GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM- I / II Winter Examination-Dec.-2011

Subject code: 110005   **Date: 22/12/2011**
Subject Name: Elements of Electrical Engineering
Time: 10.30 am -1.00 pm   **Total marks: 70**

Instructions:
1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** State and explain Kirchhoff's laws.   **05**
       (b) State and explain Faraday's laws of electromagnetic induction.   **05**
       (c) A square and its diagonals are made of a uniform covered wire. The resistance of each side is 1 Ω and that of each diagonal is 1.414 Ω. Determine the resistance between two opposite corners of the square.   **04**

Q.2 **(a)** Define: **03**
             (i) Electric field intensity
             (ii) Electric potential
             (iii) Electric flux density
       (b) Derive equation for energy stored in a capacitor   **04**
       (c) A parallel plate capacitor with five plates has each plate one meter square area at a distance of 1.5 mm and a dielectric of relative permittivity 3.5. If the capacitor is charged to 1000 volt, how much energy will be stored in it.   **07**

Q.3 **(a)** Derive the expression for the rise of current in an inductive circuit when a d.c. supply is switched on to it. Define time constant.   **07**
       (b) Coil A and B with 50 and 500 turns respectively are wound side by side on a closed iron circuit of section 50 cm^2 and mean length of 1.2 m. Estimate (i) self-inductance of each coil (ii) mutual inductance between coils (iii) e.m.f. induced in coil A if the current in coil B grows steadily from 0 to 5 Amp. in 0.01 sec. Assume μ_r of iron as 1000.   **07**

Q.4 **(a)** Prove that current in purely capacitive circuit leads its voltage by 90° and average power consumption in pure capacitor is zero.   **07**
       (b) The following expressions represent the instantaneous values of e.m.f. in three coils connected in series   **07**
             $e_1 = 50 \sin \omega t$
             $e_2 = 40 \sin(\omega t+60°)$
             $e_3 = 60 \sin (\omega t-30°)$
             Find an expression for the resultant e.m.f. when coils are connected to give the sum of e.m.f.s

Q.5 **(a)** An inductive coil of resistance R and inductance L is connected in parallel with capacitor of C. Derive an expression for the resonant frequency and Q factor.   **07**

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(b) Two impedances are connected in parallel across a 100 volt, 50 Hz a.c. **07** supply. Impedance no.1 has resistance of 8 Ω and capacitance reactance of 7 Ω. While impedance no.2 has resistance of 5 Ω and inductive reactance of 6 Ω.
Calculate:
- (i) Current through each circuit and p.f. of each circuit
- (ii) Total current and p.f. of combined circuit
- (iii) Power taken by the whole circuit.

Q.6 **(a)** Establish relationship between line and phase voltages and currents in **07** balanced delta connection. Draw complete phasor diagram of voltages and currents.

(b) Two wattmeter's connected to measure three phase power for star **07** connected loads read 10.37 Kw and 5.185 Kw. The line current is 10 Amp. Calculate (i) Line and phase voltage. (ii) Resistance and reactance per phase.

Q.7 **(a)** Explain the working of earth leakage circuit breaker with diagram. **07**
(b) Explain the working of fluorescent tube with help of circuit diagram **07** giving function of various parts.

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