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Daffodil International University

Department of Electrical and Electronic Engineering
Faculty of Engineering

Mid Term Examination, Fall – 2026

Course Code: 0713-223 | Course Title: Energy Conversion II
Section: A, B, C, D, E, F, G | Level-Term: L2-T2 | Teacher's Initial: NR, RS, RIR
Full Marks: 25 | Exam Date: October 28, 2026 | Time: 1.5 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. **Illustrate** and briefly **explain** the brushless excitation system working principle of a synchronous generator incorporating a pilot exciter with a neat, labeled diagram. CO-1 C(2) 5

Q2. **Analyze** the effect of excitation changes on a synchronous generator while delivering constant power outputs using phasor diagram. CO-2 C(4) 5

Q3. A 100 kVA, 3000 V, 50 Hz, 3-phase star-connected alternator has an armature resistance of 0.2 Ω per phase. A field current of 40 A produces a short-circuit current of 200 A and an open-circuit line voltage of 1040 V. CO-2 C(4) 5

Analyze how the power factor affects the voltage regulation by determining the full-load voltage regulations and drawing the corresponding phasor diagrams of the alternator at 0.8 power factor lagging and 0.8 power factor leading.

Q4. A 480-V, 50-Hz, Y -connected, six-pole synchronous generator has a per-phase synchronous reactance of 1.0 Ω. Its full-load armature current is 60 A at 0.8 PF lagging. This generator has friction and windage losses of 1.5 kW and core losses of 1.0 kW at 60 Hz at full load. The armature resistance is negligible and the field current has been adjusted so that the terminal voltage is 480 V at no load. CO-3 C(5) 5

(i) **Determine** the speed of rotation of this generator.
(ii) **Evaluate** the terminal voltage of this generator if it is loaded with the rated current at 0.8 PF leading.
(iii) **Calculate** the efficiency of the generator when it is operating at the rated current and 0.8 pf leading.
(iv) **Calculate** the shaft must be supplied by the prime mover at full load and induced counter torque?
(v) **Determine** the voltage regulation at 0.8 pf leading.

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Q5. Two synchronous generators are operating in parallel supplying a total load of 2.5 MW at 0.8 power factor lagging. Generator 1 has a no-load frequency of 61.5 Hz and a slope of 1 MW/Hz, while Generator 2 has a no-load frequency of 61.0 Hz and a slope of 1 MW/Hz. After steady-state operation, an additional 1 MW load is connected and the governor set point of Generator 2 is increased by 0.5 Hz.

Evaluate the system frequency and the generator powers before and after the change in system condition.

CO-3 C(5) 5

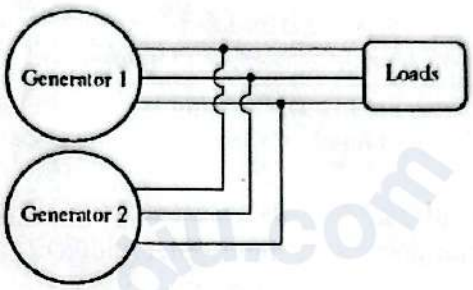


Fig. 1

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CO-3 C(5) 5

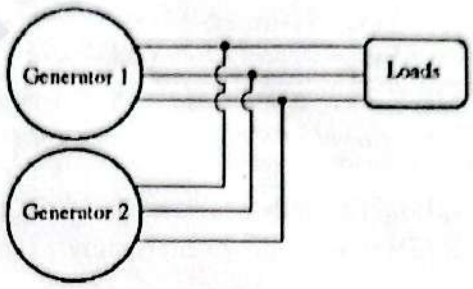


Fig. 1

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