Bihar Engineering University, Patna
End Semester Examination - 2022

Course: B.Tech. *Semester: III* *Time: 03 Hours*
Code: 100306 *Subject: Electrical Circuit Analysis* *Full Marks: 70*

Instructions:-
(i) The marks are indicated in the right-hand margin.
*(ii) There are **NINE** questions in this paper.*
*(iii) Attempt **FIVE** questions in all.*
*(iv) Question No. **1** is compulsory.*

Q.1 *Choose the correct answer of the following (Any seven question only):* **[2 x 7 = 14]**

(a) A 10 mH inductor carries a sinusoidal current of 1 A r.m.s at a frequency of 50 Hz. The average power dissipated by the inductor is
(i) 0 W (ii) 0.25 W (iii) 0.5 W (iv) 1.0 W

(b) Thevenin's equivalent circuit consists of
(i) current source and series impedance (ii) voltage source and series impedance
(iii) voltage source and shunt impedance (iv) current source and shunt impedance

(c) When the two quantities are in quadrature, the phase angle between them will be.
(i) 45° (ii) 90° (iii) 135° (iv) 60°

(d) A two-port network is symmetrical if
(i) $Z_{11}Z_{22} - Z_{12}Z_{21} = 1$ (ii) AD-BC = 1
(iii) $h_{11}h_{22} - h_{12}h_{21} = 1$ (iv) $Y_{11}Y_{22} - Y_{12}Y_{21} = 1$

(e) A two element series circuit is connected across an AC source given by
$e = 200\sqrt{2}\sin(314t+20)V$
the current is found to be $i = 10\sqrt{2}\cos(314t-25)A$
the parameters of the circuit are
(i) R = 20 Ω and C = 160μF (ii) R =14.14 Ω and C = 225μF
(iii) L = 45mH and C = 225μF (iv) L = 45mH and C = 160μF

(f) Superposition theorem is not applicable to networks containing
(i) nonlinear elements (ii) dependent voltage source
(iii) dependent current source (iv) transformers

(g) Which of the following is the Passive elements?
(i) Ideal current source (ii) Ideal voltage source
(iii) Capacitor (iv) All of these

(h) When a unit impulse voltage is applied to an inductor of 1 H, the energy supplied by the source is
(i) 2 J (ii) 1 J (iii) ½ J (iv) ¼ J

(i) There are no transients in pure resistance circuits because they
(i) Offer high resistance (ii) obey Ohm's law
(iii) have no stored energy (iv) are linear circuits

(j) When a number of two-port network is cascaded, then
(i) Z-parameters are added up (ii) Y-parameters are added up
(iii) h-parameters are multiplied (iv) ABCD- parameters are multiplied

Q.2 Two mutually coupled identical coils are connected in series having self-inductance L=4 mH and mutual inductance M=2 mH.
(a) What are the maximum and minimum possible values of equivalent inductances? [7]
(b) Determine the coefficient of coupling between the coils. [7]

P.

R. N. 07

Q.3 (a) Prove that the average power in an AC circuit is given by $W = VI\cos\Phi$, where symbols have their usual meanings. [6]

(b) A voltage of $e(t) = 150 \sin 1000t$ is applied across a series R-L-C circuit, where $R = 40\Omega$, $L = 0.13$ H and $C = 10\ \mu F$. [8]

(i) Compute the r.m.s value of the steady-state current

(ii) Find the r.m.s voltage across the inductor.

(iii) Find the r.m.s voltage across the capacitor

(iv) Determine the active and reactive power supplied by the source.

Q.4 (a) Find the Laplace transform of $f(t) = e^{-at}\cos(\omega t)$, $a>0$. [4]

(b) Calculate the inverse Laplace transform of $F(s) = \frac{1}{s(s^2-a^2)}$ [5]

(c) In the series R-C circuit, the capacitor has an initial charge 2.5 mC. At t=0, the switch is closed and a constant voltage source V = 100 V is applied. Use the Laplace transform method to find the current in the circuit after closing the switch. [5]

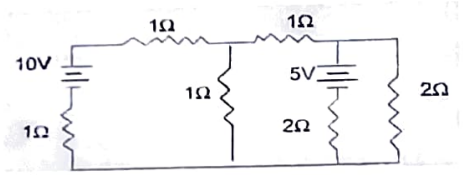
Q.5 (a) Two impedances $Z_1 = 40\angle 30^\circ\ \Omega$ and $Z_2 = 30\angle 60^\circ\ \Omega$ are connected in series across a single-phase 230 V, 50 Hz supply. Calculate the [7]

(i) Current drawn (ii) pf, and (iii) power consumed by the circuit.

(b) State and explain the Super Position Theorem and find out the step to be followed in super position theorem. [7]

Q.6 (a) State maximum power transfer theorem. Prove that efficiency of the circuit under maximum power transfer condition is 50%. [7]

(b) Draw the Thevenin equivalent circuit of the figure shown below and hence find the current through R=2Ω. [7]



Q.7 (a) Find the current in a series RL circuit having R =2 Ω and L=10H while a d.c voltage of 100v is applied. What is the value of this current after 5 secs of switching on? [7]

(b) In given fig. A steady state condition is reached with 100v d.c source At t=0, switch K is suddenly open. Find the expression of current through the inductor after t=0.5 sec. [7]

Q.8 (a) Define apparent power and Reactive power. [4]

(b) The current in a circuit lag the voltage by 30° if the power be 400 w and the supply voltage be v = 100 sin(377t+10°) find complex power [5]

(c) In an ac circuit $v = 100\sin(\omega t+30^\circ)$v, $I = 5\sin(\omega t-30^\circ)$A. find apparent power, real power and reactive power. [5]

Q.9 Write short notes on the following: [3.5x4=14]

(a) Reciprocity Theorem (b) Laplace Theorem (c) Two port network

(b) Resonance