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B. TECH.

FOURTH SEMESTER EXAMINATION, 2001-2002
ELECTRICAL MACHINES

Time : Three Hours   *Total Marks : 100*

Note : Answer all the *FIVE* questions.

Answer any TWO of the following :—   (10×2=20)

(*a*)   Enumerate the factors that influence the speed of a d.c. motor and explain how the speed of a d.c. shunt motor may be varied both above and below the speed at which it runs with full field current.

(*b*)   Why is the shunt generator characteristic on load drooping and turns back as it is overloaded ? Explain.

(*c*)   A short shunt compound wound d.c. generator supplies a load current of 150 amperes at 230 volts The generator has following winding resistances :

Armature Resistance = 0·15 Ω

Series field resistance = 0·1 Ω

Shunt field resistance = 100 Ω

Calculate the e.m.f. generated, if the brush drop is 2 volts/brush.

2.   Answer any TWO of the following :—   (10×2=20)

(*a*)   Explain leakage flux and leakage reactance in reference to a transformer and obtain its equivalent circuit with secondary quantities referred to the primary side.

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(b) Explain two-quadrant and four-quadrant operations of d.c. motor and enlist the various applications of d.c. shunt, series and compound motors with proper justification.

(c) The no load transformation ratio in a 200 KVA, 50 Hz, single phase transformer is 4000/250 volts. For a maximum core flux of 0·06 webers, find

    (i) the efficiency at half the rated KVA and at unity power factor ?

    (ii) the efficiency at full load, 0·8 power factor lagging and

    (iii) KVA load for maximum efficiency, given that the full load copper losses are 1·8 KW and Core losses are 1.5 KW.

3. Answer any FOUR of the following :—   (5×4=20)

(a) Why are the iron losses in a transformer substantially independent of the load current ? Explain.

(b) Explain the constructional difference between a current transformer and a potential transformer.

(c) Explain how a short circuit test is performed on a single phase transformer and why it gives the copper losses only and not the iron losses.

(d) Briefly explain how the rotation of the induction motor is produced.

(e) Briefly enumerate the applications and advantages of auto-transformer.

(f) Explain why the number of poles of the stator and of the rotor of an a.c. motor should be equal.

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4. Answer any TWO of the following :— (10×2=20)

(*a*) What is the effect of introducing resistance into the rotor circuit of a slip-ring induction motor while it is running on a constant load torque.

(*b*) Explain why the single phase induction motor is not self starting and enlist the different methods of its starting.

(*c*) Develop an expression to show that the torque developed in a 3ϕ induction motor depends upon the supply voltage, rotor reactance and slip. Also obtain the conditions of maximum torque.

5. Answer any TWO of the following :— (10×2=20)

(*a*) A full load current of 100 amperes requires an excitation current of 3 amperes when a single phase 1200 volts alternator is short circuited by an ammeter of resistance 0.01 Ω. On open circuit the same excitation produces 350 volts. The resistance of the armature is 0.5 Ω. Calculate the regulation of the alternator at 0·8 power factor leading.

(*b*) A 1100 volts 3-phase alternator is running at 300 rpm and has 24 poles. Find the number of conductors in the stator winding, if the magnetic flux is 5×10^{-2} webers/pole by assuming the breadth factor equal to 0·96 and coil to be full pitched.

(*c*) Is it possible to vary the speed of synchronous motor by varying the field excitation or by any other method? Explain what happens when the field current is (*i*) increased (*ii*) decreased.

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