SETHU INSTITUTE OF TECHNOLOGY, KARIAPATTI
(An Autonomous Institution, Affiliated to Anna University, Chennai)
Regulation - 2015

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

15UEE504 – ELECTRICAL MACHINE DESIGN

PART -- A (6*1=6)

UNIT- III

1.	Power transformers should be designed to have maximum efficiency a)at one-fourth load (b)at one-half load (c) at or near full load (d)any of the above	(CO3)	(R)
2.	Yokes with rectangular cross-section are used for a)small capacity transformers (b) medium capacity transformers c)large capacity transformers d)any of the above	(CO3)	(U)
3.	Power transformers have rating (a)equal to 50 kVA (b) equal to 100 kVA (c) above 200 kVA (d)none of the above	(CO3)	(U)
4.	In transformers using hot rolled steel, the cross-section of the yoke is made about _____greater than that of the core A) 5 percent b)10 percent c) 15 percent d)30 percent	(CO3)	(U)
5.	Cylindrical windings using circular conductors, employed in transformers, are a) single layered b)double layered c) multi-layered d) none of the above	(CO3)	(R)
6.	Open circuit test on a transformer is conducted to obtain (A) the leakage impedances (B) the ohmic loss (C) hysteresis loss only (D) core loss only (E) eddy current loss only.	(CO3)	(R)
7.	While considering hysteresis loss in a transformer, under which of the following the loss will not increase ? (A) when flux density is increased by 10% **(B) when thickness of lamination is caused by 10%** (C) when frequency is increased by 10% (D) when both thickness and frequency are increased by 10%.	(CO3)	(R)
8.	Transformer-core laminations are made of (A) cast iron (B) wrought iron **(C) silicon steel** (D) cast steel.	(CO3)	(U)
	UNIT- IV		
9.	The starting torque of a simple squirrel-cage motor is (a) Low (b) Increases as rotor current rises (c) Decreases as rotor current rises (d) High	(CO4)	(U)
10.	In an induction motor, rotor speed is always (a) Less than the stator speed (b) More than the stator speed (c) Equal to the stator speed (d) None of these	(CO4)	(R)
11.	The crawling in the induction motor is caused by (a) improper design of the machine (b) low supply voltage	(CO4)	(R)

	(c) high loads (d) harmonics developed in the motor.		
12.	Larger values of air gap flux density can be adopted while designing induction motors of (A) larger output (B) larger diameter of rotor**(C) both** (A) and (B) above(D) none of the above.	(CO4)	(U)
13.	An induction motor of 10 HP at 750 rpm has efficiency of 83%. An induction motor of 100 HP at 750 rpm can be expected to have an efficiency of (A) 81% (B) 83% **(C) 90%** (D) 99.9%.	(CO4)	(U)
14.	Which type of slots are generally used in induction motors ? (A) Open type **(B) Semi-closed type** (C) Closed type(D) None of the above.	(CO4)	(U)
15.	The starting torque of a simple squirrel-cage motor is (a) Low (b) Increases as rotor current rises (c) Decreases as rotor current rises (d) High	(CO4)	(A)
16.	The crawling in the induction motor is caused by (a) improper design of the machine (b) low supply voltage (c) high loads (d) harmonics developed in the motor.	(CO4)	(R)
PART -- B (4 x 3= 12 Marks) OR (6 x 2= 12 Marks)			
UNIT- III			
17.	Differentiate core and shell type transformers.	(CO3)	(R)
18.	Why is the core of the transformer laminated?	(CO3)	(R)
19.	What are the different losses in a transformer?	(CO3)	(R)
20.	List the disadvantages of using higher flux density in the core?	(CO3)	(An)
21.	What is the cause of noise in transformer?	(CO3)	(R)
22.	Why the cross section of yoke is taken greater than cross section?	(CO3)	(R)
23.	Name few insulating materials used in transformer.	(CO3)	(U)
24.	Mention the main function of cooling medium used in transformer.	(CO3)	(R)
UNIT- IV			
25.	What are the main dimensions of induction motor?	(CO4)	(R)
26.	What are the different types of induction motor? How they differ from each other?	(CO4)	(R)
27.	What type of starter cannot be used for squirrel-cage motors?	(CO4)	(R)
28.	Write the expression for output equation and output coefficient of induction motor.	(CO4)	(R)

29.		What is crawling and clogging?	(CO4)	(U)	
30.		How the induction motor can be designed for best power factor?	(CO4)	(R)	
31.		What is full pitch and short pitch or chording?	(CO4)	(U)	
32.		What is slot space factor?	(CO4)	(R)	
PART -- C (5 x 16 = 80 Marks)					
UNIT - IV					
33.	(a)	Develop the Output equation of a single phase and three phase transformer?	(CO3)	(A)	16
OR					
	(b)	Calculate the kVA output of a single phase transformer from following data; Core height/distance between core centres = 2.8 ; diameter of circumscribing circle/ distance between the core centres = 0.56 ; net iron area / area of circumscribing circle = 0.7, Current density = 2.3 A/mm^2, window space factor = 0.27, frequency = 50Hz, flux density of core = 1.2 Wb/m^2 , distance between core centres = 0.4m.	(CO3)	(A)	16
34.	(a)	Determine the dimension of core and yoke for a 200 kVA ,50 Hz single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of the core laminations .assume voltage per turn 14V, maximum flux density = 1.1Wb/m^2 , window space factor =0.32, current density =3$A/m/m^2$, stacking factor = 0.9, the net iron area is $0.56d^2$ in a cruciform core where d is the diameter of circumscribing circle. Also the width of the largest stamping is 0.85d.	(CO3)	(A)	16
OR					
	(b)	Calculate approximate overall dimension for 200kvA , 6600 /440 v , 50Hz , 3 phase core type transformer . the following data may be assumed ; emf per turn = 10v , maximum flux density = 1.3 Wb/m^2 , current density = 2.5 A/mm^2 , window space factor = 0.3 , overall height = overall width , stacking factor = 0.9. use a 3 stepped core for which net iron area is 0.6 d^2 and the width of the largest stamping is 0.9d.	(CO3)	(A)	16
35.	(a)	Determine the main dimension of the core, the number of turns and the cross section of the conductor of a 5kVA , 11000/400 V , 50Hz	(CO3)	(A)	16

		, single phase core type distribution transformer . the net conductor area in the window is 0.6 times , the net cross section of iron in the core . Assume the square cross section for a core , the flux density 1 Wb/m^2, a current density 1.4 A/mm^2 , and the window space factor 0.2 , height of the window is 3 times its width.			
		OR			
	(b)	A 6600 V, 60 Hz ,single phase transformer has a core of sheet steel. The net iron cross sectional area is 22.6x10-3 m^2, the mean length is 2.23 m , and the there a 4 lap joints. Each lap joint takes ¼ times as much reactive mmf as is required per metre of core. if B_m = 1.1 Wb /m^2, determine the number of turns on the 6600 V winding and the no load current. Assume an amplitude factor of 1.52 and that for given flux density , mmf per metre =232 A/m. specific loss = 1.76 W/kg. specific gravity of plate = 7.5.	(CO3)	(A)	16
36.	(a)	A 250 kvA , 6600/400 V, 3 phase core type transformer has a total loss of 4800 W a full load . the transformer tank is 1.25 m in height and 1m x 0.5m in plan. Design a suitable scheme for tubes if the average temperature rise is to be limited to 35^0C . the diameter of the tube is 50mm and are spaced 75 mm from each other. The average height of tube is 1.05m.	(CO3)	(A)	16
		OR			
	(b)	Explain the design of oil tank and tubes for a transformer	(CO3)	(U)	16
		UNIT - V			
37.	(a)	Derive the Output equation of a Induction motor?	(CO4)	(A)	16
		OR			
	(b)	Determine the main dimensions for a 15 hp, 400 volt, 3 phase, 4 pole, 1425 rpm induction motor. Adopt of a specific magnetic loading of 0.45 Wb/m2 and a specific electric loading of 230 ac/cm. Assume that a full load efficiency of 85% and a full load power factor of 0.88, will be obtained.	(CO4)	(A)	16
38.	(a)	The following design data are provided for an induction motor. Diameter of stator -15cm, Length of stator-9cm,Average flux density – 0.45 Tesla, Efficiency- 84% Power Factor- 0.86,3 phase, 4 pole, 400v delta connected 10 KW, Frequency- 50HZ, Current density- 5A/mm2,Stator slots- 36, Rotor slots-30,Length of rotor	(CO4)	(A)	16

		bar- 15cm,Mean dia. Of end ring-12cm. Calculate i)no load maximum flux ii) length of air gap iii) number of turns per phase iv) rotor bar current and area v)end ring current and area and vi) losses in bars and end rings.			
OR					
	(b)	A 11kW three phase 6 pole, 50Hz, 220 Volts star connected induction motor has 54 stator slots, each containing 9 conductors. Calculate the value of bar and end ring currents. The number of rotor bars is 64. The machine has an efficiency of 86 percent and a power factor of 0.85. The rotor mmf may be assumed to be 85% of stator mmf. Also find the bar and end ring sections if the current density is $5A/mm^2$.	(CO4)	(A)	16
39.	(a)	Estimate the stator core dimensions, number of stator slots and number of stator conductors per slot for a 100 kW 3300 V 50 Hz 12 pole star connected slip ring induction motor. Assume Average gap density = 0.4Wb/m2, Conductors per metre = 25000 A/m. Efficiency $\eta = 0.9$. Power factor = 0.9. Choose main dimensions to give best power factor. The slot loading should not exceed 500 ampere conductors. Also Kws = 0.96.	(CO4)	(A)	16
OR					
	(b)	Estimate the stator core dimensions and the total number of stator conductors for a three phase, 100 kW, 3300V, 50 Hz, 12 pole star connected slip ring induction motor. Assume average gap density = 0.4 Wb/m2, conductors per metre = 25000 A/m, efficiency = 0.9, power factor = 0.9 and winding factor = 0.96. Choose main dimensions to give best power factor.	(CO4)	(A)	16
40	(a)	Explain the procedure for design of rotor bars and end rings of an induction motor.	(CO4)	(U)	16
OR					
	(b)	i) Compare squirrel cage rotor and slip ring rotor with neat diagrams. ii) Illustrate the effect of length of air gap on Induction machines.	(CO4)	(U) (U)	8 8

Question Number	CO Mapping(Indicate the course outcome achieved by the Question	Marks	Percentage
1- 8, 17- 24, 33- 36	(CO3) Determine the dimensions and design suitable cooling schemes for transformers **(Applying)**	50	50%
9-16, 25-32, 37 - 40	(CO4) Compute the main dimensions and various	50	50%

	parameters of Induction Machine **(Applying)**		