B. Tech Degree III Semester Examination in Marine Engineering December 2010

MRE 302 ELECTRICAL TECHNOLOGY

Time : 3 Hours   Maximum Marks : 100

I.   (a)   What losses are present in a transformer? Write an expression for efficiency
          and develop the condition for maximum efficiency.   (10)

     (b)   A 20 KVA, 2500/250 V, 50 Hz, 1ϕ transformer has the following test results.
o.c test (LV side)	: 250 V, 1.4 A, 105 W
s.c test (HV side)	: 104 V, 8 A, 320 W
          Compute the parameters of the approximate equivalent circuit.   (10)

<div align="center">OR</div>

II. (a)   A 5 KVA distribution transformer has a full load efficiency at unity p.f of
          95%, the copper and iron losses then being equal. Calculate its all – day
          efficiency if it is loaded throughout the 24 hours as follows :
          No load for 10 hours
          Half load for 5 hours
          Quarter load for 7 hours
          Full load for 2 hours
          Assume load p.f of unity   (10)

     (b)   What is an auto transformer and state its applications? Derive an expression for
          saving in Cu in an auto transformer as compared to an equivalent two winding
          transformers.   (10)

III. (a)   With a neat diagram, list the different parts of a dc machine and explain its functions.
          Derive the emf equation of a generator.   (10)

     (b)   A 4 pole dc shunt generator has a wave winding. The armature and field resistance
          are $0.2\,\Omega$ and $60\,\Omega$. The brush contact drop is 1 V per brush. The generator is
          supplying 50 lamps, each of 60 W at 120 V. Find –
          (i)   armature current
          (ii)   current in each armature conductor
          (iii) generated voltage.
          Neglect armature reaction.   (10)

<div align="center">OR</div>

IV. (a)   Draw a neat diagram and explain a 3 point starter clearly with function of overload
          release and no – volt release coils.   (10)

     (b)   A 25 KW, 250 V, dc shunt generator has armature and field resistances of $0.06\,\Omega$
          and $100\,\Omega$ respectively. Determine the total armature power developed when working-
          (i)   as a generator delivering 25 KW output
          (ii)   as a motor taking 25 KW input   (10)

<div align="right">(P.T.O.)</div>

V.	(a)	Compare cage and wound 3 ϕ Induction motor with reference to construction, performance and its merits and demerits.	(8)
	(b)	Describe the steps used for the construction of circle diagram with a neat diagram.	(12)

OR

VI.	(a)	Induction motor is a generalized transformer. Explain.	(10)
	(b)	A 4 pole, 3 phase induction motor operates from a supply whose frequency is 50 Hz. Calculate :	

          (i)   the speed at which the magnetic field of the stator is rotating

          (ii)   the speed of the rotor when the slip is 0.04

          (iii)   the frequency of the rotor currents when the slip is 0.03

          (iv)   the frequency of rotor currents at stand still.   (10)

VII.	(a)	What are the advantages of having a stationary armature in an alternator? Derive the emf equation of an alternator.	(10)
	(b)	Find the no – load phase and line voltage of a star connected 3 phase, 6 pole alternator which runs at 1200 rpm, having flux per pole of 0.1 wb sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by 1 slot.	(10)

OR

VIII.	(a)	Explain the principle of operation and method of starting of a synchronous motor.	(10)
	(b)	Find the synchronous impedance and reactance of an alternator in which a given field current produces an armature current of 200 A on short circuit and a generated emf of 50 V on open circuit. The armature resistance is 0.1 ohm. To what induced voltage must the alternator be excited if it is to deliver a load of 100 A at a p.f of 0.8 lagging, with a terminal voltage of 200 V.	(10)

IX.	(a)	Explain the layout of a typical ac power supply scheme.	(8)
	(b)	Compare DC and AC transmission with its advantages and disadvantages.	(12)

OR

X.   Write short notes on :

          (i)   connection schemes of distribution systems

          (ii)   air blast circuit breaker

          (iii)   3 wire dc system.   (20)

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