Code No: 153AQ **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, April/May - 2023
ELECTRICAL MACHINES - I
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Name the different parts of a DC Machine. [2]
b) What is the difference between Lap winding and Wave winding? [3]
c) What are the losses occur in DC Machines? [2]
d) What are the applications of d.c. motor? [3]
e) What is Field's test? [2]
f) What is the difference between direct and indirect testing of DC Machines? [3]
g) What is the transformer ratio? [2]
h) Why the transformer rating is in KVA? [3]
i) What is the tertiary winding? [2]
j) What are the advantages of three phase transformers? [3]

PART - B

(50 Marks)

2.a) What do you understand by demagnetizing and cross magnetizing affects of armature reaction in DC machine?
b) A separately excited d.c. generator with constant excitation is connected to a constant resistance circuit. When the speed is 1200 rpm, it delivers 120A at 500V. At what speed will be the current be reduced to 60A? Armature resistance = 0.1 ohm. Contact drop per brush = 1V. Armature reaction may be ignored. [5+5]

OR

3. With the help of neat sketch, Explain how the open circuit characteristics can be obtained and how the critical speed and critical field resistance are determined. [10]

4.a) Describe the principle of operation of DC motor.
b) A 120V DC shunt motor has an armature resistance of 0.2Ω and a field resistance of 60Ω. The full load line current and full load speed are 60A and 1800 rpm. If the brush contact drop is 3V. Find the speed of the motor at half load. [5+5]

OR

5. What is the necessity of a starter for DC Motor? Explain in detail about 3– point starter. [10]

6.a) Explain in detail, how the brake test is conducted on DC Shunt motor?
b) What are the merits and demerits of Hopkinson's test? [5+5]

OR

7. With suitable diagram, show the Swinburne's test can be employed to predetermine the efficiency at full load condition when running as a (a) generator and (b) motor. [10]

8.a) Explain in detail how eddy current and hysterisis losses of a transformer can be minimized.
b) At 400 V and 50 Hz the core loss of a transformer was found to be 2400 W. When the transformer is supplied at 200 V and 25 Hz, the core loss is 800 W. Calculate the hysteresis and eddy current loss at 400 V and 50 Hz. [5+5]

OR

9. From the fundamentals, obtain the equivalent circuit of a single phase transformer. [10]

10.a) Derive an expression for the saving of copper in an autotransformer as compared to an equivalent two winding transformer.
b) A three phase step down transformer is connected to 6.6 kV supply mains and takes 80A. Calculate its secondary line voltage and line current for the following connectionsif the ratio of turns per phase is 16. (i) Y-Y (ii) Y-Δ (iii) Δ-Δ [5+5]

OR

11.a) Define voltage regulation of a transformer and derive condition for zero and maximum regulation.
b) A Scott-connected transformer supplies two single phase furnaces at 100V, each taking 200kW. The load on the leading phase is at unity power factor and that on the other phase is 0.8 lagging power factors. The 3-phase input line voltage is 11000V. Calculate the line currents on the primary side. Neglect the magnetizing current and leakage impedance. [5+5]

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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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R18

Code No: 153AQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, August/September - 2022
ELECTRICAL MACHINES - I
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) Explain the effect of armature reaction on the performance of DC generator.
b) A dc shunt generator has the following open circuit magnetization curve running at 800 rpm

Field current (A):	0	0.5	1.0	3.0	4.0	5.0
EMF (V)	10	50	100	175	245	262

Find graphically the critical resistance of shunt field circuit. If the field resistance is changed to 75 ohms, what will be the critical speed for the machine to build up? [7+8]

2.a) How demagnetizing and cross magnetizing ampere turns per pole are calculated in a DC machine?
b) A d.c. shunt generator is supplying load connected to a bus - bar voltage of 220 V. It has an armature resistance of 0.025 Ω and field resistance of 110Ω. Calculate the valueof load current and load power when it generates an emf of 230 V. Neglect the effect of armature reaction. Draw circuit diagram. [8+7]

3.a) Derive the torque equation of DC Motor.
b) A 6-pole DC motor has a wave connected armature with 87 slots, each slot containing 6 conductors. The flux per pole is 20 mwb and the armature has a resistance of 0.13 ohm when the motor is connected to 240V supply and the armature draws a current of 80A driving a load of 15KW. Calculate i) Speed ii) Armature Torque and iii) Shaft Torque. [8+7]

4.a) With the help of a neat sketch, explain the construction and working of 3-point starter?
b) A 250V dc series motor has armature and series field resistance of 0.25 and 0.15 ohms respectively. (i) Calculate the current for developing a torque of 80 Nm at 1200 rpm. (ii) Calculate the percentage reduction in flux when the motor runs at 1800 rpm at half the current obtained in part (i). [8+7]

5.a) Briefly explain the procedure to conduct Swinburne's test on DC machine and explain its significance?
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 at420 V DC. The pulley diameter is 1 m. Determine the torque, output of the motor and the efficiency of the motor. [8+7]

6.a) Explain the Direct method of testing a dc machine.

b) Hopkinson's test on two similar DC shunt machines gave the following data: Line voltage 230 V, line current (excluding both the field currents is 40 A, motor armature current 350 A, field currents 5 A and 4.2 A. Calculate the efficiency of each machine. Armature resistance of each machine is 0.02 Ω. [8+7]

7.a) Draw and explain the phasor diagram of a single-phase transformer with lagging p.f. load and leading p.f. load.

b) A single-phase transformer is rated at 120 kVA, 5000/250V. The full – load copper losses are 2200W and iron losses are 1400 W. Find efficiency at i) full load 0.8 power factor leading ii) full – load 0.6 power factor lagging. [8+7]

8.a) With neat diagram, explain the various tests conducted on transformer to predetermine the efficiency of the transformer without directly loading the transformer?

b) In a Sumpner's test on two identical single-phase transformers rated 750 kVA, 11/0.5 kV, 50 Hz the wattmeter reading on h.v side is 8000 W and on the *l*.v side is 16000W. Find the efficiency of each transformer on half full load and 0.78 power factor. What will be its maximum efficiency? [8+7]

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Code No: 15AQ **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, March - 2022
ELECTRICAL MACHINES - I
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1.a) Derive the expression for generated e.m.f in a DC generator. Discuss the factors affecting the generated e.m.f.?
b) A short-shunt dc compound generator supplies 150 A at 100 V. The resistance of armature, series field and shunt field windings are 0.04, 0.03 and 60 Ω respectively. Find the e.m.f generated. Also find the e.m.f generated if same machine is connected as a long shunt machine. [8+7]

2.a) Sketch and explain the load characteristics of the shunt and series generator.
b) A 4-pole generator has a wave-wound armature with 722 conductors, and it delivers100 A on full load. If the brush lead is 8^0. Calculate the armature demagnetizing and cross magnetizing ampere turns per pole. [7+8]

3.a) Write a short notes on speed control of DC Motors.
b) A 4-pole, 250 V d.c series motor has a wave-connected armature with 1254 conductors. The flux per pole is 22 mWb when the motor is taking 50 A. Iron and friction losses amount to 1.0 Kw. Armature resistance is 0.2 ohm and series field resistance is 1 ohm. Calculate: i) the speed ii) the shaft torque and iii) the efficiency at this load. [8+7]

4.a) Derive the condition for maximum efficiency of DC Motor.
b) A DC series motor is driving a fan load, whose torque varies a cube of speed. The total armature and series field resistance is 1 Ω. It takes 10 Amp from 200 V mains and runs at 1000 RPM. Find the resistance to be connected in series with the motor to make it run at 800 RPM. [7+8]

5.a) Explain with diagram how Hopkinson's test is performed on dc machines. What are the advantages and disadvantages of this test?
b) A 200 V d.c. shunt motor takes 5 A at no-load. R_a=0.5 Ω and R_{sh}=200 Ω. Estimate the kW output and efficiency when the motor takes 25 A on full loads. [8+7]

6.a) Explain the procedure to separate the stray losses in a DC Motor.
b) Two identical DC machines when tested by Back-to-back method gave the following test results: Field currents are 2.5 A and 2 A. Line voltage is 220 V. Line current including both field current is 10 A. Motor armature current is 73A. The armature resistance of each machine is 0.05Ω. Calculate the efficiency of both machines. [8+7]

7.a) Draw the exact equivalent circuit of a transformer and derive the equivalent circuits referred to primary and secondary. Describe the various parameters involved in it.

b) A 25 kVA, 440/110 V, 50 Hz single-phase step-down transformer is designed to work with 1.5 V per turn with a flux density not exceeding 1.35 T. Determine: (i) the required number of turns on the primary and secondary windings respectively, (ii) the cross- sectional area of the iron core, and (iii) the secondary current. [9+6]

8.a) 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.

b) Draw the connection diagrams and explain the features of Y-Y, Y-Δ three-phase connections. [7+8]

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Code No: 133AM **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, May/June - 2019
ELECTRICAL MACHINES – I
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) What is multiplex winding? [2]
b) What is the purpose of laminating the armature? [3]
c) Define Back EMF. [2]
d) How commutation takes place in DC motor? [3]
e) What is the purpose of conducting brake test? [2]
f) What are the limitations of field's test? [3]
g) What is the effect of variation of supply voltage on iron losses? [2]
h) How to minimize hysteresis loss? [3]
i) What is an auto transformer? [2]
j) Write short notes on open delta connection in case of a 3-phase transformer connection. [3]

PART-B

(50 Marks)

2.a) Explain the constructional features of DC generator in detail.

b) A 4-pole generator has a wave-wound armature with 722 conductors, and it delivers100 A on full load. If the brush lead is 8^0 calculate the armature demagnetizing and cross magnetizing ampere turns per pole. [5+5]

OR

3.a) Derive the expression for demagnetizing AT/pole.
b) Draw a developed diagram of 2 layer lap winding for a 4 pole DC generator with 16 coils. [5+5]

4.a) Explain the principle of operation of DC motor in detail.
b) A 200 V d.c shunt motor with an armature resistance of 0.3Ω is excited to give constant main field. At full load the motor runs at 600 rpm and takes an armature current of 30 A. If a resistance of 1Ω is placed in the armature circuit, find the speeds at full load torque and double full load torque. [5+5]

OR

5.a) With the help of neat sketch, explain the working of 3 point starter.
b) A 200V DC shunt motor runs at 600 rpm when the armature current is 30A. Calculate the speed if the torque is doubled. Given that Ra = 0.18Ω. [5+5]

6.a) Explain the procedure of conducting brake test on d.c. machine with a neat circuit diagram.

b) With the help of neat sketch, explain about swinburne's test. [5+5]

OR

7.a) Explain in detail about the purpose of conducting various tests on DC machines.

b) With the help of neat sketch, explain the Hopkinson's test. [5+5]

8.a) Draw the equivalent circuit of single phase transformer and explain.

b) A 8 KVA, single phase transformer has a turns ratio of 8:3 and is supplied from a 2.0 KV supply. Neglecting Losses, determine (i) Primary current (ii) The full load secondary current (iii) The secondary Voltage. [5+5]

OR

9.a) Define all day efficiency? Derive the expression.

b) The percentage resistance and percentage leakage reactance of a 5 kVA, 500 V/ 1000 V, 50 Hz., single phase transformer are respectively 3% and 4%. Calculate the voltage to be applied to the HV side to carry out short circuit test at rated current and also calculate the voltage to be applied to the LV side to carry out short circuit test at half the rated current. [5+5]

10.a) A 5KVA, 1000/200 V, 50 Hz single phase transformer gave the following test results:
Open circuit test (LV side): 200 V, 1.2 A, 90 W
Short circuit test (HV side): 50 V, 5 A, 110 W.
Compute the parameters of approximate equivalent circuit referred to LV side.

b) With the help of neat sketch, explain in detail about parallel operation of single phase transformers. [5+5]

OR

11.a) Three number of single phase ideal transformers, each of rating 5 kVA, 200V/100V, 50 Hz is connected in star/delta fashion to supply a balanced three phase 10 kW, 0.8 power factor load at 100 V (line to line). Calculate line and phase currents on the secondary and primary sides.

b) Give the comparison of autotransformer with two winding transformer on various aspects. [5+5]

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Code No: 133AM **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, December - 2019
ELECTRICAL MACHINES – I
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Why pole pitch is expressed in electrical degrees not in mechanical degrees. [2]
b) What features of DC Series generator distinguish it from other types of DC generators? [3]
c) Why the EMF generated in a DC Motor is called back EMF. [2]
d) Explain why a dc motor should not be started direct on line. [3]
e) Why Swinburne's test is preferred instead of Brake test in DC machines? [2]
f) What is retardation test? [3]
g) What is all day efficiency? How it is different from normal efficiency. [2]
h) Distinguish between step-up and step-down transformers? [3]
i) Explain why OC test and SC tests are conducted on LV and HV sides of the transformer respectively? [2]
j) What are the advantages of single three phase transformer unit over a bank of single phase transformers? [3]

PART-B

(50 Marks)

2.a) Distinguish between external and internal characteristics of DC Generators.

b) A 10kW, 6 pole DC Generator develops an e.m.f of 200V at 1500 rpm. The armature has a lap- connected winding. The average flux density over a pole pitch is 0.9T. The length and diameter of the armature are 0.25m and 0.2 respectively. Calculate the flux/pole the torque developed by the machine. [5+5]

OR

3.a) What are the possible causes for not building up emf in self excited DC Generators? What are the remedial measures to be taken?
b) A 230V, 25 kW separately excited DC generator at full load induces an EMF of 235 V. If the brush drop is 1.5V per brush, calculate the armature resistance. [5+5]

4. How 4-point starter is different from 3-point starter. With a neat diagram explain the construction and working of 4-point stator. [10]

OR

5.a) Discuss about the characteristics of DC series motor.
b) A 220 V, DC shunt motor is operating at a speed of 1440 r.p.m. The armature resistanceis 1.0 Ω and armature current is 10 A. of the excitation of the machine is reduced by 10%, and find the value of extra resistance to be put in the armature circuit to maintain the same speed and torque. [5+5]

6.a) Explain the Direct method of testing in a dc machine.

b) The Hopkinson test on two similar dc shunt machines gave the following results: Line voltage: 220 V; Line current excluding filed current: 40 A; Armature current of motoring machine: 200 A; field currents are 6 A and 7 A. Calculate the efficiency of each of the machine at the given load conduction. The armature resistance of each machine is 0.05 Ω.

[5+5]

OR

7.a) Explain the Brake test in a dc machine.

b) A 200 V DC shunt motor with armature and field resistances of 0.25 ohm and 200 ohm respectively, takes a no load current of 5 A. If it takes 50 A under loaded conditions, find its efficiency as generator.

[5+5]

8.a) What is voltage regulation of a transformer? Derive the conditions for maximum and zerovoltage regulation in a transformer.

b) A 100 kVA, 2400/240 V, 50Hz single phase transformer has an exciting current of 0.64Aand a core loss of 700 W, when its high voltage side is energized at rated voltage and frequency. Calculate the two components of the exciting current.

[5+5]

OR

9.a) Draw the exact equivalent circuit of a transformer and describe briefly the variousparameters involved in it

b) A 40 KVA single phase transformer has got maximum efficiency of 97 % at 80 % of fullload at UPF. During the day, the load on the transformer is as follows.

No. of hours	Load	Power factor
9	6 KW	0.6 lag
8	25 KW	0.8 lag
7	30 KW	0.9 lag

Determine the All day efficiency of the transformer.

[5+5]

10.a) Draw the Phasor diagrams and winding connection of three-phase transformer for:

i) Group 1: Phase displacement of zero degrees

ii) Group 3: Phase displacement of -30 degrees

b) A 50 kVA, 2200 V/1100 V single phase 50 Hz transformer has a full-load efficiency of 95% and iron loss of 500 W. The transformer is connected as an Auto-transformer to a 3300 V supply. When it delivers a load of 50 kW at unity power factor at 1100 V, calculate the currents in the

windings.

[5+5]

OR

11.a) Discuss how parallel operation of two single phase transformers is effected by unequal voltage ratios and unequal per unit leakage impedances but same X/R ratio.

b) In a 25 kVA, 2000/200 V transformer the iron and copper losses are 350 and 400 W respectively. Calculate the efficiency on UPF at (i) full load (ii) half load. (iii) Determine the load for maximum efficiency and the copper loss in this case.

[5+5]

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