

Total No. of Questions: 22

Total No. of Pages: 02

Roll No. _____

Paper Code
3E1219

B.Tech. III-Sem (Main & Back) January-2026

Electrical & Electronics Engg.

3EX4-07 Electrical Machine - I

EE,EX

3E1219

Time : 3 Hours

Maximum Marks : 70

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly. Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. _____

2. _____

Part-A

(Answer should be given up to 25 words only)

All questions are compulsory

10x2=20

- Q. 1 What is fringing in a magnetic path? .
- Q. 2 What is flux density? ^{T-437} .
- Q. 3 State Biot- Savart law. .
- Q. 4 Define reluctance of a magnetic circuit.
- Q. 5 Explain why hysteresis occurs in magnetic materials? .
- Q. 6 A coil has 500 turns and carries 2 A. Calculate in MMF. .
- Q. 7 What is armature demagnetizing effect? .
- Q. 8 A pole has 0.03 Wb flux and 10 turns. Find flux linkage. .
- Q. 9 Write the EMF equation of a DC generator. .
- Q.10 Mention two advantages of wave winding. ^{T-437} .

Part B

(Analytical/Problem solving questions)

Attempt any Five questions.

5x4=20

- Q.1 Explain the effect of air-gap length on magnetic reluctance.

- Q.2 A magnetic circuit has reluctance $3 \times 10^5 \text{ A/Wb}$ and MMF = 900AT. Calculate Flux.
- Q.3 Explain armature reaction. T-437
- Q.4. A 6-pole lap wound generator has 900 conductors, flux / pole = 0.02 Wb, speed = 800rpm. Find generated EMF.
- Q.5 Explain the energy stored in a magnetic field and derive the formula.
- Q.6 A DC shunt generator has $R_f = 150\Omega$. Find field current at 220 V. Also find field copper loss.
- Q.7 Draw and explain torque-speed characteristics of series and shunt motors.

Part C

(Descriptive/Analytical/Problem Solving/Design question)

Attempt any three questions.

3x10=30

- Q. 1 Explain the construction of a DC generator with neat labeled diagrams.
- Q. 2 A 6-pole generator, wave wound, had 720 conductors. Flux/pole = 0.025 Wb, Speed = 900 rpm. Find: (a) EMF, (b) Output power at 22 A.
- Q. 3 Discuss losses and efficiency testing in DC machines.
- Q. 4 A shunt motor shows unstable speed when connected to a weak supply system.
- (a) Draw block diagram of electromechanical feedback explaining how back EMF acts as natural stabilizer.
- (b) Explain mathematically how line voltage fluctuations distort torque-speed characteristics? T-437
- (c) Show using calculations how armature reaction can worsen instability?
- (d) Suggest methods (design+operational) to stabilize speed.
- Q. 5 A student claims that "armature reaction always reduces EMF in a generator". Critically analyse the statement.
- (a) Provide conditions where armature reaction may increase, decrease, or not affect EMF.
- (b) Use mmf diagrams to show each case.
- (c) Discuss how brush shift alters the flux pattern.
- (d) Link armature reaction effects to machine performance under over-excited and under excited conditions.