D 51022 (Pages 3)

Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, NOVEMBER 2013

AN/AM/ME 09 305–ELECTRICAL TECHNOLOGY

Time : Three Hours Maximum : 70 Marks

Part A

1. What type of motor is preferred for traction ? Why ?
2. A moving coil instrument has a resistance of 20 ohms and a full scale deflection corresponding to 1mA, Calculate the shunt resistance needed to convert it into an ammeter of 2 A range.
3. A slip ring induction motor runs at 285 r.p.m. on full load when fed from a 50 Hz supply. Calculate number of poles and slip.
4. Define the term pinch off voltage of MOSFET.
5. What is a D.C. chopper ?

(5 × 2 = 10 marks)

Part B

6. A shunt motor supplied at 250 V, runs at 900 r/min when the armature current is 30 A. The resistance of the armature circuit is 0.4 Ω. Calculate the resistance required in series with the armature to reduce the speed to 600 r.p.m., assuming that the armature current is then 20 A.
7. Write a short notes on open circuit and short circuit tests on a transformer.
8. Explain the operation of dynamo meter type instruments.
9. Explain any *one* type of starter used in cage induction motors with the neat sketch.
10. Explain any *two* speed control methods employed in d.c. shunt motor ?
11. Describe slip power recovery schemes.

(4 × 5 = 20 marks)

Part C

12. (a) (i) A series motor runs at 900 r.p.m. when taking 30 A at 230 V. The total resistance of the armature and field circuit is 0.8 Ω. Calculate the values of additional resistance required in series with the machine to reduce the speed to 500 r.p.m. if the gross torque is (a) constant ; (b) proportional to the speed (c) proportional to the square of the speed. Assume the magnetic circuit to be unsaturated.

(6 marks)

Turn over

(ii) Calculate the torque in Nm, developed by a d.c. motor having an armature resistance of 0.25 W and running at 750 r.p.m. When taking an armature current of 60 A from a 480 V supply.

(4 marks)

Or

(b) (i) With the neat sketch, draw and explain the 4-point starter along with the protective device.

(6 marks)

(ii) Write a short essay describing the effects of (a) armature reaction and (b) poor commutation on the performance of a d.c. machine. Indicate in your answer how the effects of armature reaction may be reduced and how commutation may be improved.

(4 marks)

13. (a) (i) A 400 V, three-phase supply is connected through a three-phase loss-free transformer of 1 : 1 ratio, which has its primacy connected in mesh and secondary in star, to a load comprising three 20 Ω resistors connected in delta. Calculate the currents in the transformer windings, in the resistors and in the lines to the supply and the load. Find also the total power supplied and the power dissipated by each resistor.

(6 marks)

(ii) The primary and secondary windings of a 30 kVA, 11,000/230 V transformer have resistances of 10 Ω and 0.016 Ω respectively, the total reactance of the transformer referred to the primary is 23 Ω. Calculate the percentage regulation of the transformer when suppling full load current at a power factor of 0.8 lagging.

(4 marks)

Or

(b) (i) A moving coil galvanometer of 10 Ω resistance had a 50 division scale and indicates one micro ampere per division. Show how it can be used as a milliammeter of range 50 mA and as a voltmeter of range of 5 volts.

(4 marks)

(ii) Explain the principle of operation of permanent magnet moving coil (PMMC) instruments.

(6 marks)

14. (a) (i) Derive the expression of EMF equation of an Alternator. (5 marks)

(ii) A 3-phase delta connected alternator is excited to give 6,600 V between lines on no load. Its resistance is 0.5 ohm and synchronous reactance 50 ohms per phase. Determine the terminal voltage and regulation when it is delivering a line current of 200 A at (a) 0.8 pf lag ; (b) 0.6 pf lead.

(5 marks)

(b) (i) Explain how a rotating magnetic field may be produced by stationary coils carrying three-phase currents.

Determine the efficiency and the output kilowatts of a three-phase 400V induction motor running on load when a fractional slip of 0.04 and taking a current of 50A at a power factor of 0.86. When running light at 400V, the motor has an input current of 15A and the power taken is 2000W, of which 650 W represent the friction, windage and rotor core loss the resistance per phase of the stator winding is 0.5 Ω.

(7 marks)

(ii) You have been asked to design a cheap fan to fit in a refrigerator which motor would you select ? Justify your choice.

(3 marks)

15. (a) (i) A three-phase half-wave rectifier is supplied by a three-phase a.c. input of 175V (RMS). It supplies a d.c. motor load with a back e.m.f. of 90V. Other data are $R_a = R_{ld} = 1.2\ \Omega$, $L_{rd} = \infty$, $\alpha = 58°$ and $L_s = 1.8$ mH. Determine I_{ld}, $g_{\mu\alpha}$ and $V_{\mu\alpha}$.

(4 marks)

(ii) Derive the expression for the load current $i_{ld}(t)$ for a continuously conducting n-phase rectifies with firing angle α. Assume that the a.c. voltage is sinusoidal in nature and the load is inductive.

(6 marks)

Or

(b) (i) Derive the expressions for the inductor L and the capacitor C used in a modified parallel resonant turn off circuit.

(5 marks)

(ii) Explain how the commutation of thyristors takes places in a single-phase full bridge inverter.

1 With a resistive load and

2 With an R + L load.

(5 marks)

[4 × 10 = 40 marks]