INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRICAL MACHINES

Time Allowed: 3 Hours   *Full Marks: 60*

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 marks is allotted for right answer and 1 marks is allotted for correct explanation of the answer. However, no marks will be given for wrong explanation of the answer of each MCQ type question.
Answer any Five (05) Questions from Group-B.

GROUP-A

1.   Choose the correct answer from the given alternatives and explain your answer (any ten):   2×10=20

i)   The speed in RPM of a 3 phase 4 pole Induction Motor running with 4 % slip is –
(a) 1500 (b) 2880 (c) 1440 (d) 3000.

ii)   The rotor power output of three phase IM is 15KW and the corresponding slip is 4%. The rotor ohmic loss will be (a) 600W (b) 625W   (c) 650W   (d) 700W

iii)   A capacitor- start and run induction motor, as compared to capacitor- start induction motor, has (a) more overload capacity (b) better pf and higher efficiency (c) quieter operation (d) all of these.

iv)   Two alternators are connected in parallel. Their kVA and kW load share can be changed by changing respectively their   (a) driving torque and excitation (b) excitation and driving torque (c) excitations only (d) driving torques only

v)   Salient pole type rotors as compared to cylindrical pole type are (a) smaller in diameter and larger in axial length   (b) larger in diameter and smaller in axial length   (c) larger in diameter as well as axial length   (d) small in diameter as well as axial length

vi)   The number of electrical degrees passed through in one revolution of a six pole synchronous alternator is   (a) 360   (b) 720   (c) 1080   (d) 2160

vii)   The damping winding in a synchronous motor is generally used (a) to provide starting torque only (b) to reduce noise level (c) to reduce eddy currents (d) to prevent hunting and provide the starting torque

viii)   In case the field of a synchronous motor is under excited, the power factor will be   (a) leading (b) lagging   (c) zero   (d) unity

ix)   A voltmeter gives 120 oscillations per minute when connected to the rotor of a slip ring induction motor. The stator frequency is 50Hz. The slip of the motor is (a) 2%   (b) 2.5% (c) 4% (d) 5%

x)   A 3 phase 50 Hz 1500 RPM alternator has total 48 slots and the coils are connected as 1 to 10. The value of Pitch Factor is –
(a) cos 45° (b) cos 22.5° (c) sin 45° (d) sin 22.5°

xi)   A star-delta starter is equivalent to an auto –transformer starter with a tapping of
(a) 86.6% (b) 57.73% , (c) 75%, (d) 70.2%

xii)   The stator of a three phase induction motor produces .... magnetic field (a) Steady (b) rotating   (c) alternating   (d) none of these

xiii)   The starting winding of a single-phase motor is placed in the
(a) rotor (b) stator (c) armature (d) field.

xiv) The direction of rotation of a single-phase motor can be reversed by (a) reversing connections of both windings (b) reversing connections of starting winding (c) using a reversing switch (d) reversing supply connections

xv) If a dc series motor is operated on ac supply, it will (a) have poor efficiency (b) have poor power factor (c) spark excessively (d) all of the above

GROUP-B
Answer any Five (05) questions

2. a) Draw the Torque-Speed characteristics of 3ph induction motor. 2
   b) A 5 HP, 3 phase, 50 Hz, 4 pole Induction Motor is running at 1425 RPM. The friction losses are 450W. Stator Losses are 1.1 kW. Find rotor Cu loss and motor efficiency. Consider 1 HP = 750 Watt. 6

3. a) State the reason for which double cage rotor is designed. Explain its working principle. 2+3
   b) How many types of electric braking are there in 3ph induction motor? 3

4. a) Briefly explain the cogging and crawling of a 3ph induction motor . 2+2
   b) Briefly explain the speed control of three phase induction motor by VVVF method. 4

5. a) What are the advantages of placing field winding on rotor in an Alternator? 4
   b) A 8pole, 3-ph star connected alternator's stator is wound with 2-slot per pole per phase. Find distribution factor. 4

6. a) Define voltage regulation of an alternator. 2
   b) A 1200 kVA 3300V, 50Hz, 3-ph star connected alternator has armature resistance 0.25ohm/phase. A field current of 50A produce a short-circuit current 200A and an open circuit e.m.f of 1100V line to line. Calculate the voltage regulation on Full load 0.8 p.f. lagging. 6

7. (a) Derive the EMF equation of 3 phase alternator. 4
   (b) Distinguish between 3 phase Induction Motor and 3 phase Synchronous Motor. 4

8. a) Explain 'V' curve of synchronous motor. 4
   b) Write the name of different starting methods of a synchronous motor. 2
   c) What is the purpose of damper windings in a synchronous machine? 2

9. a) Explain why a single phase induction motor should be provided with an auxiliary winding on the stator. 4
   b) What are the advantages of capacitor run motor compared to capacitor start motor? 4

10. Write short note on the following (Any Two) : 4+4
    a) BLDC Motor
    b) Stepper Motor
    c) DC Servo Motor