Sem-III (OTR)
EXTC - Applied Math-III

12/5/16

QP Code : 28674

Duration (03) hours

Marks 100

N.B. (i) Question no. ONE is compulsory.

(ii) Attempt any FOUR questions out of the remaining six questions.

(iii)Figures to right indicate full marks.

Q.1(a) Find Laplace transform of $cos^5(t)$ (05)

(b) Find z- transform of $\{a^{|k|}\}$ (05)

(c) 0btain complex form of fourier series for $f(x) = \cosh(ax) in\ (-l, l)$ (05)

(d) Show that every square matrix can be uniquely expressed as the sum of a Hermitian and skew- Hermitian matrix. (05)

Q.2(a) Find Laplace transform of $(\int_0^t e^{-4u} cos^2(u)du))$ (06)

(b) If $A = \begin{bmatrix} 0 & 2m & n \\ l & m & -n \\ l & -m & n \end{bmatrix}$ is orthogonal ,find l, m, n,also find A^{-1}. (06)

(c) Find the Fourier expansion for $f(x) = \sqrt{1 - \cos(x)}$ in $(0, 2\pi)$ (08)

Q.3(a) Test for consistency and solve

$2x - 3y + 5z = 1$, $3x + y - z = 2$, $x + 4y - 6z = 1$ (06)

(b) Find the Fourier expansion for $f(x) = 9 - x^2$ *in* $(-3, 3)$ (06)

(c) Find inverse z-transform of $f(z) = \frac{3z^2 - 18z + 26}{(z-2)(z-3)(z-4)}$, $3 < z < 4$ (08)

Q.4(a) Solve Using Laplace transform $\frac{d^2y}{dt^2} + 9y = 18t$ *where* (06)

$y(0) = 0, y(\pi/2) = 0$

(b) Find the Fourier expansion for $f(x) = 2x - x^2$ in $(0, 3)$ (06)

(c) Find z-transform of $c^k \cosh(\alpha k)$, $k \geq 0$ (08)

[TURN OVER]

Q.5 (a) Find fourier integral representation for (06)

$$f(x) = f(x) = \begin{cases} 1 - x^2 & for \quad |x| \leq 1 \\ 0 & for \quad |x| > 1 \end{cases}$$

(b) Find the two non –singular matrices P and Q such that (06)

PAQ is in normal form *where* $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{bmatrix}$ and also find its rank.

(c) Obtain fourier series for $f(x) = lx - x^2 \quad 0 < x < l$ as a half range cosine series and sine series . (08)

Q.6(a) Using Laplace transform evaluate (06)

$$\int_0^\infty e^{-t}(1 + 2t - t^2 + t^3)H(t-1)dt$$

(b) Find inverse Laplace transform of $cot^{-1}(\frac{2}{s^2})$ (06)

(c) Find inverse Laplace transform of the following (08)

(i) $\frac{1}{s}tan^{-1}(\frac{a}{s})$ (ii) $\frac{se^{-\pi s}}{s^2+2s+2}$

Q.7 (a) Find inverse Laplace transform of $\frac{1}{(s^2+4s+13)^2}$ by convolution theorem (06)

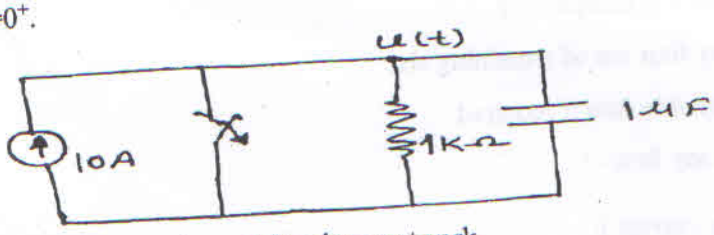
(b)Show that the matrix $A = \frac{1}{2}\begin{bmatrix} \sqrt{2} & -i\sqrt{2} & 0 \\ i\sqrt{2} & -\sqrt{2} & 0 \\ 0 & 0 & 2 \end{bmatrix}$ is a unitary matrix and

Hence find A^{-1}

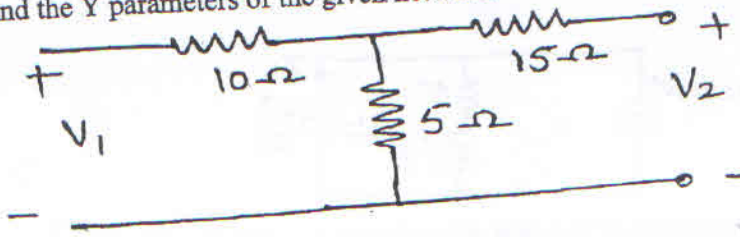
(c) Obtain fourier series for $f(x) = xsin(x)$ in $(-\pi,\pi)$ (08)

Hence deduce that $\frac{\pi-2}{4} = \frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + - - -$

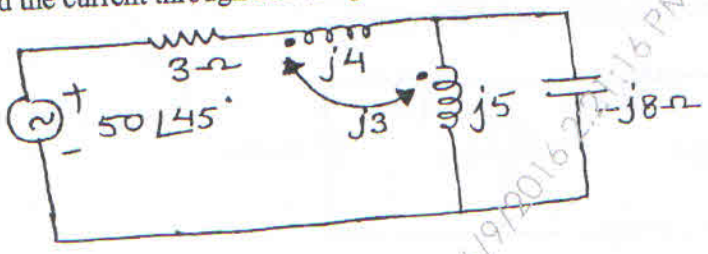
Q.2(b) In the given network switch is open at t=0, determine $v(t)$, $\frac{dv(t)}{dt}$, $\frac{d^2v(t)}{dt}$ at $t=0^+$. (10)



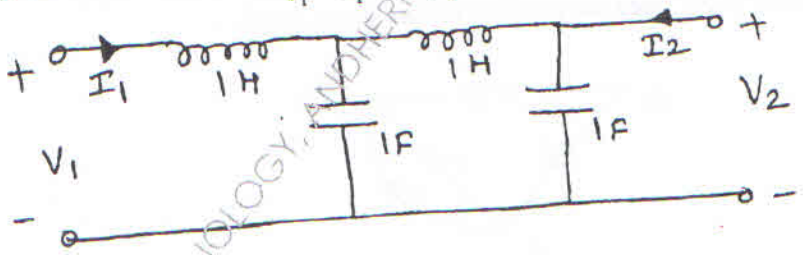
Q.3(a) Find the Y parameters of the given network. (10)



(b) Find the current through 3Ω using mesh analysis. (10)



Q.4(a) Find the network function $\frac{V_1}{I_1}$, $\frac{V_2}{I_1}$ and $\frac{V_1}{V_2}$ for the given network. (10)



(b) Check the positive realness of the following function and give reason. (05)

$$Y(S) = \frac{S^3 + 5S}{S^4 + 2S^2 + 1}$$

(c) Test whether the following polynomials are Hurwitz (05)

$S^5 + 8S^4 + 24S^3 + 28S^2 + 23S + 1$

$S^5 + 2S^3 + S$

Q.5(a) Realize the driving point impedance in Foster I and Foster II (10)

$$Z(S) = \frac{3(S^2+1)(S^2+49)}{(S^2+9)}$$

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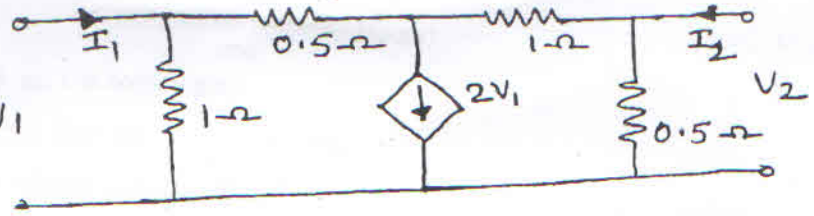
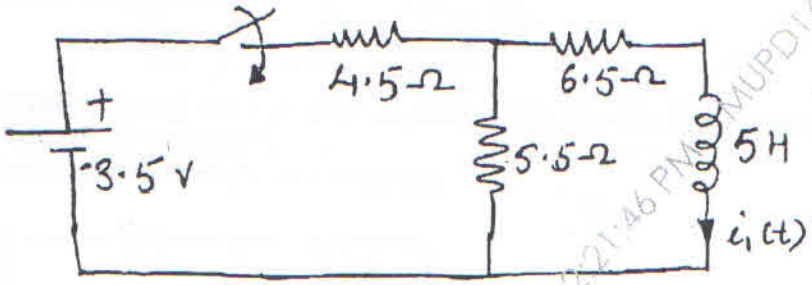
(b) Determine Z parameters for the given network. (10)



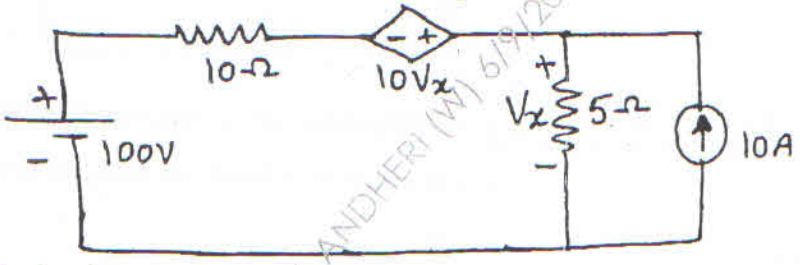
Q.6(a) Draw the Bode plot for the given Transfer Function. (10)

$$G(S)H(S) = \frac{10(S+1)}{S(1+0.02S)(1+0.2S)}$$

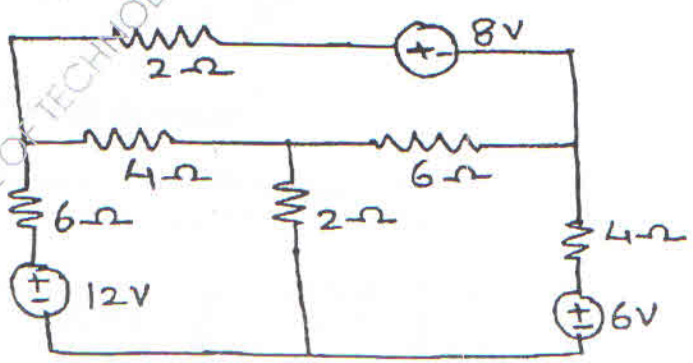
(b) For the given network calculate $i_1(t)$ when switch S closed at t=0. Consider zero initial conditions. (10)



Q.7(a) Find the current in 10 ohm resistor using Thevenin's theorem. (10)



(b) For the given network write Tie-set matrix and obtain the network equilibrium equation in matrix form using KVL (10)



Sem III (old) EXTC.

24/5/16.

Digital Logic Design

QP Code : 28757

(3 Hours) [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **four** questions out of remaining **six** questions.
(3) **Each** question carries **20** marks. Equal **marks** for the **subquestions**.
(4) **Assume** suitable **data** if **required**.

1. (a) Compare various number systems.
   (b) Differentiate between combinational & sequential logic circuits.
   (c) Explain the terms preset, clear, set, reset in FlipFlops.
   (d) Differentiate between CPLD and FPGA.

2. (a) State and prove any one DeMorgan's theorem for 3-Input variables.
   (b) Design the logic circuit for Full Adder using logic gates.

3. (a) Minimize the following logical equation using K-map
   $Y=\Sigma m\ (0, 1, 2, 4, 5, 8, 9, 10, 12)$
   (b) Convert MS-T-FF into MS-JK-FF

4. (a) Design the logic circuit for 16:1 MUX using all 4:1 MUXes.
   (b) With neat sketch, explain the working of 3-bit SISO Right Shift Register with output waveforms.

5. (a) Design the logic circuit for 4:2 priority encoder using logic gates.
   (b) With neat sketch, explain the working of 3-bit Binary up Ripple counter with output waveforms.

6. (a) Minimize the following logical equation using Quine Mc-cluskey method
   $Y=\Sigma m\ (1, 3, 7, 9, 10, 11, 13, 15)$
   (b) Design the logic circuit for full subtractor using Decoder with few gates.

7. (a) Design the logic circuit for 3-bit Binary code to Gray code converter using logic gates.
   (b) Explain MOS logic families.

Sem-III (old) (EXTC) 18/05/16

Electronic Devices & Circuits-I

QP Code : 28715

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of the remaining **six** questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) Assume suitable **data** whenever **necessary** but **justify** the same.

1. (a) Design single stage RC coupled C E amplifier for the followingspecifications: $A_v \geq 110$, $V_o = 3.5V$, $F_L = 20Hz$ .Use $V_{CC} = 15V$. **15**
   (b) For the above designed amplifier determine; voltage gain, input impedance, output impedance. **5**

2. (a) Design single stage CS amplifier employing JFET type BFW11 for the following specifications; $A_V \geq 12$, $V_o = 4.2V$, $I_{DSQ} = 1.2mA$, $V_{CC} = 21V$ and $F_L = 20Hz$. **15**
   (b) For the designed amplifier, determine what will be the maximum output voltage that can be obtained without distortion and corresponding input voltage that can be applied in the worst condition. **5**

3. (a) Draw small signal hybrid parameter equivalent circuit for CE amplifier and define the same. What are the advantages of h-parameters? **10**
   (b) Design voltage divider bias circuit for $I_E = 1.2mA$ $V_{CE} = 2.2V$, $R_E = 1k\Omega$ and $\beta = 60$. $S_{ICO} = 8$. Assume $V_{CC} = 9V$. **10**

4. (a) For the amplifier shown in figure 1 analyze and determine **10**
   (i) D C bias condition
   (ii) Small-signal voltage gain
   (iii) Input and output impedance.

   The circuit parameters are:
   $R_1 = 56k\Omega$, $R_2 = 12.2k\Omega$ $R_E = 0.4k\Omega$, $R_C = 2k\Omega$,$R_L = 10k\Omega R_S = 0.5k$, $V_{CC} = 10V$
   and BJT parameters are $\beta = 100$, $V_{BE} = 0.7V$

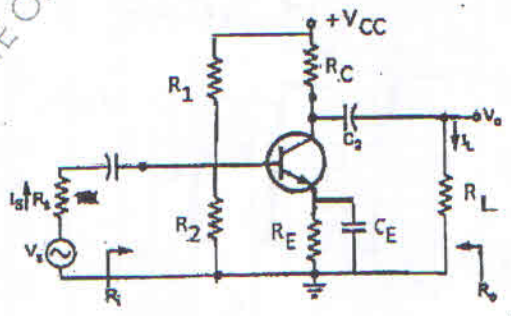


Fig.1

(b) Draw circuit diagram of JFET small signal CS amplifier with self-bias and derive the expression for, small signal mid-band voltage gain, input impedance and output impedance. 10

5. (a) Explain the biasing techniques for D- MOSFET and E-MOSFET. 10

(b) A JFET amplifier with voltage divider biasing circuit shown in figure 2 below has the following parameters: $I_{DSS} = 4mA$, $V_P = -2V$ The circuit parameters: RD = 1kΩ, $R_1 = 12M\Omega$, $I_{DQ} = 3.4mA$ and $V_{DS} = 10.5V$, $V_{DD} = 24V$. Determine the values of R_2 and R_S 10

6. (a) Design L section LC filter with full wave rectifier to meet following specifications: The DC output voltage $V_{DC} = 220V$, deliver $I_L = 70mA \pm 20mA$ to the resistive load, and required ripple factor is 0.04. Also find bleeder resistance if required. 12

(b) Design a simple Zener voltage regulator to meet the following specifications: Output voltage $V_o = 6.8V$, Load current $I_{L\,max} = 60mA$, $I_{Lmin} = 0mA$, $I_{Zmax} = 100mA$, $I_Z min = 5mA$, $P_Z = 440m$ W and Input voltage $V_i = 20V$to$30V$. 8

7. Write a short note on following (**any two**) 20

(a) SCR (Construction and Characteristics).

(b) Bias compensation techniques.

(c) E-MOSFET (Construction and Characteristics).

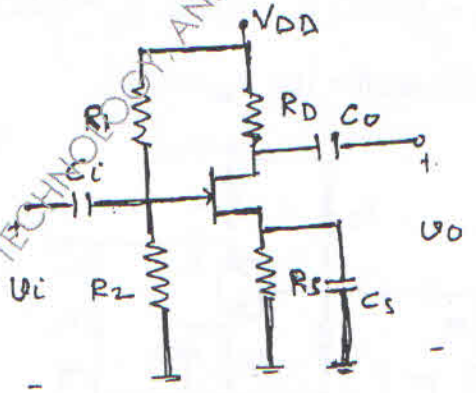


Fig.2

[TURN OVER

Transistor type	Pdmax @ 25°C Watts	Icmax @ 25°C Amps	V_{CE} (sat) volts d.c.	V_{CBO} volts d.c.	V_{CEO} (Sus) volts d.c.	V_{CES} (Sus) volts d.c.	V_{CEX} volts d.c.	V_{EBO} volts d.c.	T_j max °C	D.C. current gain min	typ.	max.	Small Signal h_{fe} min.	typ.	max.	V_{BE} max.	θ_{jc} °C/W	Derate above 25°C W/°C
2N3055	115·5	15·0	1·1	100	60	70	90	7	200	20	50	70	15	50	120	1·8	1·5	0·7
ECN055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125	1·5	3·5	0·4
ECN149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115	1·2	4·0	0·3
ECN100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9	35	—
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
2N525(PNP)	0·225	0·5	0·25	85	30	—	—	—	100	35	—	65	—	45	—	—	—	—
BC147B	0·25	0·1	0·25	50	45	50	—	6	125	200	290	450	240	330	500	0·9	—	—

Transistor type	hie	hoe	hre	θja
BC 147A	2·7 K Ω	18μ ℧	1·5 × 10⁻⁴	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25μ ℧	3·2 × 10⁻⁴	—
BC 147B	4·5 K Ω	30μ ℧	2 × 10⁻⁴	0·4°C/mw

BFW 11—JFET MUTUAL CHARACTERISTICS

$-V_{GS}$ volts	0·0	0·2	0·4	0·6	0·8	1·0	1·2	1·6	2·0	2·4	2·5	3·0	3·5	4·0
I_{DS} max. mA	10	9·0	8·3	7·6	6·8	6·1	5·4	4·2	3·1	2·2	2·0	1·1	0·5	0·0
I_{DS} typ. mA	7·0	6·0	5·4	4·6	4·0	3·3	2·7	1·7	0·8	0·2	0·0	0·0	0·0	0·0
I_{DS} min. mA	4·0	3·0	[illegible]	1·6	1·0	0·3	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0

N-Channel JFET

Type	V_{DS} max. Volts	V_{DG} max. Volts	V_{GS} max. Volts	P_d max. @25°C	T_j max.	I_{DSS}	g_{mo}	$-V_p$ Volts	r_d	Derate above 25°C	θ_{ja}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ℧	6	50 KΩ	2 mW/°C	0·59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ℧	2·5	50 KΩ	—	0·59° C/mW

UJT type	P_d max. @25°C	I_E max. @25°C	I_P peak pulse current max.	V_{BE} Volts max.	V_{BB1} Volts	T_j max	η min.	η max.	R_{BB} KΩ min.	typ.	Max.	I_P max. μA	I_V min. mA	I_{EO} μA
2N2646	300mW	50mA	2Amp.	30	35	125°C	0·56	0·75	4·7	7·0	9·1	5·0	4·0	-2·0

SEM-III EXTC (OLD) 9/6/16

Electrical Networks.

QP Code : 28859

(OLD COURSE)

(3 Hours) [Total Marks: 100]

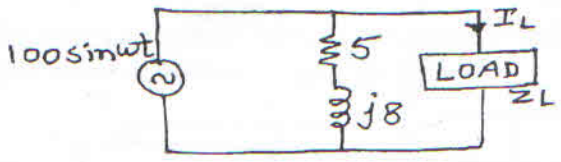
NB: 1. Question no. 1 is compulsory.

2. Attempt any four out of remaining six.

3. Assume suitable data if required.

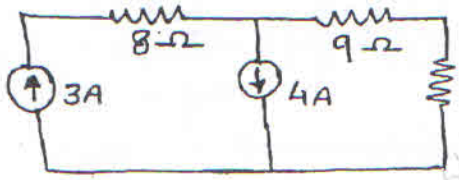
Q.1 Attempt any four- (20)

(a) Calculate current I_L



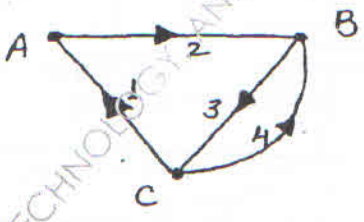
(b) The Z parameters of two port networks are $Z_{11}=5\Omega$, $Z_{22}=7\Omega$, $Z_{12}=Z_{21}=3\Omega$, calculate ABCD parameters.

(c) Determine current through 10Ω resistance.

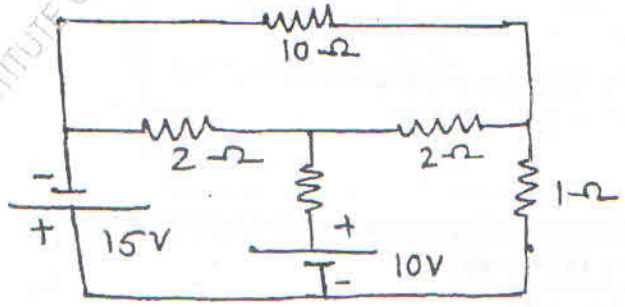


(d) Draw pole-zero plot for the function $F(s) = \frac{5(S+4)}{(S^2+6S+9)(S^2+64)}$

(e) How many trees are possible for the given graph.



Q.2(a) Find current through 1Ω resistor. (10)



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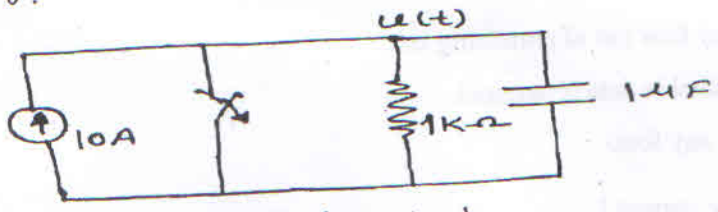
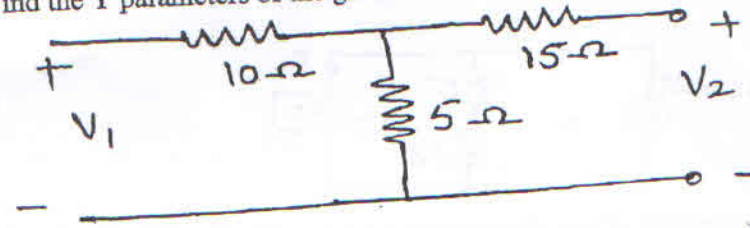
Q.2(b) In the given network switch is open at t=0, determine $v(t)$, $\frac{dv(t)}{dt}$, $\frac{d^2v(t)}{dt}$ at $t=0^+$. (10)



Q.3(a) Find the Y parameters of the given network. (10)



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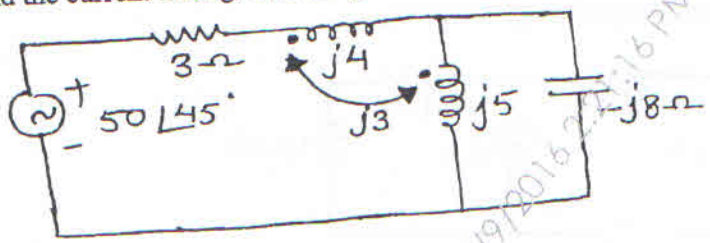

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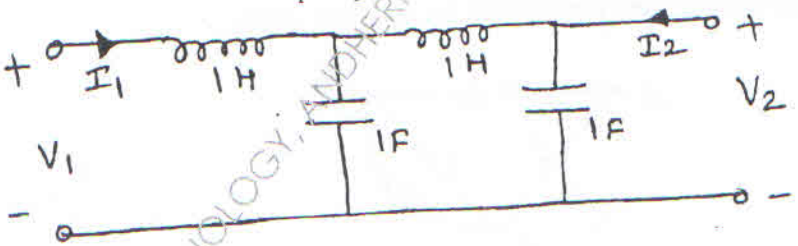

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PTO

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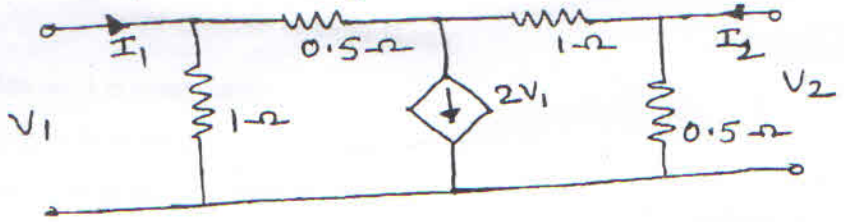

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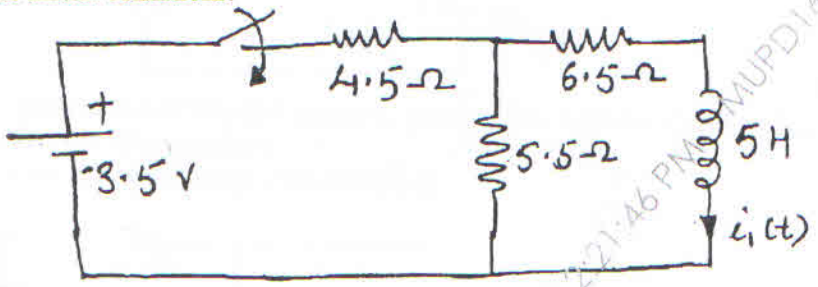

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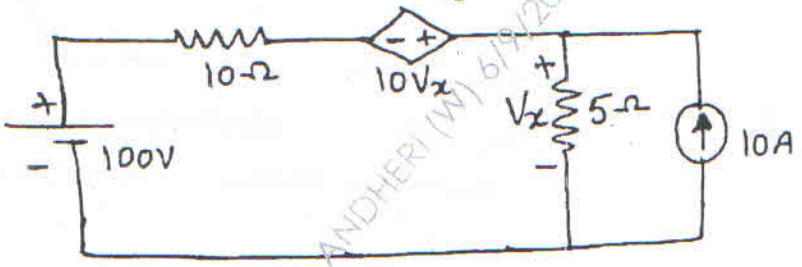

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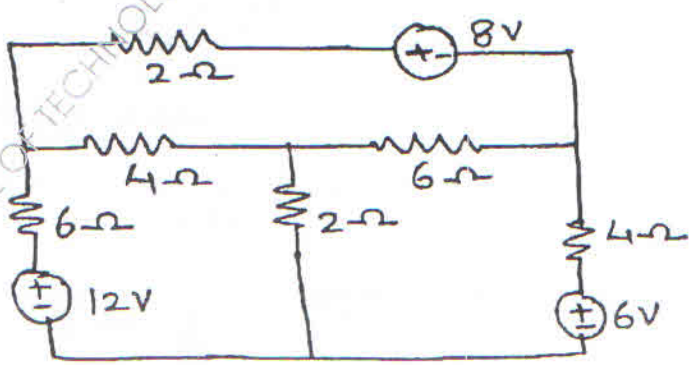

S.E. Extc (OTR) Sem III (Old). 3/6/16.

Numerical Techniques

QP Code : 28814

(OLD COURSE)

(3 Hours) **Total Marks: 100**

N.B. (1) Question No. 1 is compulsory.
(2) Attempt any **four** out of remaining **six** questions.
(3) Make **suitable** assumptions if **required** and **justify** the **same**.

1. **(a)** Find absolute, relative and percentage error in following numbers. Determine number of significant digits. **5**

i) $a = 123.41769543$ $\bar{a} = 123.41$
ii) $b = 0.0053102500$ $\bar{b} = 0.0051$
iii) $c = 450550$ $\bar{c} = 450552$

(b) Define the operators $\Delta, \nabla, \delta, \mu$ & E. Prove that **5**

i) $\frac{\Delta}{\nabla} - \frac{\nabla}{\Delta} = \Delta + \nabla$ ii) $E = 1 + \Delta$

(c) Using Picard's method obtain upto the fifth approximation of the equation **5**

$\frac{dy}{dx} = x + y$ such that $y = 1$ when $x = 0$.

(d) Derive the equation for Regula – falsi method using geometrical interpretation. **5**

2. **(a)** List the bracketing methods and open methods and find the real root of the equation $x \log x = 1.2$ using Newton Raphson method correct to three decimal places. **10**

(b) Solve the following equations by Gauss - Seidel method. **10**
$20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$.

3. **(a)** The table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface: **10**

X = height	100	150	200	250	300	350	400
D = distance	10.63	13.03	15.04	16.81	18.2	19.90	21.27

Find the value of distance when $X = 118$, $X = 218$ & $X = 418$ feet.

(b) Using Newton's divided difference formula, find the value of f(9) from the following table. **10**

x	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

4. (a) Write a program for Lagrange's interpolation method and using this formula, find the value of y when $x = 5$ from the following table. 10

x	0	2	3	6
y	648	704	729	792

(b) The result of measurement of electric resistance R of a copper bar at various temperatures t^0C are listed below: 10

t	36	32	34	31	32	32	34
R	76	77	79	80	82	83	85

Find a relation $R = a + bt$

5. (a) The velocity of the train which starts from rest is given by the following table, the time being reckoned in minutes from the start and speed in km/hour. 10

Time	3	6	9	12	15	18
Velocity	22	29	31	20	4	0

Estimate approximately the distance covered in 18 minutes by Simpson's $3/8^{th}$ rule.

(b) Solve $\frac{dy}{dx} = x^2 + y^2$ with $x_0 = 0$, $y_0 = 1$ by Euler's modified formula find the value of y when $x = 0.5$ taking $h = 0.25$. 10

6. (a) Solve $\frac{dy}{dx} = \sqrt{x+y}$ with initial conditions $y(1) = 2$ and find y at $x = 1.2$, $x = 1.4$ by Runge - Kutta Method of Fourth Order taking $h = 0.2$. 10

(b) Solve the following set of equations using Gauss Jordan method. 10

$6x + 15y + 2z = 72$, $x + y + 54z = 110$, $27x + 6y - z = 85$.

7. (a) Explain the propagation of errors. 5

(b) Derive Newton Cotes integration formula and also write a program Simpson's $1/3^{rd}$ rule. 10

(c) Write a short note on Golden section search. 5