Code No: R1621022 **R16** SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
ELECTRICAL MACHINES – I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any F**OUR** Questions from **Part-B**

~~~~~~

PART –A

1. a) A 6-pole lap wound DC generator has 720 conductors; a flux of 80 mWb/pole is driven at 1000 rpm. Fine the generated e.m.f. (3M)
   b) What is a back e.m.f? Why the e.m.f generated in the armature of a DC motor is called back emf. (2M)
   c) Why is armature control superior to field control scheme in case of a DC shunt motor. (2M)
   d) Why the main flux in a transformer is remains practically constant from no load to full load. (2M)
   e) Why core losses are neglected in short circuit test and copper losses are neglected in open-circuit test in a transformer testing. (3M)
   f) What are the features of on load tap changers? (2M)

PART -B

2. a) Find expression for magnetic force developed in a doubly-excited translational magnetic system. (7M)
   b) Explain the construction and principle of operation of DC generator. (7M)

3. a) Explain the mechanical and electrical characteristics of dc cumulative and differential dc motors. (7M)
   b) Determine (i) the total torque developed (ii) the useful torque of a 250 V, 4 pole series motor with 782 wave connected conductors developing 8 kW and taking 40 A with a flux per pole of 25 mWb. The armature resistance of the motor is 0.75 ohms. (7M)

4. a) Explain the need for conducting separation of losses test on dc machine (6M)
   b) In a retardation test on a D.C motor, with its field normally excited, the speed fell from 1525 to 1475 in 25 seconds. With an average load of 1 kW supplied by the armature, the same speed drop occurred in 20 seconds. Find the moment of inertia of the rotating parts in $kg.m^2$? (8M)

5. a) Derive the emf equation of transformer and explain the significance of each term in it. (7M)
   b) In a 400 V, 50 Hz transformer, the total iron loss is 2300 W. When the supply voltage and the frequency reduced to 200 V and 25 Hz respectively the corresponding loss is 800 W. Calculate the eddy current loss at normal voltage and frequency. (7M)

||''|'''|''|'|''''||
~~~~~~

6. a) Explain Sumpner's test on single phase transformer and also list its advantages? (8M)
   b) A 2-winding 10 kVA, 440/110 V transformer is reconnected as a step-down 550/440 V autotransformer. Compare volt-ampere rating of the autotransformer with that of original 2-winding transformer. Calculate power transferred to the load: (i) inductively (ii) conductively. (6M)

7. a) What is the total load capacity of V-V bank as compared with a delta-delta bank? (7M)
   b) A balanced 3-phase, 100 kW load at 400V and 0.8 p.f. lag is to be obtained from a balanced 2-phase, 1100V lines. Determine the kVA rating of each unit of the Scott-connected transformer. (7M)

||''|'''|''|'|''''||

Code No: R1621022 **R16** SET - 2

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
ELECTRICAL MACHINES – I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

~~~~~~

PART –A

1. a) Why magnetic field systems are are employed in practical electromechanical energy conversion devices rather than electric field systems. (2M)
   b) Draw the different characteristics of dc shunt motors (2M)
   c) What precautions are taken during starting of DC shunt and series motors and why? (2M)
   d) On what factors does the eddy current loss depend? Why this loss can be assumed to be constant. (3M)
   e) Write conditions that must be fulfilled before two transformers can be operated successfully in parallel? (3M)
   f) What are the advantages with Scott connection? (2M)

PART -B

2. a) Explain briefly about singly-excited and doubly-excited systems with suitable examples. (8M)
   b) Derive the expression for generated e.m.f in a DC generator. Discuss the factors affecting the generated e.m.f. (6M)

3. a) Explain speed-current, torque-current and speed-torque characteristics of DC compound motor. (7M)
   b) DC motor connected to a 460V supply has an armature resistance of 0.25 ohm. Calculate the value of back e.m.f when the armature current is 120A and the value of armature current when the back e.m.f is 447.4V? (7M)

4. a) With a neat diagram, explain the operation of a 4-point starter. Discuss the advantages of 4-point starter over 3-point starter. (7M)
   b) Hopkinson's test on two shunt machines gave the following results for full load: line voltage 250 V, line current excluding field current 50 A; motor armature current 380 A; field currents 5 A and 4.2 A. Calculate the efficiency of each machine. The armature resistance of each machine = 0.02 Ω. (7M)

||''|'''|''|'|''''||
~~~~~~

5. a) With the help of relevant expressions explain how the iron loss is varied by the variation of supply voltage and frequency? (8M)

   b) A 100 kVA, 2000/200 V, 50 Hz distribution transformer has core loss of 750 W at rated voltage and copper loss of 1500 W at full load. It has the following load cycle: (6M)

% load	0%	50%	75%	100%	110%
Power factor	-	0.95 lag	0.8 lag	0.85 lag	0.95 lag
Hours	3	6	8	5	2

   Determine the all-day efficiency of the transformer?

6. a) Develop the exact equivalent circuit of a 1-phase transformer. From this derive the approximate and simplified equivalent circuits. State the various assumptions made? (7M)

   b) Two similar 200 kVA, 1-phase transformers gave the following results when tested by back-to-back method: W_1 in the supply line, 4kW, W_2 in the primary series circuit, when full-load current circulated through secondries, 6 kW. Calculate efficiency of each transformer (7M)

7. a) Distinguish between off load and on load tap changing transformer. (8M)

   b) Two single phase transformers are supplied at 250V from a 6600 V, 3-phase system through a pair of Scott-connected transformers. If the load on the main transformer is 85 kW at 0.9 p.f. lagging and that on teaser transformer is 69 kW at 0.8 p.f. lagging, find the values of line currents on the 3-phase side. Neglect the magnetizing and core loss currents in the transformers? (6M)

||''|'''|''|'|''''||

Code No: R1621022 **R16** SET - 3

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
ELECTRICAL MACHINES – I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

~~~~~~

PART –A

1. a) What is meant by co-energy? What is its physical significance? (2M)
   b) A DC shunt motor develops an open circuit voltage of 250 V at 1500 rpm. Find the developed torque for an armature current of 10 A. (3M)
   c) Why Swinburn's test cannot be performed on a DC series motor? (2M)
   d) What is meant by all-day efficiency of a power transformer and why it is lower than the commercial efficiency? (2M)
   e) What is an auto–transformer? What advantages are possessed by auto-transformer? (3M)
   f) What are the salient features of star-star connected three-phase transformer? (2M)

PART -B

2. a) Derive expressions for field energy and co-energy in a singly-excited electromechanical unit. (8M)
   b) A six pole lap wound dc armature has 70 slots with 20 conductors / slot. The ratio of pole arc to pole pitch is 0.68. The diameter of bore of the pole shoe is 0.46 m. The length of the pole shoe is 0.3 m. If the air gap flux density is 0.3 Wb/m^2 and the e.m.f induced in the armature is 500 V, find the speed at which it runs. (6M)

3. a) Explain the concept of armature reaction in DC motors. (7M)
   b) A 4 pole, 240V, wave connected shunt motor gives 1118 kw when running at 1000 r.p.m and drawing armature and field currents of 50A and 1 A respectively. It has 540 conductors. Its resistance is 0.1 ohm. Assuming a drop of 1V per brush, find total torque, useful torque, useful flux per pole, rotational losses and efficiency? (7M)

4. a) Explain the Hopkinson's test for determination of efficiency of shunt machines. (7M)
   b) A 220V D.C shunt motor at no load takes a current of 2.5A. The resistances of armature and the shunt field are 0.6 ohm and 210 ohm respectively. Estimate the efficiency of the motor when the input current is 20 A. State the assumptions made? (7M)

||''|'''|''|'|'''||
~~~~~~

5. a) Explain why transformer rating is given in KVA only (6M)

   b) The primary and secondary windings of a 40 kVA, 6600/250 V single phase transformer have resistances of 10 Ω and 0.02 Ω respectively. The total leakage reactance is 35 Ω as referred to the primary winding. Find full load regulation at a p.f. of 0.8 lagging. (8M)

6. a) In an auto-transformer, power transferred from primary to secondary circuit is partly by conduction and partly by induction. Explain. (7M)

   b) Following readings were obtained from O.C. and S.C. tests on a 8 kVA, 400/120V, 50 Hz transformer: (7M)
   O.C. Test: (l.v. side) : 120 V; 4 A; 75 W
   S.C. Test: (h.v.side) : 9.5 V; 20 A; 110W
   Obtain i) Voltage regulation and efficiency for 0.8 lagging power factor load, and ii) The efficiency at half full – load and 0.8 power factor load.

7. a) Explain the purpose of using tertiary winding in three-winding transformers. (6M)

   b) Two single phase electric furnaces A and B are supplied at 220 V from a 3-phase 1100 V supply by means of a Scott connected transformer combination. If the total output is 600 kW at 0.6 power factor lagging determine currents in the winding and transformation ratio of each transformer. (8M)

||''|'''|''|'|''''||

Code No: R1621022 **R16** SET - 4

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
ELECTRICAL MACHINES – I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

~~~~~~

PART –A

1. a) What is the function of commutator in a DC machine? (2M)
   b) What is the condition for maximum power developed in dc motors and what is the efficiency of the motor at that condition. (3M)
   c) Why is the starting current high in a DC motor? (2M)
   d) Why are iron or core losses assumed to remain constant from no load to full load in a power transformer? (2M)
   e) What is the typical information that can be had by performing OC and SC tests on a single phase transformer? (3M)
   f) What is the need of tap changers in transformers? (2M)

PART -B

2. a) Show that torque developed in a doubly excited system is equal to the rate of increase of field energy with respect to displacement at constant current. (7M)
   b) Explain about the open circuit characteristics of a DC generator. Write the necessary equations? (7M)

3. a) Discuss in detail about the significance of back e.m.f that is produced in a DC motor? (6M)
   b) A six pole, lap-wound 400 V series motor has the following data: Number of armature conductors=920, flux per pole=0.045 Wb, total motor resistance = 0.6 ohms and frictional losses = 2 kW. If the current taken by the motor is 90 A, find: (i) total torque (ii) useful torque at the shaft (iii) power output. (8M)

4. a) Explain the Retardation test to estimate the rotational losses in a DC machine. (7M)
   b) In a brake test on a DC shunt motor, the load on one side of the brake band was 35 kg and the other side 5kg. The motor was running at 1300 rpm; its input being 70 A at 420 V DC. The pulley diameter is 1 m. Determine the torque, output of the motor and the efficiency of the motor. (7M)

5. a) Define voltage regulation of a transformer and derive conditions for i) zero regulation ii) maximum regulation. (8M)
   b) A single-phase transformer working at unity power factor has an efficiency of 90% at both half load and at the full-load of 500W. Determine the efficiency at 75% full load and the maximum efficiency. (6M)

||''|'''|''|'|'''||
~~~~~~

6. a) Derive expressions for load shared by two transformers operating in parallel when no-load voltages of these transformers are not equal. What will be the load distribution if the voltage ratio is exactly equal? (7M)

   b) A 400/100 V, 5 kVA, single-phase two winding transformer is to be used as an auto-transformer to supply 400 V from a 500 V voltage source. When tested as a two winding transformer at rated load and 0.8 p.f. lagging, its efficiency was found to be 0.95. (i) Determine its kVA rating as an Auto-transformer. (ii) Find its efficiency as an auto-transformer at rated load and at 0.8 p.f. lagging. (7M)

7. a) Explain about three phase to two phase transformation using Scott connection. (8M)

   b) What are distinguishing features of Y-Y, Y-Δ, Δ-Y and Δ- Δ three phase connections? Compare their advantages and disadvantages? (6M)

||''|'''|''|'|''''||