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Daffodil International University

Department of Electrical and Electronic Engineering
Faculty of Engineering
Final Examination, Spring – 2025

Course Code: 0713-223 | Course Title: Energy Conversion II
Section: A, B, C, D | Level-Term: L2-T2 | Teacher's Initial: NR
Full Marks: 40 | Exam Date: June 21, 2025 | 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 C(2)	3
	(b) **Briefly describe** the followings with necessary curve for series DC motor, (i) Electrical Characteristic (ii) Mechanical Characteristic	CO-1 C(2)	4
Q2.	(a) **Describe** the effect of field current changes on a synchronous motor with phasor diagram.	CO-2 C(4)	4
	(b) **Discuss** the commutation process in the DC generator with necessary diagrams. Why does fire occur in commutators?	CO-2 C(4)	6
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 Ω. 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 C(4)	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. **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.	CO-3 C(5)	7
Q4.	(a) A d.c. shunt machine generates 250-V on open circuit at 1000 r.p.m. Effective armature resistance is 0.5 Ω, field resistance is 250 Ω, 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 C(4)	6

	(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 Ω and an armature resistance of 0.4 Ω. 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. (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?	CO-3 C(5)	6