BT-MRE-III-12.16-1483 Reg. No. | | | | | | | | | |

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B. Tech. Degree III Semester Examination in Marine Engineering December 2016

MRE 1302 ELECTRICAL TECHNOLOGY

(*2013 Scheme*)

Time: 3 Hours Maximum Marks: 100

(5 × 20 = 100)

I. (a) Draw and explain the phasor diagram of a single phase transformer under lagging load. (6)

(b) A 3300/300V single phase transformer gives 0.6 A and 60 W as ammeter and watt meter readings when supply is given to the low voltage windings and high voltage winding is kept open. Find: (7)

(i) Power factor of no load current.

(ii) Magnetising component (iii) Iron loss component.

(c) Develop the exact equivalent circuit of a single phase transformer. From this derive the approximate and simplified equivalent circuit of the transformer. State the various assumptions made. (7)

OR

II. (a) State and prove the condition for maximum efficiency. (5)

(b) Derive an expression for saving in conductor material in an auto transformer over a two winding transformer of equal rating. (5)

(c) A transformer is rated at 100 KVA. At full load its copper loss is 1200 W and its iron loss is 960 W. Calculate: (10)

(i) the efficiency at full load unity power factor.

(ii) the efficiency at half full load, 0.8 power factor.

(iii) the efficiency at 75% full load 0.7 power factor.

(iv) the load KVA at which maximum efficiency occur.

(v) the maximum efficiency at 0.85 power factor.

III. (a) A shunt generator supplied 500 A at 500 V. Calculate its generated emf if its armature and shunt field resistances are 0.02Ω and 125Ω respectively. (5)

(b) What are the conditions for building up of voltage in a dc shunt generator? (5)

(c) What are the effects of armature reaction in a dc generator? (3)

(d) A short shunt compound generator has armature, series field and shunt field resistances of 0.06Ω, 0.03Ω and 110Ω respectively. It supplies 100 lamps rated at 250 V, 40 W. Find the generated emf. Assume that contact drop/brush =1 V. (7)

OR

IV. (a) Derive the torque equation of a dc motor. (5)

(b) DC series motor never started on no load. Explain why. (5)

(c) A 500 V dc shunt motor takes 8 A on no load. The armature and field resistances are 0.2 Ω and 250 Ω respectively. Find the efficiency of the machine: (10)

(a) When run as a motor taking a line current of 90 A at 500 V.

(b) When run as a generator delivering a current of 90 A at 500 V.

(P.T.O.)

V. (a) Sketch the torque-slip characteristic of a 3 phase induction motor indicating the starting torque, maximum torque and operating region. How do the starting and maximum torque vary with rotor resistance? (8)

(b) A 3 phase 6-pole, 50 Hz induction motor has 160 N-m as its useful full load torque. The rotor emf is observed to make 90 cycles per minute. Calculate: (12)
(i) Motor output in KW (ii) Copper losses in rotor (iii) Motor input
(iv) Efficiency if mechanical torque lost in friction and windage is 20 N-m and stator losses are 80 W.

OR

VI. (a) Describe with diagram the working of a star-delta starter. (7)

(b) A 3 phase 4 pole, 50 Hz induction motor is running at 1440 rpm. Determine the slip speed and slip. (3)

(c) Describe with the help of connection diagrams and phasor diagrams of two methods of producing starting torque in a single phase induction motor. (10)

VII. (a) A 3 phase 16 pole synchronous generator has a resultant flux of 0.06 Wb per pole. The flux is distributed sinusoidally over the pole. The stator has 2 slots per pole per phase and 4 conductors per slot. The coil span is 150°. Calculate the phase and line voltages when the machine runs at 375 rpm. (10)

(b) A 600 V, 60 KVA single phase alternator has an effective resistance of $0.2\,\Omega$. A field current of 10 A produces an armature current of 210 A on short circuit and an emf of 480 V on open circuit. Calculate: (10)
(i) Synchronous impedance and reactance.
(ii) Full load regulation with 0.8 pf lagging.

OR

VIII. (a) Draw the phasor diagrams of an alternator at unity, lagging and leading power factors. (6)

(b) Explain what is a synchronous condenser with phasor diagram. (6)

(c) A 200 V, 3 phase star connected synchronous motor has a resistance per phase of $0.2\,\Omega$ and a synchronous reactance per phase of $2.2\,\Omega$. Determine the value of generated emf when the input is 800 KW at 0.8 power factor lagging. (8)

IX. (a) Explain 3 wire dc system of distribution of electrical power. (6)

(b) Draw a single line diagram showing a typical distribution system. (6)

(c) Explain the following systems of distribution. (8)
(i) Ring main system (ii) Inter connected system.

OR

X. (a) Discuss the principle of operation of an air blast circuit breaker. What are the advantages and disadvantages of using air as the arc quenching medium? (10)

(b) Write short notes on the following. (10)
(i) Semi-enclosed rewirable fuse.
(ii) HRC catridge fuse.

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