MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Department of Electrical and Electronics Engineering
Question Bank - Academic Year (2021-22)

Course Code & Course Name	**:**	**19EED05 / Design Of Electrical Apparatus**
Name of the Faculty	**:**	**C. Ram Kumar**
Year/Sem/Sec	**:**	**III / VI /B**

Unit-I: Introduction
Part-A (2 Marks)

1. What are the considerations to be made while designing a electrical machines?
2. List the limitation of electrical machine design.
3. Define specific magnetic loading.
4. Give the factors that decide the choice of specific electric loading.
5. How the design problems of electrical machines can be classified?
6. Write down the classifications of magnetic materials.
7. Mention various duty cycles of a motor.
8. Classify the various classes of insulating material.
9. How was heat developed in electrical machines?
10. Draw temperature vs load curve of intermittent periodic duty with starting and breaking.

Part-B (16 Marks)

1.		Find the diameter and length of a 500kw, 500V, 450r.p.m, 6-pole D.C generator are 84cm and 30cm respectively. If it is lap wound with 660 conductors estimate the specific electric and magnetic loadings.	(16)
2.		Classification of various methods used for determination of motor rating for variable load drives.	(16)
3.		Describe the necessity of thermal consideration in electrical machines and insulating materials	(16)
4.		Write the short notes about standard specifications and electrical engineering materials.	(16)
5.	(i).	Briefly explain about the various types of electrical engineering materials.	(8)
	(ii).	Explain the factors affecting the choice of specific electrical loading.	(8)

Unit-II : D.C Machines

Part-A (2 Marks)

1. Write the output equation of a dc machine.
2. Give the main parts of DC Motor
3. Write down the main dimension of dc machines?
4. What is the range of specific magnetic loading in a dc machine?
5. What are the factors to be considered for the choice of specific magnetic loading?
6. What is the range of specific electric loading in dc machine?
7. Mention the guiding factors involved selection of number of poles?
8. What are the factors to be considered for the selection of number of poles in dc machine?
9. List the advantages of large number of poles
10. Why square pole is preferred?

Part-B (16 Marks)

1. 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 amp. cond./m and 0.5Wb/m2 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. (16)
2. Derive the output equation of dc machine and explain separation of D^2L (16)
3. Identify the diameter and length of armature for a 7.5kW, 4 pole, 1000rpm, 220V shunt motor. Given: full load efficiency=0.83; Maximum gap flux density=0.9 Wb/m2; 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. (16)
4. A 5 KW, 250 volts and 4 pole, 1500 rpm D.C. shunt generator is designed to have a square pole face. The average magnetic flux density in the air gap is 0.42 wb/m2 and ampere conductors per metre = 15000. Compute the main dimensions of the machine. Assume full load efficiency = 87%. The ratio of pole arc to pole pitch = 0.06. (16)
5. 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/m2 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. (16)

Unit-III : TRANSFORMERS

Part-A (2 Marks)

1. List the different losses in a transformer?
2. Define window space factor
3. How the heat dissipates in a transformer?
4. Why circular coils are preferred in transformers?
5. Distinguish between shell type and core type transformer
6. Give the relationship between emf per turn and KVA rating in a transformer.
7. Give the different cooling methods used for dry type transformer?
8. What is the range of efficiency of a transformer?
9. Why cooling tubes are provided?
10. Explain the main function of cooling medium used in transformers

Part-B (16 Marks)

1. Derive the output equation of a single and three phase transformer. (16)
2. Determine the main dimensions of the core, the number of turns, the cross sectional 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 per turn = 7.5 volt. Maximum flux density = 1.2 Wb / m2. 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/mm2. (16)
3. Calculate the dimensions of the core, the number of turns and cross sectional area of conductors in the primary and secondary windings of a 250 kVA, 6600 / 400 V, 50 Hz, single phase shell type transformer. Ratio of magnetic to electric loadings = 560 x 10-8, Bm = 1.1 T, _ = 2.5 A / mm2, Kw = 0.32, Depth of stacked core / width of central limb = 2.6; height of window / width of window = 2.0. (16)
4. The tank of a 500 kVA, 50Hz, 1-phase, core type transformer is 1.05 x 0.62 x 1.6 m high. The mean temperature rise is limited to 35°C. The loss dissipating surface of tank is 5.34 m2. Total loss is 5325 W. Find the area of tubes and number of tubes needed. (16)
5. The tank of 1250 kVA, natural oil cooled transformer has the dimensions length, width and height as 0.65 x 1.55 x 1.85 m respectively. The full load loss = 13.1 kW, loss dissipation due to radiations = 6 W / m2-°C, loss dissipation due to convection = 6.5 W / m2°C, improvement in convection due to provision of tubes = 40%, temperature rise = 40°C, length of each tube = 1m, diameter of tube = 50mm. Find the number of tubes for this transformer. Neglect the top and bottom surface of the tank as regards the cooling. (16)

Unit-IV : Induction Motors

Part-A (2 Marks)

1. What are the advantage and disadvantage of large air gap length in induction motor?
2. What are the factors which influence the power factor of an induction motor?
3. What types of slots are preferred in induction motor?
4. What is rotating transformer?
5. Why do 3 phase squirrel cage induction motor finds wide application in industry?
6. What are the criteria used for the choice for number of slots of an induction machine?
7. What are the factors to be considered for estimating the length of air gap in induction motor?
8. Define stator slot pitch
9. Why semi closed slots are generally preferred for the stator of induction motor?
10. List out the methods to improve the power factor of an induction motor?

Part-B (16 Marks)

1. Drive the output equation of a three phase induction motor with suitable assumptions. (16)
2. Identify the approximate diameter and length of stator core, the number of stator slots and the number of conductors for a 20 kW, 400V, 3 phase, 4pole, 1200rpm, delta connected induction motor. Bav =0.5T, η = 0.82, ac = 26,000 amp.cond /m, power factor = 0.8, L/τ = 1, double layer stator winding. (16)
3. Estimate the main dimensions, air-gap length, stator slots, stator turns per phase and cross sectional area of stator and rotor conductors for 3 phase, 110 kW, 3300V, 50 Hz, 10 poles, 600 rpm, Y connected induction motor, Bav = 0.48 Wb/m2, ac = 28,000 amp.cond/m, L/τ = 1.25, η = 0.9, power factor = 0.86. (16)
4. A 11 kW, three phase 6 pole, 50 Hz; 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 8.6 percent and powerfactor of 0.85. The rotor MMF may be assumed to be 85 percent of stator MM F. Also find the bar 'and the end ring sections if the current density is 5 A/mm2 . (16)
5. Estimate the main dimensions, stator slots, stator turns per phase for 3 phase, 30HP, 440V, 50 Hz, 6 poles, 975 rpm, Y connected induction motor, Bav=0.46Wb/m2, ac=25,000 amp.cond/m, L/τ = 1, η = 0.86, power factor = 0.86,Kw=.955 (16)

Unit-V : Synchronous Machines

Part-A (2 Marks)

1. Name the two types of synchronous machines
2. List the factors to be considered for the choice of specific magnetic loading?
3. Define runaway speed?
4. List the types of poles used in salient pole machines
5. Define short circuit Ratio
6. Prepare the list of factors to be considered for the choice of specific electric loading?
7. What are the constructional differences between salient pole type alternator and cylindrical rotor type alternator?
8. What is the use of-damper winding?
9. How is cylindrical pole different from salient pole in a synchronous machine?
10. List the advantages of large air-gap in synchronous machines?

Part-B (16 Marks)

1. Drive the output equation of a three phase synchronous machines b) how D and L separated for a synchronous machines. (16)
2. Determine the main dimension for 1000 kVA, 50 Hz, three phase, 375 rpm alternator. The average air gap flux density = 0.55 wb/m2 and ampere conductors / m = 28000. Use rectangular pole. Assume a suitable value forL/τ in order that bolted on pole construction is used for which machine permissible peripheral speed is 50 m/s. The runway speed is 1:8 time's synchronous speed. (16)
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. (16)
4. Determine the main dimension for 100 kVA, 50 Hz, three phase, 675 rpm alternator. The average air gap flux density = 0.65 wb/m2 and ampere conductors / m = 20000. Use rectangular pole. Assume a suitable value for L/τ in order that bolted on pole construction is used for which machine permissible peripheral speed is 50 m/s. The runway speed is 1:8 time's synchronous speed. (16)
5. Determine 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 foe stator. (16)

Course Faculty **HoD**