Total No. of Questions : 4]

SEAT No. :

PA-10047

[Total No. of Pages : 2

[6009]-330
T.E. (Electrical Engineering) (Insem)
COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES
(2019 Pattern) (Semester - II) (303149)

Time : 1 Hour] ***[Max. Marks : 30***

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable additional data, if necessary.***
5) ***Use of non-programmable calculator is allowed.***

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Q1) a) State and Explain the different modes of heat dissipation. **[6]**

b) Write various specifications of a transformer as per IS 2026 part - I. **[4]**

c) A field coil has a dissipating surface of 0.15m^2 & a length of mean of 1m. It dissipates loss of 150 watts, the emissivity being 34 watts/m^2. °c. Estimate the final steady temperature rise of the coil its and its time constant if the cross section of the coil is 100×50 mm^2, Specific heat of copper is 390 J/kg. °c. The space factor 0.56. copper weighs 8900kg/m^3. **[5]**

OR

Q2) a) Derive the expression for heating curve with usual notations and hence define heating time constant. **[6]**

b) Write the functions of Tap changer, pressure release valve, conservator and breather? **[4]**

c) What are different types of winding used in a transformer? Explain any two. **[5]**

P.T.O.

Q3) a) Derive the output equation of a three phase transformer with usual notation. **[5]**

b) Explain the procedure for the design on tank with cooling tubes and derive the relation for the number of cooling tubes. **[4]**

c) A 200 KVA, 6600/400V, three phase transformer, delta/star connected, 50 Hz, core type transformer has the following particulars: Maximum flux density = 1.3 wb/m^2, current density = 2.5A/mm^2, window space factor = 0.3, Overall height = overall width and use three stepped core, stacking Factor = 0.9, emf per turn = 10 volts. Width of largest stamping = 0.9d and net iron area = $0.6d^2$ Calculate overall core dimensions. **[6]**

OR

Q4) a) Derive the relation (A_i / area of circumscribing circle) and (A_{gi} / area of circumscribing circle) for square core **[4]**

b) Derive expression for the condition of transformer design for minimum cost in terms of total cost of iron and copper cost for three phase transformer. **[5]**

c) Design a suitable cooling tank with cooling tubes for a 500 kVA, 6600/440V, 50Hz, 3 phase transformer with the following data. Dimensions of the transformer are 100 cm height, 96 cm length and 47 cm breadth. Total losses = 7 kw. Allowable temperature rise for the tank walls is 35°c. tubes of 5 cm diameter area to be used. Determine the number of tubes required. **[6]**

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Total No. of Questions : 4]

SEAT No. :

PB116

[Total No. of Pages : 2

[6269]-330

T.E. (Electrical Engineering) (Insem)
COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES
(2019 Pattern) (Semester - II) (303149)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4.***
2) ***Assume suitable data if necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Neat figures must be drawn wherever necessary.***
5) ***Use of non-programmable calculator is permitted.***

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Q1) a) List the heat dissipating modes. Explain with justification by which mode most of heat is dissipating? **[5]**

b) In the design of the transformer if L.V. winding is placed away from the core what are disadvantages of the same. **[4]**

c) Explain the functions of transformer auxiliaries: **[6]**

i) Tap changer,

ii) Pressure release valve, and

iii) Breather and conservator

OR

Q2) a) With usual notations, derive the equation for temperature rise - time characteristics for electrical machines. **[5]**

b) Explain the effect of selecting higher value of B_m than the normal value in the overall design of the transformers. **[4]**

c) A field winding has heat dissipating surface of 15m^2 and length of mean turn of 1 m. It dissipates loss of 150 W, the emissivity being 34 W/m^2-ºC. Calculate the final steady temperature rise of the coil and its time constant if the cross section of the coil is 100 × 50 mm^2. Specific heat of copper is 390 J/kg-ºC. The space factor is 0.56. Copper weighs 8900 kg/m^3. **[6]**

P.T.O.

Q3) a) Derive the equation for voltage per turn $E_t = K \sqrt{Q}$ **[4]**

b) Explain the design of core of transformers to determine the overall dimensions of core (width and height of the magnetic frame) three phase core type transformer. **[4]**

c) Estimate the main dimensions including winding conductor areas of a three phase delta-star core type transformer rated at 300 kVA, 6600/440 V, 50 Hz,. A suitable core of three steps having a circumscribing circle of 0.25 m diameter and leg spacing of 0.4 m is available. The emf per turn is 8.5 V. Assume a current density of 2.5 A/mm^2, a window space factor of 0.28 and stacking factor of 0.9. **[7]**

OR

Q4) a) Derive the expression for the determination of number of cooling tubes in the transformers. **[4]**

b) Design the windings for three phase, 100 kVA, 11000/433 V, 50 Hz, Delta/Star connected, tappings at ± 2.5% and ± 5% on HV winding distribution transformer. Assume suitable current density. **[4]**

c) Determine the main dimensions of the core of three phase 350 kVA, 11000/3300 V, Star-Delta, 50 Hz, core type transformer. Assume: Voltage per turn = 11, Maximum flux density = 1.25 Wb/m^2,Net cross section of core = 0.6 d^2, Window space factor = 0.27, Window proportion = 3:1, current density = 250 A/cm^2. **[7]**

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Total No. of Questions : 8]

SEAT No. :

P751

[Total No. of Pages : 2

[5870] - 1055

T.E. (Electrical)

COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

(2019 Pattern) (Semester -II) (303149)

Time: 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answers Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*
2) *Figures to the right side indicate full marks.*
3) *Neat diagram must be drawn whenever necessary.*
4) *Assume suitable data, if necessary.*

Q1) a) Explain the procedure to estimate the no load current of three phase transformer. **[6]**

b) Calculate the percentage regulation at full load 0.8pf lag for a 300kVA, 6600/440v, delta-star, 3 phase, $50H_Z$, core type transformer having cylindrical coils of equal length with the following data. Height of coils=4.7 cm, thickness of HV coil=1.6 cm, thickness of LV coil=2.5 cm, insulation between LV&HV coils=1.4 cm, Mean diameter of the coils=27 cm, volt/turns=7.9 V, full load copper loss=3.75Kw **[8]**

c) State & explain the measures to overcome the mechanical forces under short circuit conditions **[4]**

OR

Q2) a) Discuss mechanical forces developed under short circuit condition in a transformer. **[6]**

b) Draw and explain generalized flow chart for design of transformer. **[6]**

c) State the assumptions made while calculating leakage reactance of transformer. **[6]**

Q3) a) Discuss the various factors to be considered for selection specific magnetic loading (B_{av}) and specific electric loading (ac). **[10]**

b) What are the various types of AC windings for three phase induction motor? Explain in brief any two. **[7]**

OR

Q4) a) Derive the output equation of a 3 phase induction motor in terms of its specific loadings. Also indicate the significance of terms involved. **[7]**

b) Estimate the main dimensions for 3ϕ, 50Hz, 10kW, 400V, 4 pole squirrel cage induction motor. Assume full load efficiency of 0.85, full load power factor of 0.9 and winding factor 0.96. The specific magnetic loading is 0.6 wb/m^2 and the specific electric loading=22000A/m. Take rotor peripheral speed as 25 m/s at synchronous speed. **[10]**

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Q5) a) Explain the factors should be considered when estimating the length of air gap of three phase induction motor. Why the air gaps should be as Small as possible? **[10]**

b) Discuss the design of wound rotor w.r.t the following **[8]**

i) no. of rotor slots

ii) no.of rotor turns

iii) area of rotor conductors

iv) rotor windings.

OR

Q6) a) Discuss the various factors which decide selection of number of stator slots in case of 3 phase induction motor **[8]**

b) A 15KW, 3ϕ, 50Hz, 400V, 4 pole, star connected squirrel cage induction motor has 60 slots, each containing 7 conductors. The rotor slot's are 50. Assume full load efficiency as 0.85 full load Power factor as 0.9 and rotor mmf is 80% of stator mmf. Calculate the value of bar and end ring current. Also find the area of each bar and each end ring, if current density is $5A/mm^2$ **[10]**

Q7) a) Derive the equation for No Load Current of 3ϕ induction motor. **[10]**

b) Draw and explain generalized flow chart for design of three phase induction motor. **[7]**

OR

Q8) a) State and explain with neat sketches different types of leakage fluxes in an induction motor and estimate slot leakage reactance in an induction motor. **[10]**

b) Explain the effect of ducts on the calculation of magnetizing current of 3ϕ induction motor. **[7]**

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Total No. of Questions : 8]

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[6003]-369

T.E. (Electrical)

COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

(2019 Pattern) (Semester-II) (303149)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right side indicate full marks.***

Q1) a) Explain the mechanical forces developed under short circuit condition in a transformer and the measures to overcome it. (Any two) **[6]**

b) Explain the procedure for the calculation of no load current in the three phase transformer. **[6]**

c) A 600 KVA, 6600/400 V, 50 Hz, three phase core type transformer has: Width of LV winding = 3CM, Width of HV winding = 3 cm, width of duct between LV and HV = 2 CM, height of HV and LV windings = 40 cm, length of mean turns =1.5m, HV winding turns = 220, $\mu_0 = 4\pi \times 10^{-7}$ H/m. Estimate the leakage reactance of the transformer referred to the HV side. **[6]**

OR

Q2) a) State the various assumptions made during the calculation of leakage flux and leakage reactance. **[6]**

b) Draw the generalized flow chart of computer aided design of a transformer. **[6]**

c) A single phase, 400V, 50 Hz transformer is built from stampings. The length of the flux path is 2.5 m. The net iron area is 2.25×10^{-3} m^2. The number of primary turns are 800. The iorn loss at the working flux density = 2.6 W/Kg, stacking factor = 0.9, weight of iron is 7.8×10^3 Kg/m^3. Total magnetizing mmf is 1989 A. Calculate the no load current of the transformer. **[6]**

Q3) a) Determine the main dimensions of a 250 H.P three phase, 50 Hz, 400 V, 1410 rpm, 4 pole, slip ring induction motor. Assume the following data:efficiency =0.9, power factor=0.9 specific magnetic loading=0.5 wb/m^2 , specific electric loading=30,0000 A/M, Winding factor=0.955, ratio of core length to core pole pitch= 1.2. The motor is delta connected. Assume the nearest synchronous speed as 1500 rpm. **[10]**

b) Explain the types of AC windings. (any two) **[7]**

OR

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Q4) a) Derive the output equation of a three phase induction motor and also state the significance of the terms involved. **[7]**

b) Explain the specific electric loading and the various factors responsible for the choice of specific electric loading. **[10]**

Q5) a) Explain the design of rotor slots, rotor bars and end rings for a squirrel cage induction motor. **[10]**

b) For a three phase, 50Hz, 10 KW, 4 pole, 400v star connected induction motor consider the following details: diameter of stator= 15 cm, average flux density=0.45 wb/m^2. Length of stator core=9 cm, power factor=0.86, number of stator slots=36, efficiency=84%, current density=5 A/ mm^2, number of rotor slots=30, number of conductors/ slot for stator=12. Design the rotor bar section and end ring by calculating the rotor bar current, area of rotor bar, end ring current and area of end ring. Assume the rotor mmf as 85% of the stator mmf. **[8]**

OR

Q6) a) Derive the relation for the end ring current in terms of the bar current for a squirrel cage induction motor. **[10]**

b) Discuss the various factors which affect the choice of length of air gap for a three phase induction motor. Why generally the air gap should be as small as possible. **[8]**

Q7) a) Draw and explain the generalized flow chart for design of induction motor. **[5]**

b) A 75 KW, 3300 V, 50 Hz, 8 pole, three phase, and star connected induction motor has magnetizing current which is equal to 35% of full load current. Calculate the value of stator turns per phase if the mmf required for flux density at 60° from pole axis 500 A, winding factor= 0.95, efficiency=0.94, power factor=0.86 **[7]**

c) Explain the procedure to find out MMF required for air gap, stator teeth, and stator core, rotor teeth and rotor core of an induction motor. **[5]**

OR

Q8) a) With the help of neat sketches explain the different types of leakage fluxes in an induction motor. (any two) **[5]**

b) Explain the effects of ducts on calculations of magnetizing current. **[5]**

c) Estimate the magnetizing current of an 11 KV, 50 Hz, three phase, star connected, 12 pole induction motor. The stator diameter is 90 cm, length of stator bore is 25 cm, stator has 108 slots with 48 conductors per slot, average flux density is 0.6 wb/m^2. Ampere turns for iron parts can be assumed to be 45% of that required for air gap, stator winding factor = 0.955, and gap contraction factor = 1.093 and length of air gap is 1 mm. **[7]**

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Total No. of Questions : 8]

SEAT No. :

PB3809

[Total No. of Pages : 2

[6262]-70

T.E. (Electrical Engineering)

COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

(2019 Pattern) (Semester - II) (303149)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Derive the equation for magnetizing current in terms of magnetizing volt-amperes, and no load current for three phase transformers. **[8]**

b) Explain the significance voltage regulation in transformers. By making changes in the design of transformers, explain how it can be controlled to standard values of voltage regulation. **[9]**

OR

Q2) a) With the help of neat figures, Explain the mechanical forces developed by leakage fluxes and their effect in the transformers. Also explain how to limit these forces developed in the design stage of transformer. **[8]**

b) A 500 kVA, 11000/433 V, 50 Hz, three phase delta-star, core type transformer has 500 turns on h.v. winding. The height of the winding is 0.6 m and the length of mean turn 1.3 m. calculate the instantaneous radial force on the h.v. winding if the short circuit occurs at the terminals of l.v. winding with h.v. energized. The leakage impedance id 5 %. The doubling effect multiplier as 1.8. Also calculate force at full load. **[9]**

Q3) a) Derive the output equation for AC machines. From the same kVA input equation for the three phase induction motor. **[9]**

b) Determine the main dimensions of three phase, 70 h.p., 415 V, star connected, 6- pole, 50- Hz induction motor for which the specific electric and specific magnetic loadings are 32000 A/m and 0.51 wb/m^2 respectively. The motor has power factor of 0.91 and efficiency of 90 per cent. Assume pole pitch equal to core length. **[9]**

OR

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Q4) a) Explain the factors considered while selecting the values of specific electric loading in the design of three phase induction motor. **[9]**

b) Draw the winding diagram for any one phase for a 4-pole, 24 slots, three phase mush connected stator of induction motor. **[9]**

Q5) a) Explain the factors affecting length of air gap of three phase induction motor. **[9]**

b) Explain the rules that are considered for selecting the rotor slots. **[5]**

c) List the methods used to reduce the harmonic torques produced in three phase induction motor. **[4]**

OR

Q6) a) Derive the equation for the end-ring current with usual symbols and their units. **[9]**

b) A 10 h.p., three phase, 4-pole, 50 Hz, 415 V, Star connected induction motor has 54 stator slots, each containing 9 conductors. Calculate the values of bar and end ring currents. The number of rotor bars is 64. The machine efficiency 85 % and power factor is 0.85. Assume the rotor mmf as 85% of stator mmf. If the current density is 5 A/mm^2, determine the bar and end-ring size. **[9]**

Q7) a) Explain the effect of length of air-gap on magnetizing current and no-load current of three phase induction motor. What are the components of total mmf of magnetizing circuit of three phase induction motor? **[8]**

b) Discuss the various losses taking place in various parts of the three phase induction motor. **[9]**

OR

Q8) a) With suitable sketches, explain the various leakage fluxes produced in the three phase induction motor. **[8]**

b) Explain the advantages of digital computers in the design of electrical machines. Plot Explain the flowchart for calculating the main dimensions of three phase induction motor. **[9]**

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Total No. of Questions : 8]

SEAT No. :

PA-1463

[Total No. of Pages : 2

[5926]-80

T.E. (Electrical Engineering)
COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES
(2019 Pattern) (Semester - II) (303149)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 Q8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, if necessary.***
5) ***Use of non-programmable calculator is allowed.***

Q1) a) Explain the various heat dissipating modes by which heat developed in electrical machines dissipates. **[6]**

b) Derive the Output equation for single transformers with usual notations. **[7]**

c) Derive the equation for radial mechanical forces developed in transformers under short circuit conditions and measures to overcome the mechanical forces develop. **[7]**

OR

Q2) a) Explain the significance of mitred joint in transformer core design. **[6]**

b) Explain the role of Buchholz Relay in power transformers. Where it is lcoated. **[7]**

c) Explain step by step the procedure to design the core of transformers. **[7]**

Q3) a) Derive the output equation of three phase ac machines and from the same derive the equation input kVA for three phase induction motor in terms of h.p. or kW. **[8]**

b) Explain the points to be considered while selecting the value of specific magnetic loading for the design of three phase induction motor. **[8]**

OR

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Q4) a) Explain in detail the factors affecting the size of ac machines. **[8]**

b) Explain the points to be considered while selecting the stator slots of three phase induction motor. **[8]**

Q5) a) Derive the equation for end ring current in squirrel cage rotor with usual notations. **[8]**

b) What are different types of rotor slots? Explain any one. What are the advantages of tapered slots? **[8]**

OR

Q6) a) Why the length of air gap in an induction motor is kept minimum possible range. What factors govern the choice of air gap in induction motor. **[8]**

b) A 11 kW, 3-phase, 6 pole, 50 Hz star connected induction motor has 54 stator slots, each containing 9 conductors. Calculatm the values of bar and end ring currents. The numbers of rotor bars is 64. The machine has an efficiency of 0.86 and power factor of 0.85. The stator mmf may be assumed 85% of stator mmf. Also find bar and end-ring sections if the current density is 5 A/mm^2. **[8]**

Q7) a) Explain the effect of duct on the calculation of magnetizing current of three phase induction motor. **[8]**

b) What are various methods to improve the starting torque of three phase squirrel cage induction motor. **[10]**

OR

Q8) a) Explain the different types of leakage flux in an induction motor. **[8]**

b) Explain the procedure for calculation of total mmf for the magnetic circuit of three phase induction motor.

Calculation of total mmf = mmf for air -gap + mmf for stator teeth + mmf for rotor teeth + mmf for stator core + mmf for rotor core. **[10]**

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Total No. of Questions : 8]

SEAT No. :

P-7568

[Total No. of Pages : 3

[6180]-83

T.E. (Electrical)

COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

(2019 Pattern) (Semester - II) (303149)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume suitable data if necessary.***

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Q1) a) Explain the procedure to estimate the no load current of a three phase transformer. **[6]**

b) Explain the mechanical forces developed under short circuit condition in a transformer. **[6]**

c) Calculate the percentage regulation at full load 0.8pf lag for a 300 kVA, 6600/440V, delta-star, 3 phase, 50Hz, core type transformer having cylindrical coils of equal length with the following data. Height of coils = 4.7 cm, thickness of HV coil = 1.6 cm, thickness of LV coil = 2.5 cm, insulation between LV & HV coils = 1.4 cm, Mean diameter of the coils = 27 cm, volt/turns = 7.9 V, full load copper loss = 3.75 Kw. **[6]**

OR

Q2) a) Explain the estimation of losses in the three phase transformer. **[6]**

b) Draw and explain the generalized flow chart of computer aided design of a transformer. **[6]**

c) A 6600 V, 60 Hz, single phase transformer has a core of sheet steel . The net cross sectional area is 22.6×10^{-3} m^2 . The mean length is 2.23m . There are four lap joints and each joint takes one fourth times as much reactive mmf as it is required per meter of core. Flux density is 1.1 Wb/m^2. Find the number of turns on the 6600 V winding and the no load current. Assume the amplitude factor as 1.52 , mmf/m = 232 A /m , specific loss = 1.76 W / kg and density = 7.5×10^3 Kg/m^3. **[6]**

Q3) a) Estimate the main dimensions for 3ϕ, 50Hz, 10kW, 400V, 4 pole squirrel cage induction motor. Assume full load efficiency of 0.85, full load power factor of 0.9 and winding factor 0.96. The specific magnetic loading is 0.6 wb /m^2 and the specific electric loading = 22000A/m. Take rotor peripheral speed as 25 m/s at synchronous speed. **[10]**

b) Derive the output equation of a three phase induction motor with usual notation. **[7]**

OR

Q4) a) Discuss the various factors to be considered for selection specific magnetic loading (B_{av}) and specific electric loading (ac). **[6]**

b) Explain with neat diagram the constructional features of a three phase induction motor. **[5]**

c) What are the various types of AC windings for three phase induction motor? Explain in brief any two. **[6]**

Q5) a) Derive the expression for end ring current in induction motor. **[6]**

b) Discuss the various factors which decide selection of suitable combination r of stator slots and rotor slots in case of 3 phase induction motor. **[6]**

c) Discuss the design of wound rotor w.r.t. the following i) no. rotor turns ii) area of rotor conductors iii) rotor windings **[6]**

OR

Q6) a) A 15kw, 3ϕ, 50Hz, 400V, 4 pole, star connected squirrel cage induction motor has 60 slots, each containing 7 conductors. The rotor slots are 50.Assume full load efficiency as 0.85, full load power factor as 0.9 and rotor mmf is 80% of stator mmf. Calculate the value of bar and end ring current. Also find the area of each bar and each end ring, if current density is 5 / mm^2. **[10]**

b) Discuss the various factors which affect the choice of length of air gap for a three phase induction motor, why generally the air gap should be as small as possible. **[8]**

Q7) a) State and explain with neat sketches the different types of leakage fluxes in an induction motor. **[5]**

b) A 75 KW, 3300 V, 50 Hz, 8 pole , three phase ,stat connected induction motor has magnetizing current which is equal to 35% of full load current. Calculate the value of stator turn sper phase if the mmf required for flux density at 30° from pole axis 500 A, winding factor = 0.95, full load efficiency = 0.94, power factor at full load = 0.86 **[5]**

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c) Explain the procedure to find out MMF required for air gap, stator teeth, stator core of an induction motor. **[7]**

OR

Q8) a) Draw and explain the generalized flow chart of computer aided design of three phase induction motor. **[5]**

b) Explain the effect of ducts on the calculation of magnetizing current of 3ϕ induction motor. **[5]**

c) Explain the procedure to calculate the no load current of an induction motor. **[7]**

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