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B.Tech. Degree III Semester Regular/Supplementary Examination in Marine Engineering December 2021

19-208-0302 ELECTRICAL TECHNOLOGY

(*2019 Scheme*)

Time: 3 Hours Maximum Marks: 60

(5 × 15 = 75)

I. (a) What are the no- load component currents of a transformer and sketch no-load vector diagram? (6)

(b) A 3300/300 V single- phase transformer gives 0.6 A and 60 W as ammeter and wattmeter readings, when supply is given to the low voltage winding, high voltage winding is kept open, find: (9)

(i) Power factor of no- load current

(ii) Magnetising component

(iii) Iron loss component

OR

II. (a) Sketch the phasor diagram of a transformer for RL load. (5)

(b) The following test results were obtained on a 20 kVA, 2200/220 V, 50 Hz single phase transformer, (10)

OC(LV Side) : 220 V, 1.1 A, 125 W

SC(HV Side) : 52.7 V, 8.4 A, 287 W

The transformer is loaded at unity power factor on secondary side with a voltage of 220 V. Determine the maximum efficiency and the load at which it occurs.

III. (a) Give the conditions for voltage build up in DC shunt generator. Define critical resistance and critical speed. (8)

(b) An 8- pole wave connected D.C generator has 1000 armature conductors and flux/pole 0.033 Wb. At what speed must it be driven to generate 500 V? (4)

(c) Name the DC motor used for: (3)

(i) lathe machines

(ii) hoists, elevators

(iii) blowers and fan

OR

IV. (a) Draw and explain the characteristics of a DC series wound motors. (7)

(b) A shunt generator delivers 195 A at terminal voltage of 250 V. The armature resistance and shunt field resistance are 0.02 Ω and 50 Ω respectively. The iron and frictional losses equal 950 W. Find: (8)

(i) emf generated

(ii) copper losses

(iii) output of the prime mover

(iv) commercial efficiency

(P.T.O.)

V. (a) Explain the working principle of a 3 phase induction motor. Why does an induction motor never run on synchronous speed? (7)

(b) The power input to the rotor of a 440 V, 50 Hz, 3-phase, 6 pole induction motor is 52 kW.The rotor emf makes 120 cycles per minute. Friction and windage losses are 1 kW. Calculate: (8)

(i) slip

(ii) rotor speed

(iii) rotor copper loss

(iv) mechanical power developed

OR

VI. (a) Sketch and explain a Star-Delta starter. (7)

(b) Explain any two starting methods of single phase induction motors. (4)

(c) A 6-pole, 50Hz, 3-phase induction motor runs at 950 rpm at full load. Calculate the following parameters. (4)

(i) What is percentage slip at full load?

(ii) What is frequency of rotor voltage?

(iii) Rotor frequency at a slip of 20%.

VII. (a) Draw the phasor diagrams of an alternator at unity, lagging and leading pf. (6)

(b) Why are alternators connected in parallel? What are the conditions for paralleling alternators? (9)

OR

VIII. (a) A 3-phase, 50 Hz, 20 pole salient pole alternator with star connected stator winding has 180 slots on the stator. Each slot consists of 8 conductors. The flux per pole is 22 mWb and is sinusoidally distributed. Calculate: (8)

(i) speed of the alternator

(ii) winding factor

(iii) generated emf per phase

(iv) line voltage

(Assume coils are full pitched).

(b) What are the advantages of rotating field over rotating armature in an alternator? (4)

(c) Define distribution factor of an alternator. (3)

IX. (a) Explain any two methods of starting synchronous motor. (8)

(b) Derive the production of rotating magnetic field in an alternator. (7)

OR

X. (a) What is hunting and what are the causes of hunting in synchronous machines? (5)

(b) A 50 kW, 400 V, 3-phase synchronous motor is operating at full load with an efficiency of 92%. If the field current is adjusted to make its power factor 0.8 leading, estimate the armature current. (5)

(c) Explain V-curve in synchronous motor. (5)

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