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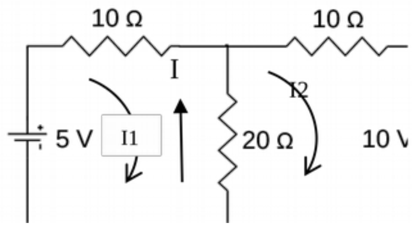
Semester Examination – December - 2017

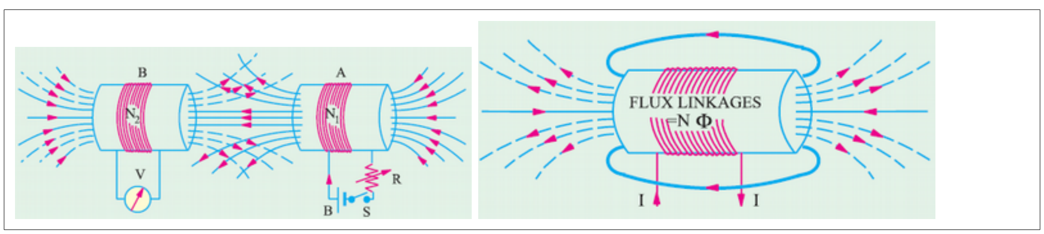
Branch: B. Tech. Computer Engineering **Sem.:- I**

Subject with Subject Code:- Basic Electrical Engineering(EE104) **Marks: 60**

MODEL ANSWER SHEET

Q.N.	Answer Points	Marks
1. a)	Definition: Temp coe of resistance of a material is defined as the change in resistance per Kelvin (°C), expressed as fraction of the resistance at the base temp considered. $\propto = \frac{Change \in resistance}{Change \in temp} x \frac{1}{Resistance\ at\ the\ base\ temp\ considered}$ derivation: $\propto 1 = \frac{R2 - R1}{\theta 2 - \theta 1} x \frac{1}{R1}$ $R2 = R1[1 + \propto 1(\theta 2 - \theta 1)]$	3 3
b)	Energy output of heater=mc($\theta 2 - \theta 1$ =6704x10^3 J Energy input to heater=Energy output/Effiecicency=6704x10^3/0.9 =7.448x10^6 J Energy input in kWh=Energy in J/3.6x10^6 =2.06kWh	2 2 2
2 a)	Eq. circuit res. R=5+[(4x12)/(16)]=8 Ω Total current I=V/R=80/8=10 A Current through 5 Ω =10 A Voltage drop across 5 Ω =I(5)=50V using current divider rule Current through 4 Ω =7.5 A Voltage drop across 4 Ω =7.5(4)=30V Current through 12 Ω =2.5 A Voltage drop across 12 Ω =2.5(12)=30V	3 3
b)	Superposition theorem(statement): In a linear dc network containing more than one independent energy source, the overall response (current through / voltage across) in any branch is equal to the algebraic sum of the responses due to each independent source acting one at a time with all other ideal independent sources set to zero. Explanation with example	3 3
or b)	Apply KVL $5=30I_1-20I_2$ (1) $10=20I_1-30I_2$ (2) solving I_1= -0.1 A I_2=-0.4A Current trough 20 ohm res.= I_2-I_1 =-0.3 A	2 4

		
3.a)	i) RMS value: RMS value is the effective value of a varying voltage or current. It is the equivalent steady (DC) value which will produce same heat in the same resistor in the same time. Vrms=Vm/√2 ii) Form factor: FF for particular waveform is defined as the ration of the rms value to the average value. FF=Rms value/AVg Value =1.11 for sinusoidal waveform iii) Peak factor: It is defined as the ratio of the peak of value to the rms value Kp=peak value /Rms value = 1.414 sinusoidal waveform	2 2 2
b)	V1=100sin 314t V2=150 sin (314t+π/6) given voltage phasors resolve each voltage phasors vertically and horizontally and find combined Vx and Vy components Vx=100 cos0+150 cos(π/6)=229.9 V Vy=100 sin(0)+150 sin(π/6)=75 V Vxy= resultant phasor= √(Vx)^2+(Vy)^2) =241 V The angle between resultant phasor and ref V1 Tan(α)=Vx/Vy α=18° Vxy=241 sin(314t+18) Phasor diagram	2 3 1
or b)	current through 100µF cap ic=(Vm/Xc)*(sin2πft+π/2) Xc=1/(2πFC)=1.59 ohm ic=9.42 sin(2000πt+π/2) Phasor diagram: Voltage and cap current	3 3
4.a)	series resonance: A resonance in series RLC circuit is condition when the supply voltage and current are in phase and the circuit impedance at resonance is purely resistive. Consider a general series circuit with R, L and C connected across sinusoidal voltage source of constant voltage magnitude and variable frequency. Total circuit impedance $Z=\sqrt{[R^2+(X_L-X_C)^2]}$ at resonance $X_{LO}=X_{CO}$ i.e. $Z_o=R$ Current at resonance=Io=V/Z0=V/R V and Io are in phase PF=cosΦo=1 Power absorbed by circuit Po=V^2/R Resonant frequency=fo=1/(2π√LC)	4

	circuit diagram	2
b)	Z1=R1+jXL1 Z2=R2+JXL2 total circuit impedance (Z)=Z1+Z2=16+j10.99 since series connection Total current (I)=V/Z=11.85 $<-34.48^{0}$ A phasor diagram:	 2 2 2
5. a)	Statically Induced E.M.F.divided into (a) mutually induced e.m.f. and (b) self-induced e.m.f. **(*a*) Mutually-induced e.m.f.** Consider two coils *A* and *B* lying close to each other (Fig.).Coil *A* is joined to a battery, a switch and a variable resistance *R* where as coil *B* is connected to a sensitive voltmeter *V*. When current through *A* is established by closing the switch, its magnetic field is set up which partly links with or threads through the coil *B*. As current through *A* is changed, the flux linked with *B* is also changed. Hence, mutually induced e.m.f. is produced in *B* whose magnitude is given by Faraday's Laws and direction by Lenz's Law. If, now, battery is connected to *B* and the voltmeter across *A* , then the situation is reversed and now a change of current in *B* will produce mutually-induced e.m.f. in *A*. It is obvious that in the examples considered above, there is no movement of any conductor, the flux variations being brought about by variations in current strength only. Such an **e.m.f.** induced in one coil by the influence of the other coil is called (statically but) mutually induced e.m.f.  **(*b*) Self-induced e.m.f.** This is the e.m.f. induced in a coil due to ***the change of its own flux linked with it.*** If current through the coil Fig. is changed, then the flux linked with its own turns will also change, which will produce in it what is called *self-induced* e.m.f. The direction of this induced e.m.f. (as given by Lenz's law) would be such as to oppose any change of flux which is, in fact, the very cause of its production. Hence, it is also known as the opposing or counter e.m.f. of self-induction.	3 3
b.	l=15 cm =0.15m a=1cm^2 = 1X10^-4m^2 permeability of Iron=2400 turns=1800 Φ=0.2mWb=0.2X10^-3Wb Reluctance(S)=l/($\mu_0\mu_r$ a)=4.97x10^5A/wb I=(SΦ)/N=55.22mA	3 3
6 a)	EMF equation of transformer: Let the flux at any instant be given by $\phi = \phi_m \sin wt$ (1) According to faradays law instantaneous emf induced in a coil of T turns $e= -(d(\phi T)/dt)= - T\omega\phi_m \cos\omega t$ $e=T\omega\phi_m \sin(\omega t-\pi/2)=E_m \sin(\omega t-\pi/2)$ where $Em= T\omega\phi_m$ is the maximum value of e for a sine wave the rms value is given by $E=Em/\sqrt{2}= 2\pi fT\phi_m/\sqrt{2}$ $E=4.44\ \phi_m f\ T$	6

b)	Charging of capacitor: Capacitor C may be charged through a high resistance R from a battery of V volts. For charging, the battery is connected across the RC sries circuit. The voltage across C does not rise to V instantaneously but builds up slowly i.e. exponentially and not linearly. Charging current ic is maximum at the start i.e. when C is uncharged, then it decreases exponentially and finally ceases when p.d. across capacitor plates becomes equal and opposite to the battery voltage V. At any instant during charging, let vc = p.d. across C; ic = charging current q = charge on capacitor plates	6

The applied voltage V is always equal to the sum of :

(*i*) resistive drop ($i_c R$) and (*ii*) voltage across capacitor (v_c)

$\therefore$ $$V = i_c R + v_c$$

Now $$i_c = \frac{dq}{dt} = \frac{d}{dt}(Cv_c) = C\frac{dv_c}{dt} \quad \therefore \; V = v_c + CR\frac{dv_c}{dt}$$

or $$-\frac{dv_c}{V - v_c} = -\frac{dt}{CR}$$

Integrating both sides, we get $\int \frac{-d\,V_c}{V - v_c} = -\frac{1}{CR}\int dt\,;\quad \therefore\; \log_c (V - v_c) = -\frac{t}{CR} + K$

where K is the constant of integration whose value can be found from initial known conc know that at the start of charging when $t = 0$, $v_c = 0$.

Substituting these values in (*iii*), we get $\log_c V = K$

Hence, Eq. (*iii*) becomes $\log_e (V - v_c) = \frac{-t}{CR} + \log_e V$

or $$\log_c \frac{V - v_c}{V} = \frac{-t}{CR} = -\frac{1}{\lambda} \quad \text{where } \lambda = CR = \text{time constant}$$

$\therefore$ $$\frac{V - v_c}{V} = e^{-t/\lambda} \quad \text{or} \quad v_c = V(1 - e^{-t/\lambda})$$

This gives variation with time of voltage across the capacitor plates and is shown in F

Time Constant: Time constant may be defined as the time during which capacitor voltage actually rises to 0.632 of its final steady value.