



C09-EE-603

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BOARD DIPLOMA EXAMINATION, (C-09)
OCT/NOV—2013
DEEE—SIXTH SEMESTER EXAMINATION
AC MACHINES—II

Time : 3 hours]

[*Total Marks* : 80

PART—A

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

1. Draw the phasor diagram of synchronous motor at leading power factor and indicate the component vectors and different angles in it.
2. List out the characteristic features of synchronous motor.
3. What is synchronous condenser and where is it used?
4. Write any three advantages of 3-phase induction motors.
5. Derive the condition for running torque to be maximum in 3-phase induction motor.

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6. Draw the power stages of a 3-phase induction motor.
7. What are different types of single-phase induction motors?
8. State the applications of shaded pole motor.
9. Draw the circuit diagram of single-phase capacitor start and capacitor run motor.
10. What are the advantages of brushless DC motor?

PART—B

Instructions : (1) Answer *any five* questions.

(2) Each question carries **ten** marks.

(3) Answers should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11. (a) Explain why the synchronous motor is not self-starting. 5

(b) A 2200-V, 3-phase star-connected synchronous motor draws a current of 50 amp. The effective resistance and synchronous reactance per phase are 0.2 and 2.2 respectively. The input is 800 kW. Determine the value of back e.m.f. and angle of retardation of the rotor at (i) 0.8 p.f. lag and (ii) 0.8 p.f. lead. 5

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12. (a) Explain the effect of excitation on armature current and power factor at constant mechanical load on synchronous motor. 5

(b) A 3-phase synchronous motor absorbing 50 kW is connected in parallel with a factory load of 200 kW having a lagging power factor of 0.75. If the combined load has a p.f. of 0.95 lagging, what is the kVA rating of synchronous motor? Also calculate the power factor at which the synchronous motor is working. 5

13. (a) Compare the induction motor with synchronous motor in any six aspects. 5

(b) A 3-phase slip ring induction motor giving a reading of 75 volts across slip rings on open circuit when at rest with normal stator voltage applied. The rotor is star-connected and has an impedance of $(0.9 + j6) \text{ } \Omega/\text{Ph}$. Find the rotor current and power factor when the machine is (i) at standstill with slip rings joined to a star-connected starter with a phase impedance of $(5 + j6) \text{ } \Omega/\text{Ph}$ and (ii) when running normally with a 4% slip. 5

14. (a) Derive the relationship among rotor input, rotor copper losses and mechanical power developed in case of 3-phase induction motor. 5

(b) A 10-HP, 4-pole, 440-volt, 3-phase, 50-Hz star-connected induction motor delivers full-load output at 1440 r.p.m. with a power factor of 0.85 lagging. The mechanical losses are 500 watts and stator losses are 350 watts. Calculate (i) the rotor copper losses, (ii) the efficiency and (iii) the line current. 5

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- 15.** Draw the circle diagram of a 7.46-kW, 440-volt, 50 Hz, 3-phase slip ring induction motor with a star-connected stator and rotor, winding ratio of unity, a stator resistance of $0.3 \Omega/\text{Ph}$ and rotor resistance of $0.2 \Omega/\text{Ph}$. The following are the test results :

No-load test data : Line voltage 440 volts, line current 8 A, $\cos \phi_o = 0.2$

Blocked test data : Line voltage 150 volts, line current 30 A, $\cos \phi_{sc} = 0.454$

Calculate (a) full-load p.f., (b) maximum output and (c) full-load slip.

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- 16.** (a) List out different methods of speed control of 3-phase induction motor and explain any one method.

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(b) Explain the working of rotor rheostat starter of a 3-phase slip ring induction motor with a neat diagram.

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- 17.** (a) Explain the working of single-phase induction motor with the help of double-field revolving theory.

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(b) Explain the working of split-phase induction motor with a neat diagram.

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- 18.** (a) Explain the modifications required for DC series motor to work satisfactorily when connected to AC supply.

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(b) Explain the principle of operation of stepper motor.

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