



**Daffodil International University**  
**Department of Electrical and Electronic Engineering**  
**Faculty of Engineering**  
**Final Examination, Spring – 2025**

Course Code: 0713-223

Section: A, B, C, D

Full Marks: 40

Course Title: Energy Conversion II

Level-Term: L2-T2

Exam Date: June 21, 2025

Teacher's Initial: NR

Time: 2 Hours

*Notes: Answer all the questions below. Right margin shows the course outcomes and allocated marks.*

- Q1. (a) What is back emf? **Mention** its significance on armature current. CO-1 3  
C(2)
- (b) Briefly **describe** the followings with necessary curve for series DC motor, CO-1 4  
C(2)
- (i) Electrical Characteristic
- (ii) Mechanical Characteristic
- Q2. (a) **Describe** the effect of field current changes on a synchronous motor with phasor diagram. CO-2 4  
C(4)
- (b) **Discuss** the commutation process in the DC generator with necessary diagrams. CO-2 6  
C(4)
- Why does fire occur in commutators?
- Q3. (a) A shunt generator has a full load current of 196 A at 220 V. The stray losses are 720 W and the shunt field coil resistance is 55  $\Omega$ . If it has a full load efficiency of 88%, **find** the armature resistance. Also, **find** the load current that corresponds to maximum efficiency. CO-3 4  
C(4)
- (b) A 4-pole, 250 V d.c. series motor takes 20 A and runs at 900 r.p.m. Each field coil has resistance of 0.025 ohm and the resistance of the armature is 0.1 ohm. CO-3 7  
C(5)
- Determine** the speed that run the motor by developing the same torque if:
- (i) a diverter of 0.2 ohm is connected in parallel with the series field
- (ii) rearranging the field coils in two series and parallel groups
- Assume unsaturated magnetic operation.
- Q4. (a) A d.c. shunt machine generates 250-V on open circuit at 1000 r.p.m. Effective armature resistance is 0.5  $\Omega$ , field resistance is 250  $\Omega$ , input to machine running as a motor on no load is 4 A at 250 V. **Calculate** speed of machine as a motor taking 40 A at 250 V. Armature reaction weakens field by 4%. CO-3 6  
C(4)

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- (b) A 2300-V 1000-hp 0.8-PF leading 60-Hz two-pole Y-connected synchronous motor has a synchronous reactance of 2.8  $\Omega$  and an armature resistance of 0.4  $\Omega$ . At 60 Hz, its friction and windage losses are 24 kW, and its core losses are 18 kW. The field circuit has a dc voltage of 200 V, and the maximum  $I_f$  is 10 A. Answer the following questions about the motor, assuming that it is being supplied by an infinite bus. CO-3 6  
C(5)
- (i) **Find**  $I_A$  and  $E_A$  with angle if this machine operates at unity power factor when supplying full load.
- (ii) What is the motor's efficiency at full load and unity power factor?
- (iii) If the flux were increased by 2.83 %, what would the new value of the armature current be? What would the new power factor be? How much reactive power is being consumed or supplied by the motor?