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Question Paper Code	14009
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**

Third Semester

**Electrical and Electronics Engineering**  
**24EEPC302 - ELECTRICAL MACHINES - I**

Regulations - 2024

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

	Marks	K- Level	CO
1. What is the relationship between torque and speed in an electric machine? (a) Torque is inversely proportional to speed. (b) Torque is directly proportional to speed. (c) Torque and speed are unrelated. (d) Torque and speed have a complex relationship.	1	K1	CO1
2. The magnetic circuit analysis involves the calculation of which parameter represents the opposition to magnetic flux in the motor? (a) Magnetic field strength (b) Magnetic permeability (c) Magnetic reluctance (d) Magnetic saturation	1	K1	CO1
3. The condition for maximum efficiency for a DC generator is _____. (a) Eddy current losses = stray losses (b) Hysteresis losses = eddy current losses (c) Copper losses = 0 (d) Variable losses = constant losses	1	K1	CO2
4. _____ are significantly reduced by laminating the core of a DC generator. (a) Hysteresis losses (b) Eddy current losses (c) Copper losses (d) Windage losses	1	K1	CO2
5. What is the primary function of the starting resistor in a DC motor starter? (a) To limit the back emf (b) To reduce the operating Speed (c) To limit the high starting armature current (d) To increase the field flux	1	K1	CO3
6. If the armature of a DC motor has 39 slots with 12 conductors per slot. Then the total number of conductor's are _____. (a) 27 (b) 468 (c) 568 (d) 51	1	K1	CO3
7. The change in secondary voltage from no-load to full-load indicates the _____ of a transformer. (a) Efficiency (b) power loss (c) voltage regulation (d) impedance	1	K1	CO4
8. The primary and secondary windings of a single-phase transformer are usually wound on a common _____. (a) Core (b) Bobbin (c) Armature (d) Commutator	1	K1	CO4
9. Which DC machine testing method allows two identical machines to be tested simultaneously at full-load without drawing a large amount of power from the supply? (a) Load test (b) Brake test (c) Swinburne's test (d) Hopkinson's test	1	K1	CO5
10. DC series motors are commonly used for traction applications (e.g., trains) because their characteristic features include: (a) Speed control above base speed (b) Constant speed with varying load (c) Very high starting torque (d) Low maintenance and cost	1	K1	CO6

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

11. What is fringing effect?	2	K1	CO1
12. What are the magnetic losses?	2	K1	CO1
13. Distinguish between shunt and series field coil construction in DC machine.	2	K2	CO2
14. What is the function of interpoles?	2	K2	CO2
15. Infer why DC series motor should not be operated on no load condition?	2	K2	CO3
16. Outline the speed and armature characteristics of DC shunt motor?	2	K2	CO3

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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|--|---|----|-----|
| 17. List the difference between core type and shell type transformer.  | 2 | K1 | CO4 |
| 18. Show the application of auto transformer.  | 2 | K1 | CO4 |
| 19. Why is Swinburne's Test classified as an indirect test for DC machines, and what losses does it determine?               | 2 | K1 | CO5 |
| 20. Define All-day Efficiency and explain why it is more important than commercial efficiency for distribution transformers? | 2 | K1 | CO5 |
| 21. List out the application of DC compound motors.  | 2 | K1 | CO6 |
| 22. How do smart transformers enhance power system operation compared to conventional transformers?                          | 2 | K1 | CO6 |

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

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|--------|---|----|----|-----|
| 23. a) | Explain the expression for field energy produced in a doubly excited magnetic field system.   | 11 | K2 | CO1 |
| OR     |   |    |    |     |
| b)     | Illustrate the relation between mutual inductance and self-inductances of two magnetically coupled coils.   | 11 | K2 | CO1 |
| 24. a) | Explain the construction and working principle of DC generators with the help of a neat diagram.  | 11 | K2 | CO2 |
| OR     |   |    |    |     |
| b)     | A separately excited dc generator has armature circuit resistance of 0.22ohms and a total drop at brushes is 2.5V. When running at 1200 rpm, it delivers a current of 120A at 220 V to a load of constant resistance If the generator speed drops to 750 rpm, with field current unaltered, find the current delivered to load. | 11 | K2 | CO2 |
| 25. a) | Illustrate the mechanical characteristics of shunt, series, and compound DC motors using sketches.  | 11 | K2 | CO3 |
| OR     |   |    |    |     |
| b)     | Draw and explain the operation of a three point starter.  | 11 | K2 | CO3 |
| 26. a) | Draw the approximate equivalent circuit of a single-phase transformer and identify the various parameters.  | 11 | K3 | CO4 |
| OR     |   |    |    |     |
| b)     | Develop the EMF equation of the transformer and explain the working principle of autotransformer.   | 11 | K3 | CO4 |
| 27. a) | Summarize Hopkinson's test in detail with its advantages and disadvantages.   | 11 | K2 | CO5 |
| OR     |   |    |    |     |
| b)     | Explain the method of open circuit and short circuit test single phase transformers.  | 11 | K2 | CO5 |
| 28. a) | Analyze the limitations of conventional transformers in modern grids compared to emerging smart transformer technology.   | 11 | K4 | CO6 |
| OR     |   |    |    |     |
| b)     | Examine the type of DC motor suitable for an elevator system and justify your answer based on torque-speed characteristics.   | 11 | K4 | CO6 |