Duration : 3 Hours   **Max. Marks: 80**

N.B . 1) Question No. 1 is compulsory .

2) Attempt any three questions out of the remaining five questions .

3) Figures to the right indicate full marks .

1. (a) Find the Laplace transform of $f(t) = t.\sinh 3t.\sin t.\cos t.e^{-t}$.   5

(b) Find the Fourier series for $f(x) = x^3$ in $(-\pi, \pi)$ 5

(c) Find the directional derivative of $\emptyset(x, y, z) = yx^3 + zy^3 + xz^3$ at   5

point A(0,-1,1) in the direction of BA where B is (1,2,3).

(d) Determine Constant 'm' if F(z)= $r^7 \cos m\theta + ir^m \sin 7\theta$.   5

2. (a) Find Fourier cosine integral representation of the function $f(x) = e^{-ax}$, $x \geq 0$ 6

and hence show that $\int_0^\infty \frac{\cos\omega s}{1+\omega^2} d\omega = \frac{\pi}{2}e^{-x}$, $x \geq 0$

(b) Solve using Laplace transform $(D^2 + 4)y = 1 + 9t,$ 6

if $(0) = 0$, $Dy(0) = 0$.

(c) Find the Fourier series for $f(x) = \begin{cases} 0 & -\pi \leq x \leq 0 \\ x & 0 \leq x \leq \pi \end{cases}$ 8

Hence Find the value for $\frac{\pi^2}{8}$

3) (a) Show that $\vec{F} = (ye^{xy}\cos z)i + (xe^{xy}\cos z)j - (e^{xy}\sin z)k$ is   6

irrotational , hence find its Scalar potential function .

(b) Find Fourier Series for the following function   6

$$f(x) = \begin{cases} (x - \pi)^2 & 0 \leq x \leq \pi \\ \pi^2 & \pi \leq x \leq 2\pi \end{cases}$$

(c) Evaluate $\int_0^\infty \frac{9}{e^t} \int_0^t (u^2.e^{-3u}.\sin 4u.)du$.dt   8

4) (a) Find the bilinear transformation which maps the points   6

$z = 0,1,\infty$ onto the points $w = -1, \infty, 3$.

(b) By using Stokes theorem evaluate $\int_C \vec{F}.\overrightarrow{dr}$ where

$\vec{F} = (x^2 + x)i + (2xy)j$ and C is the boundary of the region enclosed by

rectangle $x = 0, y = 0, x = p, y = q$ 6

(c) Find Inverse Laplace transform

$i) \left\{ \dfrac{e^{-2s}\, s}{(s+4)^3} \right\}$ $ii) \log\left\{ \dfrac{s^2-4}{s^2+121} \right\}$ 8

5) a) Define Orthogonal set of functions on (a,b) ,Show that the functions $\emptyset_1(x) = 1$,

$\emptyset_2(x) = 4x$ are orthogonal on (-1,1). Determine the constants P , Q such that

$\emptyset_3(x) = Px^2 + Qx^3 + 4$ is orthogonal to both $\emptyset_1(x)$ & $\emptyset_2(x)$

on the same interval .   6

(b) Find the analytic function $f(z) = u + iv$ in terms of Z if   6

$7u - 4v = x^3 + x^2 - 3xy^2 - y^2 - 3yx^2 + y^3 - 2xy$.

(c) Verify Green's theorem for $\int_C (3x^2)dx + (2xy)dy$,

C is a triangle whose vertices are A(0,2) , B(2,0) , C(4,2) in the XY-plane .   8

6) (a) Find Laplace transform of $f(t) = R\dfrac{t}{T}$ for $0 < t < T$ and $f(t) = f(t + \pi)$.   6

(b) Prove that $w = i\left(\dfrac{z-i}{z+i}\right)$ maps upper half of the Z-plane into the interior   6

of the unit circle in the W-plane .

(c) Obtain Complex form of Fourier series for $f(x) = \cosh3x + \sinh3x$ in $(-3,3)$ 8

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Q. P. Code : 37822

[Time: Three Hours]　　　　　　　　　　　　　　　　　　　　　　[Marks:80]

N.B:　1. Question.No.1 is compulsory.
　　　　2. Attempt any three questions from remaining five questions.
　　　　3. Assume suitable data wherever necessary.

Q.1　　　Attempt **any four** questions.　　　　　　　　　　　　　　　　　　20
　　a) Compare CB, CE and CC configuration.
　　b) How FET is employed as voltage control resistor?
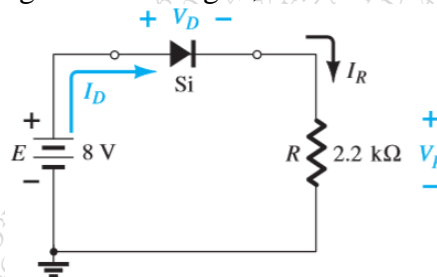　　c) For the series diode configuration of Fig. 1, determine V_D , V_R , and I_D

Fig. 1

　　d) What are the characteristics of Ideal op-amp?
　　e) Cross over distortion is behavior is characteristic of class A power. State true or False
　　　with reason.

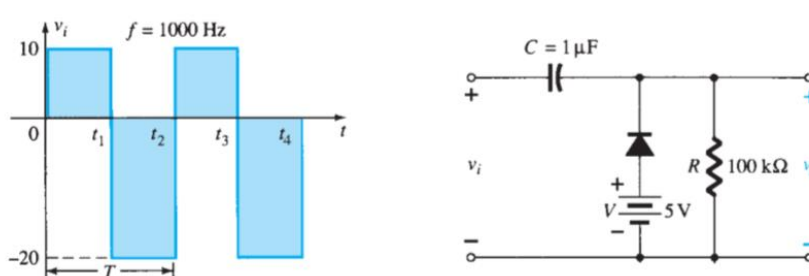Q.2　　a) Determine V_0 for the network of Fig. 2 for the input indicated.　　　　　6

Fig. 2

　　b) For the Zener diode network (Fig. 3), determine V_L, V_R, I_z and P_z. Consider supply　8
　　　voltage of 16V, Zener voltage of 10V, series resistance of 10KΩ and load resistance
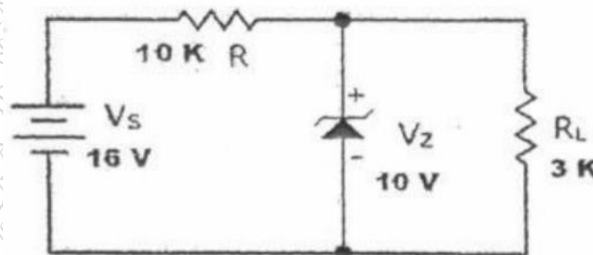　　　of 3KΩ.

Fig. 3

　　c) Explain the working of Bridge rectifier with neat circuit and waveforms.　　　6

46D3B683026F7927DA11E9601A8F5A1D

Q.3   a)   Determine the following parameters for the fixed-bias configuration of Fig. 4.   10

I_{B_Q} and I_{C_Q}.
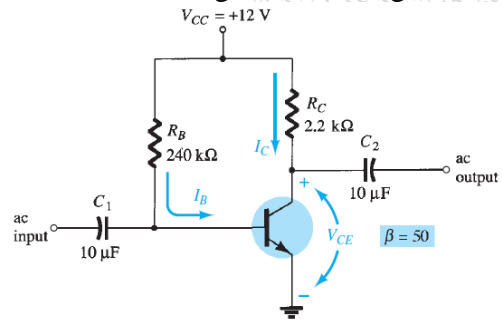V_{CE_Q}.
V_B and V_C.
V_{BC}.

Fig.4

    b)   Derive the expression of stability factor for a voltage divider biasing Bias network.   10

Q.4   a)   Determine the following parameters for the network of Fig.5.   10

      I. V_{GS_Q}.
      II. I_{D_Q}.
      III. V_{DS}.
      IV. V_S.
      V. V_G.
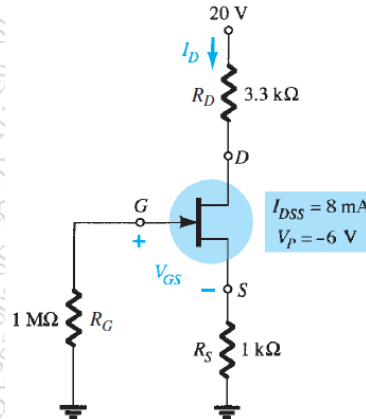   VI. V_D.

Fig.5

    b)   Explain with a neat diagram a transformer coupled audio power amplifier.   10

Q.5   a)   Draw and explain working of Schmitt trigger (inverting and non-inverting   10
configuration) with input and output waveforms.

    b)   Derive the expression for the instrumentation amplifier. Calculate the gain of fig.6.   10
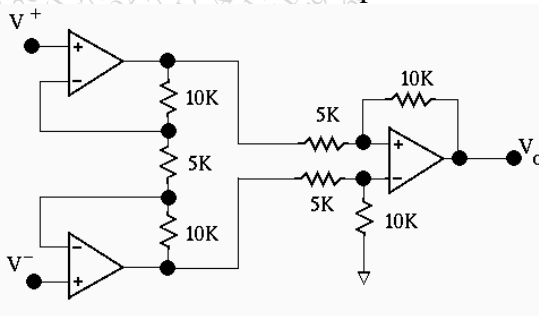

Fig. 6

Q.6   a)   Draw and explain series voltage regulator.   10
    b)   Draw the circuit and find the frequency of oscillation for Wein bridge oscillator.   10
       Explain its operation.

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Q.P. Code: 27379

Time : 3 hours   **Marks: 80**

N.B.:(1) Question No. 1 is compulsory.
(2) Attempt any 3 out of remaining
(3) Figures indicate to the full marks.
(4) Assume suitable data if necessary.

Q.1   Answer the following.   20

a. Classify transducers with suitable example.

b. Define a) Accuracy   b) Sensitivity

c. Explain working principle of-

       i) Piezo electric transducers
       Ii) Piezo resistive transducers

d. Find   seebeck voltage for a thermocouple with proportionality constant of $40\mu V/°C$

    If the junction temperature are 40°C and 80°C.

e. Explain level measurement by using float.

Q.2

a) Draw and explain working of LVDT. What causes residual voltage to occur?   10

b) i) A voltmeter with internal resistance of 200 KΩ is connected across an unknown
resistance. It reads 250 V and a milliammeter (with very small internal resistance)
connected in series with same resistance reads 10 mA. Determine Apparent resistance,
actual resistance & loading error due to loading effect of the voltmeter.

  ii) If the same voltmeter & milliammeter when connected in another resistance read 100 V

& 2 A respectively, determine the loading error in this case.   10

Q.3

a) Explain any five static characteristics of transducer with suitable examples.   10

b) What is the need of lead wire compensation? How it is to be done in RTD? What is self
heating effect in RTD?   10

Q.4

a) For a certain thermistor β =3140 K and at 27°C is known to be 1050 Ω. The thermistor is used for temperature measurement and the resistance measured is as 2330 Ω. Find the measured temperature.   10

b) Draw set up and explain working of air purge method of level measurement.   10

Q.5

a) Explain in detail radioactive type level detector.   10

b) A capacitive transducer uses two quartz diaphragm of area 750 mm^2 separated by a distance of 3.5 mm. A pressure of 900 KN/m^2 when applied to top diaphragm produces a deflection of 0.6 mm. The capacitance is 370 pF when no pressure is applied to the diaphragm. Find the value of capacitance after the application of pressure 900 KN/m^2.   10

Q.6 Write short notes   20

a) Optical pyrometer

b) Rotary encoder

c) Types of error

d) Calibration & need of calibration

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(3 Hours) [Total Marks: 80]

N.B: (1) Question No. **1** is compulsory.
   (2) Attempt any **THREE** questions from remaining.
   (3) Figures to the right indicate full marks.
   (4) Assume suitable data if necessary.

1. Answer the following:- [20]

   (a) State and Prove De Morgan's theorems.
   (b) How keyboard debouncing is eliminated using flip flop?
       Explain with suitable circuit diagram.
   (c) What are the merits and demerits of TTL family?
   (d) Simplify the following expression using K Map.
       $F = \sum (0,1,4,5,6,8,12)$.

2. (a) Convert :- i) $(2645.71)_{10}$ to Octal, Binary and Hexadecimal. [10]
                ii) Add $(83)_{10}$ and $(34)_{10}$ in BCD

   (b) Perform: - i) $(73)_{16} - (1C)_{16}$ [05]
                ii) $(958)_{10} = (?)_{BCD} = (?)_{Hex}$

   (c) Compare demultiplexer and decoder. [05]

3. (a) Prove the following using Boolean algebra and draw the logic circuit. [10]
       i. $\overline{A}\overline{B}CD + \overline{A}BCD + ABD = BD$
       ii. $A \cdot (A+B) = A$

   (b) Design 2-bit comparator using gates. [10]

4. (a) Design 4 bit Binary to Gray code converter. [10]
   (b) Implement full adder using logic gates. [10]

5. (a) Design a Decade Counter (Binary Asynchronous) with timing diagram. [10]
   (b) What is Shift register? Explain the working of 4-bit bidirectional shift register. [10]

6. Write note on: - (**Any Four**) [20]

       (a) PAL and PLA.
       (b) Hamming code.
       (c) Johnson Counter.
       (d) Hazards in Combinational logic.
       (e) Basic dynamic RAM Cell.

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

N.B: 1.   Question.No.1 is compulsory.
         2.   Attempt any three questions from remaining five questions.
         3.   Assume suitable data wherever necessary.
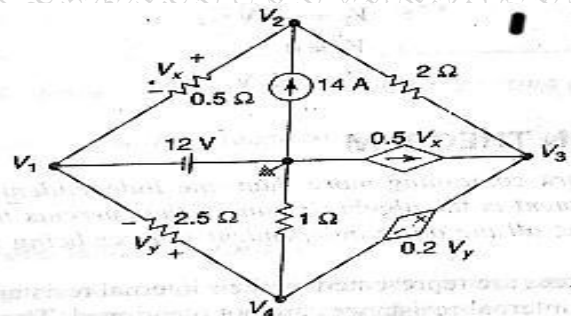
1   Attempt the following.   20
   a   Explain construction and working of series type ohmmeter.
   b   Explain the construction of Schering Bridge.
   c   Determine the range of values 'a' so that $P(s) = s^4 + s^3 + as^2 + 2s + 3$ is Hurwitz.
   d   In the given network the switch is closed at t= 0. With the capacitor uncharged find i, $\frac{di}{dt}$, at t= 0$^+$
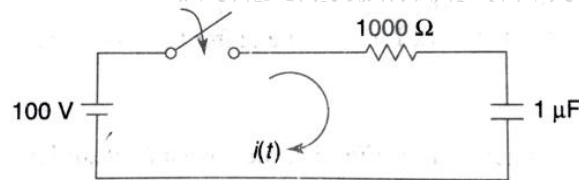
2 a   Find the node voltages in the network shown below.   10

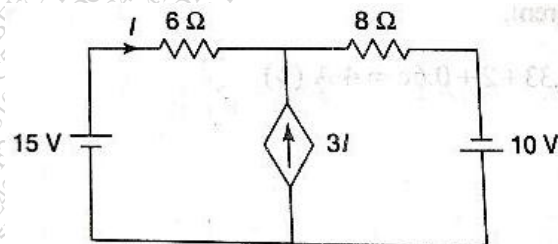   b   Explain the construction and working of PMMI electrical instrument.   10

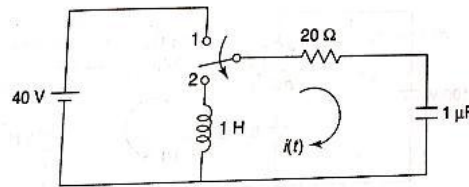3 a   State how a Megger is Constructed and its working in your own words.   10
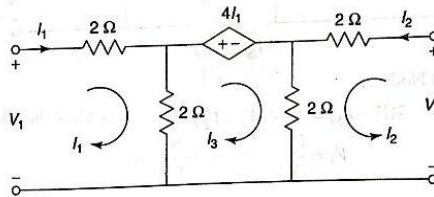   b   Find the current through the 6 Ω resistor :   10
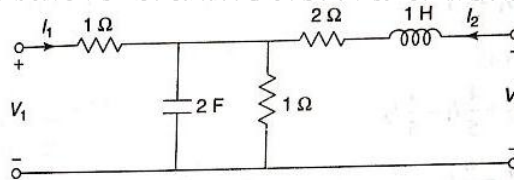

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4   a   In the network shown below the switch is changed from the position 1 to position 2 at t = 0   10
steady condition having reached before switching. Find the values of i , $\frac{di}{dt}$, at t= 0$^+$.

   b   Find Z and h parameters for the network shown below.   10

5   a   Determine the short circuit admittance parameters for the network shown below.   10

   b   Test whether polynomial ;   10
       $P(s) = s^4 + 7s^3 + 6s^2 + 21s + 8$ is Hurwitz or not.

6   a   Test whether polynomial is Hurwitz or not;   10

       i) $P(s) = s^4 + 5s^3 + 5s^2 + 4s + 10$
       ii) $P(s) = s^5 + 3s^3 + 2s$

   b   In the network shown below determine V_a and V_b.   10

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