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Daffodil International University

Department of Electrical and Electronic Engineering
Faculty of Engineering
Final Examination, Summer – 2026

Course Code: 0713-223	Course Title: Energy Conversion II	
Section: A, B, C, D	Level-Term: L2-T2	Teacher's Initial: NR, RS
Full Marks: 40	Exam Date: August 19, 2026	Time: 2 Hours

Notes: Answer all the questions below. The second right most column indicates the course outcomes [COs] with respective Bloom's level and the right most column indicates the allocated marks.

Q1.	**Explain** the commutation process in a DC generator with necessary illustrative diagrams.	CO-1 C(2)	5
Q2.	Briefly **describe** the followings with necessary curve for series DC motor, (i) Torque versus Armature Current Characteristic (ii) Speed versus Torque Characteristic	CO-1 C(2)	5
Q3.	**Analyze** how variations in field current affect the operation of a synchronous motor, and **justify** your analysis using an appropriate phasor diagram.	CO-2 C(4)	5
Q4.	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. **Analyze** the behavior of the machine by determining the speed as a motor taking 40 A at 250 V. Armature reaction weakens field by 4%.	CO-2 C(4)	5
Q5.	A 220-V compound generator is supplying a load of 100 A at 220 V. The resistances of its armature, shunt and series windings are 0.1 Ω, 50 Ω and 0.06 Ω respectively. **Evaluate** the induced e.m.f. and the armature current when the machine is connected (i) short shunt (ii) long shunt (iii) how will the series amp-turns be changed in long shunt if a divertor of 0.14 Ω is connected in parallel with the series windings? Neglect armature reaction and brush contact drop.	CO-3 C(5)	5
Q6.	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) rearranging the field coils in two series and parallel groups Assume unsaturated magnetic operation.	CO-3 C(5)	5

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Q7. 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. CO-3 C(5) 5

(i) **Evaluate** I_A and E_A with angle if this machine operates at unity power factor when supplying full load.

(ii) **Determine** the motor's efficiency at full load and unity power factor.

(iii) If the flux were increased by 2.83 %, **calculate** the new armature current.

Q8. A 75-kW, 3-ϕ, Y-connected, 50-Hz, 440-V cylindrical rotor synchronous motor operates at rated condition with 0.8 p.f. leading. The motor efficiency excluding field and stator losses is 95% and $X_s = 2.5\ \Omega$. CO-3 C(5) 5

Evaluate:

i. mechanical power developed
ii. armature current
iii. back e.m.f.
iv. power angle
v. pull-out torque of the motor

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