) Explain construction and principle of operation of a single-phase synchronous motor. [5]

OR

Q.3 (a) Briefly explain the construction and principle of operation of reluctance motor. Draw a typical torque speed characteristic of motor and explain. [6]

(b) 250 watt, 230 volt, 50Hz capacitor- start motor has the following constants for the main and auxiliary windings. [10]

Main winding: $Z_m = (4.5 + j\,3.7)\ \Omega$

Auxiliary winding: $Za = (9.5 + j\,3.5)\ \Omega$

Determine the value of capacitor that will place the main winding and auxiliary winding currents in quadrature at starting.

Where, Z_m = magnetising impedance Za = impedance of auxiliary winding.

UNIT-IV

Q.4 (a) Explain why a rotating field system is preferred in synchronous generators instead of stationary field system? [6]

(b) Explain with neat diagram, the brushless excitation system of synchronous generations. [5

(c) Explain the Potier- triangle method of finding the voltage regulation of ai alternator. [5

OR

Q.4 (a) What is two reaction theory applicable to salient pole synchronous machines? Draw and explain the phasor diagram of salient pole synchronous machine based upon two reaction theory. [6]

(b) Show that the power developed by the salient pole synchronous machine is given by $P = \frac{E_f V_t}{Xd} \sin\delta + \frac{V_t^2}{2}\left[\frac{1}{Xq} - \frac{1}{Xd}\right]\sin 2.\delta$

Where Xd & Xq are direct axis and quadrature axis reactance, δ is load angle, V_t = terminal voltage and E_f = emf induced. P = power per phase. [5]

(c) What is the synchronizing power? Find the equation for synchronizing torque on no-load of a 3-phase synchronous machine. [5]

UNIT-V

Q.5 (a) Explain briefly with neat diagrams the effect of varying excitation upon armature current and power-factor of a synchronous motor when input power to motor is maintained constant. Draw V- curves and state their significance. [8]

(b) A 2300 volt, 3-phase, star connected synchronous motor has a resistance of 0.2Ω per phase and a synchronous reactance of 2.2 Ω per phase. The motor is operating at 0.5 power factor leading with a line current of 200 Amp. Determine the value of generated emf per phase. [8]

OR

Q.5 (a) Explain with neat sketches the principle of operation of a 3-phase synchronous motor. Also explain why it will not run at other than synchronous speed. [5]

(b) What is synchronous phase modifier? Explain with the help of phasor diagram its operation. [5]

(c) A 3-phase 150 KW, 2300 volt, 50 Hz, 1000 rpm salient pale synchronous motor has Xd = 32 Ω /ph, Xq = 20 Ω/ phase. Neglecting losses, calculate the power developed by the motor if field excitation is so adjusted as to make the back emf twice the applied voltage and load angle is 16°. [6]

Where: Xd = direct axis synch reactance/ phase and
Xq = quadrature synch reactance/ phase
