SE/INST/SemIII (CBSGS)/AM-III/Nov-17

Q.P. Code : 13606

c) Expand $f(x) = \begin{cases} \pi x, & 0 < x < 1 \\ 0, & 1 < x < 2 \end{cases}$ period 2 into a Fourier Series. 08

Q.4 a) Prove that 06
$\int x^3 \cdot J_0(x)\, dx = x^3 \cdot J_1(x) - 2x^2 \cdot J_2(x).$

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

c) Solve using Laplace transform $(D^2 - 3D + 2)\, y = 4e^{2t}$ with 08
$y(0) = -3$ and $y'(0) = 5.$

Q.5 a) Prove that $2J_0''(x) = J_2(x) - J_0(x).$ 06

b) Use Laplace transform to evaluate 06
$\int_0^\infty e^{-t} \left(\int_0^t u^2 \sin hu \cos hu\, du \right) dt.$

c) Obtain complex form of Fourier Series for $f(x) = e^{ax}$ in $(-\pi, \pi)$ 08
where a is not an integer. Hence deduce that when α is a constant other than an integer

$$\cos \alpha x = \frac{\sin \pi\alpha}{\pi} \sum \frac{(-1)^n \alpha}{(\alpha^2 - n^2)} e^{inx}$$

Q.6 a) Express the function 06

$$f(x) = \begin{cases} -e^{kx} & for\ x < 0 \\ e^{-kx} & for\ x > 0 \end{cases}$$

as Fourier Integral and hence, prove that

$$\int_0^\infty \frac{\omega \sin \omega x}{\omega^2 + k^2}\, d\omega = \frac{\pi}{2} e^{-kx} \quad if \quad x > 0, k > 0.$$

b) Using Green's theorem evaluate 06

$$\oint_C (e^{x^2} - xy)\, dx - (y^2 - ax)\, dy$$

where C is the circle $x^2 + y^2 = a^2.$

c) Under the transformation $w = \frac{z-1}{z+1}$, show that the map of the straight 08
line $y = x$ is a circle and find its center and radius.

xxx xxx

(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 angle between the surfaces 05
$x \log z + 1 - y^2 = 0, \quad x^2y + z = 2$ at $(1, 1, 1)$.

b) Show that the functions $f_1(x) = 1$, $f_2(x) = x$ are orthogonal on 05
$(-1, 1)$. Determine the constants a and b such that the function
$f_3(x) = -1 + ax + bx^2$ is orthogonal to both f_1 and f_2 on that interval.

c) Find the Laplace transform of $\int_0^t u^{-1}e^{-u} \sin u \, du$. 05

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

Q.2 a) Obtain half- range sine series of $f(x) = x(\pi - x)$ in $(0, \pi)$ and hence, 06
find the value of $\sum \frac{(-1)^n}{(2n-1)^3}$.

b) Prove that 06
$\bar{F} = (y^2 \cos x + z^3)\, i + (2y \sin x - 4)\, j + (3xz^2 + 2)\, k$
is a conservative field. Find the scalar potential for $\bar{F}$.

c) Find the inverse Laplace transform of 08

(i) $\dfrac{s+2}{s^2 - 4s + 13}$

(ii) $\dfrac{1}{(s-a)(s-b)}$

Q.3 a) 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

b) Find the analytic function $f(z) = u + iv$ if 06
$3u + 2v = y^2 - x^2 + 16xy$.

TURN OVER

33FB24E5AE4CF9DAE754A30C944C19CB

SE / INST / CBSGS / Sem III / AE / Dec 2019

Q.P. Code :23584

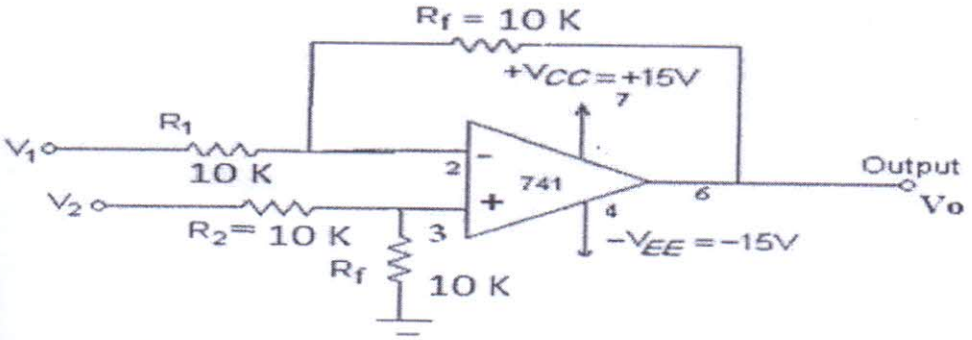
c) Explain total harmonic distortion. **04**

Q.5 a) Explain working of three opamp instrumentation amplifier. Derive again equation. **08**

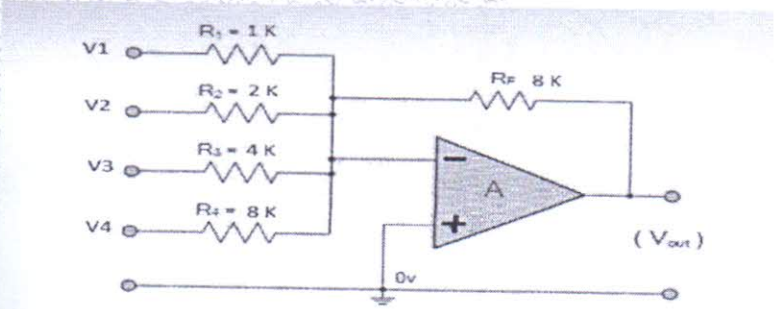
b) Explain RC Phase shift oscillator. **08**

c) Give typical values for OpAmp IC 741. **04**
1) gain Bandwidth Product
2) Output impedance
3) Slew rate
4) CMRR.

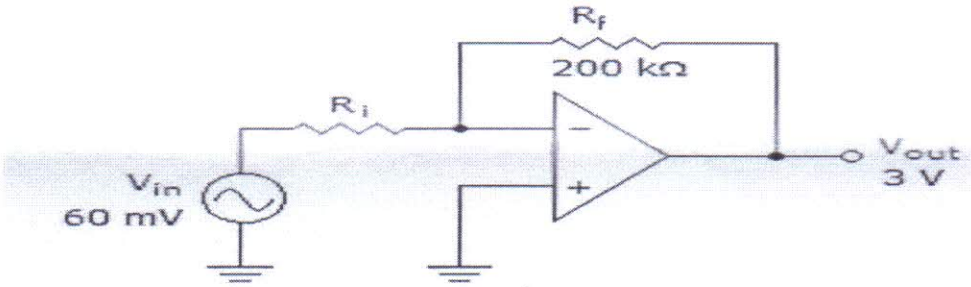
Q.6 a) Derive expression for output voltage and hence determine the output voltage consider $V_1 = V_2 = 2V$. **05**



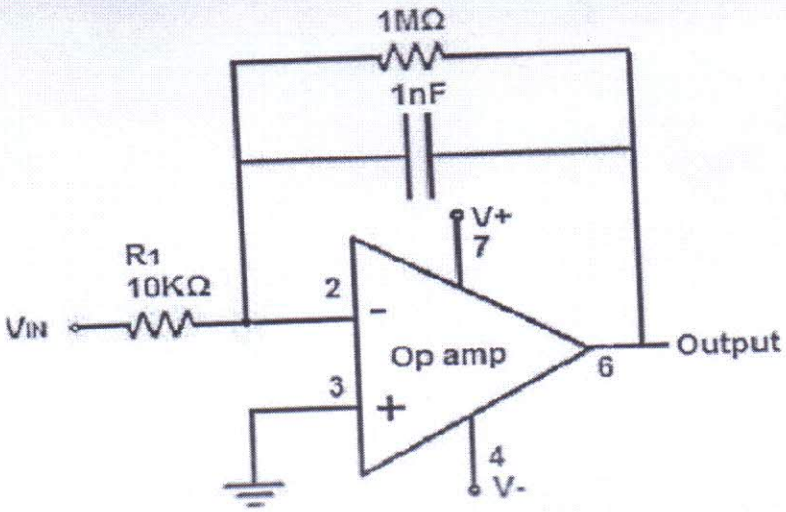
b) Derive the expression for output voltage for the following OpAmp circuit. Determine output voltage if $R_1 = 1K, R_2 = 2K, R_3 = 4K, R_4 = 8K, R_f = 8K, V_1 = 1\,V, V_2 = 0V, V_3 = 1V$ and $V_4 = 1V$. **05**



c) Identify the circuit diagram. Derive the expression for output voltage. Consider $R_f = 200K, V_{IN} = 60mV, V_0 = 3V$. What value of input resistance is needed is needed in the given circuit to produce the given output voltage? **05**



d) Identify the circuit diagram. Derive the expression for output for voltage. **05**



SE/Sem-III (CBSGS) / INST / Electrical Networks Analysis & Synthesis / NOV-17.

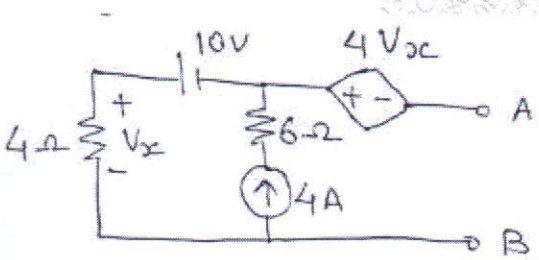
Q.P. Code: 26071

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

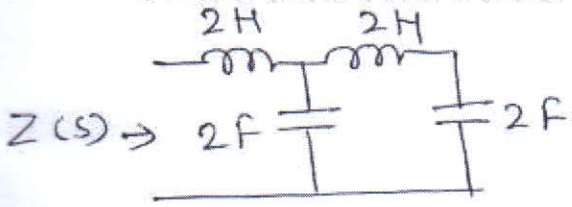
NB. Q.1 is Compulsory.
Solve any three questions from the remaining
Assume suitable data if required and justify it.

Q.1 Attempt any four **20**

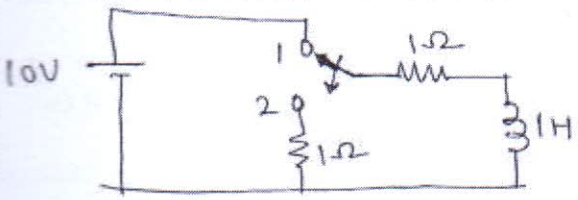
a) Determine Thevenin's equivalent circuit for the given circuit



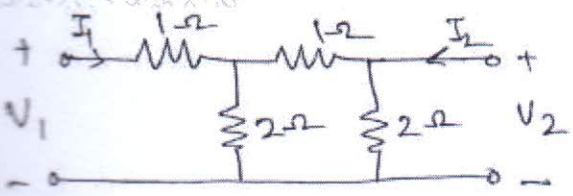
b) Determine driving point impedance function



c) Find i(t) when switch is moved from position 1 to 2 at t =0

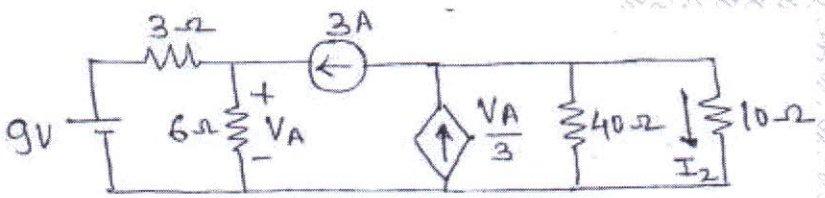


d) Find Z parameters for the shown network



e) Determine the range of values of 'a' so that
$P(s) = s^4 + s^3 + as^2 + 2s + 3$ is Hurwitz

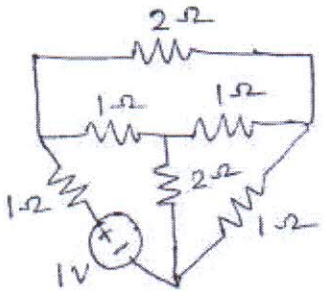
Q.2 a) Find I_2 using superposition theorem **10**



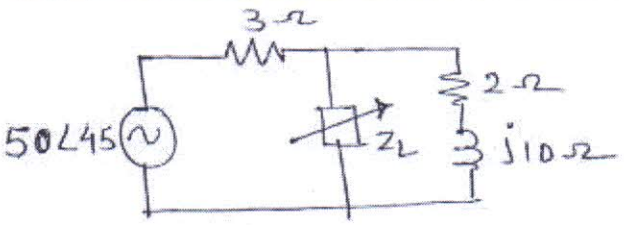
b) For the shown circuit, draw the graph and find: **10**

I. Incidence matrix

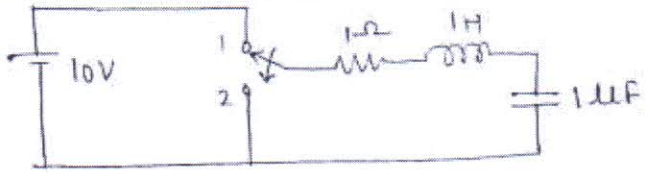
II. f-cutset matrix



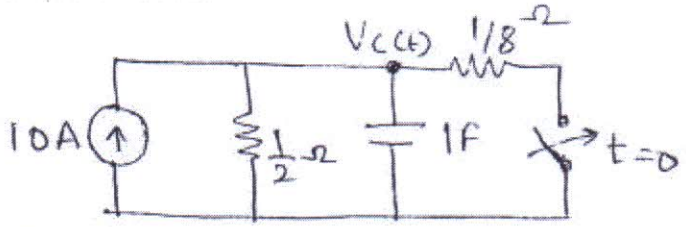
Q.3 a) Find the value of load impedance Z_L so that maximum power can be transferred. Calculate maximum power. **10**



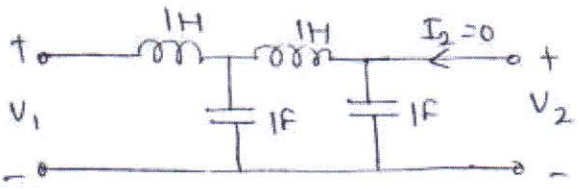
b) For the network, switch is moved from position 1 to 2 at t=0; Find i, di/dt, d^2i/dt^2, d^3i/dt^3 at $t=0^+$ **10**



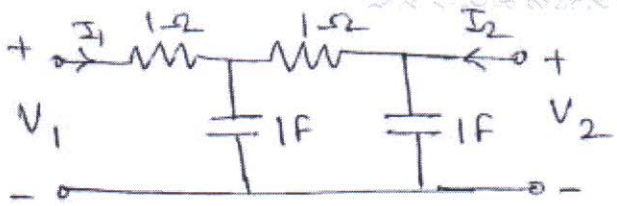
Q.4 a) Find Vc(t). **10**



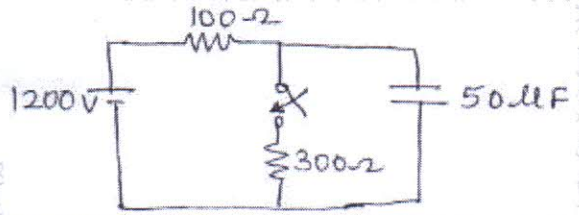
b) Obtain network function V_1/I_1, V_2/V_1 & V_2/I_1 for the network shown **10**



Q.5 a) Determine Y- parameters **10**



b) For the network, switch is open for long time at closes at t=0. Determine Vc(t) **10**



Q.6 a) Test for positive realness **10**

i) $Z(S) = \dfrac{S^2 + 2S + 25}{S + 4}$

ii) $Z(S) = \dfrac{3S^2 + 5}{S(S^2 + 1)}$

b) Synthesize the given function using Cauer-I and Cauer-II forms **10**

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

****

Instrumentation / Sem-III (CBSGS) / Transducers-I. - Dec-2017

Q. P. Code: 24140

MARKS – 80 TIME 3 hrs.

Instructions:

1) **Question no. 1 is compulsory**.
2) Attempt any three questions from the remaining questions.
3) Assume suitable data wherever required.

Q.1 Answer in brief (any Five) (20)

a) Compare accuracy and precision with suitable example.
b) Classify transducers with example of each.
c) What do you mean by calibration? What is need of calibration?
d) Explain cold junction compensation in thermocouples.
e) Explain the working principle of bubbler type level-gauge.
f) Distinguish between direct and indirect methods of level measurement with example of each of these methods.

Q.2a) Discuss the role of National Physical Laboratory in metrology. Write its advantages and disadvantages. (10)

b) Explain ultrasonic liquid level measurement system with its advantages. (10)

Q.3) Draw and explain the block diagram of generalised measurement system. (10)

b) A thermistor has a resistance of 3980 Ω at the ice point (0°C) and 790 Ω at 50 °C. The resistance-temperature relationship is given by $R_T = a R_0 \exp(b/T)$. (10)
i) calculate the constants a and b
ii) Calculate the range of resistance to be measured in case the temperature varies from 50 °C and 100 °C.

Q.4 a) List different methods of humidity measurement and explain any one in detail. (10)

b) State different types of pyrometers. Explain with a neat sketch any one of them. (10)

Q.5 a) Compare RTD, thermistor and thermocouple on the basis of--- (10)
i) Working Principle
ii) Sensitivity
iii) Linearity
iv) Ranges
v) Applications.

b) The output of a LVDT is connected to 5V voltmeter through an amplifier whose amplification factor is 200. An output of 2 mV appears across the terminals of LVDT when core moves through a distance of 0.5mm. Calculate sensitivity of the LVDT and that of the whole setup. The milivoltmeter scale has 100 divisions. The scale can read of 1/5 of division. Calculate the resolution of the instrument in mm. (10)

Q.6 a) Write short note on Encoders. (10)

b) Explain the law of intermediate temperatures and law of intermediate metals in case of thermocouple and give its significance (10)
