

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**
 A square and its diagonals are made of a uniform covered wire. The
 (c) resistance of each side is 1Ω and that of each diagonal is 1.414Ω . **04**
 Determine the resistance between two opposite corners of the square.
- 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 **07**
 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.
- Q.3** (a) Derive the expression for the rise of current in an inductive circuit when **07**
 a d.c. supply is switched on to it. Define time constant.
 (b) Coil A and B with 50 and 500 turns respectively are wound side by side **07**
 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.
- Q.4** (a) Prove that current in purely capacitive circuit leads its voltage by 90° **07**
 and average power consumption in pure capacitor is zero.
 (b) The following expressions represent the instantaneous values of e.m.f. in **07**
 three coils connected in series
 $e_1 = 50 \sin \omega t$
 $e_2 = 40 \sin(\omega t + 60^\circ)$
 $e_3 = 60 \sin(\omega t - 30^\circ)$
 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 **07**
 parallel with capacitor of C. Derive an expression for the resonant
 frequency and Q factor.

- (b) Two impedances are connected in parallel across a 100 volt, 50 Hz a.c. supply. Impedance no.1 has resistance of 8Ω and capacitance reactance of 7Ω . While impedance no.2 has resistance of 5Ω and inductive reactance of 6Ω . **07**
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 balanced delta connection. Draw complete phasor diagram of voltages and currents. **07**
(b) Two wattmeter's connected to measure three phase power for star 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. **07**
- 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 giving function of various parts. **07**
