SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203.

DEPARTMENT OF ELECRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

SUBJECT : DESIGN OF ELECTRICAL APPARATUS

SEM / YEAR: VI/III

UNIT I - DESIGN OF FIELD SYSTEM AND ARMATURE

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetising current – Flux leakage – Leakage in Armature. Design of lap winding and wave winding.

PART – A

Q.No	Questions	CO	Marks	BT Level	Competence
1.	List the major considerations to evolve a good design of an electrical machine.	CO 1	(2)	BTL 2	Create
2.	Write the different types of Electrical engineering materials.	CO 1	(2)	BTL 5	Evaluate
3.	State the fundamental requirements to be met by high conductivity materials.	CO 1	(2)	BTL 4	Analyse
4.	Brush carbons are often graphited. Justify.	CO 1	(2)	BTL 3	Apply
5.	Draw the hysteresis loop for Soft and Hard magnetic materials	CO 1	(2)	BTL 3	Apply
6.	Mention the properties that an ideal insulating material should possess.	CO 1	(2)	BTL 1	Knowledge
7.	What are the constituents of magnetic circuit in rotating machines?	CO 1	(2)	BTL 1	Evaluate
8.	What is a magnetization curve? How it is made use of in design of electrical apparatus?	CO 1	(2)	BTL 1	Create
9.	Draw "B-at" curve for air. Give its H value in terms of B.	CO 1	(2)	BTL 4	Analyse
10.	What is Carter's coefficient and describe its usefulness in design of DC machine.	CO 1	(2)	BTL 1	Knowledge
11.	Write down the expressions for gap contraction factor for slots and ducts.	CO 2	(2)	BTL 2	Understand
12.	What are ventilating ducts?	CO 1	(2)	BTL 1	Knowledge
13.	Point out the parameters in which the value of exciting current depends upon?	CO 2	(2)	BTL 4	Analyse
14.	Why the real flux density in the teeth is always less than the apparent flux density.	CO 1	(2)	BTL 3	Apply
15.	How is Armature windings classified?	CO 2	(2)	BTL 2	Analyse
16.	Tabulate the difference between Lap winding and Wave winding.	CO 2	(2)	BTL 6	Create
17.	How to determine the number of slots for lap and wave winding?	CO 2	(2)	BTL 6	Create

18.	Compare (i) Short pitch winding and Full pitch winding (ii) Progressive winding and retrogressive	CO 2	(2)	BTL 5	Evaluate
19.	Write the ohms law of a magnetic circuit.	CO 1	(2)	BTL 2	Understand
20.	How to find total mmf in a series circuit?	CO 1	(2)	BTL 1	Evaluate
	PART – B				
1.	(i)Draw and explain the parts of an Electromagnetic rotating electrical machine. (ii) Discuss the limitations in the design of Electrical apparatus.	CO 1	(7) (6)	BTL 4 BTL 4	Analyse Analyse
2.	(i) Sketch the magnetic circuits for different electrical machines by showing the flux path and also derive the mmf equation for series and parallel magnetic circuit. (ii) Compare on similarities and dissimilarities of an electric circuit and a magnetic circuit.	CO 1	(6) (7)	BTL 1 BTL 1	Knowledge Knowledge
3.	Elucidate on different types of materials required for electrical apparatus.	CO 1	(13)	BTL 3	Apply
4.	(i)A stator of machine has a smooth surface, but its rotor has open type of slots with slot width equal to tooth width=12mm. and the length of air gap=2mm. Find the effective length of airgap, if its Carter's coefficient=$1/(1+5(l_g/W_s))$. There are no radial ducts. (ii) Calculate the mmf required for the airgap of a machine having core length 0.32m including 4 ducts of 10mm each. Pole arc=0.19m, slot pitch=65.4mm, slot opening=5 mm, airgap length=5mm, flux per pole=52mwb. Given carter's coefficient is 0.18 for opening/gap=1 and is 0.28 opening per gap=2.	CO 1	(7) (6)	BTL 4 BTL 4	Analyse Analyse
5.	Estimate the effective gap area per pole of a 10 pole, slip ring induction motor with following data: Stator bore = 0.65m, core length = 0.25m, No. Of stator slots=90, stator slot opening = 3mm, rotor slots =120, rotor slot opening = 3mm, air gap length =0.95mm, Carter's co-efficient for ducts= 0.68, Carter's co-efficient for slots = 0.46, number of ventilating ducts=3 each on rotor and stator, width of each ventilating duct=10mm.	CO 1	(13)	BTL 2	Understand
6.	A 175MVA, 20 pole water wheel generator has a core length of 1.72m and a diameter of 6.5m. The stator slots (open) have a width of 22mm, the slot pitch being 64mm and the air gap length at the centre of the pole is 30mm. There are 41 radial ventilating ducts each 6mm wide. The total mmf per pole is 27000A. The mmf required for the air gap is 87% of the total mmf per pole. Estimate the average flux density in the airgap if the field form factor is 0.7.	CO 1	(13)	BTL 5	Evaluate

7.	(i)Explain the methods that are employed for the calculation of mmf in the tapered teeth. (ii) A laminated tooth of armature steel in an electrical machine is 30mm long and has a taper such that a maximum width is 1.4 times the minimum. Estimate the mmf required for a mean flux density of 1.9Wb/m^2 in this tooth. Use simpson's rule. The B-'at' curve for the material of tooth is: B (Wb/m^2): 1.6, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3 'at' (A/m): 3700, 10000, 17000, 27000, 41000, 70000, 109000	CO 1	(7) (6)	BTL 1 BTL 4	Knowledge Analyse
8.	(i) Calculate the apparent flux density at a particular section of tooth from the following data: Tooth width=12mm, slot width=10mm,gross core length=0.32m, no. of ventilating ducts=4 with each 10mm, real flux density=2.2wb/m^2. Permeability of teeth corresponding to real flux density=31.4*10^{-6} H/m. Stacking factor=0.9. (ii) Find the permeability at the root of the teeth of a dc machine armature from the following data: slot pitch = 2.1cm, tooth width at the root = 1.07cm, gross length = 32cm, stacking factor =0.9, real flux density at the root of the teeth = 2.25 tesla, apparent flux density at the root = 2.36 tesla.	CO 2	(7) (6)	BTL 1 BTL 4	Knowledge Analyse
9.	(i) The armature core of a dc machine has a gross length of 0.33m including 3 ducts each 10mm wide and the iron space factor is 0.9. if the slot pitch at a particular section is 25mm and the slot width 14mm, estimate the true flux density and mmf per metre for the teeth at this section corresponding to an apparent flux density of 2.3Wb/m^2. The magnetization curve data for armature stampings is: B (Wb/m^2): 1.6, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3 'at' (A/m): 3700, 10000, 17000, 27000, 41000, 70000, 109000 (ii) Determine the airgap length of a dc machine from the following data: slot width=10mm, gross core length=0.12m, no.of ducts=1 of 10mm width, slot pitch =25mm, Carter's coefficient for slots and ducts=0.32, gap density at pole centre=0.7T. Field mmf per pole=3900AT, mmf require for iron parts of magnetic circuit=800AT.	CO 2	(7) (6)	BTL 1 BTL 1	Knowledge Knowledge

10.	(i)A 15KW, 230V, 4 pole dc machine has the following data: armature diameter = 0.25m, armature core length = 0.125m, length of air gap at pole centre = 2.55mm, flux per pole = 11.7×10^{-3} Wb, ratio pole arc/ pole pitch =0.66. Calculate the mmf required for the air gap (a) The armature surface is treated as smooth (b) If the armature is slotted and the gap contraction factor is 1.18 (ii) Derive the relation between real and apparent flux densities in dc machine.	CO 2	(6) (7)	BTL 1 BTL 1	Knowledge Knowledge
11.	Account on the principal components of armature leakage flux.	CO 2	(13)	BTL 6	Create
12.	List out the steps for design of lap winding and wave winding for a DC machine.	CO 2	(13)	BTL 2	Understand
13.	A 4 pole simplex wave wound armature has 25 slots and 25 coils. The commutator has 25 segments. Work out its winding details.	CO 2	(13)	BTL 2	Understand
14.	Draw the winding diagram in developed form for a simplex lap wound 24 slot, 4 pole d.c. armature with 24 commutator segments. Also draw the sequence diagram to show the position of the brushes.	CO 2	(13)	BTL 3	Apply
	PART-C				
1.	The armature of a dc machine has a diameter of 0.2m, 20 parallel slots each 6mm wide and 25mm deep; the core is 0.15m long with 1 duct 10mm wide, and the air gap 3mm long. Insulation the stampings is 10% of the thickness. If the maximum flux density under the pole is $0.9 Wb/m^2$, determine the mmf required to overcome the reluctance of gap and teeth. Carter's co-efficient for the slots is 0.275 and for the ducts is 0.39. the magnetization curve for the iron is as follows: B (Wb/m^2): 1.4, 1.6, 1.8, 2.0, 2.2, 2.3 H (A/m): 1800, 3000, 6500, 19400, 63000, 112000	CO 1	(15)	BTL 5	Evaluate
2.	Determine the apparent flux density in the teeth of a dc machine when the real flux density is $2.15 Wb/m^2$, slot pitch 28 mm, slot width 10mm and gross core length 0.35m. The number of ventilating ducts is 4, each 10mm wide. The magnetizing force for a flux density of $2.15 Wb/m^2$ is 55000 A/m. The iron stacking factor is 0.9.	CO 1	(15)	BTL6	Create
3.	Develop the winding diagram for a 4 pole, 16 slot dc machine with progressive simplex double layer lap winding.	CO 2	(15)	BTL 6	Create
4.	Work out the winding details for a 4 pole, 17 slot dc machine with double layer wave winding.	CO 2	(15)	BTL 5	Evaluate

UNIT II - DESIGN OF TRANSFORMERS					
Construction - KVA output for single and three phase transformers – Overall dimensions – design of yoke, core and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers. Computer program: Complete Design of single phase core transformer					
PART – A					
Q.No	**Questions**	**CO**	**Marks**	**BT Level**	**Competence**
1.	What is a transformer? How are transformers classified?	CO 3	(2)	BTL 2	Understand
2.	Explain the operation of buccholz realy in a transformer	CO 3	(2)	BTL 2	Understand
3.	What are the advantages of three phase transformer over single phase transformer?	CO 3	(2)	BTL 1	Knowledge
4.	Write down the output equation for 1 phase and 3 phase transformers	CO 3	(2)	BTL 6	Create
5.	Define stacking factor.	CO 3	(2)	BTL 4	Analyse
6.	Explain why circular coils are preferred in transformers.	CO 3	(2)	BTL 1	Knowledge
7.	Distinguish between shell type and core type transformer	CO 3	(2)	BTL 1	Knowledge
8.	Explain why the area of yoke is taken larger than that of a core for transformers.	CO 3	(2)	BTL 1	Knowledge
9.	Why stepped cores are used in transformers? List its advantages and disadvantages	CO 3	(2)	BTL 4	Analyse
10.	Draw the cross section of 3 stepped core. How many different size of laminations are used in it?	CO 3	(2)	BTL 2	Understand
11.	Draw the cruciform section of the transformer core and give the optimum dimensions in terms of circumscribing diameter d.	CO 3	(2)	BTL 3	Apply
12.	On what criteria the type of the core is selected?	CO 3	(2)	BTL 4	Analyse
13.	Mention the types of High voltage and Low voltage windings.	CO 3	(2)	BTL 1	Knowledge
14.	The voltage per turn of a 500KVA, 11KV, Δ/Y three phase transformers is 8.7V.Calculate the number of turns per phase of LV and HV windings.	CO 3	(2)	BTL 3	Apply
15.	Mention the components required for the estimation of no load current in a transformer.	CO 3	(2)	BTL 2	Understand
16.	Give the formula for no load current of a 1 phase and 3 phase transformer.	CO 3	(2)	BTL 6	Create
17.	How does heat dissipation occurs in a transformer?	CO 3	(2)	BTL 5	Evaluate
18.	Name the various cooling schemes used with transformers.	CO 3	(2)	BTL 5	Evaluate
19.	What do you mean by air blast cooling?	CO 3	(2)	BTL 3	Apply
20.	Prepare the list if factors to be considered for selecting the cooling methods of a transformer.	CO 3	(2)	BTL 1	Knowledge
PART – B					

1.	(i)Explain the construction of a single phase transformer and derive its KVA output equation. (ii)Calculate the KVA output of a single phase transformer from the following data: Core height / distance between core centres = 2.8 , diameter of circumscribing circle / distance between the 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 = 50 Hz , Flux density of core = $1.2Wb/m^2$, Distance between core and centres = 0.4m.	CO 3	(6) (7)	BTL 6 BTL 6	Create Create
2.	Explain the construction of a three phase transformer and Derive its KVA output equation.	CO 3	(13)	BTL 1	Knowledge
3.	Draw the diagrams of the following transformers by showing the overall dimensions. (i)Single phase core type transformer (ii)Single phase shell type transformer (iii)Three phase core type transformer	CO 3	(13)	BTL 4	Analyse
4.	Write down the steps for designing of main dimensions for Core, Yoke and Winding of a core and shell type transformer.	CO 3	(13)	BTL 4	Analyse
5.	Determine the dimensions of core and yoke for a 200kVA, 50 Hz, single phase core type transformer. A cruciform core is used with distance between adjacent limbs=1.6times the width of core laminations. Assume voltage/turn=14V, maximum flux density=$1.1Wb/m^2$, window space factor=0.32, current density=$3A/mm^2$ and the 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 largest stamping is 0.85d.	CO 3	(13)	BTL 1	Knowledge
6.	Calculate the main dimensions and winding details of a 100 kVA 2000/400 V 50 Hz single phase shell type, oil immersed, self cooled transformer. Assume voltage per turn 10 V, flux density in core 1.1 wb/m^2, current density 2 A/mm^2, window space factor 0.33. The ratio of window height to window width and ratio of core depth to width of central limb = 2.5, the stacking factor is 0.9.	CO 3	(13)	BTL 2	Understand
7.	Determine the dimensions of core and yoke for a 100 kVA, 50 Hz, Single phase core transformer. A square core is used with distance between adjacent limbs of 1.8 times width of the lamination. Assume voltage / turn as 14 volt, Maximum flux density 1.1 Tesla, Window area constant 0.32,Current density $3A/mm^2$,Take stacking factor 0.9,Flux density in the yoke to be 80% of the flux density in the core.	CO 3	(13)	BTL 4	Analyse
8.	Determine the dimensions of core and window for a 5kVA, 50 Hz, 1- phase, Core type transformer. A rectangular core is used with long side twice as long as short side. The window height is 3 times the width. Voltage per turn = 1.8 V. Space factor = 0.2 δ = 1.8 A/mm^2 , B_m = $1Wbmm^2$	CO 3	(13)	BTL 1	Knowledge

9.	Determine the dimensions of the core , the number of turns , the cross section area of conductors in primary and secondary windings of a 100 kVA, 2200/480 V, 1 phase , core type transformer to operate at a frequency of 50 Hz by assuming the following data. Approximate Volt/turn = 7.5 volt. Maximum flux density = 1.2 Wb/m^2.Ratio of effective cross sectional area of core to square of diameter of circumscribing circle is 0.6.Ratio of height to width of window is 2.Window space factor = 0.28.Current density = 2.5 A/mm^2	CO 3	(13)	BTL 1	Knowledge
10.	A 1-phase 400V, 50Hz transformer is built from stampings having a relative permeability of 1000. Length of the flux path is $2.5*10^{-3}$ m^2 and the primary winding has 800 turns. Estimate the maximum flux and no load current. The iron loss at the working flux density is 2.6 W/Kg. Iron weighs 7.8*1000 Kg/m^3. Stacking factor is 0.9	CO 3	(13)	BTL 3	Apply
11.	A 220/110 V, 1 kVA, 50 Hz, 1 phase transformer having a net core area of 25 cm^2 and the total length of mean flux path of a magnetic core is 40 cm. The total iron used in the transformer is 8kg, the core is operating at flux density of 1.Wb/m^2 for which mmf required/metre length,200 AT. The specification loss is 1 watt/kg. Calculate the no load current and the reactance of the exciting branch.	CO 3	(13)	BTL 2	Understand
12.	The tank of 1250kVA natural oil cooled transformer has the dimensions length, width and height as 0.65*1.55*1.85 m respectively. The load loss=13.1kW, loss dissipation due to radiations 6W/m^2-·C, loss dissipation due to convection =6.5 W/m^2 improvement in convection due to provision of tubes=40%, temperature rise is 40°C, length of each tube is 1m, diameter of each tube is 50mm. Find the number of tubes for this transformer. Neglect the top and bottom surface of the tank as regards the cooling.	CO 3	(13)	BTL 2	Understand
13.	A 250 kVA, 6600/400 V, 3 phase core type transformer has a total loss of 4800 W at full load. The transformer tanks is 1.25m in height and 1m * 0.5m in plan .Design a suitable scheme for tubes if the average temperature rise is to be limited to 35·C.The diameter of the tubes is 50mm and are spaced 75mm from each other. The average height of tubes is 1.05m.Specific heat dissipation due to radiation and convection is 6 and 6.56W/m^2-·C respectively. Assume that convection is improved by 35 percent due to provision of tubes.	CO 3	(13)	BTL 5	Evaluate
14.	Draw the flowchart and write program for resistance and leakage reactance calculation of single phase transformer.	CO 3	(13)	BTL 3	Apply
	PART-C				
1.	Calculate the approximate overall dimensions for a three phase, 200 kVA,6600/440 V, 50 Hz core type transformer with the following data. Emf/turn =10 V, maximum flux density =1.3 Wb/m^2 , current density =2.5 A/mm^2 ,Window space factor = 0.3 Stacking factor = 0.94, overall height = overall width, a 3 stepped core is used, width of the largest stamping = 0.9 d and the net iron area = 0.6 d^2 where d is the diameter of circumscribing circle.	CO 3	(15)	BTL 5	Evaluate

2.	Determine the main dimensions of the core of a 5kVA, 11000/400V, 50Hz, 1 phase core type distribution transformer. The net conductor area in the window is 0.6 times the net cross section area of iron in the core. The core is of square cross section, maximum flux density is $1Wb/m^2$. Current density is $1.4A/mm^2$. Window space factor is 0.2. Height of the window is 3 times its width.	**CO 3**	**(15)**	**BTL 5**	**Evaluate**
3.	A 1000kVA, 6600/440V,50Hz, 3 phase delta/star, core type oil immersed natural cooled transformer. The design data of the transformer is: distance between adjacent links=0.47m, outer diameter of HV winding=0.44m, height of frame=1.24m, core loss=3.7kW and I^2R loss= 10.5kW. Design a suitable tank for the transformer. The average temperature rise of oil should not exceed 35^0C. The specific heat dissipation from the tank walls is $6W/m^2$-^oC and $6.5W/m^2$-^oC due to radiation and convection respectively. Assume that the convection is improved by 35% due to provision of tubes.	**CO 3**	**(15)**	**BTL 6**	**Create**
4.	(i) Draw the flowchart and write a program for core and window dimension design of single phase transformer. (ii) Draw the flowchart and write a program for no load current calculation of single phase transformer.	**CO 3**	**(8)** **(7)**	**BTL 6** **BTL 6**	**Create** **Create**

UNIT III - DESIGN OF DC MACHINES

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Selection of number of poles – Design of Armature – Design of commutator and brushes – design of field Computer program: Design of Armature main dimensions

PART – A

Q.No	Questions	CO	Marks	BT Level	Competence
1.	Give the main parts of dc machine.	CO 4	(2)	BTL 3	Apply
2.	Write down the expression for output equation of a DC Machine.	CO 4	(2)	BTL 6	Create
3.	State the factors influencing the choice of average flux density	CO 4	(2)	BTL 1	Knowledge
4.	Name the factors influencing the choice of specific electric loading	CO 4	(2)	BTL 4	Analyse
5.	Compare the disadvantages of higher specific electric and magnetic loadings.	CO 4	(2)	BTL 3	Apply
6.	What are the factors to be considered while selecting the number of poles in a DC machine?	CO 4	(2)	BTL 2	Understand
7.	List the advantages and disadvantages of having higher number of poles.	CO 4	(2)	BTL 1	Knowledge
8.	Why square pole is preferred?	CO 4	(2)	BTL 4	Analyse
9.	Write the equation for maximum value of main dimensions of a DC Machine.	CO 4	(2)	BTL 3	Apply
10.	Prepare the factors to be considered while selecting a suitable value of armature diameter.	CO 4	(2)	BTL 4	Analyse
11.	Find the maximum permissible output from a machine frame having a diameter of 2m.The maximum permissible specific electric loading is 50,000 and the emf generated in a conductor at no load is to be limited to 7.5 V.	CO 4	(2)	BTL 2	Understand
12.	Mention the factors governing the choice of number of armature slots in a DC Machine.	CO 4	(2)	BTL 1	Knowledge
13.	What are the two types of Armature winding employed in a DC Machine.	CO 4	(2)	BTL 2	Understand
14.	List out the factors which depend on the length of commutator.	CO 4	(2)	BTL 6	Create
15.	State the losses seen at commutator surface.	CO 4	(2)	BTL 1	Knowledge
16.	State the relationship between the number of commutator segments and number of armature coils in dc generator.	CO 4	(2)	BTL 1	Knowledge
17.	How to design the number of brushes for a DC Machine?	CO 4	(2)	BTL 5	Evaluate
18.	What are the two types of field winding employed in the design of field system?	CO 4	(2)	BTL 1	Knowledge
19.	Give the expression for finding the area of shunt field conductor a_f..	CO 4	(2)	BTL 2	Understand
20.	How the ampere turns of the series field coil is estimated?	CO 4	(2)	BTL 5	Evaluate

PART – B

Q.No	Questions	CO	Marks	BT Level	Competence
1.	With a neat diagram explain the constructional features of a dc machine. Also derive its output equation.	CO 4	(13)	BTL 4	Analyse

2.	A 5 kW,250 V , 4 pole ,1500 rpm shunt generator designed to have a square pole face. The loadings are: average flux density in the gap = 0.42Wb/m^2 and ampere conductors per metre = 15,000.Find the main dimensions of the machine. Assume full load efficiency = 0.87 and ratio of pole arc to pole pitch = 0.66.	CO 4	(13)	BTL 1	Knowledge
3.	A design is required for a 50kW, 4 pole , 600 rpm, dc shunt generator, the full load terminal voltage being 220V.If the maximum gap density is 0.83Wb/m^2 and the armature ampere conductors per metre are 30,000.Calculate suitable dimensions of armature core to give a square pole face. Assume that the full load armature voltage drop is 3 percent of the rated terminal voltage and that the field current is 1 percent of the rated full load current. Ratio of pole arc to pole pitch is 0.67.	CO 4	(13)	BTL 2	Understand
4.	Estimate the main dimensions of a 200 kW, 250 volts, 6 poles, 1000, rpm DC generator. The maximum value of flux density in the air gap is 0.87 Wb/m^2 and the ampere conductors per metre length of armature periphery are 31000.The ratio of pole arc to pole pitch is 0.67 and the efficiency is 91 percent. Assume that the ratio of length of core to pole pitch = 0.75.	CO 4	(13)	BTL 4	Analyse
5.	Identify the diameter and length of armature for a 7.5kW, 4 pole, 1000rpm, and 220V shunt motor. Given: full load efficiency=0.83; Maximum gap flux density=0.9 Wb/$m^{2;}$ specific electric loading=30000 ampere conductors per meter; field form factor=0.7. Assume that the maximum efficiency occurs at full load and the field current is 2.5% of rated current. The pole face is square.	CO 4	(13)	BTL 5	Evalute
6.	Explain the procedure and the factors affecting the selection of number of poles in a DC machine**.** What are the advantages and disadvantages of large number of poles in a dc machine?	CO 4	(13)	BTL 3	Apply
7.	Find the main dimensions and the number of poles of a 37kW, 230V; 1400 rpm shunt motor, so that a square pole face is obtained. The average gap density is 0.5 Wb/m^2 and the ampere conductors per meter are 22,000. The ratio of pole arc to pole pitch is 0.7 and the full load efficiency is 90%	CO 4	(13)	BTL 4	Analyse
8.	Determine the number of poles, main dimensions, pole pitch and armature mmf/pole of a 92kW, 220Volt; 1480 rpm D.C motor whose full load efficiency is 89.76%.Specific magnetic loading is 0.545 tesla and specific electric loading is 32,750 AC/m. The pole arc to pole pitch ratio is 0.6%.Assume square pole face.	CO 4	(13)	BTL 1	Knowledge
9.	Design the diameter and length of armature core for a 55 kW, 110 V, 1000 rpm, 4 pole shunt generator, assuming specific electric and magnetic loadings of 26000 ampere conductors/m and 0.5Wb/m^2 respectively. The pole arc should be about 70% of pole pitch and length of core about 1.1 times the pole arc. Allow 10 ampere for the field current and assume a voltage of 4V for the armature circuit. Specify the winding used and also determine suitable values for the number of armature conductors and number of slots.	CO 4	(13)	BTL 2	Understand

10.	A 4 pole, 400 V, 960 rpm shunt motor has an armature 0.3m in diameter and 0.2m in length. The commutator diameter is 0.22m.Give full details of winding stating the number of slots, number of commutator segments and the number of conductors in each slot for an average flux density of approximately $0.55 Wb/m^2$ in the airgap.	CO 4	(13)	BTL 6	Create
11.	(i)Find the minimum number of poles for a 1200kW generator if the average voltage between commutator segments is not to exceed 15 and the armature mmf per pole is not to exceed 10,000 A. (ii) Determine the total commutator losses for a 1000kW, 500V, 800rpm, and 10 pole generator. Given that, Commutator diameter is 1.0m, current density in brushes is $75*10^{-3} A/mm^2$, brush pressure $14.7 kN/m^2$, Coefficient of friction is 0.28 and the total brush drop is 2.2V.	CO 4	(7) (6)	BTL 1 BTL 1	Knowledge Knowledge
12.	(i)Design a suitable commutator for a 350kW, 600rpm, 440V, 6 pole dc generator having an armature diameter of 0.75m.The number of coils is 288.Assume suitable values wherever necessary. (ii)State and explain the factors which govern the choice of specific magnetic loading in a dc machine.	CO 4	(7) (6)	BTL 2 BTL2	Understand Understand
13.	Design the shunt field winding of a 6 pole, 440V, DC generator allowing a drop of 15% in the regulator. The following design data are available: mmf per pole is 7200AT; mean length of the turn = 1.2m; winding depth = 3.5cm; watts per sq.m.of cooling surface = 650. Calculate the inner, outer end surfaces of the cylindrical field coil for cooling. Take diameter of the insulated wire to be 0.4mm greater than the bare wire. Assume 2 micro ohm cm as the resistivity of copper at the working temperature.	CO 4	(13)	BTL 3	Apply
14.	Draw the flowchart and write program to design the armature main dimensions of dc machines.	CO 4	(13)	BTL 1	Knowledge
	PART-C				
1.	A 4 pole, 25HP, 500V, 600 rpm series crane motor has an efficiency of 82%. The pole faces are square and ratio of pole arc to pole pitch 0.67. Assuming an average gap density of $0.55 Wb/m^2$ and ampere conductors per metre are 17,000. Obtain the main dimensions of the core and particulars of a suitable armature winding.	CO 4	(15)	BTL 6	Create
2.	Determine the main dimensions, number of poles and length of airgap of a 600kW, 500V, 900 rpm generator. Assume average gap density as $0.6 Wb/m^2$ and ampere conductors/m as 35000. The ratio of pole arc/pole pitch is 0.75 and the efficiency is 91%. The following are the design constraints: Peripheral speed $\ngtr$ 40 m/s, frequency of flux reversals $\ngtr$ 50Hz, current/brush arm $\ngtr$400A and armature mmf/pole $\ngtr$7500A. The mmf required for airgap is 50% of armature mmf and gap contraction factor is 1.15.	CO 4	(15)	BTL 5	Evaluate
3.	Explain in detail the procedure for shunt field design.	CO 4	(15)	BTL 6	Create

4.	A 6 pole, 220 V, 200kW dynamo is to be level compounded. The mmf required per pole is 7500 A at no load and 9000 A at full load. Calculate the number of series turns per pole, and show a suitable arrangement for these turns. The height of the winding is 0.15m; the field coils are 50 mm thick and fit around at square pole of 0.23 m side. Calculate the diameter of the shunt field conductor. If insulation increases the diameter by 0.1 mm, calculate also the shunt field current. Resistivity is 0.02Ω/m and mm^2. Keep 10 % of the voltage across the shunt field in reserve.	**CO 4**	**(15)**	**BTL 5**	**Evaluate**

UNIT IV - DESIGN OF INDUCTION MOTORS

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram - Computer program: Design of slip-ring rotor

PART – A

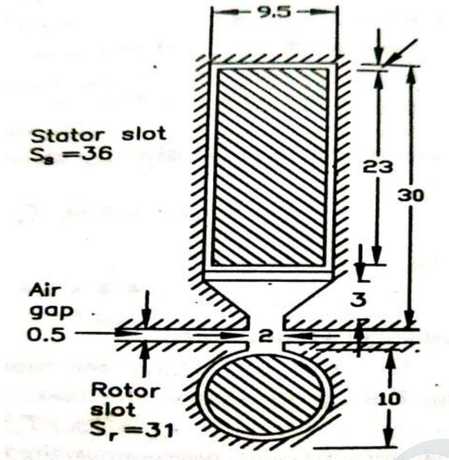
Q.No	Questions	CO	Marks	BT Level	Competence
1.	Why wound rotor construction is adopted in an induction motor?	CO 5	(2)	BTL 2	Understand
2.	Why induction motor is called as rotating transformer?	CO 5	(2)	BTL 1	Knowledge
3.	Mention the advantages of Squirrel cage rotor over slip ring type rotor.	CO 5	(2)	BTL 3	Apply
4.	Define crawling and how it can be minimised?	CO 5	(2)	BTL 6	Create
5.	Write the expression for output equation and output coefficient of induction motor	CO 5	(2)	BTL 2	Understand
6.	How the induction motor is designed for best power factor?	CO 5	(2)	BTL 1	Knowledge
7.	What are the factors to be considered for the choice of specific electric loading?	CO 5	(2)	BTL 4	Analyse
8.	What are the factors to be considered for the choice of specific magnetic loading?	CO 5	(2)	BTL 3	Apply
9.	List the factors to be considered when estimating the airgap length.	CO 5	(2)	BTL 1	Knowledge
10.	Why selection of number of rotor slots is very important in case of squirrel cage motors?	CO 5	(2)	BTL 5	Evaluate
11.	"The number of stator slots should be never equal to rotor slots"-Justify.	CO 5	(2)	BTL 3	Apply
12.	State any three rules for concerning the choice of rotor slots for squirrel cage machines.	CO 5	(2)	BTL 2	Understand
13.	Prepare the methods used to eliminate harmonic torques.	CO 5	(2)	BTL 2	Understand
14.	State the major difference in calculation of magnetising current in a DC machine and Induction motor.	CO 5	(2)	BTL 4	Analyse
15.	Draw the magnetic circuit of a 4 pole induction motor.	CO 5	(2)	BTL 4	Analyse
16.	How will you evaluate the value of blocked rotor current in an induction motor?	CO 5	(2)	BTL 1	Knowledge
17.	Define the term Magnetic leakage.	CO 5	(2)	BTL 6	Create
18.	What is circle diagram? Mention its importance in induction motor	CO 5	(2)	BTL 5	Evaluate
19.	Generalize the tests needed for the construction of circle diagram.	CO 5	(2)	BTL 1	Knowledge
20.	How will you locate the point 'E' in a circle diagram if the rotor is of Squirrel cage type?	CO 5	(2)	BTL 1	Knowledge

PART – B

Q.No	Questions	CO	Marks	BT Level	Competence
1.	Explain the construction of an induction motor and also derive an expression for its output equation.	CO 5	(13)	BTL 4	Analyse

2.	Determine D and L of a 70HP, 415 V, three phase, 50Hz, star connected, 6 pole IM for which ac=30000 A.con/m and B_{av}= 0.51 Wb/m^2. Take efficiency=90% and PF=0.91. Assume τ=L. Estimate the number of stator conductors required for a winding in which the conductors are connected in two parallel paths. Choose a suitable number of conductors per slots so that the slot loading does not exceed 750Amp.cond.	**CO 5**	**(13)**	**BTL 4**	**Analyse**
3.	Find the main dimensions of a 15kW, three phase 400 volts, 50Hz,2810 rpm squirrel cage induction motor having an efficiency of 88 percent and full load p.f of 0.9.Specific magnetic loading is 0.5 Wb/m^2 and specific electric loading is 25000 A/m. Take rotor peripheral speed as approximately 20m/sec at synchronous speed.	**CO 5**	**(13)**	**BTL 1**	**Knowledge**
4.	Identify the main dimension, air gap length, stator slots, slots/ phase and cross sectional area of stator and rotor conductors for three phase, 15HP, 400V, 6 pole, 50Hz, 975 rpm induction motor. The motor is suitable for star – delta starting. B_{av} = 0.45 wb/m2. ac = 20000 AC/m. L / τ = 0.85. η = 0.9, P.F = 0.85.	**CO 5**	**(13)**	**BTL 3**	**Create**
5.	Estimate the stator core dimensions, number of slots, and number of stator conductors per slot for a 100 kW, 3300 V, 50Hz, 12 pole star connected slip ring induction motor. Assume : Average gap density: 0.4Wb/m^2; conductors per metre: 25,000 A/m^2; Efficiency = 0.9, power factor = 0.9 and winding factor = 0.96. Choose the main dimensions to give the best power factor. The slot loading should not exceed 500 ampere conductors.	**CO 5**	**(13)**	**BTL 1**	**Knowledge**
6.	Design a cage rotor for a 40 HP, 3phase, 400V, 50Hz,6 pole, delta connected induction motor having full load efficiency of 87%and a full load power factor = 0.85, D=33cm, L=17cm, Stator slots = 54, conductors per slot = 14. Assume suitably missing data if any.	**CO 5**	**(13)**	**BTL 2**	**Understand**
7.	A 90 kW, 500V, 50 Hz, three phase, 8 pole induction motor has a star connected stator winding accommodated is 63 slots with a 6 conductors / slot. If slip ring voltage, an open circuit is to be about 400V at no load find suitable rotor winding. Identify number of rotor slots, number conductors / slot, coil span, number of slots per pole. P.f = 0.86 and the efficiency is 0.89.	**CO 5**	**(13)**	**BTL 1**	**Knowledge**
8.	A 3 phase induction motor has 54 slots with 10 conductors per slots and 72 rotor slots with 6 conductors per slot. Find the number of stator and rotor turns. Find the voltage across the rotor slip rings when the rotor is open circuited and at rest. Both stator and rotor core are star connected and a voltage of 400V is applied across the stator terminals.	**CO 5**	**(13)**	**BTL 1**	**Knowledge**
9.	A 75 kW,3000 V, 8 pole, 50 Hz,3 phase, star connected slip ring induction motor has the following data: Stator bore=0.66m; stator core length=0.50m; number of stator slots=96; number of rotor slots=72; number of stator turns per phase = 286; total specific permeance due to stator slots = 4.9μ; No load current per phase=6.1 A; No load power factor=0.095; harmonic leakage reactance per phase = 0.9Ω. Estimate the total standstill leakage reactance of motor referred to stator. The winding employs full pitch coils.	**CO 5**	**(13)**	**BTL 2**	**Understand**

10.	A 15KW, 400V, 3 phase, 50Hz, 6 pole induction motor has a diameter of 0.3m and the length of core 0.12m. The number of stator slots is 72 with 20 conductors per slot. The stator is delta connected. Estimate the value of magnetizing current per phase if the length of air gap is 0.55m. The gap contraction factor is 1.2. Assume the mmf required for the iron parts to be 35 percent of the air gap mmf. Coil span = 11 slots.	**CO 5**	**(13)**	**BTL 5**	**Evaluate**
11.	A 20 HP, 3 phase 400 V, 50Hz,4 Pole star connected induction motor has 3 slots/pole phase with short pitched coils of 160· Span .Flux per pole is 0.009/Wb, gap area 180 cm^2, effective airgap is 0.55 m. Estimate the component of magnetizing current for the air gap.	**CO 5**	**(13)**	**BTL 3**	**Apply**
12.	Calculate the equivalent resistance of rotor per phase referred to stator from the following data of a 400V, 3 phase, 4 pole, and 50Hz cage motor. Stator slots = 48 with 30 conductors per slot; rotor slots = 53 with one bar in each slot. The length of each rotor bar is 0.12 m and area $60mm^2$.The end rings have a mean diameter of 0.18m and an area of cross section 150 mm^2. Full pitch winding with 60· Phase spread is used for the stator. The material used for bars and end rings has a resistivity of 0.021Ω/m and mm^2.	**CO 5**	**(13)**	**BTL 2**	**Understand**
13.	Explain the tests to be conducted for drawing a circle diagram and list out the steps for construction of circle diagram of a 3 phase induction motor.	**CO 5**	**(13)**	**BTL 4**	**Apply**
14.	Draw a flowchart and write a program for designing a slip ring rotor	**CO 5**	**(13)**	**BTL 6**	**Create**
PART-C					
1.	A 15 kW, 6 pole, 50HZ, 3 phase squirrel cage induction motor has the following data: Stator bore diameter = 0.32m; axial length of the stator core = 0.12m; number of stator slots = 54; number of conductors per stator slot = 24; current in each stator conductor = 17.5 A ; full load power factor = 0.85 lagging. Design a suitable cage rotor giving the number of rotor slots, selection of each bar and section of each ring. The full load speed is to be about 950 rpm approximately. Use copper for the rotor bars and rings. Resistivity of copper is 0.02 Ω/m and mm^2.	**CO 5**	**(15)**	**BTL 6**	**Create**

2.	Find the leakage reactance of a 7.5kW,400 V,3 phase 50 Hz,4 pole cage type induction motor. The stator bore is 0.18m and the core length is 0.13m.The stator has 36 slots and the rotor has 1 slots. The details of the slots are shown in Figure (a). The length of the airgap is 0.6mm and the number of stator turns is 276.The length of overhang on one side is 0.25m.The stator winding is mush type for which the overhang leakage permeance is given by $\lambda_o = \mu_o * 0.37 * 10^{-6} L_o / 2\sqrt{2}y_{ss}$. Where , L_o = length of overhang on one side and y_{ss} = Stator slot pitch.  Figure (a). Stator and rotor dimensions (All Dimensions are in mm)	CO 5	(15)	BTL 6	Create
3.	Draw the circle diagram for a 3.73 kW, 200-V, 50-Hz, 4-pole, 3-φ star-connected induction motor from the following test data : No-load : Line voltage 200 V, line current 5 A; total input 350 W Blocked rotor : Line voltage 100 V, line current 26 A; total input 1700 W Estimate from the diagram for full-load condition, the line current, power factor and also the maximum torque in terms of the full-load torque. The rotor Cu loss at standstill is half the total Cu loss.	CO 5	(15)	BTL 5	Evaluate
4.	Draw the circle diagram of a 7.46 kW, 200-V, 50-Hz, 3-phase slip-ring induction motor with a star-connected stator and rotor, a winding ratio of unity, a stator resistance of 0.38 ohm/phase and a rotor resistance of 0.24 ohm/phase. The following are the test readings ; No-load : 200 V, 7.7 A, $\cos\varphi_0 = 0.195$ Short-circuit : 100 V, 47.6 A, $\cos\varphi_s = 0.454$ Find (a) starting torque and (b) maximum torque, both in synchronous watts (c) the maximum power factor (d) the slip for maximum torque (e) the maximum output.	CO 5	(15)	BTL 5	Evaluate

UNIT V - DESIGN OF SYNCHRONOUS MACHINES					
Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators - Computer program: Design of Stator main dimensions-Brushless DC Machines					
PART – A					
Q.No	**Questions**	**CO**	**Marks**	**BT Level**	**Competence**
1.	What are the factors that influence the choice of specific magnetic loading in synchronous machines?	CO 6	(2)	BTL 1	Knowledge
2.	Name the two types of synchronous machines	CO 6	(2)	BTL 1	Knowledge
3.	List the types of poles used in salient pole machines.	CO 6	(2)	BTL 1	Knowledge
4.	Define Short Circuit Ratio (SCR) of a Synchronous machine.	CO 6	(2)	BTL 1	Knowledge
5.	Mention the effect of SCR on a machine's performance.	CO 6	(2)	BTL 6	Create
6.	List out the advantages of single layer windings.	CO 6	(2)	BTL 1	Knowledge
7.	Prepare the factors to be considered for selection of armature slots.	CO 6	(2)	BTL 1	Knowledge
8.	Write the different methods for the elimination of harmonics.	CO 6	(2)	BTL 2	Understand
9.	What are the effects of large airgap length on the performance of synchronous machine?	CO 6	(2)	BTL 4	Analyse
10.	State the factors to be considered in choosing the airgap length in case of a synchronous machine.	CO 6	(2)	BTL 3	Apply
11.	Sketch the shape of salient pole rotor for synchronous machine.	CO 6	(2)	BTL 3	Apply
12.	Tabulate the difference between salient pole rotor and cylindrical rotor type alternator.	CO 6	(2)	BTL 2	Understand
13.	Justify why damper windings are employed in synchronous machine?	CO 6	(2)	BTL 2	Understand
14.	Indicate the location of damper windings in a synchronous machine also show the position of damper bars.	CO 6	(2)	BTL 4	Analyse
15.	Write down the expression for field mmf equivalent to armature mmf per pole.	CO 6	(2)	BTL 6	Create
16.	Write the corresponding Winding depth values for the pole pitches of 1mm,2mm,3mm.	CO 6	(2)	BTL 4	Analyse
17.	How the area of the field conductors is can be calculated?	CO 6	(2)	BTL 5	Evaluate
18.	Which relationship is used for the determination of core length "L" when peripheral speed of a turbo alternator is specified?	CO 6	(2)	BTL 2	Understand
19.	Mention any three important features of turbo-alternator rotors?	CO 6	(2)	BTL 5	Evaluate
20.	What are Brushless DC machines? List its advantages.	CO 6	(2)	BTL 3	Apply
PART – B					
1.	(i) Derive the output equation of a synchronous machine. (ii) Mention the factors that influence the choice of specific electric and magnetic loadings in a synchronous machine.	CO 6	(7) (6)	BTL 1 BTL 1	Knowledge Knowledge

2.	Determine the main dimensions for a 1000KVA, 50Hz, 3 phase, 375rpm alternator. The average air gap flux density is $0.55 Wb/m^2$ and the ampere conductors per metre are 28,000. Use rectangular poles and assume a suitable value for ratio of core length to pole pitch in order that bolted on pole construction is used for which the maximum permissible peripheral speed is 50m/s. the runaway speed is 1.8 times the synchronous speed.	CO 6	(13)	BTL 3	Apply
3.	Find main dimension of 100 MVA, 11 KV, 50 Hz, 150 rpm, three phase water wheel generator. The average gap density = 0.65 wb/m2 and ampere conductors / m are 40000. The peripheral speed should not exceed 65 m/s at normal running speed in order to limit runaway peripheral speed.	CO 6	(13)	BTL 3	Apply
4.	Two preliminary designs are made for a 3 phase alternator, the two designs differing only in the number and size of stator slots and the dimensions of stator conductors. The first design uses 2 slots per pole per phase and there are 9 conductors per slot, each slot being 75mm deep and 19mm wide, and the mean width of stator tooth is 25mm. the thickness of slot utilization is 2mm; all other insulations may be neglected. The second design is to have 3 slots per pole per phase. Retaining the same flux density in the teeth and current density in the stator conductors as in the first design, calculate the dimensions of the stator slots for the second design.	CO 6	(13)	BTL 5	Evaluate
5.	Identify the output coefficient for a 1500kVA, 2200 Volts,3 phase,10 pole,50Hz,Star connected alternator with sinusoidal flux distribution. The winding had 60° phase spread and full pitch coils. ac=30000 amp.cond/m, Bav=0.6 Wb/m^2.If the peripheral speed of the rotor must not exceed 100m/sec and the ratio pole pitch to core length is to be between 0.6 and 1,find D and L. Assume an airgap length of 6mm.Find also the approximate number of stator conductors.	CO 6	(13)	BTL 1	Knowledge
6.	Determine the main dimensions of a 75000 KVA, 13.8KV, 50Hz, 62.5rpm, 3 phase star connected alternator. The peripheral speed is about 40m/s. Assume average gap density=$0.65 wb/m^2$, ampere conductors/metre= 40,000 and current density=$4 A/mm^2$. Also find the no. of stator slots, conductors per slot, conductor area. Assume slot pitch= 55mm.	CO 6	(13)	BTL 1	Knowledge
7.	Describe a suitable number of slots conductors / slot for stator winding of three phase,3300V, 50 Hz, 300 rpm alternator, the diameter is 2.3m and axial length of core = 0.35 m. Maximum flux density in air gap should be approximately 0.9 wb / m2. Assume sinusoidal flux distribution use single layer winding and star connection for stator.	CO 6	(13)	BTL 1	Knowledge
8.	A 500KVA, 33KV, 50Hz, 600rpm, 3 phase salient pole alternator has 180 turns per phase. Estimate the length of air gap if the average flux density is $0.54 Wb/m^2$., the ratio pole arc to pole pitch 0.65; the short circuit ratio 1.2; the gap contraction factor 1.15 and the winding factor 0.955. The mmf required for gap is 80 percent of no load field mmf and the winding factor of 0.955.	CO 6	(13)	BTL 4	Analyse

9.	Evaluate for a 15 MVA, 11kV, 50 Hz, 2pole, star connected turbo alternator (i) air- gap diameter, (ii) core length, (iii) number of stator conductors, from the given data Bav= 0.55 wb/sq.m, ac=36000amp.cond/m, δ=5A/sq.mm, synchronous speed n_s=50rps, Kws=0.98, peripheral speed=160m/s.	**CO 6**	**(13)**	**BTL 4**	**Analyse**
10.	Illustrate the steps required for the design of damper winding of synchronous machine and show the position of damper bars in a diagram.	**CO 6**	**(13)**	**BTL 6**	**Create**
11.	Explain the design procedure followed for designing of a field winding in a synchronous machine.	**CO 6**	**(13)**	**BTL 2**	**Understand**
12.	The field coils of a salient pole alternator are wound with a single layer winding of bare copper strip 30mm depth with separating insulation of 0.15mm thick. Analyze winding length, no.of.turns and thickness of conductor to develop an mmf of 1200AT with a potential difference of 5V per coil and with a loss of 1200W/sq.m of total coil surface. The mean length of turn is 1.2m. The resistivity of copper is 0.021Ω/m	**CO 6**	**(13)**	**BTL 4**	**Analyse**
13.	A 588MVA, 22000V, 50Hz, 2 pole, 3 phase star connected direct water-cooled generator has a stator bore of 1.3m and a stator core length of 6m. If the stator winding has 2 conductors per slot and there are two circuits per phase, calculate (a) the number of stator slots (b) the average flux density in the air gap. The specific electric loading is 200000 ampere conductors per metre. Assume a winding factor of 0.92.	**CO 6**	**(13)**	**BTL 2**	**Understand**
14.	(i) Mention the factors that govern the design of field system alternator. (ii) Sketch the shape of salient pole rotor and cylindrical rotor. What are the constructional differences between salient pole type alternator and cylindrical rotor type alternator?	**CO 6**	**(6)** **(7)**	**BTL 2** **BTL 2**	**Understand** **Understand**
	PART-C `				
1.	(i) What is short circuit ratio? How the value of SCR affects the design of alternator? (ii) How is cylindrical pole different from salient pole in a synchronous machine?	**CO 6**	**(8)** **(7)**	**BTL 5** **BTL 5**	**Evaluate** **Evaluate**
2	Identify for 500kVA, 6600V, 20Hz, 500 rpm and connected three phase salient pole machine diameter, core length for square pole face number of stator slots and number of stator conductors for double layer winding. Assume specific magnetic loading = 0.68 tesla, ac = 30000 AC/m and Kws = 0.955.	**CO 6**	**(15)**	**BTL 5**	**Evaluate**
3	Find the main dimensions of a 2500 KVA, 187.5 rpm, 50Hz, 3 phase, 3KV, salient pole alternator. The generator is to be vertical water wheel type. Use circular pole with ratio of core length to pole pitch=0.65. Specify the type of pole construction used if the runaway speed is about 2 times the normal speed.	**CO 6**	**(15)**	**BTL 6**	**Create**

4	A 3000 rpm, 50 hz, 3 phase turbo-alternator has a core length of 0.94m. The average gap density is 0.45 Wb/m^2 and the ampere conductors per metre are 25,000. The peripheral speed of rotor is 100m/s and the length of airgap is 20mm. Find the kVA output of the machine when the coils are (i) full pitch (ii)chorded by 1/3 pole pitch. The winding can be taken as infinitely distributed with a phase spread of 60^0.	**CO 6**	**(15)**	**BTL 6**	**Create**