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10MAT31

Third Semester B.E. Degree Examination, June 2012
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions choosing atleast two from each part.***

PART – A

1 a. Obtain the Fourier series for the function

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

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

b. Find the half range cosine series for the function $f(x) = (x-1)^2$ in $0 < x < 1$ **(06 Marks)**

c. Obtain the constant term and the coefficient of the first sine and cosine terms in the Fourier expansion of y as given below. **(07 Marks)**

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

2 a. Express the function

$$f(x)=\begin{cases}1, & |x|\le 1\\ 0, & |x|>1\end{cases}$$

as a Fourier integral and hence evaluate $\int_0^\infty \frac{\sin x}{x}\,dx$. **(07 Marks)**

b. Find the sine and cosine transform of $f(x) = e^{-ax}$, $a > 0$ **(06 Marks)**

c. Find the inverse Fourier sine transform of $\frac{e^{-as}}{s}$. **(07 Marks)**

3 a. A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is vibrating giving to each of its points a velocity $\lambda x(l - x)$, find the displacement of the string at any distance x from one end and at any time t. **(07 Marks)**

b. Find the temperature in a thin metal bar of length 1 where both the ends ate insulated and the initial temperature in bar is $\sin \pi x$. **(07 Marks)**

c. Find the solution of Laplace equation, $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$, by the method of separation of variables. **(06 Marks)**

4 a. Fit a parabola $y = a + bx + cx^2$ to the following data: **(07 Marks)**

x	-3	-2	-1	0	1	2	3
y	4.63	2.11	0.67	0.09	0.63	2.15	4.58

b. A fertilizer company produces two products Naphtha and Urea. The company gets a profit of Rs.50 per unit product of naphtha and Rs.60 per unit product of urea. The time requirements for each product and total time available in each plant are as follows:

Plant	Hours required		Available hours
	Naphtha	Urea	
A	2	3	1500
B	3	2	1500

The demand for product is limited to 400 units. Formulate the LPP and solve it graphically. **(06 Marks)**

c. Solve the following using Simplex method:
Maximize $Z = x_1 + 4x_2$
Subject to constraints $-x_1 + 2x_2 \le 6$; $5x_1 + 4x_2 \le 40$; $x_j \ge 0$. **(07 Marks)**

PART – B

5 a. Use Regula-falsi method to find a root of the equation $2x - \log_{10}x = 7$ which lies between 3.5 and 4. **(06 Marks)**

b. Solve by relaxation method.

$10x - 2y - 2z = 6$; $-x + 10y - 2z = 7$; $-x - y + 10z = 8$ **(07 Marks)**

c. Use the power method to find the dominant eigenvalue and the corresponding eigenvector of the matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ with the initial eigenvector as $[1 \ 1 \ 1]^T$. **(07 Marks)**

6 a. The following data is on melting point of an alloy of lead and zinc where t is the temperature in Celsius and P is the percentage of lead in the alloy, tabulated for P = 40(10)90 (i.e., P from 40 to 90 at intervals of 10). Find the melting point of the alloy containing 86% of lead.

P	40	50	60	70	80	90
t	180	204	226	250	276	304

(07 Marks)

b. Using Lagrange's formula, find the interpolation polynomial that approximates to the functions described by the following table:

x	0	1	2	5
f(x)	2	3	12	147

and hence find f(3). **(07 Marks)**

c. Evaluate $\int_0^5 \frac{dx}{4x+5}$, by using Simpson's $\frac{1}{3}^{rd}$ rule, taking 10 equal parts. Hence find log 5. **(06 Marks)**

7 a. Solve the partial differential equation

$$\frac{\partial^2 U}{\partial x^2} + \frac{\partial^2 U}{\partial y^2} = -10(x^2 + y^2 + 10)$$

over the square with side x = 0, y = 0, x = 3, y = 3 with u_0 on the boundary and mesh length h = 1. **(07 Marks)**

b. Solve the heat equation $\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}$, subject to the conditions

$U(0, t) = u(1, t) = 0$ and $u(x,0) = \begin{cases} 2x & \text{for } 0 \le x \le 1/2 \\ 2(1-x) & \text{for } 1/2 \le x \le 1 \end{cases}$

Taking h = 1/4 and according to Bender Schmidt equation. **(06 Marks)**

c. Evaluate the pivotal values of the equation $u_{tt} = 16\, u_{xx}$ taking h = 1 upto t = 1.25. The boundary conditions are $u(0, t) = u(5, t) = 0$, $u_t(x, 0) = 0$ and $u(x, 0) = x^2(5 - x)$. **(07 Marks)**

8 a. If $U(z) = \frac{2z^2 + 5z + 14}{(z-1)^4}$, evaluate u_2 and u_3. **(06 Marks)**

b. Find the Z-transform of i) $\sin(3n + 5)$ ii) $\frac{1}{(n+1)!}$. **(07 Marks)**

c. Solve the $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using Z-transforms. **(07 Marks)**

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10ES32

Third Semester B.E. Degree Examination, June 2012
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO questions from each part.*
2. Missing data may be assumed suitably.
3. Draw equivalent circuit wherever necessary.

PART – A

1 a. Define :
i) Transition capacitance ; ii) Diffusion capacitance ; iii) Reverse recovery time. **(06 Marks)**

b. For the circuit shown in Fig.Q.1(b), sketch the output waveform and transfer characteristics for cut-in voltage = 0.7 V. **(08 Marks)**

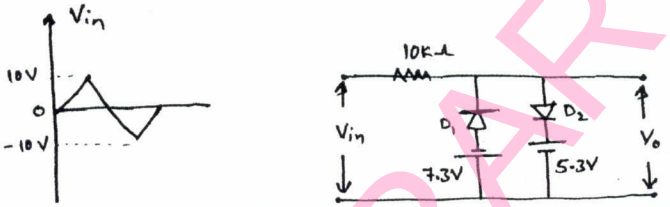


Fig.Q.1(b)

c. Sketch the output voltage waveform for the circuit shown in the Fig.Q.1(c). Assume Si = 0.7 V. **(06 Marks)**

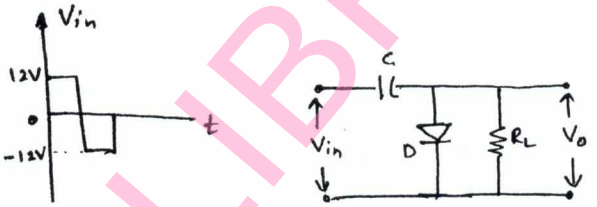


Fig.Q.1(c)

2 a. Determine the levels of I_{CQ} and V_{CEQ} for the voltage divider configuration using the EXACT and APPROXIMATE techniques. Use V_{CC} = 18 V, R_1 = 82 kΩ, R_2 = 22 kΩ, R_C = 5.6 kΩ, R_E = 1.2 kΩ, β = 50. **(08 Marks)**

b. For the circuit shown in Fig.Q.2(b), determine the range of possible values of V_C. Assume silicon transistor with β = 200, V_{CC} = 15V. **(06 Marks)**

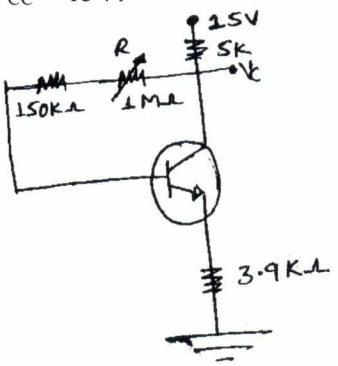


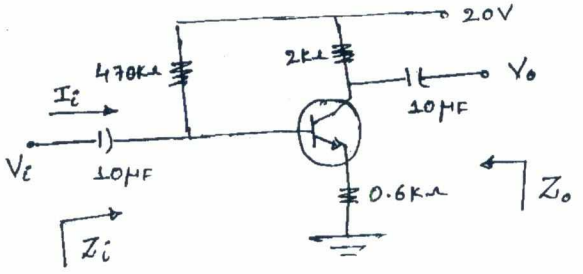
Fig.Q.2(b)

c. Derive an expression for the stability factor S(β) for a collector feedback bias circuit with R_E = 0Ω. **(06 Marks)**

3 a. Derive the expression for A_v, A_i, Z_i and Z_o of a voltage divider bias circuit using r_e model. **(10 Marks)**

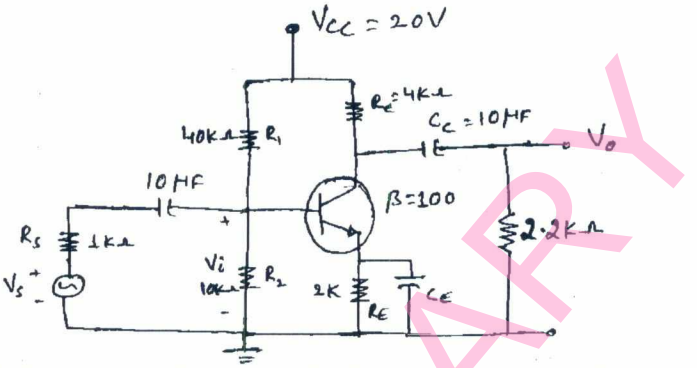
b. For the circuit shown in Fig.Q.3(b), calculate r_e, z_i, z_o, A_V, A_I, β = 120, r_o = 40 kΩ for un bypassed (R_E). **(10 Marks)**

Fig.Q.3(b)



4 a. Use the network shown in Fig.Q.4(a). i) Determine f_{H_i} and f_{H_o}; ii) Find $F_{(B)}$ and F_T.

Fig.Q.4(a)



Take $C_\pi(c_{bc})$ = 36 pF, $Cu(c_{bc})$ = 4 pF, C_{cc} = 1 pF, C_{wi} = 6 pF, C_{wo} = 8 pF, $r_o = \infty\Omega$. **(12 Marks)**

b. Define f_α, f_β and f_T and state the relation between f_β and f_T. **(08 Marks)**

PART – B

5 a. Obtain the expression for Z_{in}, Z_o and A_v for a Darlington Emitter follower. List the advantages of Darlington Emitter follower. **(10 Marks)**

b. List the general characteristics of negative feedback amplifiers. **(04 Marks)**

c. Determine the voltage gain, input and output impedance with feedback for voltage series having A = -100, R_i = 10 kΩ and R_o = 20 kΩ for feedback β = -0.1. **(06 Marks)**

6 a. Explain with a neat sketches, how power amplifiers are classified. **(08 Marks)**

b. With a neat circuit diagram, explain the working of a complementary symmetry class B amplifier. **(08 Marks)**

c. Calculate the 2nd harmonic distortion for an O/P waveform displayed on an oscilloscope provides the following measurements : $V_{CE\,Min}$ = 1V, $V_{CE\,Max}$ = 22V, V_{CEQ} = 12V. **(04 Marks)**

7 a. What is Barkhausen criterion? Explain how oscillations start in an oscillator. **(06 Marks)**

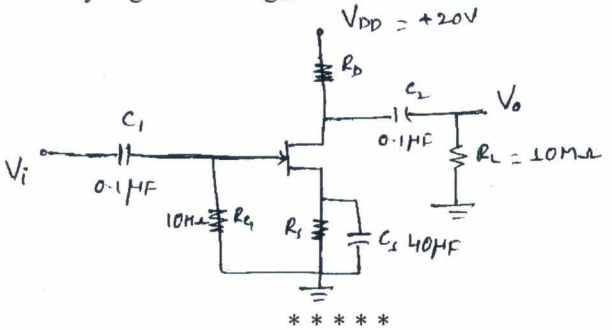
b. Differentiate between RC phase shift oscillator and Wein Bridge oscillator. **(06 Marks)**

c. Explain with a neat circuit diagram of a Hartley oscillator. Write the expression for the frequency of oscillations. **(08 Marks)**

8 a. With necessary equivalent circuit obtain the expression for Z_i and A_V for a JFET common gate configuration. **(10 Marks)**

b. Design the values of R_D and R_S for the network shown in Fig.Q.8(b) that will result in a gain of 8 using a relatively high level of g_m for this device defined at V_{GSQ} = 1/4 V_p. **(10 Marks)**

Fig.Q.8(b)



$I_{DSS} = 10mA$, $V_p = -4V$ } $g_{mo} = 5ms$

$Y_{OS} = 20\mu s$

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10ES33

Third Semester B.E. Degree Examination, June 2012
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define combinational logic. List the various steps in designing a combinational logic system. **(04 Marks)**

b. Define the following:
i) Literal
ii) Product of sums
iii) Canonical products of sums
iv) Sum of min-terms
v) Essential prime implicant. **(05 Marks)**

c. Simplify the function using K-Map:
$y = f(a, b, c, d) = \Pi M(0, 4, 5, 7, 8, 9, 11, 12, 13, 15)$. Write the simplified SOP and POS expression. **(06 Marks)**

d. Design a 4-bit odd parity detector circuit and realize it using only NAND gates. **(05 Marks)**

2 a. Simplify the following using Q-M method. Use decimal notations:
$f(a, b, c, d) = \sum (7, 9, 12, 13, 14, 15) + \sum d(4, 11)$. Realize the simplified expression using only NOR gates. **(10 Marks)**

b. Determine minimal sum and minimal product using MEV technique, taking a, b and c as the map variables.
$f(a, b, c, d) = \sum (3, 4, 5, 7, 8, 11, 12, 13, 15)$. Realize the simplified expression using only NAND gates. **(10 Marks)**

3 a. Design a combinational circuit to find the 9's complement of a single digit BCD number. Realize the circuit using suitable logic gates. **(08 Marks)**

b. Implement the following function pairs using 74138 decoder:
$f_1(a, b, c) = \sum(0, 2, 4)$; $f_2(a, b, c) = \sum(1, 2, 4, 5, 7)$. **(06 Marks)**

c. Realize 16:4 encoder using two 8:3 priority encoders. **(06 Marks)**

4 a. Implement $f(a, b, c) = \sum(1, 4, 5, 7)$ using 4:1 multiplexer. **(06 Marks)**

b. Design a suitable BCD adder circuit using 7483 and provision has to be made for self correction in case if the sum is not a valid BCD number. Justify your design with examples. **(08 Marks)**

c. Design a 1-bit comparator using 2:4 decoder. Also design the circuit using only NOR gates. **(06 Marks)**

PART – B

5 a. Differentiate sequential logic circuit and combinational logic circuit. **(04 Marks)**

b. What is the difference between latch and flipflop? Explain the operation of SR latch with an example. **(06 Marks)**

c. Draw the circuit diagram of master slave JK flip flop using only NAND gates. Explain how race around condition is eliminated in this design. **(06 Marks)**

d. Write a note on 0s and 1s catching problem. **(04 Marks)**

6 a. Derive the characteristic equations of SR, JK, D and T flipflops. **(08 Marks)**

b. Design mod-11 asynchronous counter using JK flipflops. **(06 Marks)**

c. Design a 4 bit register using positive edge triggered D flipflops to operator as indicated in the table below–

Mode select a_1	Mode select a_0	Register operation
0	0	Hold
0	1	Clear
1	0	Complement contents
1	1	Circular right shift

Table 6(c) **(06 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 below in Fig.Q7(b). Design a sequential circuit using D-flipflop. **(10 Marks)**

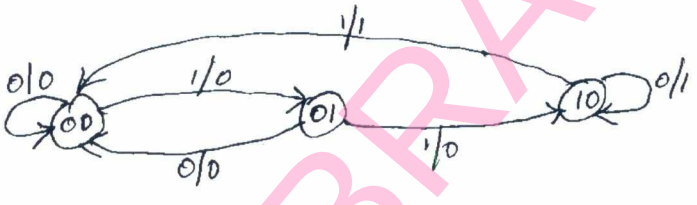

Fig.Q7(b)

8 a. Design a counter using JK flipflops whose sequence is {0, 1, 4, 6, 7, 5, 0 .....} by obtaining minimal sum equations. **(10 Marks)**

b. Design a synchronous 5421 code sequence using positive edge triggered D-flipflop with minimum combinational circuits. **(10 Marks)**

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10ES34

Third Semester B.E. Degree Examination, June 2012
Network Analysis

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer FIVE full questions, selecting atleast TWO questions from each part.***
2. Missing data, if any, may suitably be assumed.

PART – A

1 a. Find the equivalent resistance at AB using Y - Δ transformation technique in Fig. Q1(a). **(05 Marks)**

b. Find the current I in 28 Ω resistor by Mesh analysis in Fig. Q1(b). **(05 Marks)**

c. Find the power dissipated in 10 Ω resistor by node voltage method in Fig. Q1(c). **(10 Marks)**

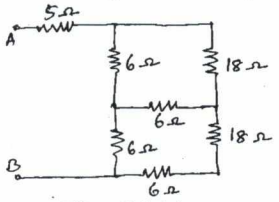

Fig. Q1(a)

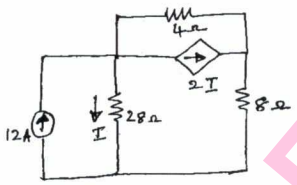

Fig. Q1(b)

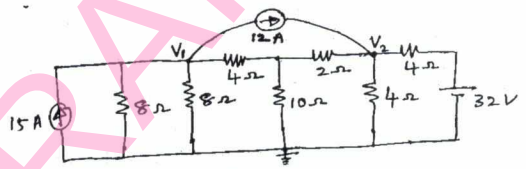

Fig. Q1(c)

2 a. Write the oriented graph of the network shown in Fig. Q2(a). The numerical values of resistances also indicate the branch numbers. Select a tree with branches 1, 2, 3 as the tree branches, write tieset and cutest schedule. **(10 Marks)**

b. For the network shown in Fig. Q2(b), draw the dual network and write the node equations. **(10 Marks)**

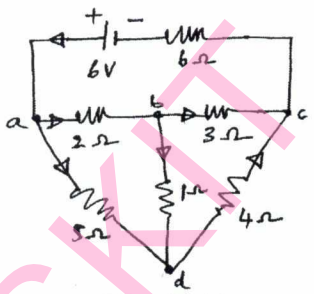

Fig. Q2(a)

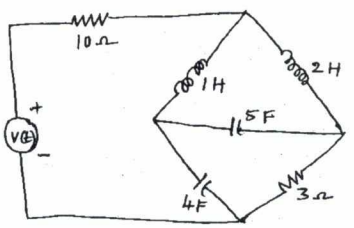

Fig. Q2(b)

3 a. Determine the current through 10 Ω resistance of the network shown in Fig.Q3(a), using superposition theorem. **(10 Marks)**

b. State Milliman's theorem. Using Milliman's theorem, find I_L through R_L for the network shown in Fig. Q3(b). **(10 Marks)**

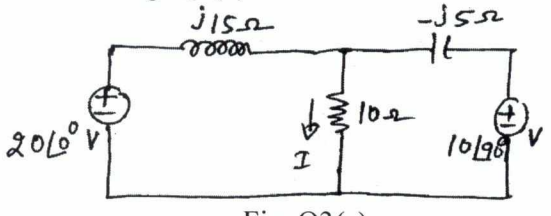

Fig. Q3(a)

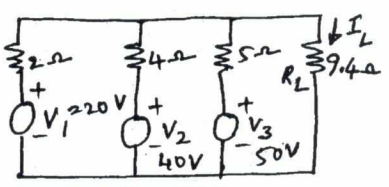

Fig. Q3(b)

4 a. State Thevenin's theorem. For the circuit shown in Fig. Q4(a), find the current through R_L using Thevenin's theorem. **(10 Marks)**

b. State maximum power transfer theorem. For the circuit shown in Fig. Q4(b), find the value of Z_L for which maximum power transfer occurs. Also find P_{max}. **(10 Marks)**

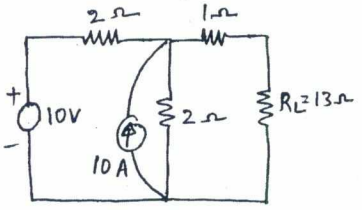

Fig. Q4(a)

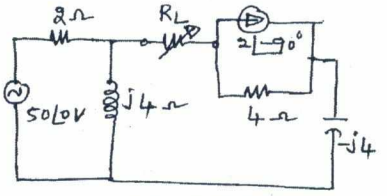

Fig. Q4(b)

PART – B

5 a. Define quality factor and bandwidth. Also establish the relationship between quality factor and bandwidth in a series resonance circuit and thereby prove that $Q = \frac{f_0}{BW}$, where f_0 is the resonance frequency. **(10 Marks)**

b. A series RLC circuit with R = 10 Ω, L = 10mH and C= 1μF has an applied voltage of 200 V at resonant frequency. Calculate the resonant frequency f_0, the current in the circuit at resonance, voltage across the elements at resonance. Also find quality factor and bandwidth. **(10 Marks)**

6 a. Determine : i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at t = 0+ when the switch is closed at t = 0 in Fig. Q6(a). **(10 Marks)**

b. Determine : i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at t = 0 + when the switch K is moved from position 1 to 2 at t = 0 in the network shown in Fig. Q6(b), steady state having reached before switching. **(10 Marks)**

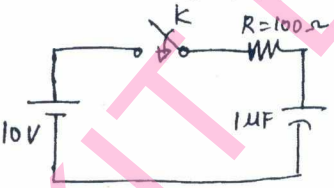

Fig. Q6(a)

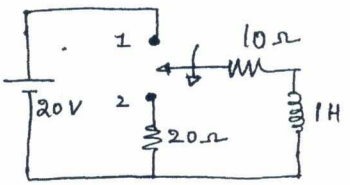

Fig. Q6(b)

7 a. Find the expression for the resultant current i(t) when switch K is closed at t = 0 in Fig. Q7(a). **(10 Marks)**

b. Find the Laplace transform of the given function $f(t) = 5 + 4e^{-2t}$. **(04 Marks)**

c. Find the L.T of the saw tooth waveform in Fig. Q7(c). **(06 Marks)**

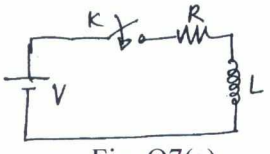

Fig. Q7(a)

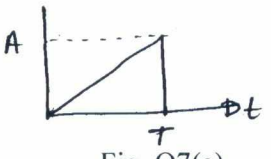

Fig. Q7(c)

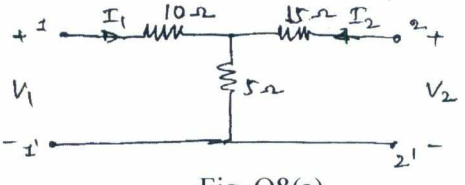

Fig. Q8(a)

8 a. Find the Z-parameters for the network shown in Fig. Q8(a). **(10 Marks)**

b. The Z-parameters of a two port network are $Z_{11} = 20\ \Omega$, $Z_{22} = 30\ \Omega$, $Z_{12} = Z_{21} = 10\Omega$. Find Y and ABCD parameters of the network. **(10 Marks)**

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10IT35

Third Semester B.E. Degree Examination, June 2012

Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following terms:
   i) Gross error and systematic error
   ii) Absolute error and relative error **(06 Marks)**

b. Explain the working of true RMS voltmeter, with a neat block diagram. **(08 Marks)**

c. Convert a basic D′ Arsonal movement with an internal resistance of 100Ω and a full scale deflection of 10 mA into a multi range dc voltmeter with ranges from 0 – 5 V, 0 – 50 V and 0 – 100 V. **(06 Marks)**

2 a. A $4\frac{1}{2}$ digit voltmeter is used for voltage measurement:
   i) Find its resolution
   ii) How would 12.98 V be displayed on 10 V range?
   iii) How would 0.6973 V be displayed on 1 V and 10 V range? **(07 Marks)**

b. Explain the working principle of successive approximation digital voltmeter, with the help of block diagram. **(07 Marks)**

c. With a basic block diagram, explain the method used for digital measurement of time period. **(06 Marks)**

3 a. Explain the working of dual trace oscilloscope, with a neat block diagram and necessary waveforms. **(10 Marks)**

b. With the help of basic block diagram and circuit diagram, explain the working principle of electronic switch. **(08 Marks)**

c. Briefly explain about the focus control knob available on the CRO panel. **(02 Marks)**

4 a. Describe the working of oscilloscope delayed time base system, with the help of block diagram and associated waveforms. **(10 Marks)**

b. Explain the basic operation of digital storage oscilloscope, with the help of block schematic and associated waveforms. **(10 Marks)**

PART – B

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

b. Explain the working principle of frequency synthesizer, with a neat block diagram. **(10 Marks)**

6 a. Mention the limitations of wheatstone's bridge. Derive the balance equation for Kelvin's double bridge. **(10 Marks)**

b. A capacitance comparison bridge is used to measure a capacitive impedance at a frequency of 2 kHz. The bridge constants at balance are $C_3 = 100\ \mu F$, $R_1 = 10\ K\Omega$, $R_2 = 50\ K\Omega$ and $R_3 = 100\ K\Omega$. Find the equivalent circuit of the unknown impedance. **(04 Marks)**

c. Derive an expression for frequency of the wein bridge circuit. **(06 Marks)**

7 a. Explain the construction and working of bonded resistance wire strain gauge and semiconductor strain gauge. **(10 Marks)**

b. With necessary sketches, explain the construction and working principle of LVDT. **(10 Marks)**

8 a. Mention the advantages and limitations of RTD. **(04 Marks)**

b. Define the terms: i) Seebeck effect, ii) Peltier effect. **(04 Marks)**

c. Explain how bolometer bridge can be used for the measurement of power. Also discuss the application of unbalanced bolometer bridge. **(08 Marks)**

d. List the important features of LCD. **(04 Marks)**

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10ES36

Third Semester B.E. Degree Examination, June 2012
Field Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Derive the expression for $\vec{E}$ due to an infinite line of charge. **(08 Marks)**

b. Given $\vec{D} = 5 \operatorname{Sin}\theta \, \hat{a}_\theta + 5 \operatorname{Sin}\phi \, \hat{a}_\phi$, find the charge density at (0.5m, $\pi/4$, $\pi/4$). **(04 Marks)**

c. Given that $\vec{A} = 30\, e^{-r} \, \hat{a}_r - 2z \, \hat{a}_z$. Evaluate both sides of the divergence theorem for the volume enclosed by r = 2, z = 0 and z = 5. **(08 Marks)**

2 a. Define electric scalar potential. Derive an expression for potential due to several point charges. **(06 Marks)**

b. A total charge of 40/3 nc is uniformly distributed over a circular ring of radius 2m placed in Z = 0 plane, with center as origin. Find the electric potential at A (0, 0, 5). **(06 Marks)**

c. Discuss the boundary conditions at the interface between two dielectrics of different permittivities. **(08 Marks)**

3 a. Starting from Gauss's law in integral form, derive Laplace's and Poisson's equations. Write Laplace's equation in all the coordinate systems. **(06 Marks)**

b. Determine whether or not the following vectors represent a possible electric field

i) $\vec{E} = 5 \operatorname{Cos} z \, \hat{a}_z$ V/m

ii) $\vec{E} = (12yx^2 - 6z^2x) \, \hat{a}_x + (4x^3 + 18zy^2) \, \hat{a}_y + (6y^3 - 6zx^2) \, \hat{a}_z$. **(06 Marks)**

c. Conducting spherical shells with radii a = 10 cm and b = 30 cm are maintained at a potential difference of 100V such that V = 0 at r = b and V = 100V at r = a. Determine V and $\vec{E}$ in the region between the shells. If $\epsilon_r = 2.5$ in the region, determine the total charge induced on the shells and the capacitance there on. **(08 Marks)**

4 a. State Biot-Savart law. Obtain an expression for magnetic field intensity due to straight conductor of finite length. **(07 Marks)**

b. In the region 0 < r < 0.5m, in cylindrical co-ordinates, the current density is $\vec{J} = 4.5e^{-2r} \, \hat{a}_z$ and $\vec{J} = 0$ elsewhere. Use amperes circuital law to find $\vec{H}$. **(05 Marks)**

c. Given the magnetic field $\vec{H} = 2r^2(z + 1) \sin\phi \, \hat{a}_\phi$. Verify Stokes theorem for the portion of a cylindrical surface defined by r = 2, $\frac{\pi}{4} < \phi < \frac{\pi}{2}$, 1 < z < 1.5 and for its perimeter. **(08 Marks)**

PART – B

5 a. Obtain the expression of magnetic force between differential current elements. **(05 Marks)**

b. A point charge Q = 18 nc has a velocity of 5×10^6 m/s in the direction $\vec{a_v} = 0.6\hat{a_x} + 0.75\ \hat{a_y} + 0.3\hat{a_z}$. Calculate the magnitude of the force exerted on the charge by the field :

i) $\vec{E} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a_z}$ kV/m

ii) $\vec{B} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a_z}$ mT

iii) $\vec{B}$ and $\vec{E}$ acting together. **(08 Marks)**

c. If $\vec{B} = 0.05x\ \hat{a_y}$ T in a material for which $\chi_m = 2.5$,

find : i) ulr ; ii) ul ; iii) $\vec{H}$; iv) $\vec{M}$; v) $\vec{J}$ and vi) $\vec{J}_b$. **(07 Marks)**

6 a. Write an explanatory note on : Maxwell's equations in point and integral forms applicable to time varying fields. **(05 Marks)**

b. Given $\vec{E} = EmSin(wt - \beta z)\hat{a_y}$ in force space, find $\vec{D}$, $\vec{B}$ and $\vec{H}$. Sketch $\vec{E}$ and $\vec{H}$ at t = 0. **(10 Marks)**

c. Find the induced voltage in the conductor if $\vec{B} = 0.04\hat{a}_y$ T and $\vec{v} = 2.5Sin10^3 t\hat{a_z}$ m/s, find induced emf, if $\vec{B}$ is changed to $0.04\ \hat{a_x}$ T. **(05 Marks)**

7 a. Starting from Maxwell's equation, derive the wave equation for a uniform plane wave travelling in free space. **(08 Marks)**

b. A 800 MHz plane wave travelling has an average Poynting vector of 8 mW/m^2. If the medium is losses with $\mu_r = 1.5$ and $\epsilon_r = 6$. Find :

i) Velocity of wave
ii) Wavelength
iii) Impedance of the medium
iv) r.m.s. electric field E and
v) r.m.s. magnetic field H. **(08 Marks)**

c. Wet marshy soil is characterized by $\sigma = 10^{-2}$ s/m, $\epsilon_r = 15$ and $\mu_r = 1$. At frequencies 60Hz and 10 GHz indicate whether soil be considered a conductor or a dielectric. **(04 Marks)**

8 a. Explain the reflection of uniform plane waves, with normal incidence at a plane dielectric boundary. **(08 Marks)**

b. A free space-silver interface has Ei = 100 V/m on the free space side. The frequency is 15 MHz and silver constants are $\epsilon_r = \mu_r = 1$, $\sigma = 61.7$ MS/m. Determine E_r and E_t at the interface. **(08 Marks)**

c. Define :

i) Reflection coefficient
ii) Standing wave ratio. **(04 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, June 2012

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Express $z = \frac{2-\sqrt{3}i}{1+i}$ in the form a + ib. **(06 Marks)**

b. Find modulus and amplitude of $z = \frac{3+i}{2+i}$. **(07 Marks)**

c. Find all the values of $z = \left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)^{3/4}$. **(07 Marks)**

2 a. Find the n^{th} derivative of $y = e^{ax}\cos(bx + c)$. **(06 Marks)**

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

c. Expand $y = \log(1+x)$ in Maclaurins series upto 5^{th} term. **(07 Marks)**

3 a. If $u = \frac{x^2y^2}{x+y}$, find the value of $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2}$. **(06 Marks)**

b. If $u = 3x^2 + y^2$ and $x^2 - y^2 = 1$, find $\frac{du}{dx}$. **(07 Marks)**

c. If $x = r\cos\phi$, $y = r\sin\phi$, $z = z$, find $\frac{\partial(x, y, z)}{\partial(r, \phi, z)}$. **(07 Marks)**

4 a. Obtain the reduction formula for $\int_0^{\pi/2} \sin^n x\,dx$ and hence obtain $\int_0^{\pi/2} \sin^4 x\,dx$. **(06 Marks)**

b. Evaluate $\int_0^1 x^2(1-x^2)^{7/2}dx$. **(07 Marks)**

c. Evaluate $\int_0^1\int_0^3 x^3y^3\,dx\,dy$. **(07 Marks)**

5 a. Evaluate $\int_0^1\int_0^2\int_0^3 (x+y+z)dz\,dy\,dx$. **(06 Marks)**

b. Evaluate $\int_0^\infty x^2e^{-4x}\,dx$ using gamma function. **(07 Marks)**

c. Find $\beta\left(\frac{5}{2}, \frac{3}{2}\right)$ in terms of gamma function.. **(07 Marks)**

6 a. Solve the equation $\sqrt{1-y^2}\,dx + \sqrt{1-x^2}\,dy = 0$. **(06 Marks)**

b. Solve $\frac{dy}{dx} = \frac{x-y}{x+y}$. **(07 Marks)**

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

7 a. Solve $\frac{dy}{dx} = \frac{\sin 2x - \tan y}{x \sec^2 y}$. **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} + x^2 y = x^2$. **(07 Marks)**

c. Solve $\frac{dy}{dx} + \sin xy = \sin x \cos x$. **(07 Marks)**

8 a. Solve $(D^2 + a^2)y = x^2$. **(06 Marks)**

b. Solve $(D^3 + D^2 - D - 1)y = e^{2x}$. **(07 Marks)**

c. Solve $(D^4 - 1)y = \sin x + 2$. **(07 Marks)**

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