

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S,FE) (FT/WP) (S2 PT) Examination December 2025/January 2026 (2019 Scheme)

Course Code: EET202

Course Name: DC MACHINES AND TRANSFORMERS

Max. Marks: 100

Duration: 3 Hours

Use graph sheets wherever necessary

PART A

(Answer all questions; each question carries 3 marks)

Marks

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|----|---|-----|
| 1 | Explain the function of equalizer rings in a lap wound DC machine. | (3) |
| 2 | Explain the functions of yoke and pole shoe of a DC generator. | (3) |
| 3 | Derive the emf equation of a DC generator. | (3) |
| 4 | Explain the purpose of compensating windings in DC machines. | (3) |
| 5 | Explain the necessity of starters for a DC motor. | (3) |
| 6 | List out two applications each of DC shunt, series and compound motors. | (3) |
| 7 | What is meant by voltage regulation of a transformer? For what type of load, you may get negative voltage regulation? | (3) |
| 8 | A 60 kVA transformer has iron loss of 550W and full load copper loss of 800W. Find the efficiency at full load, if the full load power factor is 0.7 lagging. | (3) |
| 9 | Write down the conditions to be satisfied for the parallel operation of three phase transformers? | (3) |
| 10 | What is the purpose of tertiary winding in three winding transformer? | (3) |

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

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| 11 | a) Write any four differences between wave winding and lap winding. | (4) |
| | b) Draw the winding diagram of a DC machine with 6 poles, 18 slots progressive double layer lap winding. Also prepare the winding table. | (10) |
| 12 | a) Explain the constructional details of DC machines with the help of a neat diagram. | (10) |
| | b) Explain the need of dummy coils in DC machines. | (4) |

Module -2

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| 13 | a) What is armature reaction? Explain the effects of demagnetizing and cross | (6) |
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magnetizing components of armature reaction?

- b) A shunt generator gave the following open circuit characteristics at a speed of 1500 rpm. (8)

I_f	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
E	10	60	120	160	200	230	245	260	275	285	300

Plot the OOC and calculate:

- i. the emf to which the machine will excite at 1500 rpm, when the shunt field resistance is 400Ω
 - ii. the critical resistance at 1500 rpm.
- 14 a) Derive the condition for maximum efficiency in a DC generator. (5)
- b) A 4 pole DC shunt generator with 780 wave connected armature conductors and running at 500 rpm supplies a load of 25 ohm resistance at a terminal voltage of 250V. The armature resistance is 0.25 ohms and field resistance is 250 ohms. Find (4)
- (i) Armature current
 - (ii) Induced EMF
 - (iii) Flux per pole
- c) Define commutation. Explain the process of commutation with neat sketches. (5)

Module -3

- 15 a) Draw and explain the electrical and mechanical characteristics of DC series motors. (6)
- b) An 8 kW, 200V DC shunt motor takes 4A at no load when running at 800 rpm. The field resistance is 100 ohms. The resistance of armature at stand still gives a drop of 6 volts across the armature terminals when 12A was passed through it. Calculate (a) speed, (b) Torque in N-m and (c) Efficiency at full load condition. (8)
- 16 a) With neat diagrams, explain the speed control methods in DC shunt motors. (6)
- b) With neat diagrams, explain how the Swinburne's test is conducted on a DC motor to predetermine the efficiency at full load condition when running as a generator. Also list out the advantages and disadvantages of this test. (8)

Module -4

- 17 a) Explain the principle of operation of a transformer. Also derive the emf equation of a single phase transformer. (4)
- b) Draw the phasor diagrams of (i) an ideal transformer on no load and (ii) a practical transformer supplying leading power factor load. (6)

- c) Define All-day efficiency of a transformer. How can you improve the All-day efficiency of a distribution transformer? (4)
- 18 a) A 200 / 400 V, 50 Hz, single phase transformer gave the following test results. (10)

OC (LV)	200 V	0.7 A	70W
SC (HV)	15 V	10A	85W

Find the parameters and draw the equivalent circuit of the transformer as referred to the low voltage side.

- b) Why transformers are rated in KVA? (4)

Module -5

- 19 a) Derive an expression for the saving of copper in an autotransformer as compared to an equivalent two winding transformer. (6)
- b) Write the differences between power transformers and distribution transformers. (4)
- c) What is meant by vector groups? Write short note on Dy11. (4)
- 20 a) What is the need for parallel operation of transformers? List out the essential and desirable conditions to be satisfied for parallel operation of transformers. (7)
- b) Discuss the operation of open delta (V-V) configuration of transformers with the help of winding connection diagram, phasor diagram and voltage relations. (7)
