**Q. P. Code : 50072**

**( 2½ Hours )** **( Total Marks : 60 )**

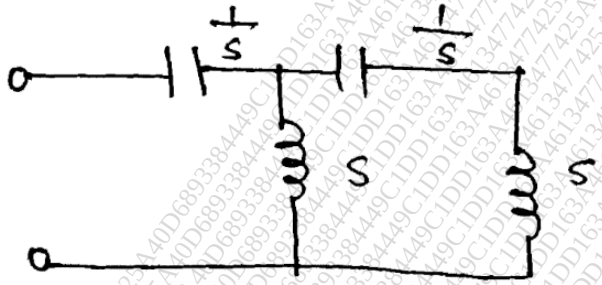
**Please check whether you have the right question paper.**

**N.B.:** 1) **Questions No.1** is **compulsory**.
2) Solve **any three** questions out of remaining **five** questions.
3) **Figures** to the **right** indicate **full marks**.

**1.** a) State and explain properties of positive real function. **(05)**

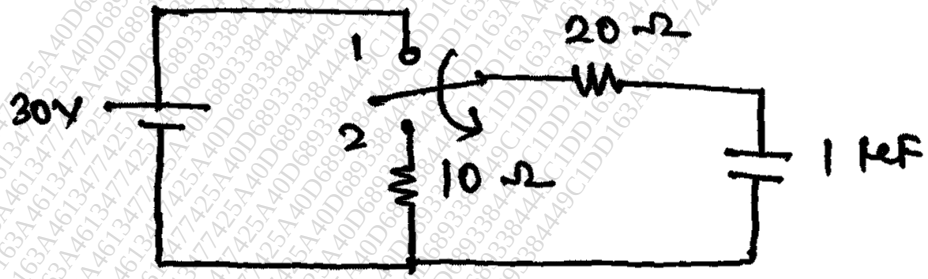
b) Compare series and parallel resonance circuit. **(05)**

c) Determine the driving point impedance of the network shown. **(05)**




d) Determine whether $p(s) = s^4 + s^3 + 2s^2 + 3s + 2$ is Hurwitz. **(05)**

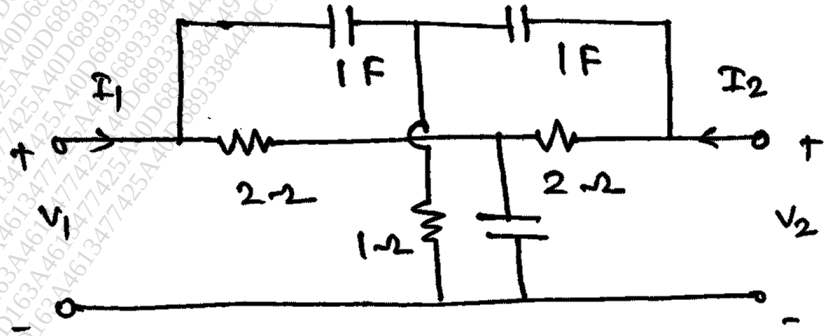
**2.** a) In the network shown the switch is changed from position 1 to 2 at $t = 0$. Find the values of $i$, $\frac{di}{dE}$ and $i$, $\frac{d^2i}{dt^2}$ at $t = 0^+$. **(10)**



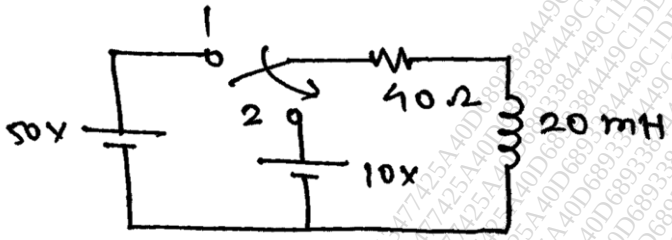

b) Find the Foster forms of the following impedance function : **(10)**

$$z(s) = \frac{(s+1)(s+4)}{(s+5)(s+3)}.$$

**3.** a) Find Y parameters for the network shown : **(10)**



b) The network given below is under steady state with switch at position 1. At $t = 0$ the switch is moved to positions 2. Find $i(t)$. **(10)**



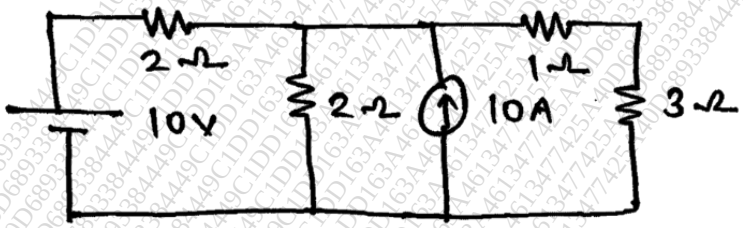

**4.** a) Test whether the following function is positive real : **(05)**

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

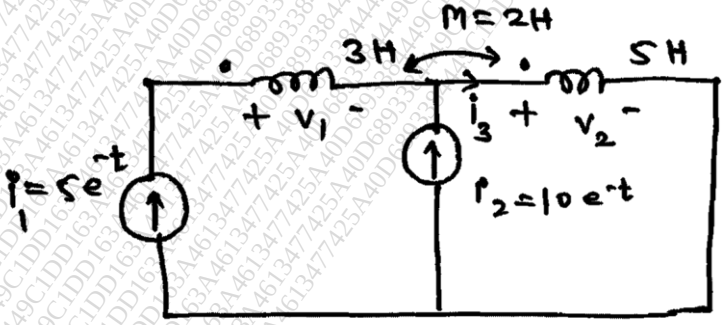
b) Derive the condition for reciprocity and symmetry for the network in terms of z parameters. **(10)**

c) Derive the relation for characteristic impedance of a transmission line. **(05)**

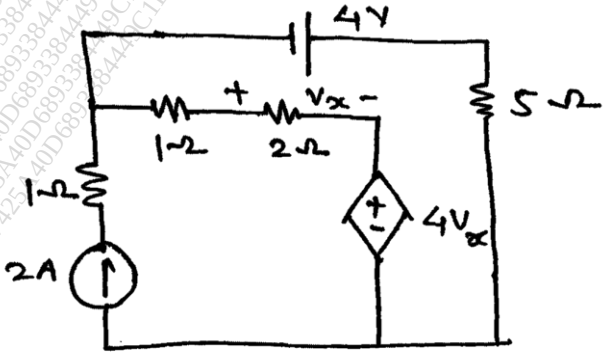
**5.** a) Find the current through 3 Ω resistor using Theremins theorem : **(05)**




b) In the network shown find the voltages $v_1$ & $v_2$ : **(05)**

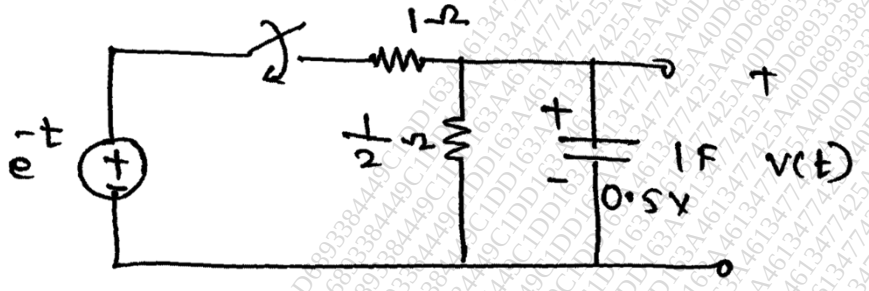



c) Find the current through 5Ω resistor for the network given below : **(10)**



**6.** a) The characteristic impedance of a high frequency line is 100 Ω. It is terminated in an impedance of $100 + j100\Omega$. Using a smith chart find the impedance at $\frac{1}{8}^{th}$ wavelength away from the load end.

b) In the network shown the switch is closed at $t = 0$ connecting a source $e^{-t}$ to the network at $t = 0$. $V_c(0) = 0.5\ V$. Determine $V(t)$.

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**[Time: 3Hours]** **[ Marks:80]**

**N.B:**
1. **Question No. 1 is compulsory.**
2. **Out of remaining questions, attempt any THREE questions.**
3. **Assume suitable data, wherever necessary.**

Q1 Attempt **any Four:** **20**

a) Construct 2-input EX-OR and EX-NOR Gates using only NAND gates.
b) Differentiate between Combinational and Sequential Circuits.
c) Write truth table and draw logic diagram of Half Adder.
d) Explain any five features of VHDL.
e) Design MOD-6 counter using IC 7490.

Q2 a Simplify F = II M (0,2,5,8,10, 12, 15) + d (1,6) using K-map. **10**
Implement the function using only NOR gates.

b Design 8-bit comparator using four bit magnitude comparator IC 7485. **10**

Q3 a Design Mod-8 synchronous counter using JK flip-flop. Draw output Waveform. **10**

b Eliminate the redundant states and draw the reduced state diagram. **10**

| **PS** | **NS** | | **O/P** |
|---|---|---|---|
| | X=0 | X=1 | Y |
| A | B | C | 1 |
| B | D | C | 0 |
| C | F | E | 0 |
| D | E | B | 1 |
| E | B | C | 1 |
| F | C | E | 0 |
| G | F | G | 0 |

Q4 A Implement $F_1$ (A, B, C) = $\sum$ m (0,2,4,7) **10**
$F_2$ (A, B, C ) =$\sum$ m (1,2,5,7)
Using IC 74151, 8:1 Multiplexer.

b Design a mealy sequence detector to detect ----10l l -----using D flip-flops, Wherein overlapping is allowed. **10**

Q5 a List out different types of PLD's. Implement the given functions using PLA. **10**
F1 (A,B,C) = $\sum$ m (3,6, 7) F2(A,B,C) = $\sum$ m (1,2,4, 7)

b Draw neat diagrams of 2-input TTL NAND gate and explain in brief. **10**

Q6 Write short notes on (**any Four**) **20**

a) CPLD Architecture
b) Stuck at 0 &1 Faults
c) Johnson Counter & its applications
d) State Assignment Techniques
e) JK-Flip flop

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

**N.B: (1) Question No.1** is **compulsory** and solves **any three** questions from remaining questions.
**(2)** Assume suitable **data** if **necessary**.
**(3)** Draw **neat** and **clean figures**.

**1.** Answer **Any Two** :

a) Compare effect of temperature in BJT, JFET, Diode and MOSFET. **10**

b) With neat diagram, explain the operation of UJT relaxation oscillator. **10**

c) Explain construction, working and characteristics of photodiode. **10**

**2.** a) Explain concept, working and characteristics of Tunnel diode. **10**

b) Why FET is called as square law device? Differentiate between BJT and FET. **10**

**3.** a) Determine ideal reverse saturation current density in a silicon PN junction at T =300$^{o}$ K. Consider the following parameters in a silicon PN junction : Na = Nd =$10^{16}$ cm-$^{3}$,ni = 1.5*$10^{10}$,E r =11.7,Dp = 10 cm$^{2}$/S, Dn = 25 cm$^{2}$/S,Tpo =Tno=5*$10^{-7}$. **10**

b) Discuss Ebers moll model for BJT in detail. **10**

**4** a) Describe construction, working and characteristics of: **10**

i) DIAC

ii) IGBT

b) Draw and explain VI characteristics of Triac **05**

c) Sketch and explain characteristics of PN junction solar cell **05**

**5** a) Justify space charge width increases with reverse bias voltage in a pn junction diode. **10**

b) Explain the need of heterojunction? Explain the terms straddling, staggered and broken gap in relation to heterojunction **10**

**6** Write short notes **(Any Three)** : **20**

(a) Optocoupler

(b) SCR

(c) Comparison of photodiode and avalanche photodiode

(d) Comparison of DMOSFET and EMOSFET

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

Note:- 1) Question number **1** is **compulsory.**

2) Attempt any **three** questions from the remaining **five** questions

3) **Figures** to the **right** indicate **full** marks.

Q.1 a) Find the Laplace transform of cost cos2t cos3t 05

b) Show that the set of functions cosnx, n= 1,2,3,……. is orthogonal over $(0 , 2\pi)$ 05

c) Prove that $f(z) = (x^3 – 3xy^2 + 2xy) + i(3x^2y – x^2 + y^2 – y^3)$ is analytic and find $f^I(z)$ in terms of z . 05

d) Find the directional derivative of $\varphi = x^2+y^2+z^2$ in the direction of the line $\frac{x}{3} = \frac{y}{4} = \frac{z}{5}$ at (1, 2, 3) 05

Q.2 a) Find the fourier series for $f(x) = x^2$ in $(0 , 2\pi)$ 06

b) Show that the vector $\bar{F} = (x^2 + xy^2)\, i + (y^2 + x^2y)\, j$ is irrotational and find its scalar potential 06

c) Prove that the transformation $w = \frac{1}{z+i}$ transforms real axis of z- plane into a circle of w – plane 08

Q.3 a) Using convolution theorem, find inverse Laplace transform of $\frac{s^2}{(s^2+2^2)^2}$ . 06

b) Prove that $J_{5/2}(x) = \sqrt{\frac{2}{\pi x}}\left(\frac{3-x^2}{x^2}\sin x - \frac{3}{x}\cos x\right)$ 06

c) Find half range cosine series for $f(x) = x(\pi - x)$, $0<x<\pi$. Hence show that $\sum_1^\infty \frac{1}{n^4} = \frac{\pi^4}{90}$ 08

Q.4 a) Evaluate by Green's theorem $\int_c (e^{x^2} - xy)\,dx - (y^2 - ax)dy$ where c is the circle $x^2 + y^2 = a^2$. 06

b) Prove that $2J_0''(x) = J_2(X) - J_0(x)$. 06

c) i) Evaluate $\int_0^\infty \frac{e^{-t} - e^{-3t}}{t}$ dt 08

ii) Find Laplace transform of $t\sqrt{1 + sint}$

Q.5 a) Find the orthogonal trajectory of the family of curves $x^3y - xy^3 = c$. 06

b) Prove that $\int x \cdot J_{2/3}(x^{3/2})\,dx = -\frac{2}{3}x^{-1/2}J_{-1/3}(x^{3/2})$. 06

c) Obtain complex form of Fourier Series for $f(x) = e^{2x}$ in (0, 2). 08

Q.6 a) Use stoke's Theorem to evaluate $\int_c \bar{F} \cdot d\bar{r}$ where $\bar{F} = yz\,i + zx\,j + xy\,k$ and C is the boundary of the circle $x^2 + y^2 + z^2 = 1$ and $z = 0$. 06

b) Find the fourier integral representation for 06

$f(x) = e^{ax}$ , $x \leq 0$ , $a > 0$

$= e^{-ax}$ , $x \geq 0$ , $a > 0$

Hence show that $\int_0^\infty \frac{\cos wx}{w^2 + a^2}\,dx = \frac{\pi}{2a}e^{-ax}$ , $x > 0$ , $a > 0$

c) Solve using Laplace transform $(D^2 + 2D + 5)y = e^{-t}sint$, where $y(0) = 0$, $y'(0) = 1$. 08

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**Duration :3 Hours** **Marks:80**

**N.B.: (1) Question No. 1 is compulsory.**
**(2) Solve any three questions from remaining five questions.**
**(3) Draw neat diagrams and assume suitable data wherever necessary. Justify your assumptions.**

**Question no 1.**

**Solve any four**

a) Define the following terms:-
Accuracy,Precision,Sensitivity,Linearity and Resolution **(5M)**
b) Draw Venturi meter for flow measurement. **(5M)**
c) Draw and explain the working of practical Q-meter circuit. **(5M)**
d) Write the specification of CRO. **(5M)**
e) Compare digital and analog measuring meters. **(5M)**

**Question no 2.Attempt the following**

a) Draw and explain the block diagram of CRO .List advantage and disadvantages of it. **(10M)**
**b)** Draw and explain Kelvin double bridge for measurement of unknown resistance **(10M)**

**Question no 3. Attempt the following**

a) Draw and explain Maxwell bridge for inductance measurement with expresssions involved in it.List drawbacks of it. **(10M)**
b) What are the types of errors in measurement systems? Explain all in details. **(10M)**

**Question no 4. Attempt the following**

a) Draw and explain ultrasonic type level transducer.
List advantages and disadvantages of it. **(10M)**
b) Draw and explain Dead weight tester **(10M)**

**Question no 5. Attempt the following**

a) Draw and explain the construction and working of electronics voltmeter using transistors. **(10M)**
b) Draw & explain block diagram of data acquisition system. **(10M)**

**Question no 6. Write short note on the following** **(20M)**

a) Data logger
b) Magnetic flow meter.
c) DSO
d) Static and dynamic characteristics of instruments

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