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**Daffodil International University**
Department of Electrical and Electronic Engineering
Faculty of Engineering
**Mid-Term Examination, Summer – 2026**

Course Code: **0713-213** Course Title: Energy Conversion I
Section: A/B/C/D/E/F/G Level-Term: L2-T1 Teacher's Initial: DRA / PA/ RS
Full Marks: 25 Exam Date: July 4, 2026 Time: 1.5 Hours

***Attempt to Answer all 3 Questions***

**Q1. a)** **Draw** the phasor diagram of a *inductively* loaded transformer with winding resistance and but no magnetic leakage reactance — **CO-1 C(3)** **[3]**

**b)** The core of a 100-kVA, 11500/550 V, 50-Hz, 1-ph, core type transformer has a cross-section of 22 cm × 22 cm. **Determine** (i) the number of H.V. and L.V. turns per phase and (ii) the e.m.f. per turn if the maximum core density is not to exceed 1.5 Tesla. Assume a stacking factor of 0.9. — **CO-1 C(3)** **[4]**

**Q2. a)** **Explain** the purpose of Short-Circuit Test in a Transformer with necessary diagrams and associated equations. — **CO-1 C(2)** **[3]**

**b)** A transformer has a primary winding of 840 turns and a secondary winding of 200 turns. When the load current on the secondary is 75 A at 0.85 power factor lagging, the primary current is 20 A at 0.9 power factor lagging. **Calculate** the no-load current of the transformer and its phase with respect to the voltage. — **CO-1 C(3)** **[5]**

**Q3. Answer any 2 (Two) from the following questions:**

**a)** A 50-kVA, 4,500/220 V transformer has $R_1$ = 4.45 Ω, $R_2$ = 0.009 Ω. The values of reactances are $X_1$ = 5.2 Ω and $X_2$ = 0.017 Ω. **Compute** for the transformer (i) equivalent resistance as ref. to primary (ii) equivalent resistance as ref. to secondary (iii) equivalent reactance as ref. to both primary and secondary (iv) equivalent impedance as ref. to both primary and secondary (v) total Cu loss of the transformer. — **CO-2 C(3)** **[5]**

**b)** The data refer to a 1-phase transformer are: Turn ratio 19.5:2; $R_1$ = 30 Ω; $X_1$ = 100 Ω; $R_2$ = 0.08 Ω; $X_2$ = 0.25 Ω. No-load current = 1.3 A, leading the flux by 30°. The secondary delivers 210 A at a terminal voltage of 500 V and p.f. of 0.8 lagging. **Determine** the primary current and applied voltage. — **CO-2 C(4)** **[5]**

**c)** ***Obtain*** the equivalent circuit of a 250/520-V, 50-Hz, single-phase transformer from the following test data : — **CO-2 C(4)** **[5]**
O.C Test : 250 V, 1.2 A, 80 W – on L.V. side
S.C. Test : 22 V, 12 A, 110 W – on H.V. side
**Find** the equivalent circuit of the transformer and **calculate** the secondary terminal voltage when delivering a load current of 15A at pf of 0.8 lagging, the primary voltage being 250V.