S.E. Electronics & Telecommunication
Sem III

Applied Math III

Con. 5584-10. GT-6292

(3 Hours) [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.
(3) **Figures** to **right** indicates the **full** marks.
(4) Assume the **suitable** data if **required** with justification.

Q 1. (a)Find Laplace Transform of $\int_0^t x e^{-2x} \sin 3x \, dx$ (5)

(b)Find inverse Fourier sine transform of $\frac{e^{-as}}{s}$ (5)

(c) Show that the rows of the following matrix are linearly dependent and find the linear relationship between the rows

$$A = \begin{bmatrix} 1 & 0 & 2 & 1 \\ 3 & 1 & 2 & 1 \\ 4 & 6 & 2 & -4 \\ -6 & 0 & -3 & -4 \end{bmatrix}.$$ (5)

(d) Is the set $\{Sin x, Sin 3x, Sin 5x, ...\}$ orthogonal over $[0, \pi/2]$. If so, find the corresponding orthonormal set . (5)

Q.2 (a) (i) Find Inverse Laplace Transform of the following functions :- (8)

$$\frac{5s^2 - 15s - 11}{(s+1)(s-2)^2}$$

(ii) Solve the equations by Gauss-Jordon Method.

x+y+z=9,2x-3y+4z=13,3x+4y+5z=40

(b) Show that A is orthogonal and find A^{-1} if $A = \frac{1}{9}\begin{bmatrix} -8 & 4 & 1 \\ 1 & 4 & -8 \\ 4 & 7 & 4 \end{bmatrix}$ (6)

(c) Find the Fourier cosine and sine transform of

$$f(x) = \begin{cases} \sin x & 0 < x < a \\ 0 & x > a \end{cases}$$ (6)

[TURN OVER

Q.3 (a) Obtain Fourier series of $f(x) = x^2, -\pi \le x \le \pi$. Hence deduce that

$$\frac{\pi^4}{90} = \frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \ldots$$ (8)

(b) For what values of λ, the following equations have solutions. (6)

$x + y + z = 1,\ x + 2y + 4z = \lambda,\ x + 4y + 10z = \lambda^2$.

Determine the solution for those values of λ.

(c) Evaluate (6)

$$\int_0^\infty e^{-t}\left(\int_0^t u^4 \sinh u \cosh u\, du\right) dt$$

Q. 4 (a) If A is non-singular square matrix of order 'n', Prove that

(i) $|\text{adj A}| = |A|^{n-1}$ (ii) $adj(adj(A)) = |A|^{n-2} A$ (8)

(b)Find the Laplace Transform of

$$f(t) = |Sin\, t|$$. (6)

(c)Define Fourier integral of $f(x)$. Find Fourier integral of $f(x) = \begin{cases} 0 & x < 0 \\ 1/2 & x = 0 \\ e^{-x} & x > 0 \end{cases}$ (6)

Q.5 (a) If $L\{f(t)\} = \bar{f}(s)$ then show that $L\{t^n f(t)\} = (-1)^n \frac{d^n}{ds^n} \bar{f}(s)$. (8)

and hence find Laplace Transform of $t\, erf\left(3\sqrt{t}\right)$.

(b) Reduce to normal form and find rank of the following matrices (6)

$$\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$

c) Find the Z-transform of $\{a^{|k|}\}$. (6)

Q.6 (a) Find half range cosine series of $f(x)=\sin x$ in $(0,\pi)$. Hence deduce that

$$\frac{\pi^2-8}{16}=\frac{1}{1^2 3^2}+\frac{1}{3^2 5^2}+\frac{1}{5^2 7^2}+\ldots$$ (8)

(b) Solve the following Differential Equations using Laplace Transformation

$$\left(D^2+2D+5\right)y=e^{-t}\,Sint \quad y(0)=0\ ,\ y'(0)=1\ ,\ D=\frac{d}{dt}$$ (6)

(c) Find $Z\{f(k)\}$,if $f(k)=c^k\sinh(\alpha k), k\geq 0$ (6)

Q.7 (a) Find Fourier series of $f(x)=\left(\frac{\pi-x}{2}\right)^2$ over $[0,2\pi]$. Hence show that (8)

(i) $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\ldots=\frac{\pi^2}{6}$

(ii) $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\ldots=\frac{\pi^2}{12}$

(b) Find the complex form of Fourier Series for $f(x)=coshax$ in $(-l,\ l)$ (6)

(c) Find the inverse Z-transform of $\frac{1}{(z-a)^2}$, if $(i)\,|z|<a,(ii)\,|z|>a$ (6)

END

SE/EXTC/Sem III

Sub - ED&C-I

1-12-10

ws Oct- 10 171

Con. 5996-10.

GT-6279

(3 Hours)

[Total Marks : 100

Electronic Devices & Circuits - I

N.B. :
1. Question No.**1 and 2** is compulsory.
2. Answer any **three** from remaining questions.
3. **Figures** to the right indicate full marks.
4. Assume suitable data if required.

1. a Design single stage RC coupled C E amplifier for peak output voltage of 3V at 5kΩ load, $A_v \geq 100$ $R_i \geq 1.51k\Omega$ the lower cutoff frequency is 20 Hz .Use $V_{CC} = 12V$ .The source resistance is 600Ω . 15

   b For the above designed amplifier determine; voltage gain, input impedance, output impedance, current supplied by source Vcc. 05

2. a Design a single stage RC coupled common source amplifier employing JFET type BFW11 to provide a voltage gain of $A_v \geq 10$ at peak output voltage of $V_O = 4.5V$ with biasing circuit to provide $V_{GSQ} = 0.3V_P$ with the load resistance of 120kΩ and supply voltage of 20V with lower 3dB frequency of 20Hz. 15

   b Fro 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. 05

3. a Draw circuit of self- biased CE amplifier using diode compensation for I_{CO} and V_{BE} .Describe how bias compensation is achieved. 10

   b The circuit shown in figure1 has to be designed to make $V_O = V_C = 0$ volts and $V_{CE} = 3V$. Determine R_C, R_E and S_{ICO}. Assume for transistor β=200, $V_{BE} = 0.7V$.($V_{CC} = 6V$, $-V_{CC} = -6V$, and $R_1 = R_2 = 90K\Omega$) 10

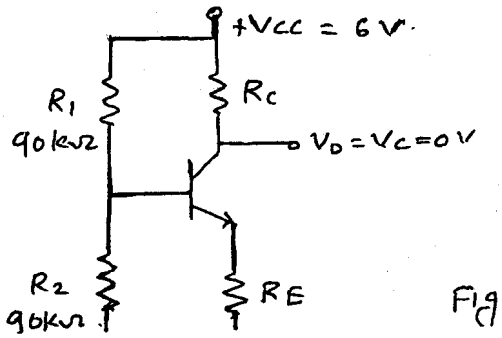
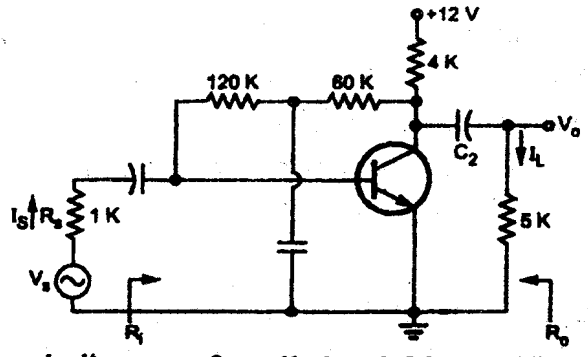


Fig. 1

4. a For the amplifier shown in figure.2 analyze and determine 10
   i) D C bias condition
   ii) Small-signal voltage gain
   iii) Input and out put impedance.
   BJT parameters are $\beta = h_{fe} = 140, h_{ie} = 1.5k\Omega$.

Fig.2



b Draw circuit diagram of small signal CS amplifier with voltage divider bias and derive the expression for Q point, small signal mid-band voltage gain, input impedance and output impedance. 10

5. a Draw small signal h-parameter equivalent circuit for CE amplifier and define the same from characteristics. 6

b For the circuit shown in fig.3 the drain current equation is 6

$$I_{DQ} = 7\left(1 + \frac{V_{GSQ}}{2.5}\right)^2 mA$$ Determine I_{DQ}, V_{GSQ}, V_{DSQ}, ,and g_m.

($R_D = 2.5k\Omega$, $R_S = 1k\Omega$, $R_G = 1.2M\Omega$ and $V_{DD} = 24V$)

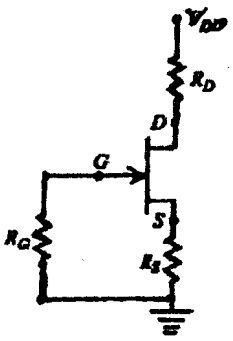


Fig .3

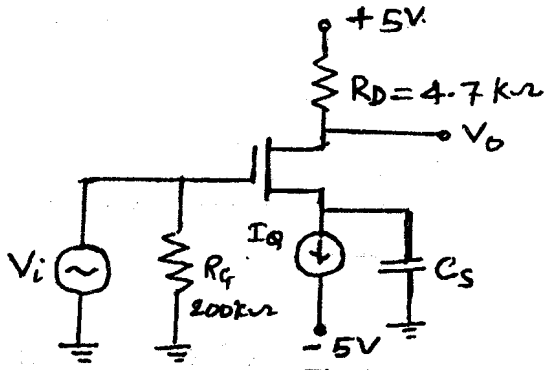


Fig.4

c For the amplifier shown in figure.4 analyze and determine 8
   i) D C bias condition(V_{GSQ},I_{DQ},V_{DSQ})
   ii) Small-signal voltage gain
   iii) Input and output impedance.

6. a Explain and derive the expression for ripple factor for capacitor filter with full wave rectifier. 8

b A R-C filter with R=500Ω and C=10μf is connected between R_L=5kΩ and a full wave rectifier with capacitor filter having its output V_{DC}=150V with peak to peak ripple voltage is V_{rpp}=15V.The line frequency is 60Hz.Calculate 6

i) D C output voltage.

ii) Output ripple voltage

iii) Power dissipation in R.

c Design a zener voltage regulator to meet the following specifications: Output voltage $V_O = 6V$ for load voltage for all load currents $I_L \leq 0.5A$.The unregulated supply varies between 8 and 10 V, and the zener diode provides regulation for $I_Z \geq 0$. 6

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

a SCR (Construction and Characteristics).

b DC load line for BJT amplifier.

c Insulated Gate Bipolar Transistor (Construction and Characteristics and application).

Transistor type	Pdmax @ 25°C Watts	Icmax @ 25°C Amps	V_{CE}(sat) volts d.c.	V_{CEO} volts d.c.	V_{CEO} (Sus) volts d.c.	V_{CEX} (Sus) volts d.c.	V_{CBX} 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_{j-c} °C/W	Derate above 25°C W/°C
2N 3055	115·5	15·0	1·1	100	60	70	90	7	200	20	50	70	15	50	120	1·8	1·5	0·7
ECN 055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125	1·5	3·5	0·4
ECN 149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	35	60	115	1·2	4·0	0·3
ECN 100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9	35	0·05
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
2N 525(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
ECN 100	500 Ω	—	—	—
ECN 149	250 Ω	—	—	—
ECN 055	100 Ω	—	—	—
2N 3055	25 Ω	—	—	—

BFW 11—JFET MUTUAL CHARACTERISTICS

–Vgs 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
Ids 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
Ids 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
Ids min. mA	4·0	3·0	2·2	1·6	1·0	0·5	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_{fs} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{j-a}
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

S.E/ EXTC/ Sem III

Electrical Networks

206 : 2ndhf10Dmk

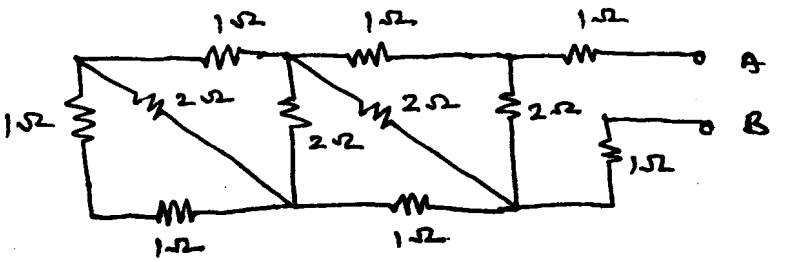
Con. 6264-10.

GT-6285

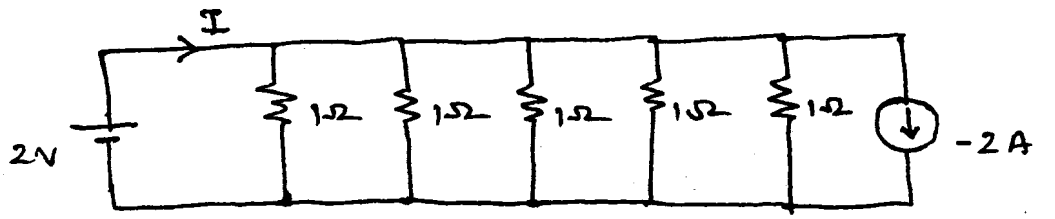
(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory** and solve any **four** questions from remaining questions.
(2) **All** questions carry **equal** marks.
(3) Assume **suitable** data wherever **necessary**.

1. (a) (i) For the circuit shown below determine R_{AB}. 4



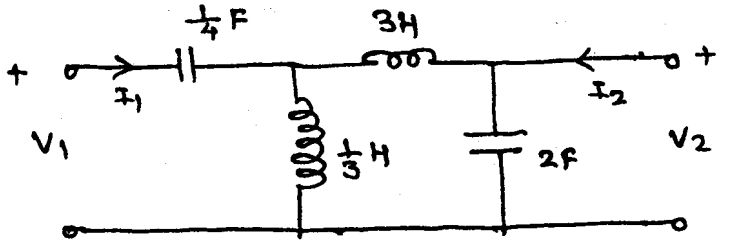
(ii) For the circuit shown below determine current I.



(b) Voltage across capacitor C is exponentially increasing with time constant 100 m/sec. If supply voltage to series RC circuit is 10 V determine $V_C(t)$ at — 4
(i) t = 50 m/sec.
(ii) t = 100 m/sec.
(iii) t = 500 m/sec.
Also find C if R = 100 K Ω.

(c) Draw laplace equivalent circuits for R, L and C taking into account initial conditions. 4

(d) For the circuit given below determine Z_{11}. 4

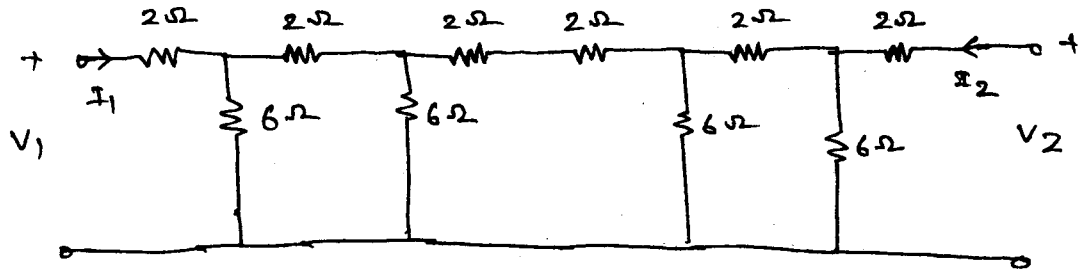


(e) Test whether following polynomials are Hurwitz :— 4
(i) $P(s) = s^3 + 2s^2 + 4s + 2$
(ii) $P(s) = s^4 + s^3 + 4s^2 + 2s + 3$.

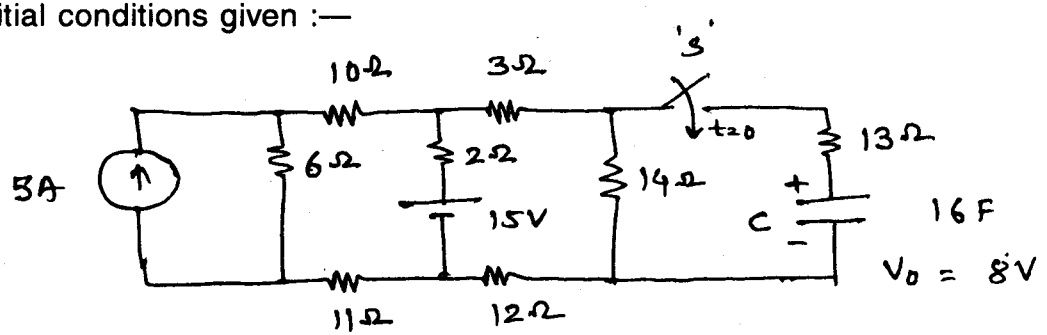
[TURN OVER

2. (a) Derive condition for Reciprocity in terms of 'Z' and 'Y' parameters and condition of symmetry in terms of transmission line and 'h' parameters. **10**

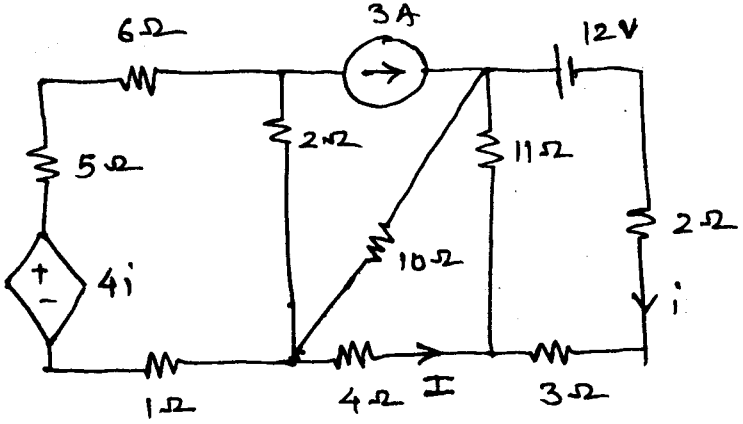
   (b) For the circuit shown below determine ABCD parameters :— **10**



3. (a) For the circuit shown below determine $I_C(t)$, if switch 'S' is closed at t = 0 with initial conditions given :— **10**



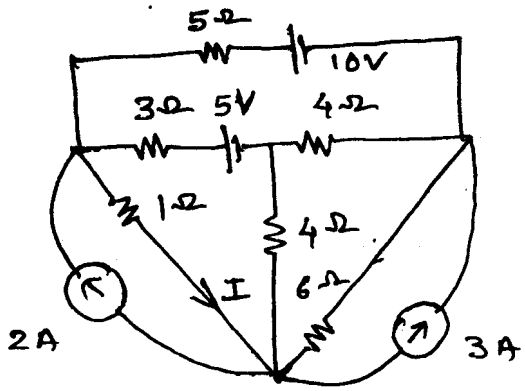
   (b) For the circuit shown below determine current 'I' using loop and Nodal analysis. **10**



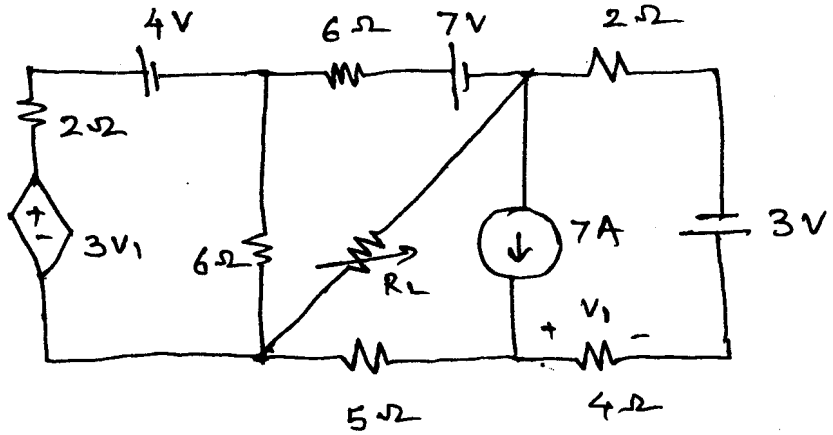
4. (a) Synthesis the following impedance function in Cauer 1 and Cauer 2 form with R-C elements :— **10**

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

(b) For the network shown below determine I using Graph Theory. **10**



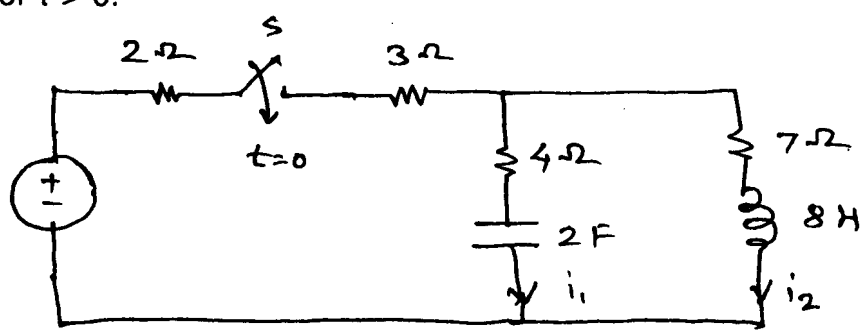
5. (a) For the network shown below determine R_L for maximum power transfer and also determine P_L(max). **10**



(b) Draw Bode plot of the system with following transfer function :— **10**

$$Z(s) = \frac{10^6(s+2)}{s(s+100)(s+1000)}$$

6. (a) For the circuit shown below switch 'S' is closed at t = 0. Determine $i_1(t)$ and $i_2(t)$ for t > 0. **10**



(b) Explain with appropriate circuit diagram and equations, transient response of series R-L-C circuit. **10**

7. (a) Check for positive real function :— **10**

(i) $F(s) = \dfrac{s^4 + 2s^3 + 2s^2\, s + 8}{s^3 + s^2 + s + 1}$

(ii) $F(s) = \dfrac{(s^2 + 1)(s^2 + 3)}{s(s^2 + 2)}$.

(b) Discuss in detail with appropriate circuit diagram and equations natural response of R-L-C parallel circuit. **10**

30 Dec 2010 S.E/ Extc / Sem III

Applied Maths III

Con. 5584–10. GT–6292

(3 Hours) [Total Marks : 100

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(d) Is the set $\{Sin\,x, Sin\,3x, Sin\,5x, ...\}$ orthogonal over $[0, \pi/2]$. If so, find the corresponding orthonormal set . (5)

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(b) For what values of λ, the following equations have solutions. (6)

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Determine the solution for those values of λ.

(c) Evaluate (6)

$$\int_0^{\infty} e^{-t} \left(\int_0^t u^4 \sinh u \cosh u \, du \right) dt$$

Q. 4 (a) If A is non-singular square matrix of order 'n', Prove that

(i) $|\text{adj A}| = |A|^{n-1}$ (ii) $adj(adj(A)) = |A|^{n-2} A$ (8)

(b)Find the Laplace Transform of

$$f(t) = |Sin\, t| \quad . \quad (6)$$

(c)Define Fourier integral of $f(x)$. Find Fourier integral of $f(x) = \begin{cases} 0 & x < 0 \\ 1/2 & x = 0 \\ e^{-x} & x > 0 \end{cases}$ (6)

Q.5 (a) If $L\{f(t)\} = \overline{f}(s)$ then show that $L\{t^n f(t)\} = (-1)^n \frac{d^n}{ds^n} \overline{f}(s)$. (8)

and hence find Laplace Transform of $t\, erf\left(3\sqrt{t}\right)$.

(b) Reduce to normal form and find rank of the following matrices (6)

$$\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$

c) Find the Z-transform of $\{a^{|k|}\}$. (6)

Q.6 (a) Find half range cosine series of $f(x)=\sin x$ in $(0,\pi)$. Hence deduce that

$$\frac{\pi^2-8}{16}=\frac{1}{1^2 3^2}+\frac{1}{3^2 5^2}+\frac{1}{5^2 7^2}+\ldots$$ (8)

(b) Solve the following Differential Equations using Laplace Transformation

$$\left(D^2+2D+5\right)y=e^{-t}\,Sin\,t \quad y(0)=0\ ,\ y'(0)=1\ ,\ D=\frac{d}{dt}$$ (6)

(c) Find $Z\{f(k)\}$,if $f(k)=c^k\sinh(\alpha k), k\geq 0$ (6)

Q.7 (a) Find Fourier series of $f(x)=\left(\frac{\pi-x}{2}\right)^2$ over $[0,2\pi]$. Hence show that (8)

(i) $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\ldots=\frac{\pi^2}{6}$

(ii) $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\ldots=\frac{\pi^2}{12}$

(b) Find the complex form of Fourier Series for $f(x)=coshax$ in $(-l,\ l)$ (6)

(c) Find the inverse Z-transform of $\frac{1}{(z-a)^2}$, if $(i)\,|z|<a,(ii)\,|z|>a$ (6)

S.E./E&TC / Sem III

Electronic Instrumentation

Con. 5562-10. **GT-6282**

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

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) **Figures** to the **right** indicate **full** marks.

1. Attempt any **four** :— **20**
   (a) Explain the term synchronization and various sources of synchronization with reference to CRO.
   (b) Draw and explain the block diagram of data logger. State its few areas of application.
   (c) Explain the working principle of Eddy current type sensor with applications and advantages.
   (d) Why is a wave analyzer called frequency selective voltmeter.
   (e) Define the term Telemetry also draw and explain briefly the block diagram of Telemetry system employed in Instrumentation Systems.

2. (a) What are Digital Transducers ? Explain Digital Transducer which uses optical method for its operation with its advantages. **10**
   (b) A 4-bit R-2R Ladder network type Digital to Analog Converter has input 1010 and reference voltage 10 V. Find its output voltage and conversion resolution. **6**
   (c) Explain various factors which govern intensity of phosphor screen on CRO. **4**

3. (a) Describe in detail Thermistor for its working principle, Resistance-Temperature characteristics and construction. Also state its various applications apart from measurement of temperature. **10**
   (b) Self capacitance and the inductance of the coil is to be measured using series connection in Q-meter. First measurement is at frequency 2 MHz and tunning capacitor value is 460 pf. The frequency is 4 MHz and tunning capacitor value is 100 pf for second measurement. Calculate the value of self capacitance of a coil and inductance. **6**
   (c) Explain the Capacitive Transducer based on differential arrangement for its working principle and advantages over other arrangements. **4**

4. (a) Describe in detail the working principle of swept superheterodyne type Spectrum Analyzer with block diagram. **10**
   (b) Sketch and explain the display using swept Superheterodyne Spectrum Analyzer for following signals :— **6**
      (i) A pure sine wave with frequency half way between the two extreemes of the swept frequency range.
      (ii) An Amplitude Modulated sine waveform.
      (iii) A sine wave with a small amount of harmonic distortion.
   (c) Explain in detail Roll Mode operation of Digital Storage Oscilloscope. **4**

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5. (a) Explain in detail weighted resistor Digital to Analog Conversion Technique with its advantages and disadvantages over other types of Digital to Analog Converters. **10**
   (b) Explain in detail ALT and CHOP mode of operation of CRO. **6**
   (c) Define and relate sampling rate and Bandwidth specifications of DSO. **4**

6. (a) What is time base selector in Digital Frequency meter ? Draw and explain its block diagram and state its importance in the measurements done using Digital Frequency meter. **10**
   (b) Gating period of 1 msec, 10 msec, 100 msec, 1 sec, 10 sec are provided on a digital counter-timer-frequency meter having 3 digit display. A gating period of 10 msec is selected to measure an unknown frequency and a reading of 034 is obtained. **6**
      (i) What is the likely value of frequency of an unknown signal ?
      (ii) To obtain a move accurate measurement of frequency of an unknown signal, what will you do and why ? Justify.
   (c) Calculate the gauge factor (G) if 1·5 mm diameter conductor that is 24 mm long changes length by 1 mm and diameter by 0·02 mm under a compression force. **4**

7. Write short notes on (any **three**) :— **20**
   (a) General specifications of Digital Voltmeter
   (b) Automation in Digital Instruments
   (c) Velocity Modulation with reference to CRO
   (d) Universal Counter.

S.E. Electronics & telecom

Sem III

Digital Logic Design.

Con. 5997-10. **GT-6288**

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

N.B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **four** questions from Q. Nos. **2** to **7**.
(3) Assume **suitable** data if **necessary**.

1. (a) (i) Convert $(43)_8 = (?)_{10} = (?)_2$ **2**
(ii) Find H if $(193)_H = (623)_8$.
(b) Justify, NAND and NOR gates are universal logic gates. **3**
(c) Explain min term and max term. **5**
(d) Compare TTL and ECL logic families. **5**

2. (a) Perform the following if possible – **10**
(i) $(10110.11)_2 \times (101.1)_2$
(ii) $(234)_4 \times (12)_4$
(iii) $(CA)_H \times (6E)_H$
(iv) $(23–48)_{10}$ using 2's complement.
(b) (i) Explain the difference between weighted codes and nonweighted codes. **6**
(ii) Perform $(54)_{10} – (22)_{10}$ in BCD using 10's compliment.

3. (a) Impliment using only – **8**
(i) NAND gates
(ii) NOR gates for f (0, 1, 2, 3, 8, 9, 12, 13, 14).
(b) Reduce using Quine Mc cluskey method and implement using logic gates **12**
f (A, B, C, D) = Σm (2, 3, 6, 7, 8, 9, 13, 15) + d (4, 10, 12).

4. (a) Impliment a 16:1 mux. using 4:1 mux. **10**
(b) Design a combinational circuit using **10**

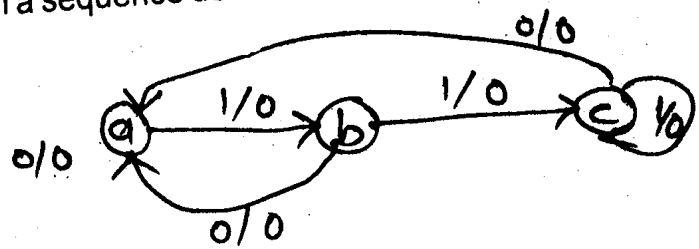
PAL for W (A,B,C,D) Σm = (2,12,13)
X (A,B,C,D) Σm = (7,8,9,10,11,12,13,14,15)
Y (A,B,C,D) Σm = (0,2,3,4,5,6,7,8,10,11,15)
Z (A,B,C,D) Σm = (1,2,8,12,13).

5. (a) Explain J.K. Latch using NAND gates. **8**
(b) Explain Bidirectional shift resister. **8**
(c) Convert SR-F.F. to T.FF. **4**

6. (a) Design a synchronus counter for the sequence below – 10

QC	QB	QA
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0

(b) Design a sequence detector to detect the following sequence using D.F.Fs--110--- 10



7. (a) Explain ECL logic family. 10
(b) Explain MOS logic families. 10