SH-I/Electronics-101C-1(T)/19

B.Sc. Semester I (Honours) Examination, 2019

ELECTRONICS

Course ID : 11711 **Course Code : SHELC-101C-1(T)**

Course Title : Basic Circuit Theory and Network Analysis

Time: 1 Hour 15 Minutes **Full Marks: 25**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any three* of the following: 1×3=3

(a) State one limitation of Ohm's law.

(b) Draw V-I characteristics of an ideal voltage source.

(c) What is 'node' of a circuit?

(d) What is the equivalent capacitance when several capacitances C_1, C_2, C_3 …, C_n are connected in series?

(e) Draw the symbolic representations of a DC voltage source and a DC current source.

(f) A voltage source has internal impedance $(4 + j5)\Omega$. Find the load impedance for maximum power transfer.

2. Answer *any three* of the following: 2×3=6

(a) What do you mean by dependent and independent sources?

(b) What are active and passive circuit elements? Give examples of each.

(c) States Kirchoff's Voltage Law (KVL) and Kirchoff' Current Law (KCL).

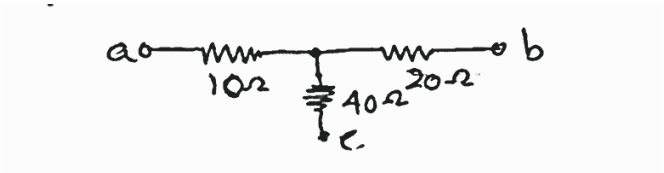
(d) Distinguish between 'mesh' and 'loop' of an electric circuit.

(e) In a series RLC circuit, if the value of L and C are 100μH and 0·1μF respectively, find the resonant frequency in Hz.

(f) What is an alternating current? What is period?

3. Answer *any two* of the following: 5×2=10

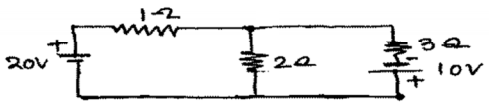
(a) Transform the T(star) network to π (Delta) network. 5



(b) State and prove Thevenin's theorem for dc network. 2+3=5

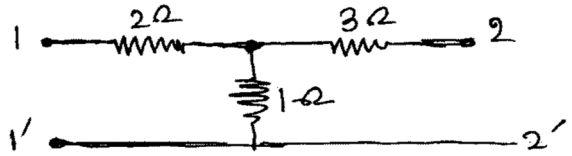
(c) An alternating e.m.f. is applied to a pure inductor and a pure capacitor. Investigate the phase relationship of the alternating current with the alternating e.m.f. in each case. What do you mean by wattles current? 2+2+1=5

(d) For the circuit shown below, find the currents in each branch by nodal method. 5



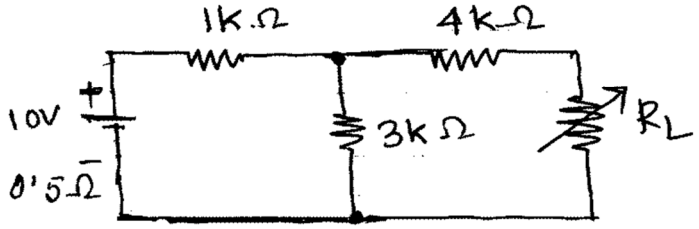
4. Answer *any one* of the following: 6×1=6

(a) What is two-port network? Find the h-parameters of the two-port network shown below. 2+4=6



(b) A constant e.m.f. E is applied to a circuit containing a resistor R and a capacitor C in series. Deduce an expression for the charge on the capacitor as a function of time. Define time constant of an RC circuit. 4+2=6

(c) State Maximum Power Transfer theorem. Find the value of R_L for the circuit shown below so that maximum power is transferred to R_L from battery and hence find the amount of maximum power transferred. 2+2+2=6



SH-I/Electronics-102C-2(T)/19

B.Sc. Semester I (Honours) Examination, 2019

ELECTRONICS

Course ID : 11712 **Course Code : SHELC-102C-2(T)**

Course Title : Mathematics Foundation for Electronics

Time: 1 Hour 15 Minutes **Full Marks: 25**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any three* of the following: 1×3=3

(a) What do you mean by differential equation?

(b) Give one example of partial differential equation of 2nd order.

(c) What is 'order' and 'degree' of a differential equation?

(d) What is a 'singular' point?

(e) What is recurrence relation?

(f) Give the definition of Gamma function (Γ).

2. Answer *any three* of the following: 2×3=6

(a) What is the 'ordinary' point? 2

(b) What is the origin of 'indicial' equation? 2

(c) What is the relation between Beta and Gamma functions?

Show that: $\Gamma(n+1) = n\Gamma(n) = n!$ 1+1=2

(d) $\beta(m+1,n) = \frac{m}{m+n}.\beta(m,n)$ — Prove this from the definition. 2

(e) What is an analytic function? 2

(f) Give one example of row matrix and column matrix. 1+1=2

3. Answer *any two* of the following: 5×2=10

(a) Solve one dimensional heat flow equation:

$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ by separation of variables method.

(b) Show that the polar forms of Cauchy-Riemann (C-R) equation are

$\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{\partial v}{\partial r} = -\frac{\partial u}{\partial \theta}$.

(c) Construct the recurrence rotation by solving given differential equation, by power series method:

$(1-x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 0$

(d) Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}$.

Or,

Obtain the indicial equation for the given Bessel's equation of order '*n*'.

$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$

4. Answer *any one* of the following questions: 6×1=6

(a) Find the value of $\Gamma(\frac{1}{2})$ and hence plot the graph of Gamma function for $n = -\infty$ to $+\infty$ (i.e for whole range.) 3+3=6

(b) What is Argand's diagram? Draw the Argand diagram for a complex number. State Residue Theorem. What are the various methods of calculation of Residue? (1+2)+(1+2)=6

(c) Find the diagonal form of matrix

$$A = \begin{pmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{pmatrix}$$ 6

Or,

Evaluate the given integral using residue theorem

$I = \int_c \frac{4-3z}{z(z-1)(z-2)}dz$

where *C* is a circle with $|Z| = {}^3/_2$. 6

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