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06MAT31

Third Semester B.E. Degree Examination, Dec.09/Jan.10

Engineering Mathematics - III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Obtain Fourier series for the function f(x) given by

$$f(x) = \begin{cases} 1+\frac{2x}{\pi}, & -\pi \le x \le 0 \\ 1-\frac{2x}{\pi}, & 0 \le x \le \pi \end{cases}$$

and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+.............$ **(07 Marks)**

b. Find the half-range cosine series for the function $f(x) = (x-1)^2$ in the interval $0 < x < 1$. **(07 Marks)**

c. Obtain the constant term and the coefficients of the first sine and cosine terms in the Fourier expansion of y as given in the following table. **(06 Marks)**

x	0	1	2	3	4	5	6
y	9	18	24	28	26	20	9

2 a. Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & |x| \le 0 \\ 0, & |x| > \pi \end{cases}$.

Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3}.\cos\left(\frac{x}{2}\right)dx$ **(07 Marks)**

b. Find the Fourier cosine transform of e^{-x^2} **(07 Marks)**

c. Find the Fourier sine transform of $e^{-|x|}$. Hence show that $\int_0^\infty \frac{x\sin mx}{1+x^2}dx = \frac{\pi}{2}.e^{-m}$, $m > 0$. **(06 Marks)**

3 a. Form the partial differential equation by eliminating the arbitrary functions f and g from the relation $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$ **(07 Marks)**

b. Solve $\frac{\partial^3 t}{\partial x^2 \partial y} + 18xy^2 + \sin(2x-y) = 0$ **(07 Marks)**

c. Solve $(mz-ny)\frac{\partial z}{\partial x} + (nx-lz)\frac{\partial z}{\partial y} = (ly-mx)$ **(06 Marks)**

4 a. Derive one dimensional heat equation by taking u(x, t) as the temperature, x is the distance and t is the time. (Write the figure also.) **(07 Marks)**

b. Obtain the D'Almbert's solution of the wave equation $u_{tt} = C^2 u_{xx}$, subject to the condition $u(x, o) = f(x)$ and $\frac{\partial u}{\partial t}(x, o) = o$. **(07 Marks)**

c. Obtain the various solutions of the Laplace's equation $u_{xx} + u_{yy} = 0$, by the method of separation of variables. **(06 Marks)**

PART – B

5 a. Complete the real root of the equation $x\log_{10}x - 1.2 = 0$ by Regula-Falsi method, correct to four decimal places. **(07 Marks)**

b. Solve the system of equations using Gauss-Jordan method:

$$2x + 5y + 7z = 52$$
$$2x + y - z = 0$$
$$x + y + z = 9$$

(07 Marks)

c. Using the power method, find the largest Eigen value and the corresponding Eigen vector of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ **(06 Marks)**

6 a. The area of a circle (A) corresponding to diameter (D) is given below: **(07 Marks)**

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the area corresponding to diameter 105 using an appropriate interpolation formula.

b. Use Newton's divided difference formula to find f(9), given the data, **(07 Marks)**

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

c. Evaluate $\int_4^{5.2} \log_e x \, dx$ using Weddle's rule, taking 7 ordinates. **(06 Marks)**

7 a. Derive Euler's equation in the form

$$\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$$

(07 Marks)

b. Find the curves on which the functional $\int_0^1 \left[(y')^2 + 12xy\right] dx$, with $y(0) = 0$ and $y(1) = 1$can be extremised. **(07 Marks)**

c. Find the geodesics on a surface given that the arc length on the surface is $S = \int_{x_1}^{x_2} \sqrt{x[1 + (y')^2]}\, dx$ **(06 Marks)**

8 a. Find the Z-transforms of the following :

i) $\cosh n\theta$ ii) $(n + 1)^2$ **(07 Marks)**

b. Find the inverse z-transform of $\frac{z}{(z-1)(z-2)}$. **(07 Marks)**

c. Find the response of the system $y_{n+2} - 5y_{n+1} + 6y_n = u$, with $y_0 = 0$, $y_1 = 1$ and $u_n = 1$ for n = 0, 1, 2, 3, ... by z-transform method. **(06 Marks)**

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06ES32

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or Equations written eg, 42+8=50, will be treated as malpractice.

PART – A

1 a. Describe how diffusion and transition capacitances differ. **(05 Marks)**

b. A full wave bridge rectifier is supplied from the transformer secondary voltage of 100 V. Calculate the dc output voltage and peek inverse voltage of the diodes employed. **(05 Marks)**

c. For the clipper circuit shown in the Fig.1(c), the input is V_i = 50 Sin wt. Calculate and plot to scale the transfer characteristic, indicating slopes and intercepts. **(10 Marks)**

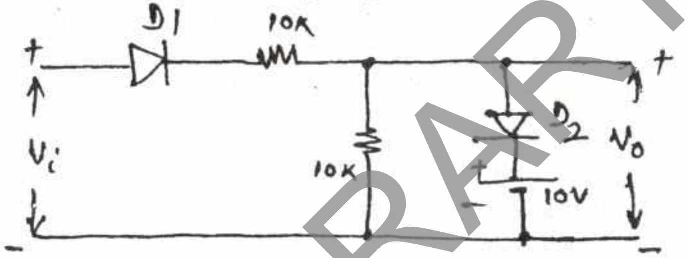


Fig.1(c).

2 a. Determine the voltage V_{cE} and I_c for the voltage divider configuration shown in Fig.2(a). **(10 Marks)**

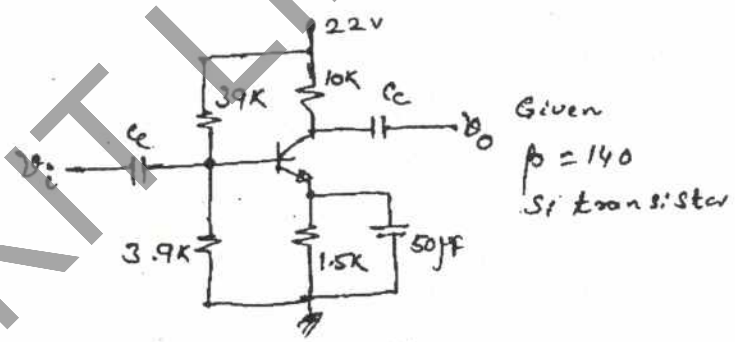


Fig.2(a).

b. Determine R_1 and R_c for the network of Fig.2(b). Given I_{CQ} = 2 mA, V_{CEQ} = 10 V. Assume S_i transistor. **(10 Marks)**

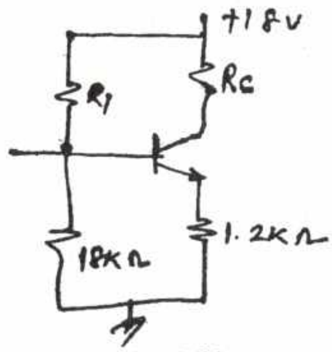
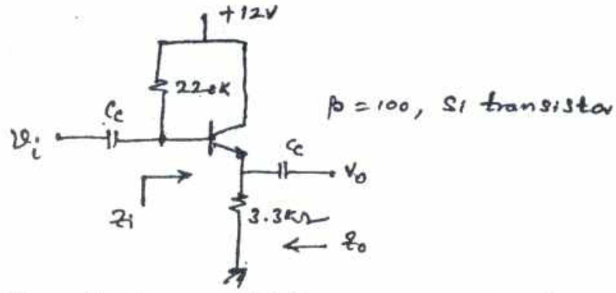


Fig. 2(b)

3 a. For the emtter – follower network of Fig.3(a), using r_e model determine: i) r_e ; ii) z_i ; iii) z_o ; iv) A_V ; v) A_I. **(10 Marks)**

Fig.3(a).



b. Using complete hybrid equivalent model for a two part system derive expressions for A_i, A_V, z_i and z_o. **(10 Marks)**

4 a. Prove that Miller effect capacitance $C_{Mi} = (1 - A_v)\, c_f$ and $C_{Mo} = \left(1 - \frac{1}{A_V}\right) c_f$. **(10 Marks)**

b. A four stage amplifier has a lower 3 db frequency for an individual stage of f_1 = 40 Hz and individual upper 3 db frequency of f_2 = 2.5 MHz. Calculate the overall lower 3 db and upper 3 db frequency of this full amplifier. Derive the expressions used. **(10 Marks)**

PART – B

5 a. Explain with the help of circuits what is cascade connection and cascode connection. What are the advantages of these connections? **(10 Marks)**

b. Explain the important advantages of a negative feedback amplifier. **(04 Marks)**

c. List the four types of feedback connections. Show one practical circuit for each feedback connection. **(06 Marks)**

6 a. Explain the working of a transformer coupled class B push pull amplifier. **(10 Marks)**

b. A Class B amplifier provides a 20 V peak signal to a 16 ohm load and a power supply of V_{cc} = 30 V. Determine the input power, output power and circuit efficiency. **(05 Marks)**

c. Calculate the harmonic distortion components for an output signal, having a fundamental amplitude of 2.5 V, second harmonic amplitude of 0.25 V, third harmonic amplitude of 0.1 V and fourth harmonic amplitude of 0.05 V. Also calculate the total harmonic distortion. **(05 Marks)**

7 a. Explain Barkhausen criterion for oscillations. **(05 Marks)**

b. With the help of a need circuit diagram, explain the working of Hartley oscillator. **(07 Marks)**

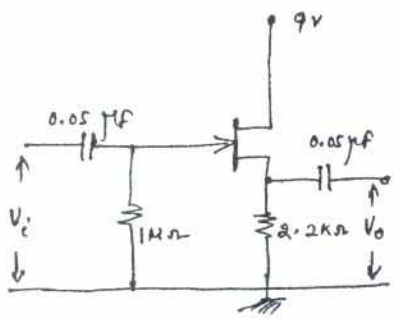
c. List the advantages of a crystal oscillator. Explain the working of a series resonant crystal oscillator. **(08 Marks)**

8 a. List three advantages of PET over BJT. **(03 Marks)**

b. With a neat circuit diagram, explain potential divider biasing of JFET. **(07 Marks)**

c. Calculate the voltage gain and input and output impedance for the circuit of Fig.8(c). **(10 Marks)**

Fig.8(c).



Given:
I_{DSS} = 16 mA
V_p = - 4V
r_d = 40 K Ω
V_{GSQ} = - 2.86 V.

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06ES33

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Logic Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8=50, will be treated as malpractice.

PART – A

1 a. Show that $y = f(ABCD) = \sum (0, 2, 5, 7, 8, 10, 13,15)$ is the complement of $y = f(ABCD) = \pi(1, 3, 4, 6, 9, 11, 12, 14)$. Illustrate your answer using Karnaugh map to show the complement nature of the two equations. Realize both the functions using 7486 IC chip [Exclusive OR gates] only. **(12 Marks)**

b. Design a logic circuit that controls the passage of a signal 'A' according to the following requirement.
   i) Output 'X' will equal 'A' when control inputs B and C are the same.
   ii) 'X' will remain 'HIGH' when B and C are different
   Implement the circuit using suitable gates. **(08 Marks)**

2 a. Simplify the following expression using Quine- McClusky technique. Implement the simplified circuit using basic gates: $f(ABCD) = \sum (1, 3, 4, 5, 6, 9, 11, 12, 13, 14)$. **(12 Marks)**

b. Simplify the following Boolean expression using VEM technique. [3 variable map].
$f(ABCD) = \sum m(0, 4, 5, 6, 13, 14, 15) + dc(2, 7, 8, 9)$

A	B	C	D	f	A	B	C	D	f
0	0	0	0	1	1	0	0	0	ϕ
0	0	0	1	0	1	0	0	1	ϕ
0	0	1	0	ϕ	1	0	1	0	0
0	0	1	1	0	1	0	1	1	0
0	1	0	0	1	1	1	0	0	0
0	1	0	1	1	1	1	0	1	1
0	1	1	0	1	1	1	1	0	1
0	1	1	1	ϕ	1	1	1	1	1

ϕ = don't care term. **(08 Marks)**

3 a. Design a logic circuit using a 3 to 8 logic decoder that has active low data inputs, an active HIGH enable and active low data outputs. Use such a decoder to realize the full adder circuit. **(08 Marks)**

b. Design a suitable BCD adder circuit using 74LS83 and a provision has to be made for self correction in case if the sum is not a valid BCD number format. **(12 Marks)**

4 a. Implement the following Boolean function using 4 :1 MUX
$y(ABCD) = \sum m(0, 1, 2, 4, 6, 9, 12, 14)$. **(10 Marks)**

b. Design a circuit that accepts 2 unsigned 4 bit numbers and provides 3 outputs. The inputs are $A_3 A_2 A_1 A_0$ and $B_3 B_2 B_1 B_0$. Outputs are A = B, A > B and A < B. Draw the logic diagram. **(10 Marks)**

PART – B

5 a. Explain the following:
   i) Switch debouncing and it's elimination
   ii) Race around problem and its elimination. **(14 Marks)**

  b. Obtain the characteristic equation for the following flip flops:
   i) JK flip flop
   ii) SR flip flop. **(06 Marks)**

6 a. With the help of a diagram, explain the following with respect to shift register:
   i) Parallel in and serial out
   ii) Ring counter and twisted ring counter. **(08 Marks)**

  b. Design a Mod – 5 synchronous counter using JK flip flop. **(12 Marks)**

7 a. With a suitable example, explain Mealy and Moore model in a sequential circuit analysis. **(10 Marks)**

  b. A sequential circuit has one input and one output. The state diagram is as shown in Fig.7(b). Design a sequential circuit with 'T' flip flop. **(10 Marks)**

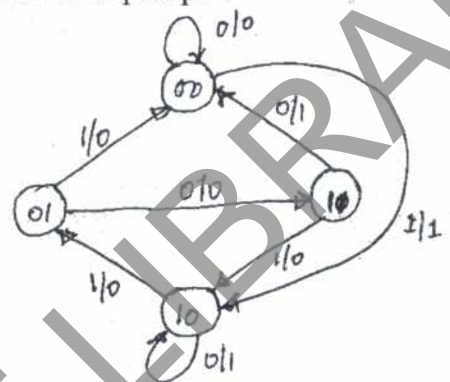

Fig.7(b).

8 a. Analyse the following sequential circuit shown in Fig.8(a) and obtain:
   i) Flip flop input and output equations.
   ii) Transition equation
   iii) Transition table
   iv) State table
   v) Draw the state diagram. **(12 Marks)**

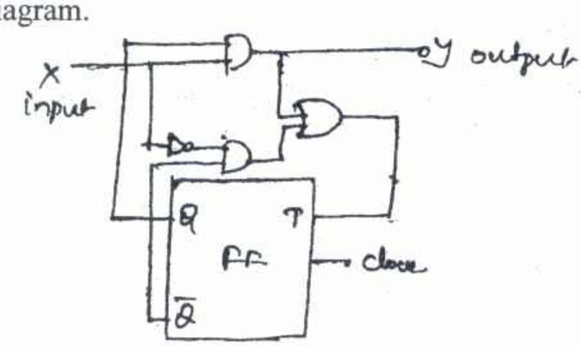

Fig.8(a).

  b. With a suitable example and appropriate state diagram, explain how to recognize a particular sequence. Ex: 1011. (Any sequence can be assumed). **(08 Marks)**

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06ES34

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Network Analysis

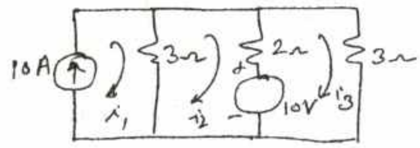
Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Write the mesh equations for the circuit shown in Fig.1 and solve for currents i_1, i_2 and i_3. **(10 Marks)**

Fig.1(a)



b. The node voltage equations of a network are

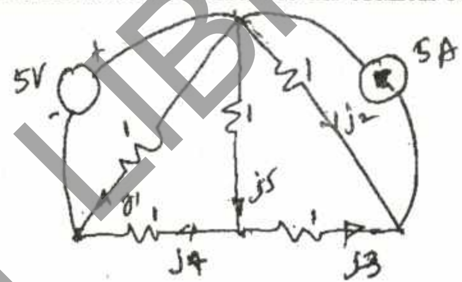
$$\left(\frac{1}{5}+\frac{1}{2}j+\frac{1}{4}\right) v_1 - \frac{1}{4} v_2 = \frac{50\angle 0^\circ}{5} \text{ and } -\frac{1}{4} v_1 + \left(\frac{1}{4}-\frac{1}{j2}+\frac{1}{2}\right) v_2 = \frac{50\angle 90^\circ}{2}.$$

Derive the network. **(10 Marks)**

2 a. Define the following terms with respect to the network topology. Give examples.
i) Tree ; ii) Graph ; iii) Sub graph ; iv) Tieset ; v) Cutset. **(08 Marks)**

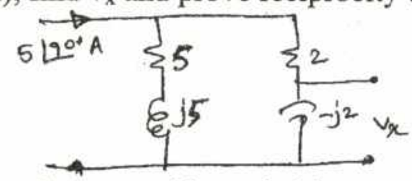
b. For the network shown in Fig.2(b), write the graph and obtain the tieset schedule considering j_1, j_2, j_5 as tree branches. Also calculate all branch currents. **(12 Marks)**

Fig.2(b)



3 a. In the circuit shown in Fig.3(a), find v_x and prove reciprocity theorem. **(10 Marks)**

Fig.3(a)



b. State and explain super position theorem with a suitable example. **(10 Marks)**

4 a. Obtain the Thevenin's equivalent network for the circuit in Fig.4(a) between the terminals X and Y. **(10 Marks)**

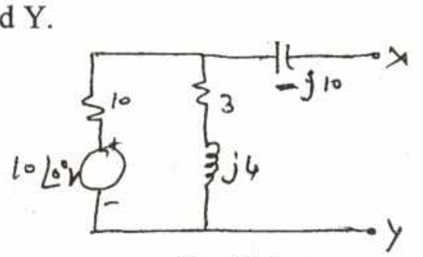


Fig.4(a).

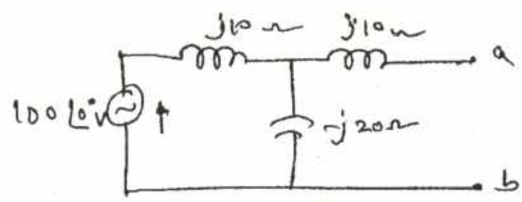


Fig.4(b).

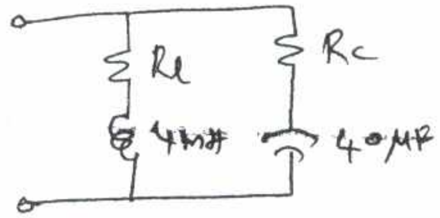
b. What should be the value of pure resistive load to be connected across the terminals a and b in the network shown in Fig. 4(b), so that maximum power is transferred to the load? Calculate the maximum power. **(10 Marks)**

PART – B

5 a. Show that for a series RLC resonant circuit the selectivity $\varphi = \frac{f0}{f2 - f1}$, where fo: resonate frequency f1 and f2 are half power frequency. **(08 Marks)**

b. Determine R_L and R_C for which the circuit shown in Fig.6 resonates at all frequencies. **(06 Marks)**

Fig.5(b)



c. It is required that a series RLC circuit should resonate at 1 MHz. Determine values of R, L and C if bandwidth of the circuit is 5 kHz and its impedance is 50 Ω at resonance. **(06 Marks)**

6 a. Explain the importance of study of initial conditions in electric circuit analysis. **(06 Marks)**

b. Explain the behaviour of R, L and C elements for transients. Mention their representation at the instant of switching. **(06 Marks)**

c. In the circuit shown in Fig.6(c), the switch is moved from 'a' to 'b' at t = 0. Find the values of i, $\frac{di}{dt}, \frac{d^2i}{dt^2}$ at $t = 0^+$, if R = 1 Ω, L = 1 H, C = 0.1 μF and V = 100 V. Assume steady state is achieved when k is at 'a'. **(08 Marks)**

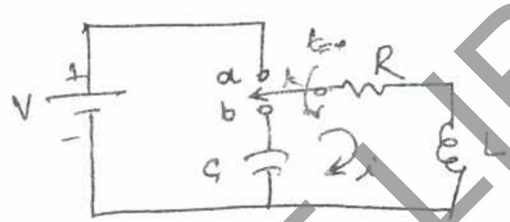


Fig.6(c).

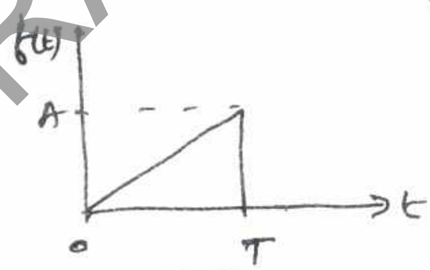


Fig.7(a).

7 a. Obtain the Laplace transform of saw took waveform shown in Fig.7(a). **(06 Marks)**

b. Find the Laplace transform of i) δ (t) ; ii) t ; iii) e^{-at}. **(06 Marks)**

c. Find f (o) and f (∞) using initial value and final value theorem for the function given below.

$$F(s) = \frac{s^3 + 7s^2 + 5}{s(s^3 + 3s^2 + 4s + 2)}.$$ **(08 Marks)**

8 a. Find y parameters for the network shown in Fig.8(a). **(08 Marks)**

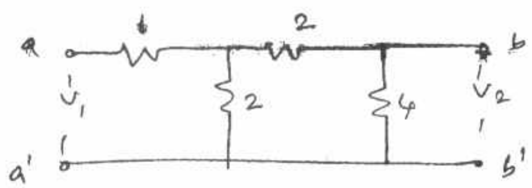


Fig.8(a).

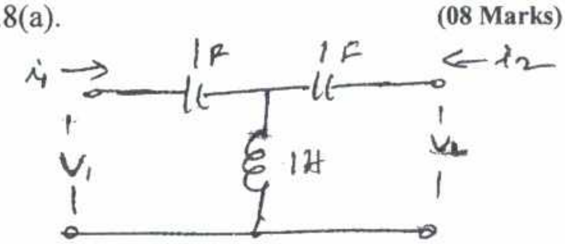


Fig.8(b)

b. Determine the 'h' parameters for the network shown in Fig.8(b). **(08 Marks)**

c. Mention the application of

i) Transmission parameters ; ii) 'h' parameters ; iii) 'z' parameters. **(04 Marks)**

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06IT35

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the following:
i) Systematic errors ii) Relative errors. **(04 Marks)**

b. Explain the working principle of multi-range voltmeter, with the help of suitable circuit diagram. **(08 Marks)**

c. Convert a basic meter movement with an internal resistance of 50 Ω and a full scale deflection current of 2 mA in to a multi-range 'dc' voltmeter with voltage ranges of 0-10V, 0-50V, 0-100V and 0-250V with following Fig.1(c). **(08 Marks)**

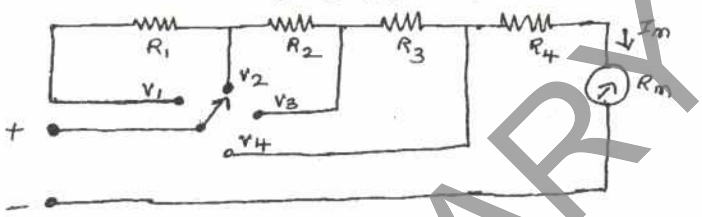

Fig.1(c).

2 a. Explain the ramp type digital voltmeter with the help of block diagram. **(10 Marks)**

b. Explain the digital multimeter with basic circuit diagram. **(10 Marks)**

3 a. Explain the C.R.T. features briefly. **(06 Marks)**

b. With the basic block diagram, explain the principle of operation of simple C.R.O. **(08 Marks)**

c. Explain the operation of an electronic switch, with the help of a block diagram. **(06 Marks)**

4 a. Explain the principle and operation of sampling oscilloscope. What are its advantages and disadvantages? **(10 Marks)**

b. Explain the operation of digital storage-oscilloscope with the help of a block diagram. Mention the advantages. **(10 Marks)**

PART – B

5 a. With a block diagram, explain modern laboratory signal generator. **(10 Marks)**

b. Sketch the circuit and waveforms for an OP-AMP astable multivibrator for use as a square wave generator. Explain its operation. **(10 Marks)**

6 a. Explain the Wheatstone bridge and derive the balance equation for Wheatstone bridge. **(06 Marks)**

b. Explain AC bridge and derive the balance equation for capacitance comparison bridge. **(08 Marks)**

c. Find the equivalent parallel resistance and capacitance that causes a wein bridge to null with the following components values:
$R_1 = 3.1\ k\Omega$, $c_1 = 5.2\mu F$, $R_2 = 25\ k\Omega$, $f = 2.5kHz$ and $R_4 = 100k\Omega$ **(06 Marks)**

7 a. Explain the potentiometer with figure. **(06 Marks)**

b. Explain the resistance thermometer with circuit diagram. **(06 Marks)**

c. Explain the construction, principle and operation of LVDT. Show characteristics curve. **(08 Marks)**

8 a. Explain piezo electrical transducer, with circuit diagram. **(06 Marks)**

b. Explain the light emitting diodes (LED) with diagram. **(06 Marks)**

c. Explain how power is measured using a bolometer, with a suitable diagram. **(08 Marks)**

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Third Semester B.E. Degree Examination, Dec.09/Jan.10
Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define electric field intensity due to a point charge in vector form. With usual notations, derive the expression for field at a point due to many charges. **(07 Marks)**

b. State and prove divergence theorem. **(05 Marks)**

c. Calculate the divergence of vector D at the points specified using cartesian, cylindrical and spherical coordinates:

i) $D = \frac{1}{z^2}[10xyz.a_x + 5x^2za_y + (2z^3 - 5x^2y)a_z]$ c/m^2 at point P(2, 3, 5)

ii) $D = 5z^2.a_\rho + 10\rho z \cdot a_z$ at $\rho(3, -45°, 5)$ **(08 Marks)**

2 a. Define electric field and electric potential. With usual notations establish the relationship between electric field intensity and electric potential. **(10 Marks)**

b. With usual notations, derive the boundary conditions for perfect dielectric materials of permitivities $\in_1$ and $\in_2$. **(05 Marks)**

c. Given the potential field $V = 50x^2yz + 20y^2$ volts in free space, find

i) Potential V at P(1, 2, 3)

ii) $|E_p|$ (Magnitude of electric potential)

iii) $\hat{a}_r$ at P. **(05 Marks)**

3 a. With usual notations, deduce the Poisson's equation and Laplace equation from Maxwell's first equation. Express $\nabla^2 V$ in different co-ordinate systems. **(10 Marks)**

b. Given $V = A \ln\left[B\frac{(1-\cos\theta)}{1+\cos\theta}\right]$ volts

i) Show that V satisfies Laplace equation in spherical coordinates.

ii) Find A and B so that V = 100V, |E| = 500 V/m at r = 5mt, θ = 90° and φ = 60°. **(10 Marks)**

4 a. State and prove the Stroke's theorem. **(06 Marks)**

b. If the vector magnetic potential at a point in a space is given as $A = 100\,\rho^{1.5}a_z$ wb/mt, find the following: i) H ii) J and show that $\oint H.dl = I$ for the circular path with ρ = 1. **(06 Marks)**

c. In cylindrical coordinates, a magnetic field is given as $H = [4\rho - 2\rho^2]a_\phi$ A/m, $0 \le \rho \le 1$.

i) Find the current density or a function of ρ within cylinder.

ii) Find the total current that passes through the surface Z = 0 and $0 \le \rho \le 1$ mt in the a_z direction. **(08 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – B

5 a. With usual notations, derive the equation for magnetic force between two differential current elements. **(06 Marks)**

b. Find the torque vector on a square loop having corners (-2, -2, 0), (2, -2, 0), (2, 2, 0) and (-2, 2, 0) i) about the origin by $B = 0.4a_x T$ ii) About the origin by $B = 0.6a_x - 0.4a_y T$. **(06 Marks)**

c. Determine the mutual inductance between conducting loop and a very long straight wire shown in Fig.5(c). **(08 Marks)**

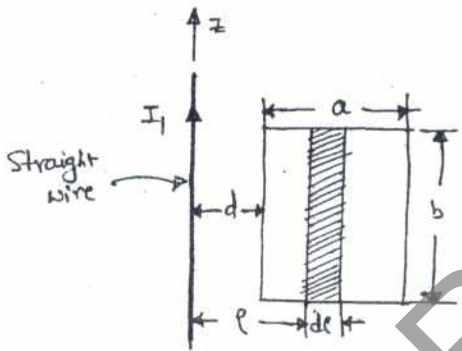


Fig.5(c)

6 a. With usual notations, derive the Maxwell's equation in point form as derived from Faraday's law. Hence show that electric field $E = 2x^3 a_x + 4x^4 a_y$ v/m can not arise from a static distribution of charges. **(08 Marks)**

b. With usual notations, derive the differential form of continuity equation from the Maxwell's equations. **(04 Marks)**

c. The time varying magnetic field in free space is given as $B = \begin{cases} 4\sin\omega t a_z & \rho \le \rho_0 \\ 0 & \rho > 0 \end{cases}$

Determine E using Faraday's law. Verify the same using Maxwell's equations. **(08 Marks)**

7 a. State and explain Polynting theorem. **(04 Marks)**

b. With usual notations, derive the expression for intrinsic impendence for lossy media. **(06 Marks)**

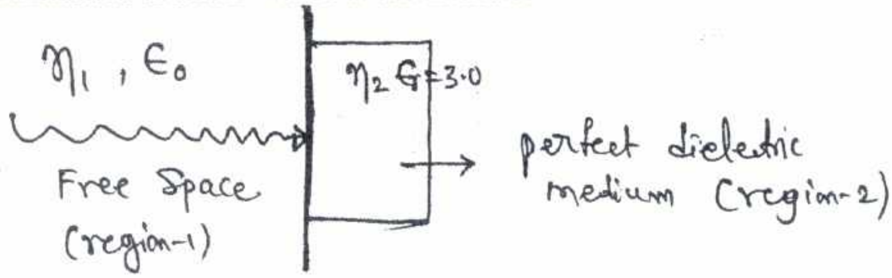
c. The electric field intensity of 300 MHz uniform plane wave in free space is given by $E = (20 + j50)(a_x + 2a_y)e^{-j\beta z}$ V/m. Find

i) ω, λ, u and β ii) E at t = 1 ns z = 10 cm iii) What is $|H|_{max}$? **(10 Marks)**

8 a. Write a short note on standing wave ratio (SWR). **(04 Marks)**

b. With usual notations, derive a general expression for a traveling plane wave. **(06 Marks)**

c. Travelling $\vec{E}$ and $\vec{H}$ waves in the free space (region-1) are normally incident on the interface with a perfect dielectric (region-2) with $\epsilon_r = 3.0$. Compare the magnitude of the incident wave and transmitted $\vec{E}$ and $\vec{H}$ waves at the interface.



(10 Marks)

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Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8=50, will be treated as malpractice.

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MATDIP301

Third Semester BE Degree Examination, Dec.09-Jan.10
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Find the modulus and amplitude of $\frac{4+2i}{2-3i}$. **(06 Marks)**

b. Express the complex number $2 + 3i + \frac{1}{1-i}$ in the form of a + ib. **(07 Marks)**

c. Express the complex number $\sqrt{3}+i$ in the polar form. **(07 Marks)**

2 a. Find the n^{th} derivative of $e^{-x}\sin^2x$. **(06 Marks)**

b. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}+e^{2x}$. **(07 Marks)**

c. If $y = \sin^{-1}x$ then prove that $(1 + x^2)\, y_{n+2} - (2n+1)\, xy_{n+1} - n^2y_n = 0$. **(07 Marks)**

3 a. Using Maclaurin's series expand tanx upto the term containing x^3. **(06 Marks)**

b. Find the angle between the radius vector and tangent to the curve $r = \sin\theta + \cos\theta$. **(07 Marks)**

c. With usual notations prove that

i) $P = r\sin\phi$

ii) $\frac{1}{p^2}=\frac{1}{p^2}+\frac{1}{p^4}\left(\frac{dr}{d\theta}\right)^2$. **(07 Marks)**

4 a. If $u = f(r, s, t)$ where $r=\frac{x}{y}$, $s=\frac{y}{z}$, $t=\frac{z}{x}$ then prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0$. **(06 Marks)**

b. If $u = f(x + ay) + g(x - ay)$ then show that $\frac{\partial^2u}{\partial y^2}=a^2\frac{\partial^2u}{\partial x^2}$. **(07 Marks)**

c. If $u = x^2 - 2y$, $v = x + y + z$, $w = x - 2y + 3z$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$. **(07 Marks)**

5 a. Obtain the reduction formula for $\int\cos^n x\,dx$ where n is a positive integer. **(06 Marks)**

b. Evaluate $\int_0^1 x^6\sqrt{1-x^2}\,dx$. **(07 Marks)**

c. Evaluate $\int_0^1\int_x^{\sqrt{x}}(x^2+y^2)\,dydx$.. **(07 Marks)**

6 a. Evaluate $\int_0^1\int_0^2\int_1^2 x^2yz \ dzdydx$. **(06 Marks)**

b. Prove that $\sqrt{\frac{1}{2}} = \sqrt{\pi}$. **(07 Marks)**

c. Show that $\int_0^{\pi/2}\sqrt{\text{Sin}\theta}\ d\theta \times \int_0^{\pi/2}\frac{d\theta}{\sqrt{\text{Sin}\theta}} = \pi$. **(07 Marks)**

7 a. Solve $(e^y + 1)\ \text{Cos}x dx + e^y\ \text{Sin}x\ dy = 0$. **(06 Marks)**

b. Solve $ydx - xdy = \sqrt{x^2 + y^2}\ dx$. **(07 Marks)**

c. Solve $x\frac{dy}{dx} + y = x^3y^6$. **(07 Marks)**

8 a. Solve $4\frac{d^3y}{dx^3} + 4\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$. **(06 Marks)**

b. Solve $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 3x = \text{Sin}t + e^{-t}$. **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$. **(07 Marks)**

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