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10EE65

Sixth Semester B.E. Degree Examination, May/June 2016

(ELECTRICAL & ELECTRONICS ENGINEERING)

COMPUTER AIDED ELECTRICAL DRAWING

Time: 3 hrs

Max. Marks: 100

Instructions:

1. **Answer Question 1 and Question 2 from Part A**
2. **Answer Question 3 or Question 4 from Part B**
3. **Use of CAD tool that satisfies the requirements of the syllabus is permitted. Suitable data may be assumed if not given.**

Part A

1. Draw the developed winding diagram having 2coil side per slot, 4 pole, 19 slots. The type of winding is duplex, progressive lap winding. Show the positions of the brush, direction of EMF. Draw the sequence diagram. **(30 Marks)**

OR

Draw the developed winding diagram of an 3 phase induction motor, which have 18 slots, 6 poles, 2 coil sides / slot, full pitch, star connected lap winding. **(30 Marks)**

2. Draw a neat Single line diagram for a 110KV/11KV MUSS with following details:
   a. 110 KV incoming lines - 2
   b. Line O.C.B 110KV - 2
   c. Transformer stepdown 110KV/11KV - 2
   d. Lowtension O.C.B for transformer - 2
   e. Duplicate bus bars on HT & LT sides to be indicated.
   f. Bus Coupler on H.T side only.
   g. Feeders 11 KV at LT bus - 6
   h. Station supply transformer 11 KV / 415 V to be shown at Low tension side.
   i. Low tension circuit breakers for feeders - 6
   j. In appropriate positions indicate Lightning arrestors , P.T's & C.T's.
   k. Earthing Switch at incoming lines - 2
   l. Coupling condenser (C.C) at incoming lines - 2. **(20 Marks)**

Part B

3. Draw the sectional elevation nad plan of the single phase, Shell type transformer for the following data:

Rating: 125KVA, Single phase

Core:

Width of the central limb = 14cm
Over all height of the core, H = 38cm
Over all width of the core, W = 54cm
Over all depth of the core, D = 37cm
Window dimension = 13×24cm

Winding:

4HV coils, 4LV coils, placed alternatively

Rectangular coil dimension:

Inside = 15×41
Outside = 35×57
Thickness = 2cm
Insulation between the coils = 1cm

(50 Marks)

OR

4. Draw to a suitable scale end and longitudinal elevation (top half in section) of a100 KW, 500V, 1250 R.P.M 6 Pole DC shunt generator. The armature is supported over the spider and the shaft is supported by means of pedestal bearing for the dimensions given below.

Armature:

Outside diameter = 75 cm
Length = 27.8 cm
Number of slots = 86
Size of slot = 1.11 cm x 5.24 cm
Depth of iron behind the slot = 9.26 cm
Ventilating ducts= 3, each 1 cm width
Air gap length below main pole = 0.5 cm

Main pole (laminated):

Total height = 24 cm with shoe
Width = 17.75 cm
Length = 25.7 cm

Interpole (solid):

Breadth=4.63 cm
Length=20 cm
Air gap length below Interpole = 0.8 cm

Yoke:

Thickness of yoke = 7.5 cm
Length of yoke = 40 cm

Commutator:

Number of commutator segments = 344
Diameter =56 cm
Segment pitch = 0.51
Length =12.35 cm
Number of brushes per spindle=3

Shaft:

Shaft diameter below armature = 9 cm
Shaft length between bearings centers = 120 cm

(50 Marks)

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1. **Answer Question 1 and Question 2 from Part A**
2. **Answer Question 3 or Question 4 from Part B**
3. **Use of CAD tool that satisfies the requirements of the syllabus is permitted. Suitable data may be assumed if not given.**

Part A

1. Design and draw a developed winding diagram for a 16 slot, double layer 4pole dc lap winding. Make provision for equalizer ring. Fix the position and polarity of the brushes, mark the direction of rotation of armature. **(30 marks)**

OR

Design and draw the developed winding diagram of an AC motor having the following details.
No. of phase= 3
No. of slots = 12
No. of poles = 4 double layer full pitch wave with star connections. **(30 Marks)**

2. Draw the single line diagram of a generating station having the following equipment.
   a. Incoming lines: 110 KV, 50 Hz, 1
   b. Outgoing lines: 13.2 KV,50 Hz, 3
      11KV, 50 Hz, 4
   c. Transformers: 15MVA,110/13.2KV ,3Φ, Δ/ Y, 1
      8 MVA,110/11KV,3Φ,Δ/Y, 1
   d. Auxiliary Station transformer : 750 KVA , 11 KV/400 V , Δ/Y, 1
   e. Bus Bars : 110 KV, 1
      11 KV, 1

   Show the positions of CT, PT, Isolating Switches , Lightning arrestors , Circuit Breakers. **(20 Marks)**

Part B

3. Draw the armature core and housing assembly of an alternator having the following data:

Stamping OD = 405mm
Stamping ID = 240mm
Housing OD = 455mm
Core length = 180mm
No.of slots = 48

Dimension of slots:

Shape = Trapezoidal
Total height = 44.3mm
Lip Height = 4mm
Slot opening = 3mm
Slot width at the top = 16mm
slot width at bottom (over lips) = 10.76mm

Show the fixing of the armature to the housing in both views. **(50 Marks)**

OR

4. Draw the sectional end view of the casing of a conventional 4 pole DC machine, with the following data:

Diameter on pole arc = 425mm
Inside diameter of yoke = 745mm
Outside diameter of yoke = 845mm

Main Pole:

Pole height = 160mm,
Including pole shoe, Pole width = 150mm
Diameter of the rivet holes = 4×10mm
Cross section of central steel rod = 48mm×28mm
Pole arc / Pole pitch = 0.667
Dimension of Inter pole = 40mm×150mm
Axle Height = 450mm **(50 Marks)**

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Time: 3 hrs Max. Marks: 100

Instructions:

1. **Answer Question 1 and Question 2 from Part A**
2. **Answer Question 3 or Question 4 from Part B**
3. **Use of CAD tool that satisfies the requirements of the syllabus is permitted. Suitable data may be assumed if not given.**

Part A

1. Draw the developed winding diagram of the armature of a dc machine with the following data: -
   No of poles = 4
   No of slots = 12
   Type of winding = simplex wave, double layer. **(30 Marks)**

   OR

   Draw the developed winding diagram of an AC machine having the following details.
   No. of phase = 3
   No. of poles = 4
   No. of slots = 24 mush winding. **(30 Marks)**

2. Draw the single line diagram of a typical substation with the data of the equipment given below:
   a. Two incoming lines 110 KV
   b. Two transformers of 110/11KV
   c. Double bus bars for high tension and low tension sides have to indicated
   d. Bus couplers on the high tension side only.
   e. Feeders of 11KV at low tension side total no=6.

   In appropriate position indicate lightning arrestors, CT , PT , earthing switches , wave traps and coupling . Condensers at incoming lines and station auxiliary transformers of 11 KV/415 V. **(20 Marks)**

Part B

3. Draw the detailed drilling of each part of 500 KVA , 6600/400 V, single phase power transformer with the following data. Show full assembled plan and elevation

Dimension of the core:

Core construction is cruciform Diameter = 33cm
Width of the largest stamping = 33cm
Width of the smallest stamping 17.5 cm
Height of the core = 43 cm
Centre to centre distance between cores = 49 cm
Core laminations are used by means of 2 end plates – 3 mm thick by a bolt of dia 1.2 cm.

Yoke:

Yoke height = 25cm Yoke length = 77 cm
Total height of transformer = 9.3cm

Winding:

L.V winding:

Total turns = 22 No of turns / limb = 11
Inside dia of LV Winding = 33.75cm Outside dia of LV winding =38.35 cm
Total height of the core occupied by the LV winding = 36.2cm

H.T winding: 2 layers

Inside dia of HT 1st layer = 41.5 cm Outside dia of H.T 1st layer = 43.3 cm
Inside dia of HT 2nd layer = 45 cm Outside dia of H.T 2nd layer = 46.8 cm

(50 Marks)

OR

4. Draw to a suitable scale end view and elevation with top half in section of a DC machine, with the following details:

Yoke:

Outside diameter = 49.6cm Inner diameter = 40 cm
Axial Length = 16 cm

Main pole:

Number of poles = 4 Total height = 12.6 cm
Width =6 cm Air gap = 1.6 mm

Interpole :

Number of poles= 4 Total height= 11 cm
Width = 4.5 cm Air gap = 2.5 mm

(50 Marks)

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Time: 3 hrs Max. Marks: 100

Instructions:

1. **Answer Question 1 and Question 2 from Part A**
2. **Answer Question 3 or Question 4 from Part B**
3. **Use of CAD tool that satisfies the requirements of the syllabus is permitted. Suitable data may be assumed if not given.**

Part A

1. Draw the developed winding diagram with the following data: -
   No of armature conductors=30
   No of poles=4
   Type of winding = double layer simplex progressive wave.
   Fix the position of poles, direction of current, mark the positions of the brushes.
   (30 Marks)

OR

Draw the developed winding diagram of an AC machine having the following details.
No. of phase = 3
No. of poles = 4
No. of slots = 24 Un-bifurcated winding in 2 tiers. **(30 Marks)**

2. Draw the single line diagram of a generating station having the following equipment.
   a. Incoming lines : 110 KV , 50 Hz, 2
   b. Outgoing lines: 110KV,50 Hz, 1
      11KV, 50 Hz, 3
   c. Transformers: 5MVA,110/11KV ,3Φ, 2
      15MVA, 110/220KV,3Φ, 1
      500 MVA, 11/400 KV, 3Φ, Δ /Y, One Auxiliary station Transformers
   d. The station is connected to another substation through the 15 MVA Transformer of 110/220KV. Show the positions of CT, PT, Isolating Switches, Lightning arrestors, Circuit Breakers. **(20 Marks)**

Part B

3. Draw to a suitable scale end view and elevation with top half in section of a DC machine, with the following details:

Yoke:

Outside diameter = 49.6cm
Inner diameter = 40 cm
Axial Length = 16 cm

Main pole:

Number of poles = 4 Total height = 12.6 cm
Width =6 cm Air gap = 1.6 mm

Interpole :

Number of poles= 4 Total height= 11 cm
Width =9.5 cm Air gap = 2.5 mm **(50 Marks)**

OR

4. Draw the detailed drilling of each part of 500 KVA , 6600/400 V, single phase power transformer with the following data. Show full assembled plan and elevation

Dimension of the core:

core construction is cruciform Diameter = 33cm
Width of the largest stamping = 33cm
Width of the smallest stamping 17.5 cm
Height of the core = 43 cm
Centre to centre distance between cores = 49 cm
Core laminations are used by means of 2 end plates – 3 mm thick by a bolt of dia 1.2 cm

Yoke:

Yoke height = 25cm
Yoke length = 77 cm
Total height of transformer = 9.3cm

Winding:

L.V winding:

Total turns = 22 No of turns / limb = 11
Inside dia of LV Winding = 33.75cm Outside dia of LV winding =38.35 cm
Total height of the core occupied by the LV winding = 36.2cm

H.T winding:2 layers

Inside dia of HT 1st layer = 41.5 cm Outside dia of H.T 1st layer = 43.3 cm
Inside dia of HT 2nd layer = 45 cm Outside dia of H.T 2nd layer = 46.8 cm

(50 Marks)

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Instructions:

1. **Answer Question 1 and Question 2 from Part A**
2. **Answer Question 3 or Question 4 from Part B**
3. **Use of CAD tool that satisfies the requirements of the syllabus is permitted. Suitable data may be assumed if not given.**

Part A

1. Draw the armature winding diagram with 4 poles 14slots double layer progressive lap winding. Show the positions of the brush, direction of rotation of current, direction of EMF. Draw the sequence diagram. **(30 Marks)**

OR

Design and draw developed 3 phase full pitched AC lap winding for 24 conductor, double layer, 4poles, also show winding in star connection. **(30 Marks)**

2. Draw the single line diagram of a generating station having the following equipment.

a. Incoming lines : 110 KV , 50 Hz, 2

b. Outgoing lines: 110KV,50 Hz, 1
60KV, 50 Hz, 1
11KV, 50 Hz, 1

c. Transformers: 15MVA, 110/66KV, 3Φ, Y, 2
10MVA,110/11KV,3Φ,Y/Y, 1
3 MVA, 11/400 KV, 3Φ, Y/Y, 1

d. Bus Bars : 110 KV, 2
66 KV, 1
11 KV, 1
400 KV, 1

Show the positions of CT , PT , Isolating Switches , Lightning arrestors , Circuit Breakers. **(20 Marks)**

Part B

1. Draw to scale half sectional end view and front view of alternator with the following data:

Diameter of shaft = 7.6 cm	Height of pole = 7.6 cm
Diameter of frame (outer) = 92 cm	Length of yoke = 22 cm
Diameter of rotor = 46 cm	Outer diameter of stator = 76 cm
Number of poles = 10	Length of stator = 16cm

(50 Marks)

OR

2. Draw the longitudinal sectional view of a limb of a single phase transformer with the following details

Diameter of circumscribing circle= 22.6 cm

Diameter of LV Winding in 2 layers:
Inside = 25 cm,
Outside = 28 cm
Height of LV winding = 41.2 cm

Diameter of HV Winding:
Inside = 32 cm,
Outside =36.8 cm
Height of HV winding = 40 cm **(50 Marks)**

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1. **Answer Question 1 and Question 2 from Part A**
2. **Answer Question 3 or Question 4 from Part B**
3. **Use of CAD tool that satisfies the requirements of the syllabus is permitted. Suitable data may be assumed if not given.**

Part A

1. Develop a double layer, progressive, lap winding for a DC machine having 16 slots and 4 poles. Draw the sequence diagram. Indicate the position of the brushes, show the direction of induced EMF and give equalizer connection. **(30 Marks)**

OR

Draw the developed winding diagram of a 3 phase induction motor, which have 18 slots 2 poles, winding is chorded by 2 slots, double layer lap delta connection. **(30 Marks)**

2. Draw a single line diagram of a 66KV MUSS with the following details.
   a. 66KV incoming lines, 2 nos
   b. Step down transformer 66KV/11KV ,2
   c. OCB's for transformer bank on L.T side, 2
   d. Duplicate bus bars for H.T and L.T side to be provided
   e. Bus couplers for HT side only
   f. Feeders, 11 KV radiating from L.T bus bars, 4
   g. L.T circuit breakers for feeders, 4
   h. Position of lightning arrestors, isolators, CT's and PT's are to be indicated.

(20 Marks)

Part B

3. Draw to a suitable scale half sectional end view and longitudinal end view of a 60 H.P, 4 Pole DC shunt motor, with the following details:

Armature:

Outside diameter = 18.5 cm
Length = 13.5 cm
Number of slots = 24
Size of slot = 0.7cm x 2 cm

Main pole (laminated):

Total height = 11 cm
Width = 7 cm
Pole arc = 10 cm
Length of pole = 14 cm
Air gap = 0.5 cm

Interpole (solid):

Size = 2 x 10.8cm

Length =11c m

Brush:

Total no of spindles = 4

Commutator:

Diameter =13cm

Length =10cm

Winding:

Pole = 2cm, thick (Shunt winding)

Interpole winding = 1 cm thick

The armature is directly mounted on the shaft and is held between two end plates. The shaft is supported by means of end shields bearings in the end cover. **(50 Marks)**

OR

4. Following are the details of a 500 KVA single phase , 6600 / 400 V Transformer:

Core:

Laminated steel plates of 0.35 mm
Width of the largest stamping = 280 mm
Width of the smallest stamping = 175 mm
Height of the core = 430 mm
Distance between the centre of the core = 490 mm

Core laminations are fixed by means of 2 end plates 3 mm thickness by a bolt of Diameter 12mm.

Yoke :

Construction – cruciform,
Yoke length = 770 mm,
Yoke height = 250 mm,
Total height of the transformer = 930 mm.

LV Winding:

Helical type
Number of turns = 22
Number of turns / limb = 11
Number of layers / limb = 1
Section of Conductor = made of 20 square strips of size 5 mm × 5 mm bare and 5.5 mm ×5.5 mm with insulation.
Height of one turn = 28.5 mm

Total height of the core occupied by the LV winding = 362 mm
Inside diameter & outside diameter of LV winding are 337.5 mm and 383 mm respectively.

HV Winding:

Concentric type – arranged in 2 layers on each limb
Number of turns = 378 ; Number of turns / limb = 189
Inside diameter of HV 1st layer = 415 mm ; Outside diameter of 1st layer = 433 mm
Inside diameter of HV 2nd layer = 450 mm ;
Outside diameter of HV 2nd layer = 468 mm ;

Draw the front elevation right half of right limb in section and right half section plan.

(50 Marks)

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Part A

1. Draw a developed winding diagram for a four pole, wave winding, progressive, for an alternator with 34 conductors accommodated in 17 slots show the position of brush, direction of EMF. **(30 Marks)**

OR

Design and draw the developed winding diagram for an alternator with following details
No. of poles =2 No. of phase =3 No .of slots =15
Winding = double layer, lap short pitched by one slot. **(30 Marks)**

2. Draw the single line diagram of a generating station having the following details
   a. Generators :50MVA,11KV,3Φ, Two
   b. Transformers: 50MVA, 11/132KV, 3Φ, Two
   c. Transformers(auxiliary):500 KVA , 11000/400 V, 2
   d. Transformers(reverse) : 1 MVA , 132/11 KV, 1
   e. Outgoing lines: 132 KV, 3Φ, 2
   f. Also indicate positions of CT, PT, Isolating Switches, lightning Arrestors, Circuit Breakers. **(20 Marks)**

Part B

3. Draw the front elevation left half in section and sectional plan of a 15 KVA , 50 Hz distribution transformer Details of magnetic circuits:

Cross section of the core = 63mm×91.6mm
window= 298.5mm ×114.5mm
Yoke height = 63.5 mm

LV winding:

Number of coils on each leg = 1 Number of turns / coil = 72

Number of layers /coil = 3 Section of conductor = 2.79mm×10.6mm

HV winding:

Number of coils on each leg = 1 Number of turns / coil = 720

Number of layers /coil = 8 Cross Section of wire = 2.59mm dia

Insulation details:

Air space around the core = 1.66 mm

Insulation between core and LT = 1.6mm

Insulation on H T = 3 mm

Insulation at the top and bottom winding and insulation between layer = 0.35 mm

Provide 10 mm bolt with sleeve at suitable spacing. **(50 Marks)**

OR

4. Draw to a suitable scale end and longitudinal elevation (top half in section) of a100 KW, 500V, 1250 R.P.M 6 Pole DC shunt generator. The armature is supported over the spider and the shaft is supported by means of pedestal bearing for the dimensions given below.

Armature:

Outside diameter= 75 cm

Length = 27.8 cm

Number of slots = 86

Size of slot = 1.11 cm x 5.24 cm

Depth of iron behind the slot = 9.26 cm

Ventilating ducts= 3, each 1 cm width Air gap length below main pole = 0.5 cm

Main pole (laminated):

Total height = 24 cm with shoe

Width = 17.75 cm

Length = 25.7 cm

Interpole (solid):

Breadth=4.63 cm Length=20 cm

Air gap length below Interpole = 0.8 cm

Yoke:

Thickness of yoke = 7.5 cm

Length of yoke = 40 cm

Commutator:

Number of commutator segments = 344

Diameter =56 cm

Segment pitch = 0.51

Length =12.35 cm

Number of brushes per spindle=3

Shaft:

Shaft diameter below armature = 9 cm

Shaft length between bearings centers = 120 cm. **(50 Marks)**

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