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

N.B. **(1)** Question no.1 is compulsory.
(2) Attempt any three questions from Question No. 2 to 6
(3) Make any suitable assumption wherever required.

Q.1 Answer any four.

	(a)	Give the working principle of Photodiode with its application	5M
	(b)	Explain the various bias compensation techniques in a BJT.	5M
	(c)	Determine the operating point parameters I_{CQ} and V_{CEQ} for the Fixed Bias circuit. Assume $\beta = 100$ and $V_{BE} = 0.7V$, $R_C = 3k\Omega$, $R_B = 470K\Omega$, $V_{CC} = 12V$. .	5M
	(d)	Explain the Effect of negative feedback on voltage gain, input impedance, output impedance, and bandwidth.	5M
	(e)	State and Explain Barkhausen's criteria for sustained oscillations.	5M
Q.2	**(a)**	Analyze Voltage Shunt Negative feedback Amplifier with respect to Input Resistance, Output Resistance and Voltage gain.	10M
	(b)	Derive expression for voltage gain, input impedance and output impedance of a CS amplifier.	10M
Q.3	**(a)**	Draw FWR with C filter and describe the circuit operation with waveform. Compare the performance of C, L, LC filters	10M
	(b)	Explain the Colpitts Oscillator in detail with circuit diagram and equations.	10M
Q.4	**(a)**	Explain Crystal oscillator with the help of suitable diagram and waveforms.	10M
	(b)	Give the DC and AC analysis of Dual Input Unbalanced output differential Amplifier	10M
Q.5	**(a)**	Explain the Construction and Working of E-MOSFET with the help of its characteristics.	10M
	(b)	Explain various types of coupling and their effect on the performance of BJT.	10M
Q.6		Write short note on following. **(Any TWO)**	20M
	(a)	Zener Diode as voltage Regulator.	
	(b)	Hartley Oscillator.	
	(c)	re-model used in Transistor	

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Q. P. Code : 37078

(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) Evaluate $\int_0^\infty e^{-2t} sin^2 2t\, dt$. 05

b) Find an analytic function $f(z) = u + iv$ where $u + v = e^x(\cos y + \sin y)$. 05

c) Obtain Fourier series of $x \cos x$ in $(-\pi, \pi)$. 05

d) Evaluate $\int_C \bar{F} \cdot d\bar{r}$ where $\bar{F} = x^2\, i + xy\, j$ from $(0,0)$ to $(1,1)$ along the parabola $y^2 = x$. 05

Q.2 a) Find half-range cosine series for $f(x) = e^x,\ 0 < x < 1$. 06

b) Prove that 06
$\bar{F} = (x + 2y + az)\, i + (bx - 3y - z)\, j + (4x + cy + 2z)\, k$
is solenoidal and determine the constants a, b, c if $\bar{F}$ is irrotational.

c) Prove that $w = i\left(\frac{z-i}{z+i}\right)$ maps upper half of the $z-$plane into the interior of the unit circle in the $w-$plane. 08

Q. 3 a) Prove that $J_n(x)$ is an even function if n is even integer and is an odd function if n is odd integer. 06

b) Find the inverse Laplace transform of 06
$\frac{s^2+2s+3}{(s^2+2s+5)(s^2+2s+2)}$.

c) Obtain the complex form of Fourier series for $f(x) = e^{ax}$ in $(0, a)$. 08

Q. 4 a) Prove that $\nabla f(r) = f'(r)\frac{\bar{r}}{r}$ and hence, find f if $\nabla f = 2r^4\bar{r}$. 06

b) Prove that $4J''_n(x) = J_{n-2}(x) - 2J_n(x) + J_{n+2}(x)$. 06

c)

(i) Find the Laplace transform of $e^{4t}\ sin^3 t.$ 04

(ii) Find the Laplace transform of $t\sqrt{1+\sin t}.$ 04

Q. 5 a) Prove that $\int x \cdot J_{\frac{2}{3}}\left(x^{\frac{3}{2}}\right) dx = -\frac{2}{3}\, x^{-\frac{1}{2}} J_{-\frac{1}{3}}\left(x^{\frac{3}{2}}\right).$ 06

b) Find p if $f(z) = r^2 \cos 2\theta + i\, r^2 \sin p\theta$ is analytic. 06

c) If $f(x) = \begin{cases} \pi x, & 0 \le x \le 1 \\ \pi(2-x), & 1 \le x \le 2 \end{cases}$ with period 2, show that 08

$f(x) = \frac{\pi}{2} - \frac{4}{\pi} \sum_{n=0}^{\infty} \frac{1}{(2n+1)^2} \cos(2n+1)\pi x.$

Q. 6 a) Show that the set of functions $\cos nx,\ n = 1, 2, 3, \ldots$ is orthogonal on $(0, 2\pi)$. 06

b) Use Stoke's theorem to evaluate $\int_C \bar{F} \cdot d\bar{r}$ where $\bar{F} = (2x - y)\, i - yz^2\, j - y^2 z\, k$ and S is the surface of hemisphere $x^2 + y^2 + z^2 = a^2$ lying above the xy −plane. 06

c) Use Laplace transform to solve 08

$\frac{d^2y}{dt^2} + y = t$ with $y(0) = 1, y'(0) = 0.$

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Q.P.Code: 37325

Duration: - Three Hours **Total Marks:- 80**

NOTE

1. Question No 1 is Compulsory.
2. Solve any three out of the remaining.
3. Figure to the right side indicates marks.
4. Assume the suitable data and mention the same if required.

Q No 1 Answer the following Questions

a. What are the various methods for meeting fluctuating load? [5]

b. State and explain the laws of thermodynamics'. [5]

c. What are the drawbacks of nuclear power generation? [5]

d. Discuss the role of Biomass in power generation. [5]

Q No 2a A thermal power plant consist of two units of 60 MW running for 8000 hrs and one 30 MW unit running for 2000 hrs per year. Energy produced by the plant is $876*10^6$ KWH per year. Determine the plant load factor and plant use factor. Assume maximum demand is equal to the plant capacity. [10]

Q No 2b What is condenser? Discuss the working of any condenser with figure. [10]

Q No 3a Discuss the coal handling system in thermal power plant with neat diagram. [10]

Q No 3b The run off data of a particular site is given below.

Month	Mean discharge per month (Millions of cum)	Month	Mean discharge per month (Millions of cum)
January	40	July	75
February	25	August	100
March	20	September	110
April	10	October	66
May	00	November	50
June	50	December	40

(1) Draw the hydrograph (2) Find mean flow (3) Draw flow duration curve [10]

Q No 4a Discuss any one type of cooling tower.

Q No 4b Explain the following terms with respect to nuclear power generation. [10]

a. Nuclear Material b. Reactor Control

Q No 5a Discuss the features of Pelton Wheel Turbine in hydro power generation. [10]

Q No 5b What is solar pond technology? Discuss the working of solar pond electric power plant. [10]

Q No 6a Discuss the various factors affecting the selection of site for wind power generation. [10]

Q No 6b Discuss the combined heat power generation system. [10]

Q. P. Code: 37877

Duration – 3 Hours **Total Marks - 80**

N.B.:- (1) Question No.**1** is compulsory.
(2) **Attempt** any **three** questions out of remaining Question No. 2 to Question No. 6.
(3) Assume suitable data if necessary and justify the same.

Q 1 a)	Define types of possible errors in an instrument. How these errors can be minimized?	**5**
b)	Explain resolution and sensitivity of digital meter.	**5**
c)	Explain piezo electric transducer.	**5**
d)	Explain a De Sauty's bridge to measure the capacitance of capacitor.	**5**
Q 2 a)	Explain working principle, construction of moving iron instrument and hence derive the torque equation.	**10**
Q 2 b)	Describe construction, working principle and theory of dynamometer type wattmeter.	**10**
Q 3 a)	Explain with block diagram Ramp type digital voltmeter.	**10**
Q 3 b)	Explain Kelvins double bridge to measure low resistance and hence derive the equation for unknown resistance.	**10**
Q 4 a)	Explain Hay's bridge to measure inductance and hence derive the equation for inductance using above bridge, draw phasor diagram.	**10**
Q 4 b)	Explain the calibration of voltmeter and ammeter using potentiometer.	**10**
Q 5 a)	Explain Thermistor .Write down advantages and disadvantages of Thermistor.	**10**
Q 5 b)	Explain the construction and working of LVDT with advantages and disadvantages.	**10**
Q 6 a)	Write a short note on PMMC instrument	**10**
Q 6 b)	Explain the construction and working of Digital frequency meter.	**10**

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(Time: 3 Hours) **[Total marks: 80]**

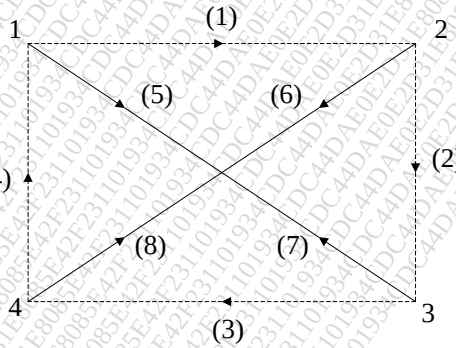
N.B:- (1) **Question 1 is compulsory**
(2) Solve any **three** questions from remaining **five** questions.
(3) Figures to the right indicate **full** marks.
(4) Assume suitable data if necessary.

Q1 Attempt the following 20

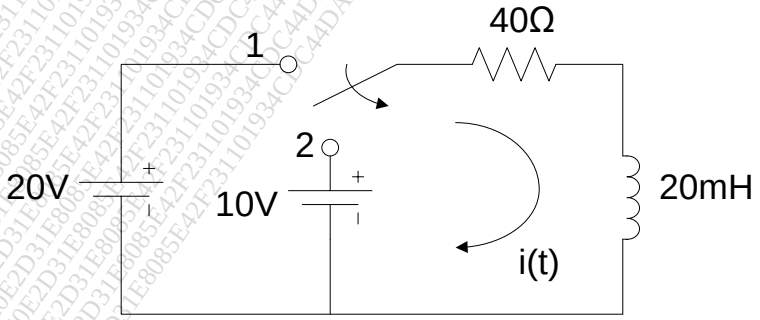
a) Derive the response on unit step signal in case of series RL circuit.
b) Explain Millman's theorem.
c) What do you understand by tree, link and twig. Explain with example

d) Test whether $P(s) = s^5 + 2s^4 + 4s^3 + 6s^2 + 2s + 5$ is hurwitz

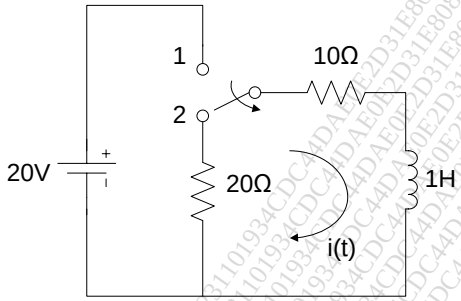
Q2 a) For a given graph, write incidence matrix, f-cutset and f-tieset matrix. 10



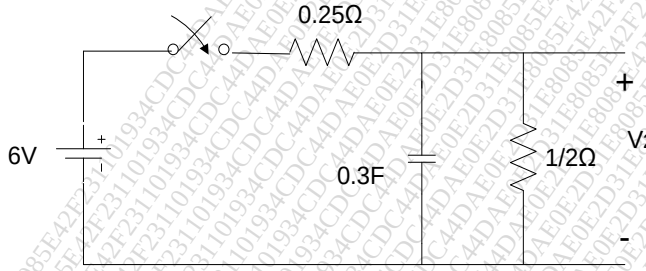
Q2 b) The network shown is under steady state with switch at position 1. At t=0, switch is moved to position 2. Find i(t). 10



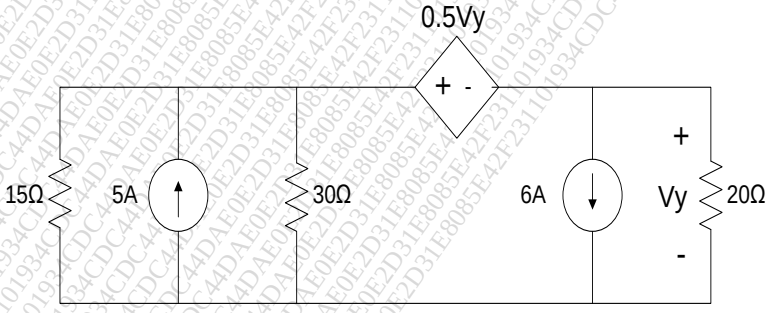
Q3 a) In the network shown in figure, the switch is changed from position 1 to 2 at t=0, steady state condition having reached before switching. Find the values of $i, \frac{di}{dt}, \frac{d^2i}{dt^2}$ at $t=0^+$. 10



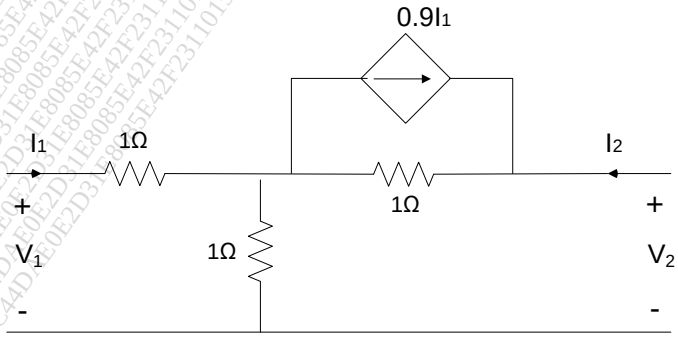
Q3 b) In the network shown, the switch is open for a long time and at t=0, it is closed. Determine $V_2(t)$. 10



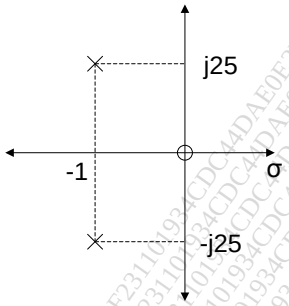
Q4 a) Use nodal analysis to find Vy in the given circuit. 10



Q4 b) Find the Z parameters for the network shown. Hence find h parameters. 10



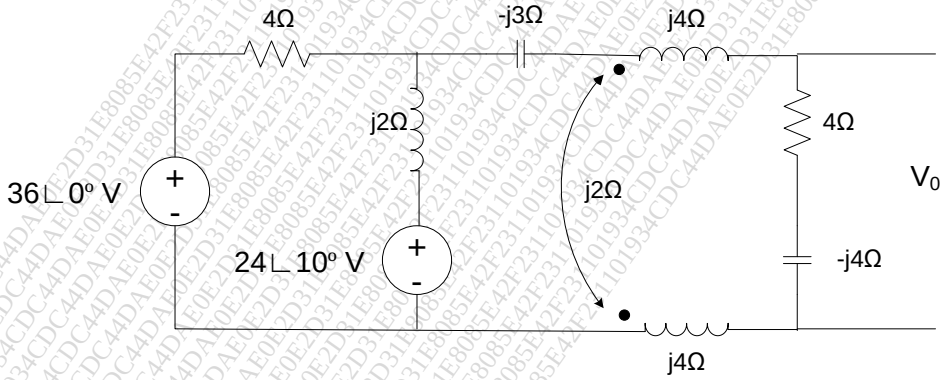
Q5 a) For a series RLC circuit H=1, for its driving point admittance. Pole diagram is given in figure. Find values of R, L and C. 10



Q5 b) Realize Foster I and Foster II for following impedance function 10

$$Z(s) = \frac{(s^2+1)(s^2+3)}{s(s^2+2)}$$

Q6 a) Find V_0 in the network shown 10



Q6 b) Find h_{12}, Z_{12}, Y_{12} and h_{22} for the given two port network . 10