Q. Code: 199831

Reg. No. | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019

Fifth Semester

EE16502 – Design of Electrical Apparatus

(Electrical and Electronics Engineering)

(Regulation 2016)

Time: Three Hours **Maximum : 100 Marks**

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	What is gap contraction factor for slots?	1	U
2.	Generalize the main consideration for the good design of electrical machine?	1	R
3.	Mention the factors governing the length of armature core in a DC machine.	2	R
4.	Distinguish between real and apparent flux densities in a DC machine.	2	R
5.	Why stepped cores are used in transformers?	3	U
6.	Define window space factor.	3	U
7.	Write the coordination of best PF of IM.	4	U
8.	Express the equation for output coefficient in an induction motor.	4	R
9.	Write the expressions for the length of air-gap in salient pole synchronous machine?	5	R
10.	Define runaway speed.	5	R

PART B - (5 X16 = 80 Marks)

11.	(a)	(i)	A 350 kW, 500 V,450 rpm, 6 pole DC generator is built with an armature diameter of 0.87m and core length of 0.32 m, the lap wound armature has 660 conductors. Calculate the specific electric and magnetic loading.	**(8)**	1	A
		(ii)	State and explain the general factors that influence the choice of specific electric and magnetic loading of rotating machines.	**(8)**	1	R

(OR)

	(b)	What are the main group of electrical conducting materials? Describe the properties and applications of those materials.	**(16)**	**1**	**R**
12.	(a)	Determine the main dimensions, number of poles and the length of air gap of a 600 kW, 500 V and 900 rpm generator. Assume average gap density as 0.6 Wb/m^2 and ampere conductors per metre as 35000. The ratio of pole arc to pole pitch is 0.75 and the efficiency is 91 percent. The following are the design constraints: peripheral speed $\leq$40 m/s, frequency of flux reversals $\leq$ 50 Hz, current per brush arm $\leq$ 400 A and armature mmf per pole $\leq$ 7500 A. The mmf required for air gap is 50 percent of armature mmf and gap contraction factor is 1.15	**(16)**	**2**	**AP**
		(OR)			
	(b)	Find the main dimensions, number of poles and length of air - gap of a 600 kW, 500 V, 900 rpm generator. Assume average gap density of 0.6 Wb/m^2 and ampere conductors per metre 35000. The ratio of pole arc to pole pitch is 0.75 and the efficiency is 85%.	**(16)**	**2**	
13.	(a)	(i) Develop an output equation for a single phase and three phase transformer	**(8)**	**3**	**R**
		(ii) Calculate the core and window area required for a 100 kVA, 6600/400 V, 50 Hz, single phase core type transformer. Assume a maximum flux density of 1.25 Wb/m^2 and a current density of 2.5 A/mm^2, voltage per turn is 30 V and window space factor is 0.32.	**(8)**	**3**	
		(OR)			
	(b)	A 250 kVA, 6600 / 400 V, 3 phase core type transformer has a total loss of 4800 W at full load. The transformer tank is 1.25 m in height and 1 m x 0.5 m in plan. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35 degree Celsius. The diameter of tubes is 50 mm and are spaced 75 mm from each other. The average height of tubes is 1.05 m. Specific heat dissipation due	**(16)**	**3**	**AP**

to radiation and convection is respectively 6 and 6.5 W/m^2 - C. Assume that convection is improved by 35 % due to provision of tubes.

14.	(a)	Determine the main dimensions, number of radial ventilating ducts, number of stator slots and the number of turns per phase of a 3.7 kW, 400 V, 3 phase, 4 pole, 50 Hz squirrel cage induction motor to be started by a star delta starter. Work out the winding details. Assume : Average flux density in the gap = 0.45 Wb/m^2, ampere conductors per metre = 23000, efficiency = 0.85, and power factor = 0.84. Machines rated at 3.7 kW, 4 pole, are sold at a competitive price and therefore choose the main-dimensions to give a cheap design.	**(16)**	**4**	**AN**
		(OR)			
	(b)	(i) Find the current in the bars and end rings of a cage rotor of a 6 pole, 3 phase induction motor having 72 stator slots with 15 conductors in each slot if the stator current per phase is 20 A and rotor slots are 55. Hence find the suitable size of the cage bars and end rings.	**(12)**	**4**	
		(ii) Write the procedure for selecting the rotor slots.	**(4)**	**4**	
15.	(a)	(i) Find the main dimensions of a 2500 kVA, 187.5 rpm, 50 Hz, 3 phase, 3 kV, salient pole synchronous generator. The generator is to be vertical wheel type. The specific magnetic loading is 0.6 Wb/m^2 and the specific electric loading is 34000 ac/m. Use circular poles with ratio of core length to pole pitch = 0.65. Assume a winding factor of 0.955.	**(8)**	**5**	**AN**
		(ii) State and explain the factors to be considered for selection of armature slots in an alternator.	**(8)**	**5**	**R**
		(OR)			
	(b)	Describe the procedure for the design of field winding of alternator.	**(16)**	**5**	**AP**