Sem-III -(choice based)/ EXTC | Applied Mathematics -III

May-2018.

Q. P. Code: 24393

(3 Hours) **[Total Marks: 80]**

N.B.: 1) Question No. 1 is Compulsory.

2) Answer any **THREE** questions from **Q.2 to Q.6**.

3) Figures to the right indicate full marks.

Q.1 a) Evaluate the Laplace transform of $\sqrt{1+\sin t}$ [5]

b) Find directional derivative of $\phi = 4xz^2 + x^2yz$, at $(1,-2,-1)$ in direction of $2i - j - 2k$ [5]

c) Find orthogonal trajectories of the family of curves $e^x \cos y - xy = c$. [5]

d) Obtain half range sine series for $f(x) = x, \quad 0 < x < 2$. [5]

Q.2 a) If $u + v = e^{2x}(x\cos 2y - y\sin 2y)$ then find analytic function $f(z)$ by Milne Thomson Method [6]

b) Find the Fourier series for $f(x) = 9 - x^2$, $-3 \le x \le 3$ [6]

c) Find the Laplace transform of the following

i) $L[t\sqrt{1+\sin t}]$ ii) $L\left[\frac{\sinh 2t}{t}\right]$ [8]

Q.3 a) Using Convolution theorem, find Inverse Laplace of $\frac{s}{(s^2+4)^2}$. [6]

b) Prove that $J_{-\frac{5}{2}}(x) = \sqrt{\frac{2}{\pi x}}\left[\frac{3}{x}\sin x + \frac{(3-x^2)}{x^2}\cos x\right]$. [6]

c) Find Fourier series for $f(x) = (\pi - x)^2$ in $0 \le x \le 2\pi$. Hence deduce that

$$\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots$$ [8]

Q.4 a) Find the Fourier transform of $f(t) = e^{-|t|}$ [6]

b) Show that the function $f_1(x) = 1$, $f_2(x) = x$ are orthogonal on $(-1,1)$ and determine the constant A & B so that functions $f_3(x) = 1 + Ax + Bx^2$ is orthogonal to both $f_1(x)$ and $f_2(x)$ on that interval. [6]

c) Find bilinear transformation which maps the points z=1, i,-1 onto the points w=i, 0,-i hence

find the image of $|z|<1$ on to w plane find invariant points of this transformation [8]

Q5 a) Solve using Laplace Transform $\frac{d^2y}{dt^2}+2\frac{dy}{dt}+y=te^{-t}$ given $y(0)=4$ and $y'(0)=2$. [6]

b) Find Complex form of the Fourier series for $f(x)=e^{ax}$ in $-\pi<x<\pi$ where 'a' is a real constant. Hence deduce that $\frac{\pi}{a\sinh a\pi}=\sum_{n=-\infty}^{\infty}\frac{(-1)^n}{n^2+a^2}$ [6]

c) Verify Green's Theorem in the plane for $\oint_C (3x^2-8y^2)\,dx+(4y-6xy)dy$ where C is the boundary of the region defined by $y = x^2$ and $y = \sqrt{x}$. [8]

Q6 a) Prove that $J_n^{"}(x)=J_{n-2}(x)-2J_n(x)+J_{n+2}(x)$ [6]

b) Find the map of the line x-y=1 by transformation $w=\frac{1}{z}$ [6]

c) Evaluate $\iint_S \overline{F}.d\overline{s}$ where $\overline{F}=4x\hat{i}-2y^2\hat{j}+z^2\hat{k}$ where S is the region bounded by $x^2+y^2=4$, $z=0$, $z=3$ using Gauss divergence theorem. [8]

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sem-III - Choice based / EXTC / Electronics Devices & Circuits -I /

Q.P. Code: 25072 M-18

Time: 3 Hours **Marks: 80**

N.B. : (1) Question No. 1 is compulsory.

(2) Solve any three questions from the remaining five

(3) Figures to the right indicate full marks

(4) Assume suitable data if necessary and mention the same in answer sheet.

Q.1 Attempt any 5 questions **[20]**

a) Prove that for a JFET the gate-source bias for zero temperature drift of drain current is at $|V_p| - 0.63$ volts.

b) Explain the hybrid pi model of BJT.

c) Explain Zener as voltage regulator.

d) Consider a BJT has parameters f_T =500MHz at I_C = 1mA, β = 100 and $C\mu$ = 0.3pF. Calculate bandwidth of f_β and capacitance $C\pi$ of a BJT.

e) Draw and explain small signal model of a diode.

f) Why should R_C be as large as possible in the design of CE amplifier?

Q.2 a) Design a voltage divider bias network using a supply of 24 V, a transistor with β=110 and an operating point of I_{CQ} = 4 mA and V_{CEQ} = 8V. Assume $V_E = \frac{1}{8}V_{CC}$. **[10]**

b) Explain the fabrication steps of passive elements. **[5]**

c) What are the important JFET parameters and define it from characteristics. **[5]**

Q.3 a) Design the resistors of a single stage CS amplifier for audio frequency with BFW11 with $I_{DS} = (3.3 \pm 0.6)$ mA and $|A_v| = 12$. **[10]**

b) Draw CS JFET amplifier with self bias circuit and derive the expression for voltage gain input impedance and output impedance. **[10]**

Q.4 a) Draw small signal hybrid parameter equivalent circuit for CE amplifier and define the same. What are the advantages of h parameters? **[10]**

b) For the circuit shown below in Fig.4b, the transistor parameters are V_{BE} $_{(on)}$ = 0.7 V, β = 200 and $V_A = \infty$. **[10]**

i) Derive the expression for lower cut-off frequency (or time constant) due to input coupling capacitor.

ii) Determine lower cut-off frequency and midband voltage gain.

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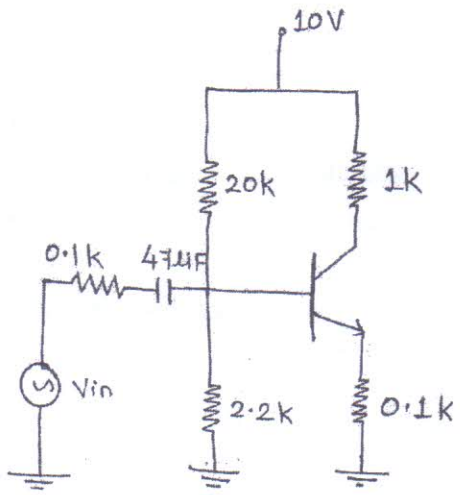


Fig.4b

Q.5 a) Design an L section LC filter with full wave rectifier to meet the following specifications: The DC output voltage $V_{DC} = 220$ V, deliver $I_L = (70 \pm 20)$ mA to the resistive load and the required ripple factor is 0.04. **[10]**

b) For the circuit shown below in Fig.5b, the transistor parameters are $V_{BE(on)} = 0.7$ V, $\beta = 100$ and $V_A = \infty$. Determine Z_i, Z_o and A_V **[10]**

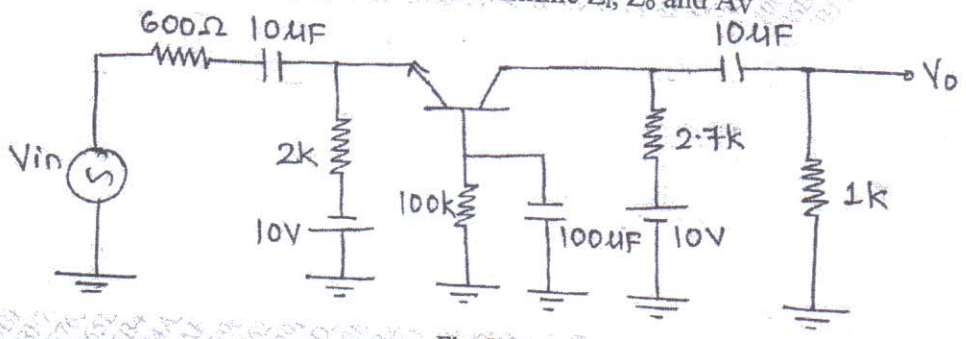


Fig. 5b

Q.6 Short notes on: (Attempt any four) **[20]**

a) BJT high frequency equivalent circuit
b) Types of resistors and capacitors
c) Stability factors of various biasing techniques of BJT
d) Different types of filters
e) Comparison of BJT CE and JFET CS amplifier

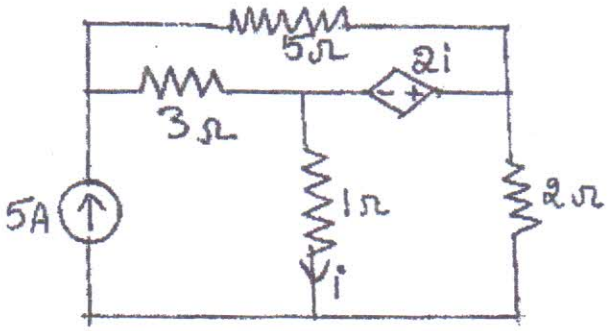
Sem-III (Choice based) / EXTC / Circuit Theory & Network / M-18

QP Code : 24948

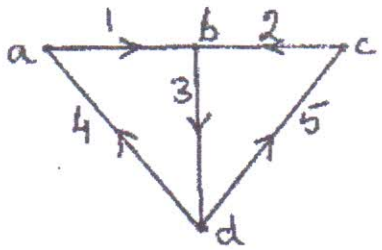
[3 Hours] [Total Marks : -80]

N.B : 1. Question No. 1 is compulsory.
2. Attempt any three from the remaining questions.

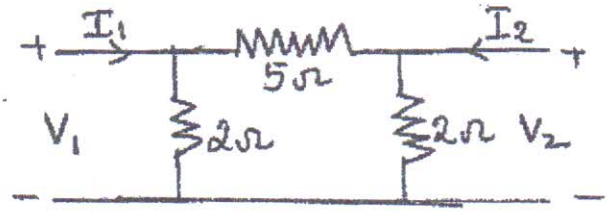
(a) Find the voltage drop across 5Ω resistor in the circuit given below. 5



(b) For the graph given below obtain the incidence matrix and find the number of possible trees. 5

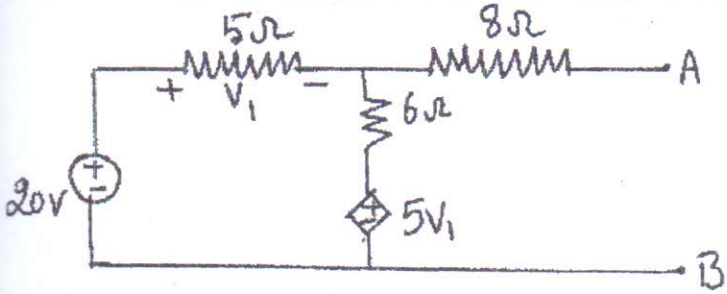


(c) Find y parameters for the two-port network shown in figure. 5



(d) Check whether the following polynomials are Hurwitz 5
(i) $P(s) = S^4 + 7S^3 + 6S^2 + 21S + 8$
(ii) $P(s) = S^5 + 2S^3 + S$

(e) Find the Thevenin's equivalent across AB and find the power dissipated in a 25Ω load. 10



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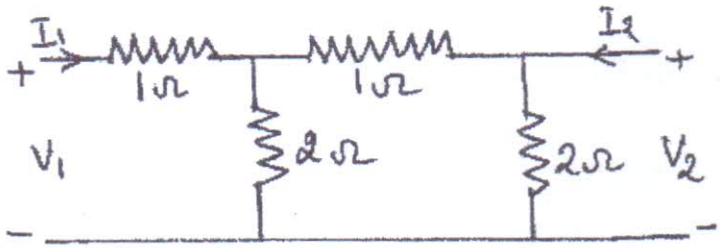
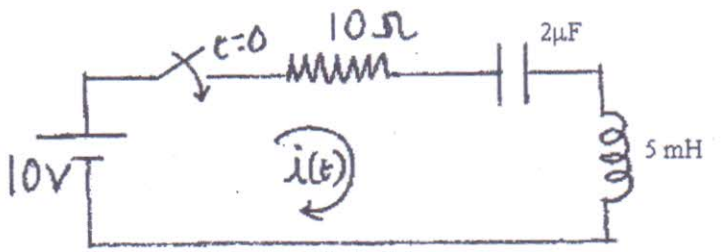
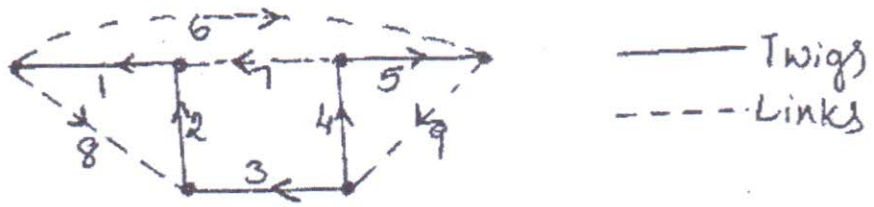
(b) Find h parameters for the following Two-port network. 5



(c) In the network shown below the switch is closed at t = 0. Assuming all initial conditions to be zero, find i, di/dt, d^2i/dt^2 for $t = 0^+$. 5



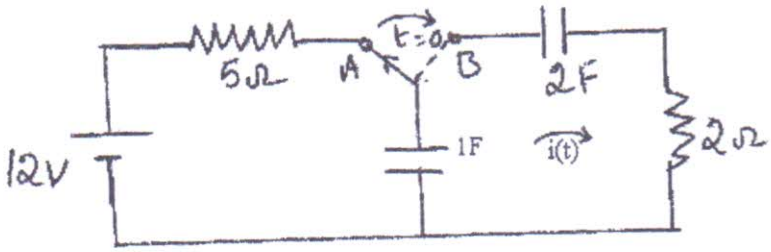
3. (a) Find the tie-set and f-cutset matrix for the oriented graph shown below. 10



(b) Realize the following function in Foster I and Foster – II forms. 10

$$Z(s) = \frac{(S+1)(S+4)}{S(S+2)}$$

4. (a) A switch is in position A for a long time and then thrown to position B at t = 0. Find i(t) for > 0. At what value of 't' the current i(t) will become half of current at t =0 10



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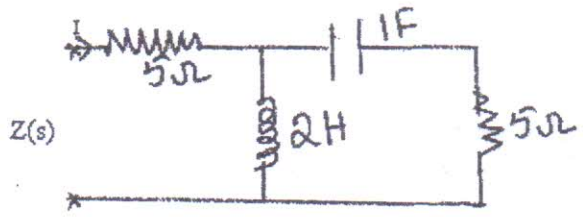
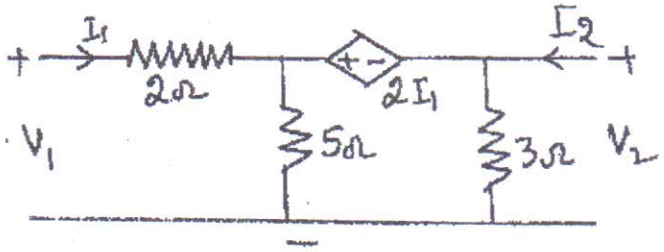
(b) For the following network find the driving point impedance function. 5



(c) Find the condition for symmetry and reciprocity for a two port network using any one parameter. 5

(a) Obtain the ABCD parameters of the following network. If two such networks are cascaded find the overall ABCD parameter. 10



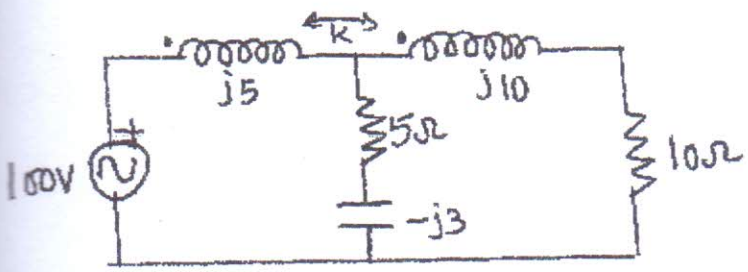
(b) Check whether the following function if positive real or not. 5

$$F(s) = \frac{(S^2 + 6S + 5)}{(S^2 + 9S + 14)}$$

(c) Find the oriented graph if the incidence matrix of the network is as given below. 5

$$A = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & -1 & 1 & 0 & -1 & 0 & 0 \\ -1 & 1 & 0 & 0 & 0 & 0 & -1 \\ 0 & 0 & 0 & -1 & 0 & 1 & 0 \end{bmatrix}$$

(a) Find the mesh currents if the coupling factor k = 0·6 10



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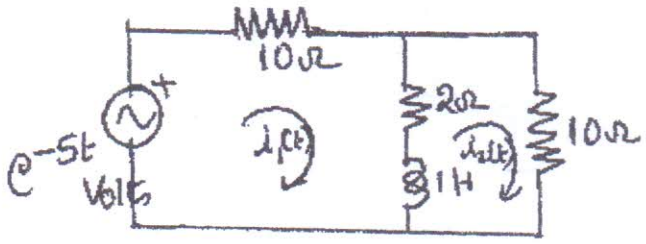
(b) Find $i_2(t)$ using Laplace transform. 10



may 2018.

S.E. Sem III (Choice Base)
Elect. Inst. & Control.
(EXTC)

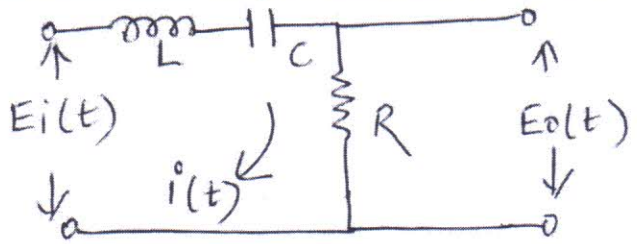
Q.P.Code: 21762

(3 Hours) **[Total Marks: 80]**

N.B. : (1) Question **No. 1** is **compulsory.**
(2) Attempt any **three** questions from **remaining** questions.
(3) Assume suitable **data** if **necessary**.

Q.1 (a) List name of bridges for RLC measurement with proper classification. 04

Q.1 (b) Find transfer function of given network. 04



Q.1 (c) What is cold junction compensation in thermocouples? 04

Q.1 (d) Draw a block diagram of generalized data acquisition system and explain its components. 04

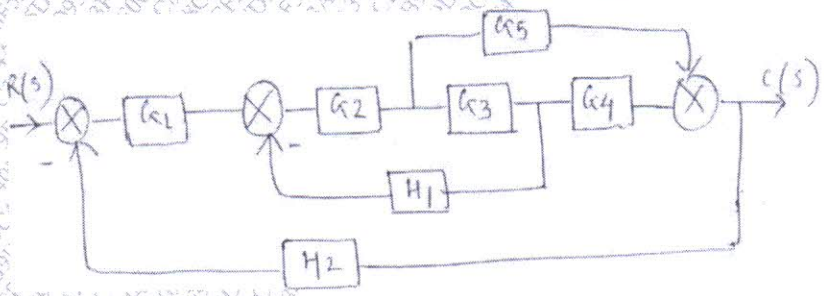
Q.1 (e) Check whether given system is stable 04

$$s6 + 3s5 + 2s4 + 9s3 + 5s2 + 12s + 20 = 0$$

Q.2 (a) Explain Kelvin's double bridge and its application in low resistance measurement. 05

05

(b) Obtain C[s] / R[s] using block diagram reduction technique 10



Q.3 (a) For unity gain system having 10

$$G(s) = \frac{K}{S(S+5)(S+3)}$$

Sketch root locus and comment on stability.

(b) Draw Bode plot for following transfer function is 10

$$G(s)H(s) = \frac{800}{s^2(s+10)(s+40)}$$

And predict stability.

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Q.4 (a) What is multiplexing ?compare FDM with TDM

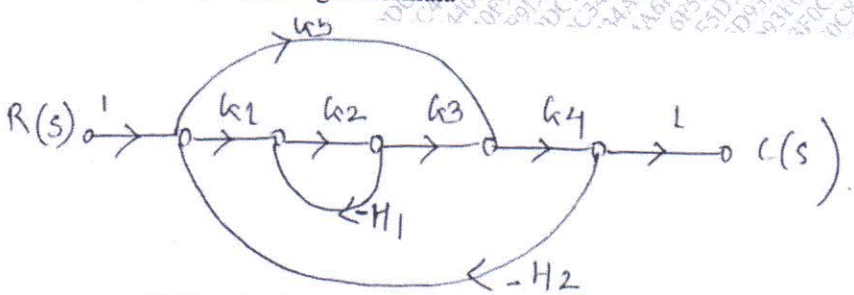
(b) The system has

$$G(S)H(S) = \frac{K}{S(S+2)(S+4)(S+8)}$$

Using Routh criterion find range of K for stability.

(c) Explain working of strain gauge and its application in load measurement.

Q.5 (a) Find C(s)/R(s) using Mason's gain formula



(b) Draw and discuss Hay bridge and its application in measurement of inductance.

Q.6 (a) Explain landline telemetry and discuss about any one landline telemetry system.

(b) For a system with transfer function $\frac{64}{s2+5s+64}$ with unit step input

Find damping ratio, damped frequency of oscillations and time for peak overshoot.

(c) Compare temperature transducers Thermistors and thermocouples on the basis of principle, characteristics, ranges and applications.

(d) Explain how the stability of system is analyzed using Nyquist criteria.