Code No: R5100206 **R5**

I B.Tech YEAR(R05) Supplementary Examinations, May/June 2010
ELECTRICAL CIRCUITS
(Common to Electrical & Electronic Engineering and Electronics & Control Engineering)
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Explain the concept of self and mutual inductance.
   (b) Distinguish between static induced emf and dynamically induced e.m.f.
   (c) Two inductors have self inductance of 0.1mH and 0.4mH and a mutual inductance of 0.15mH. What is the value of coefficient of coupling between them? If a current of I(t) = 3 sint + 1.5 sin 2t is passed through the first inductor, what is the expression for the voltage induced in the second coil? [4+4+8]

2. (a) Explain the Faraday's Law of electromagnetic induction?
   (b) A cast steel ring has a circular cross section 3cm in diameter and a mean circumference of 80cm. The ring is uniformly wound with 600 turns.
      i. Estimate the current required to produce a flux of 0.5 mcob in the ring.
      ii. If a saw cut 2mm wide is made in the ring, find approximately the flux produced by the current found in (i).
      iii. Find the current value which will give the same flux as in (i). Assume the gap density to be the same as in the iron and neglect fringing. [6+10]

3. (a) Bring out the differences between series and parallel resonance?
   (b) A series RLC circuit consists of resistance R = 20Ω, inductance, L=0.01H and capacitance, C = 0.04 μF. Calculate the frequency at resonance. If a 10 Volts of frequency equal to the frequency of resonance is applied to this circuit, calculate the values of V_C and V_L across C and L respectively. Find the frequencies at which these voltages V_C and V_L are maximum? [6+10]

4. (a) Three impedances each of (3-j4) Ω is connected in delta connection across a 3-ϕ, 230V balanced supply. Calculate the line and phase currents in the Δ connected load and the power delivered to the load?
   (b) In power measurement of 3-ϕ load connected by 3-ϕ supply by two wattmeter method, prove that $\tan\theta = \frac{-\sqrt{3}(w_1-w_2)}{(w_1+w_2)}$ for leading power factor loads. [8+8]

5. (a) Explain
      i. Self inductance
      ii. Mutual Inductance.
   (b) Two identical 1000 turns coils X and Y lie in parallel planes such that 60% of the magnetic flux produced by one coil links the other. A current of 5A in X produces in it a flux of 0.05mwb. If the current in X changes from +6A to −6A in 0.01sec what will be the magnitude of the e.m.f induced in Y? Also, Calculate the self inductance of each coil and the mutual inductance?
   (c) Define leakage factor and its effect in a magnetic circuit. [6+6+4]

6. (a) Explain
      i. Statically induced e.m.f and
      ii. Dynamically induced e.m.f
   (b) The combined inductance of two coils connected in series is 0.6H or 0.1H, depending upon the relative directions of the currents in the coils. If one of the coils when isolated has a self inductance of 0.2H, Calculate
      i. Mutual inductance, and
      ii. The Coefficient of coupling.
   (c) Explain the terms
      i. MMF
      ii. Reluctance. [6+6+4]

7. A 20μF capacitor is connected in series with a 1.2MΩ resistor. This series combination is connected across a 120V dc supply. Calculate.
   (a) The time constant of the circuit
   (b) The initial value of the charging current
   (c) The initial rate of rise of voltage across the capacitor.
   (d) The voltage across the capacitor after of a time equal to the time constant
   (e) The circuit current after a time equal to the time constant.
   (f) The voltage across the capacitor after 4 sec after switch on.
   (g) The time taken by the capacitor voltage to reach 70V. [16]

8. (a) Draw the model graphs for the following (clearly indicate axis)
      i. Current decay transient in RC discharging circuit
      ii. V_R and V_c in RC discharging circuit
      iii. Charging current profile in RL circuit
   (b) A series R.C circuit has R =20Ω and c = 100μF. A voltage ϑ = 200 sin 314t is applied at t =2.15m sec. Obtain an expression for i. Also, find the value of current after time 1m. sec from the switching instant. [6+10]

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