BT MRE–III(SS)–12–20–1345   Reg. No. ☐☐☐☐☐☐☐☐☐

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B.Tech. Degree III Semester Special Supplementary Examination in Marine Engineering December 2020

MRE 302 ELECTRICAL TECHNOLOGY
(Prior to 2013 Scheme)

Time : 3 Hours   Maximum Marks : 100

$(5 \times 20 = 100)$

I.   (a)   Draw and explain the no load phasor diagram of a single phase   (5)
            transformer.
      (b)   Define voltage regulation of a transformer. Deduce the expression for the   (5)
            voltage regulation.
      (c)   A single phase transformer is connected to a 230 V, 50 Hz supply.   (10)
            The net cross sectional area of the core is 60 cm^2. The number
            of turns in the primary is 500 and in the secondary 100. Determine
            (i) transformation ratio (ii) emf induced in the secondary winding (iii)
            maximum value of the flux density in the core.

OR

II.   (a)   Derive the expression for the saving of copper on an autotransformer as   (10)
            compared to an equivalent two winding transformer.
      (b)   A 15 KVA, 3000/250V, 50Hz single phase transformer gave the following   (10)
            test data:
            Open circuit Test (LV side): 250 V, 0.62 A, 105 W
            Short circuit Test (HV side): 157 V, 5.2 A, 360 W.
            Determine the equivalent circuit parameters referred to the high voltage
            side.

III. (a)   Derive the emf equation of a DC generator.   (5)
      (b)   What are the different losses in a DC machine?   (5)
      (c)   A shunt generator has a full load current of 196 A at 220 V. The stray   (10)
            losses are 720 W and the shunt field coil resistance is 55 Ω. If it has a full
            load efficiency 88%, find the armature resistance. Also, find the load
            current corresponding to maximum efficiency.

OR

IV.   (a)   Draw and explain the characteristics of a DC series motor.   (10)
      (b)   A 230 V DC shunt motor has an armature resistance of 0.1 Ω and shunt   (10)
            field resistance of 275 Ω. It runs at a speed of 1000 rpm when drawing an
            armature current of 75 A. Calculate the additional resistance to be inserted
            in the field circuit to raise the motor speed to 1200 rpm at an armature
            current of 125 A. Assume linear magnetization.

V.   (a)   Explain the working principle of a 3 phase induction motor. Why does an   (10)
            induction motor never run on synchronous speed?
      (b)   A 6 pole, 50 Hz, 3 phase induction motor running on full load with 4% slip   (10)
            develops a torque of 149.3 N-m at its pulley rim. The friction and windage
            losses are 200 W and stator copper and iron losses equal to 1620 W.
            Calculate (i) output power (ii) the rotor Cu loss (iii) the efficiency at
            full load.

OR

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VI. (a) Explain the different methods for the speed control of an induction motor. (10)

(b) Draw the circle diagram for a 3 phase, 6 pole, 50 HZ, 400V, star connected (10)
induction motor from the following data (line values):
No load test: 400 V; 9A; 1,250 W
Short circuit test: 200 V, 50A; 6,930 W
The stator loss at standstill is 55% of total copper losses and full load
current is 32A.From circle diagram determine pf, slip, output, efficiency,
speed and torque at full load.

VII. (a) Derive the expression for induced emf in alternators and explain coil span (10)
factor and distribution factor.

(b) A 3 phase, 16 pole alternator has a star connected winding with 144 slots (10)
and 10 conductors/slot. The flux/pole is 0.03 Wb sinusoidally distributed
and the speed is 375 rpm. Find the frequency, the phase and line emf.
Assume full pitched coil.

OR

VIII. (a) State the requirements for paralleling alternators. (10)
(b) Why a synchronous motor is not self-starting? (10)

IX. (a) Explain 3 phase 4 wire system of distributing electrical power. (10)
(b) Compare the DC and AC transmission systems. (10)

OR

X. (a) What are the requirements of a good distribution system? (10)
(b) Describe the principle of operation of air circuit breaker with diagram. (10)

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