EEE

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 30149

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electrical and Electronics Engineering

EE 3303 — ELECTRICAL MACHINES – I

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate statistically induced EMF from dynamically induced EMF. Give one example for each.

2. Why it is named as leakage flux?

3. Draw the pictorial view of armature flux and field flux positions in the air gap during demagnetizing and cross magnetizing situations of DC machine.

4. List the role of inter-poles in the DC machine.

5. Write the reason for higher starting current in DC motors.

6. Compare brake test with Swinburne's test of DC machine.

7. Sketch the phasor representation of ideal transformer on No load.

8. Name the major components (in practical setup) required to separate the components of core loss of the transformer.

9. List the drawback of autotransformer by comparing two winding transformer.

10. Write the advantages of three phase transformer.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Derive the expression for the energy in singly excited magnetic field system. (7)

(ii) Write a technical note on doubly excited magnetic field system. (6)

Or

(b) (i) Develop the mathematical expression for the force and torque developed in the singly excited system. (7)

(ii) The magnetic circuit has dimensions, cross sectional area of core = cross sectional area of air-gap = 8 cm^2, air-gap length = 0.055 cm, mean core length = 30 cm and N = 520 turns. Assume the value, μ_r = 65,000 for core material. Find (1) the reluctances of the core and air-gap, for the condition that the magnetic circuit is operating with flux density in the core = 1.0 T, (2) the flux and (3) the current. (6)

12. (a) (i) Explain, why EMF is induced in the DC machine. Draw the wave shape of the EMF induced in the machine with split-ring and with slip-ring assembly. Also derive the mathematical expression for the EMF induced in the DC machine. (7)

(ii) A DC generator has an EMF of 100 V, when the useful flux per pole is 20 mWb and the speed is 800 rpm. Calculate the generated EMF (1) with same flux and a speed of 1000 rpm; (2) with a flux per pole of 24 mWb and a speed of 940 rpm. (6)

Or

(b) (i) Draw and explain the magnetization and load characteristics of separately excited DC machine and self-excited DC machine. (7)

(ii) Two shunt generators running in parallel with a load current of 3000 A. The generators have armature resistances 0.05 Ω and 0.03 Ω. The field resistances are 30 Ω and 25 Ω. The induced EMFs are 400 V and 380 V. Calculate

(1) current supplied by each generator;

(2) bus-bar voltage and

(3) kW output of each generator. (6)

13. (a) (i) Derive the expression for the torque developed in the DC machine. Also list the factors affecting the torque developed. (7)

(ii) The armature resistance of a 200 V DC shunt motor is 0.12 Ω. It runs at 600 rpm at constant torque load and draws a current of 21 A. Calculate its new speed if the field current is reduced to 10%. (6)

Or

(b) (i) From the basic principles, derive the condition for the maximum efficiency in the DC machine. (7)

(ii) Two DC generators A and B are connected to a common load. Machine A had a constant EMF of 400 V and internal resistance of 0.25 Ω, while the machine B has a constant EMF of 410 V and internal resistance of 0.4 Ω. Calculate the current and power output from each generator if the load voltage is 390 V. What would be the current and power from each machine and the terminal voltage if the load was open circuited? (6)

14. (a) (i) Draw the per phase equivalent circuit (exact and approximate circuit) of single phase transformer with necessary assumptions by indicating different steps. (7)

(ii) Consider a 20 kVA, 2000/200 V, 50 Hz transformer. The SC test results are as follows: *SC test*: 80 V, 10 A, 290 W (HV side)

Determine the regulation at full load and half full load,

(1) 0.7 pf lag and

(2) 0.7 pf lead. (6)

Or

(b) (i) Write a technical note on the parallel operation of single phase transformer. (7)

(ii) A 5 kVA distribution transformer has a full load efficiency of 90 % at which copper loss equals Iron loss. The transformer is loaded 24 hours as given below. No load for 9 hours, 25% of full load for 6 hours, 50% of full load for 6 hours, and full load for 3 hours. Calculate all day efficiency of the transformer. (6)

15. (a) (i) Explain the construction and working of auto-transformer with neat sketches. (7)

(ii) With necessary circuit and derivation, prove that the Scott connection is used to convert three phase AC to two phase AC, if the phase angle between two phase is 90°. (6)

Or

(b) Elucidate the following phasor group of three phase transformer.

(i) any one arrangement for zero-degree phase displacement (7)

(ii) any one arrangement for 180° phase displacement. (6)

PART C — (1 × 15 = 15 marks)

16. (a) A 500 V shunt motor takes 8 A on no load. The armature and field resistances are 0.2 Ω and 250 Ω respectively, when measured at room temperature. Neglect the change in resistance due to temperature variation. Find the efficiency of the machine. (15)

(i) While running as a motor taking a line of 80 A at 500 V.

(ii) While running as a generator delivering a current of 90 A at 500 V. Assume the stray load losses to be 1.2% of the output power.

Or

(b) Calculate the values of equivalent circuit parameters referred to LV side of a single phase 3 kVA, 220/440 V, 50 Hz transformer with the following test results. (15)

Open circuit test (HV open): 220 V, 1 A, 100 W

Short circuit test (LV short): 20 V, 9 A, 75 W

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Reg. No. : | E | N | G | G | T | R | E | E | . | C | O | M |

Question Paper Code : 70091

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Electrical and Electronics Engineering

EE 3303 – ELECTRICAL MACHINES - I

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define an electromechanical system. Give example of devices which convert electrical to mechanical and mechanical to electrical energy.

2. Describe multiply excited magnetic field system.

3. List the important conditions for exciting a self-excited DC generator.

4. Draw the internal and external load characteristics of a DC shunt generator.

5. A 220V DC shunt machine has a armature resistance of 0.5 Ω. If the full load armature current is 20, calculate the induced emf when the machine acts (a) generator (b) motor.

6. Write the significance and condition for Hopkinson's test.

7. Define all day efficiency of a transformer.

8. Give the mandatory conditions in paralleling transformers.

9. Write the working principle of a step down auto transformer with a single diagram.

10. State the condition for which a 3 phase - 4 wire distribution transformer will give maximum efficiency (η_{max}) and the range of loading for maximum efficiency.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Compare magnetic and electric circuits. (6)

(ii) Derive the expression for the force and torque on a Current Carrying Conductor. (7)

Or

(b) (i) Calculate the force acting on the plunger of a linear actuator. (7)

(ii) Calculate the current requires to produce a flux of 1.75m. wb in the ring if the relative permeability of the iron is 900, number of turns N = 600 and radius of the cross section r = 3.5 cm. (6)

12. (a) (i) Derive the induced E.M.F. equation of a DC generator. (7)

(ii) Define armature reaction in DC generator and discuss its effects on a two pole generator. (6)

Or

(b) State different commutation techniques of DC generator and illustrate resistance commutation. (13)

13. (a) List the different speed control of DC shunt motor and explain the speed control of at following conditions. (13)

(i) speed below rated speed.

(ii) speed above rated speed.

Or

(b) Explain the laboratory experimental procedure for doing Swinburne's test with a circuit and list the calculations to be made to predetermine the efficiency of DC motor and generator by using Swinburne's test results. (13)

14. (a) (i) Derive the induced EMF equation of transformer. (7)

(ii) A transformer has 600 turns of the primary winding and 20 turns of the secondary winding. Determine.

(1) the secondary voltage if the secondary circuit is open and the primary voltage is140 V.

(2) the primary current if the secondary current is 90 A (6)

Or

(b) (i) A 10 kVA single-phase transformer provides a no-load secondary voltage of 110 volts. If the equivalent secondary winding resistance is 0.015 Ω and its total reactance is 0.04 Ω, determine its voltage regulation when supplying a load at 0.85 power factor lagging. (7)

(ii) Explain the construction and working principle of single phase transformer. (6)

15. (a) A 400 kVA transformer has a primary winding resistance of 0.5 ohm and a secondary winding resistance of 0.001 ohm. The iron loss is 2.5 kW and the primary and secondary voltages are 5kV and 320 V respectively. If the power factor of the load is 0.85, determine the efficiency of the transformer (i) on full load and (ii) on half load. (13)

Or

(b) Sketch and explain an electrical circuit connection of transformer that used to get two- phase power supply from three-phase source and write the application. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Derive the expression for copper saving in a step down auto transformer with a circuit. (15)

Or

(b) (i) A 200 k VA single-phase transformer is in circuit throughout 24 hours. For 8 hours in a day, the load is 150 kW at 0.8 power factor lagging and for 7 hours, the load is 90 kW at 0.9 power factor. Remaining time or the rest period, it is at no-load condition. Full-load Cu loss is 4 kW and the iron loss is 1.8 kW. Calculate the all-day efficiency of the transformer. (8)

(ii) Discuss the real time applications of the following electro mechanical energy conversion devices. (7)

(1) DC Shunt generator

(2) DC series generator

(3) DC Shunt motor

(4) DC Series motor

(5) 3 Phase power transformer

(6) 3 Phase distribution transformer

(7) Auto transformer

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Question Paper Code : 30149

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electrical and Electronics Engineering

EE 3303 — ELECTRICAL MACHINES – I

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate statistically induced EMF from dynamically induced EMF. Give one example for each.

2. Why it is named as leakage flux?

3. Draw the pictorial view of armature flux and field flux positions in the air gap during demagnetizing and cross magnetizing situations of DC machine.

4. List the role of inter-poles in the DC machine.

5. Write the reason for higher starting current in DC motors.

6. Compare brake test with Swinburne's test of DC machine.

7. Sketch the phasor representation of ideal transformer on No load.

8. Name the major components (in practical setup) required to separate the components of core loss of the transformer.

9. List the drawback of autotransformer by comparing two winding transformer.

10. Write the advantages of three phase transformer.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Derive the expression for the energy in singly excited magnetic field system. (7)

(ii) Write a technical note on doubly excited magnetic field system. (6)

Or

(b) (i) Develop the mathematical expression for the force and torque developed in the singly excited system. (7)

(ii) The magnetic circuit has dimensions, cross sectional area of core = cross sectional area of air-gap = 8 cm^2, air-gap length = 0.055 cm, mean core length = 30 cm and N = 520 turns. Assume the value, μ_r = 65,000 for core material. Find (1) the reluctances of the core and air-gap, for the condition that the magnetic circuit is operating with flux density in the core = 1.0 T, (2) the flux and (3) the current. (6)

12. (a) (i) Explain, why EMF is induced in the DC machine. Draw the wave shape of the EMF induced in the machine with split-ring and with slip-ring assembly. Also derive the mathematical expression for the EMF induced in the DC machine. (7)

(ii) A DC generator has an EMF of 100 V, when the useful flux per pole is 20 mWb and the speed is 800 rpm. Calculate the generated EMF (1) with same flux and a speed of 1000 rpm; (2) with a flux per pole of 24 mWb and a speed of 940 rpm. (6)

Or

(b) (i) Draw and explain the magnetization and load characteristics of separately excited DC machine and self-excited DC machine. (7)

(ii) Two shunt generators running in parallel with a load current of 3000 A. The generators have armature resistances 0.05 Ω and 0.03 Ω. The field resistances are 30 Ω and 25 Ω. The induced EMFs are 400 V and 380 V. Calculate

(1) current supplied by each generator;

(2) bus-bar voltage and

(3) kW output of each generator. (6)

13. (a) (i) Derive the expression for the torque developed in the DC machine. Also list the factors affecting the torque developed. (7)

(ii) The armature resistance of a 200 V DC shunt motor is 0.12 Ω. It runs at 600 rpm at constant torque load and draws a current of 21 A. Calculate its new speed if the field current is reduced to 10%. (6)

Or

(b) (i) From the basic principles, derive the condition for the maximum efficiency in the DC machine. (7)

(ii) Two DC generators A and B are connected to a common load. Machine A had a constant EMF of 400 V and internal resistance of 0.25 Ω, while the machine B has a constant EMF of 410 V and internal resistance of 0.4 Ω. Calculate the current and power output from each generator if the load voltage is 390 V. What would be the current and power from each machine and the terminal voltage if the load was open circuited? (6)

14. (a) (i) Draw the per phase equivalent circuit (exact and approximate circuit) of single phase transformer with necessary assumptions by indicating different steps. (7)

(ii) Consider a 20 kVA, 2000/200 V, 50 Hz transformer. The SC test results are as follows: *SC test*: 80 V, 10 A, 290 W (HV side)

Determine the regulation at full load and half full load,

(1) 0.7 pf lag and

(2) 0.7 pf lead. (6)

Or

(b) (i) Write a technical note on the parallel operation of single phase transformer. (7)

(ii) A 5 kVA distribution transformer has a full load efficiency of 90 % at which copper loss equals Iron loss. The transformer is loaded 24 hours as given below. No load for 9 hours, 25% of full load for 6 hours, 50% of full load for 6 hours, and full load for 3 hours. Calculate all day efficiency of the transformer. (6)

15. (a) (i) Explain the construction and working of auto-transformer with neat sketches. (7)

(ii) With necessary circuit and derivation, prove that the Scott connection is used to convert three phase AC to two phase AC, if the phase angle between two phase is 90°. (6)

Or

(b) Elucidate the following phasor group of three phase transformer.

(i) any one arrangement for zero-degree phase displacement (7)

(ii) any one arrangement for 180° phase displacement. (6)

PART C — (1 × 15 = 15 marks)

16. (a) A 500 V shunt motor takes 8 A on no load. The armature and field resistances are 0.2 Ω and 250 Ω respectively, when measured at room temperature. Neglect the change in resistance due to temperature variation. Find the efficiency of the machine. (15)

(i) While running as a motor taking a line of 80 A at 500 V.

(ii) While running as a generator delivering a current of 90 A at 500 V. Assume the stray load losses to be 1.2% of the output power.

Or

(b) Calculate the values of equivalent circuit parameters referred to LV side of a single phase 3 kVA, 220/440 V, 50 Hz transformer with the following test results. (15)

Open circuit test (HV open): 220 V, 1 A, 100 W

Short circuit test (LV short): 20 V, 9 A, 75 W

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 20976

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Third Semester

Electrical and Electronics Engineering

EE 3303 – ELECTRICAL MACHINES – I

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Faraday's law of electro magnetic induction.

2. Define Fringing.

3. Explain the methods of improving commutation briefly.

4. State the reasons for parallel operation of DC Generators.

5. What is the significance of back EMF?

6. State the condition for maximum efficiency in DC machine?

7. Define all day efficiency.

8. State the conditions for parallel operation of single-phase transformers.

9. Compare star-delta and delta-star transformer.

10. Draw the additive and subtractive polarity of auto-transformer with the help of two winding transformer.

PART B — (5 × 13 = 65 marks)

11. (a) Differentiate statically and dynamically induced EMF. Also, explain the concept of statically and dynamically induced EMF with suitable diagram. (6+7)

Or

(b) Derive the energy stored and electromagnetic torque in double excited magnetic field system.

12. (a) (i) An 8-pole D.C. shunt generator with 778 wave-connected armature conductors and running at 500 R.P.M., supplies a load of 12.5 Ω. Resistance at terminal voltage of 50 V. The armature resistance is 0.24 Ω and field resistance is 250 Ω. Find the armature current, the induced E.M.F. and the flux per pole. (7)

(ii) Draw and explain the characteristics of DC shunt and series generators. (6)

Or

(b) (i) A long-shunt compound generator delivers a load current of 50 A at 500 V and has armature, series field and shunt field resistances of 0.05 Ω, 0.03 Ω and 250 Ω respectively. Calculate the generated voltage and the armature current. Allow 1 V per brush for contact drop. (7)

(ii) Explain the process of commutation with necessary diagrams. (6)

13. (a) (i) Derive the torque equation of DC motor. (5)

(ii) Explain the Field Controlled DC Series Motor. (8)

Or

(b) Discuss the Hopkinson's Test of DC motor. Why it is needed? What are its advantages? (13)

14. (a) Write the procedure for Open circuit and short circuit test on single phase transformer. (13)

Or

(b) Discuss the Sumpner's Test of Transformer. Why it is needed? What are its advantages? (13)

15. (a) Draw and explain the circuit of Auto-transformer. State its applications. (10+3)

Or

(b) Draw and explain the circuit of Scott connection. State its applications. (10+3)

PART C — (1 × 15 = 15 marks)

16. (a) A D.C. series motor operates at 800 R.P.M. with a line current of 100 A from 230-V mains. Its armature circuit resistance is 0.15 Ω and its field resistance 0.1 Ω. Find the speed at which the motor runs at a line current of 25 A, assuming that the flux at this current is 45 per cent of the flux at 100 A.

Or

(b) In a 50 KVA Transformer, the iron loss is 500 W and full load copper loss is 800 W. Find the efficiency at full and half loads at 0.8 p.f. lagging.

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 51009

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Third Semester

Electrical and Electronics Engineering

EE 3303 — ELECTRICAL MACHINES – I

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the principle of conservation of energy.
2. Define doubly excited magnetic field system.
3. Define the term critical field resistance in DC shunt generator.
4. Write the emf equation of a DC generator.
5. Outline the need of starter in dc motor.
6. Why should a dc series motor not be started on no load?
7. Justify that under short circuit test the core loss is negligible.
8. Define the turns ratio of the transformer.
9. State the merits and demerits of an auto transformer over two winding transformer.
10. List out the advantages of Scott connection of three phase transformers.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the multiply excited system of electromechanical energy conversion system.

Or

(b) Derive the expression for the field energy and co-energy of single excited magnetic system.

12. (a) An 8 pole lap connected armature has 960 conductors, a flux of 40 mWb per pole and a speed of 400 rpm. Calculate the emf generated. If the armature were wave connected generator at what speed must it be driven to generate 400 V.

Or

(b) Draw and explain the load characteristics of DC shunt and compound generator and state the reason for their different characteristics.

13. (a) A 200 V DC shunt motor has an armature resistance of 0.25 Ω and runs at 1100 rpm, Drawing an armature current of 40A. It is required to reduce the speed to 750 rpm. If the armature current remain same, find the additional resistance to be added in series with the armature circuit.

Or

(b) What is Electrical braking and Explain the various types of braking in DC Motor with neat sketches.

14. (a) Explain the principle of operation of a transformer and also draw the vector diagram to represent a load in unity, leading and lagging power factor.

Or

(b) A 1 kVA, 1000/200 V, 50Hz, 1Φ transformer has the following results

OC test : 1000 V, 0.24 A and 90W on HV side

SC test : 50 Hz, 5A and 110 W on HV side

Draw the equivalent circuit of the transformer referred to LV side.

15. (a) Derive an expression for saving in copper material in auto transformer over a two winding transformer of equal rating.

Or

(b) Compare the features of various three phase transformer connections with the neat diagram.

PART C — (1 × 15 = 15 marks)

16. (a) Describe with the neat sketch, the back to back test to obtain the efficiency on single phase transformers.

Or

(b) In a long-shunt compound generator, the terminal voltage is 230 V when generator delivers 150 A. Determine

(i) Induced emf (5)

(ii) Total power generated (5)

(iii) Distribution of this power. (5)

Given that shunt field, series field and armature resistance are 92 Ω, 0.015 Ω and 0.032 Ω respectively.