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10MAT31

Third Semester B.E. Degree Examination, June/July 2013

Engineering Mathematics - III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Obtain the Fourier series expansion of $f(x) = \begin{cases} x, & \text{if } 0 \le x \le \pi \\ 2\pi - x, & \text{if } \pi \le x \le 2\pi \end{cases}$ and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots\dots\dots$ **(07 Marks)**

b. Find the half range Fourier sine series of $f(x) = \begin{cases} x, & \text{if } 0 < x < \pi/2 \\ \pi - x, & \text{if } \pi/2 < x < \pi \end{cases}$. **(06 Marks)**

c. Obtain the constant term and coefficients of first cosine and sine terms in the expansion of y from the following table: **(07 Marks)**

x	0	60°	120°	180°	240°	300°	360°
y	7.9	7.2	3.6	0.5	0.9	6.8	7.9

2 a. Find the Fourier transform of $f(x) = \begin{cases} a^2 - x^2, & |x| \le a \\ 0, & |x| > a \end{cases}$ and hence deduce $\int_0^\infty \frac{\sin x - x\cos x}{x^3} dx = \frac{\pi}{4}$. **(07 Marks)**

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

c. Find the inverse Fourier transform of e^{-s^2}. **(07 Marks)**

3 a. Obtain the various possible solutions of one dimensional heat equation $u_t = c^2 u_{xx}$ by the method of separation of variables. **(07 Marks)**

b. A tightly stretched string of length l with fixed ends is initially in equilibrium position. It is set to vibrate by giving each point a velocity $V_o \sin\left(\frac{\pi x}{l}\right)$. Find the displacement u(x, t). **(06 Marks)**

c. Solve $u_{xx} + u_{yy} = 0$ given $u(x, 0) = 0$, $u(x, 1) = 0$, $u(1, y) = 0$ and $u(0, y) = u_0$, where u_0 is a constant. **(07 Marks)**

4 a. Using method of least square, fit a curve $y = ax^b$ for the following data. **(07 Marks)**

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

b. Solve the following LPP graphically:
Minimize $Z = 20x + 16y$
Subject to $3x + y \ge 6$, $x + y \ge 4$, $x + 3y \ge 6$ and $x, y \ge 0$. **(06 Marks)**

c. Use simplex method to
Maximize $Z = x + (1.5)y$
Subject to the constraints $x + 2y \le 160$, $3x + 2y \le 240$ and $x, y \ge 0$. **(07 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. Using Newton-Raphson method find a real root of $x + \log_{10} x = 3.375$ near 2.9, corrected to 3-decimal places. **(07 Marks)**

b. Solve the following system of equations by relaxation method:
$12x + y + z = 31$, $2x + 8y - z = 24$, $3x + 4y + 10z = 58$ **(07 Marks)**

c. Find the largest eigen value and corresponding eigen vector of following matrix A by power method

$$A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}.$$

Use $X^{(0)} = [1, 0, 0]^T$ as the initial eigen vector. **(06 Marks)**

6 a. In the given table below, the values of y are consecutive terms of series of which 23.6 is the 6^{th} term, find the first and tenth terms of the series. **(07 Marks)**

x	3	4	5	6	7	8	9
y	4.8	8.4	14.5	23.6	36.2	52.8	73.9

b. Construct an interpolating polynomial for the data given below using Newton's divided difference formula. **(07 Marks)**

x	2	4	5	6	8	10
f(x)	10	96	196	350	868	1746

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by Weddle's rule taking 7-ordinates and hence find $\log_e 2$. **(06 Marks)**

7 a. Solve the wave equation $u_{tt} = 4u_{xx}$ subject to $u(0, t) = 0$; $u(4, t) = 0$; $u_t(x, 0) = 0$; $u(x, 0) = x(4 - x)$ by taking $h = 1$, $k = 0.5$ upto four steps. **(07 Marks)**

b. Solve numerically the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(0, t) = 0 = u(1, t)$, $t \geq 0$ and $u(x, 0) = \sin \pi x$, $0 \leq x \leq 1$. Carryout computations for two levels taking $h = 1/3$ and $k = 1/36$. **(07 Marks)**

c. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in Fig.Q7(c). **(06 Marks)**

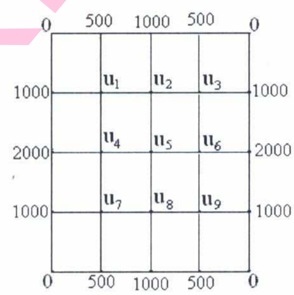

Fig.Q7(c)

8 a. Find the z-transform of: i) $\sin h\, n\theta$; ii) $\cos h\, n\theta$. **(07 Marks)**

b. Obtain the inverse z-transform of $\frac{8z^2}{(2z-1)(4z-1)}$. **(07 Marks)**

c. Solve the following difference equation using z-transforms:
$y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = y_1 = 0$ **(06 Marks)**

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Third Semester B.E. Degree Examination, June/July 2013
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

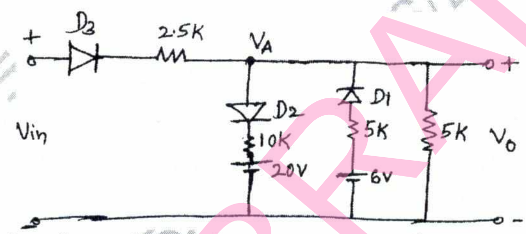
Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the following terms with respect to semiconductor diode:
   i) Diffusion capacitance
   ii) Transition capacitance and
   iii) Reverse recovery time. **(06 Marks)**

b. For the clipping circuit shown in Fig.Q.1(b). Obtain its transfer characteristics to the scale for a ramp input which varies from 0 to 50 volts. Indicate slopes at different levels and assume ideal diodes. **(10 Marks)**

Fig.Q.1(b)



c. Design an ideal clamper circuit to obtain the output waveform as shown in Fig.Q.1(c) for the given input. **(04 Marks)**

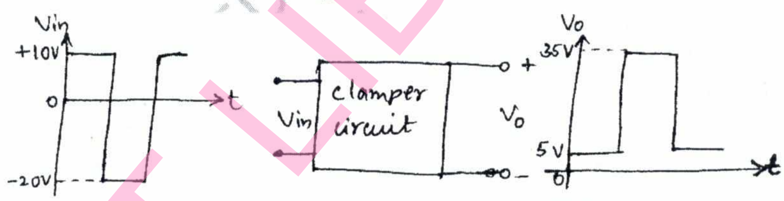
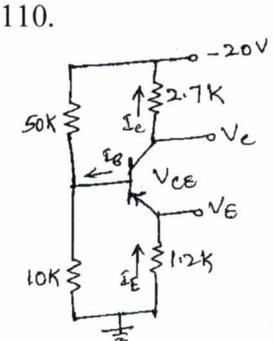


Fig.Q.1(b)

2 a. What is bias stabilization? Derive an expression for $S_{(I_{CO})}$ and $S_{(V_{BE})}$ for fixed bias configuration. **(06 Marks)**

b. For the voltage divider circuit shown in Fig.Q.2(b), calculate:
   i) I_B, I_C and I_E; ii) V_E and V_B; iii) V_{CE} and V_C; iv) V_{CB} and $I_{C(sat)}$.
   Assume silicon transistor with $\beta = 110$. **(08 Marks)**

Fig.Q.2(b)



c. Design an emitter-bias network using the following data:
   $I_{CQ} = 1/2\ I_{C(sat)}$, $V_{CEQ} = 1/2\ V_{CC}$, $V_{CC} = 20V$, $I_{C(sat)} = 10mA$, $\beta = 120$ and $R_C = 4R_E$. **(06 Marks)**

3 a. Define h-parameters and hence derive h-parameter model of a CE-BJT. **(06 Marks)**

b. State and prove Miller's theorem. **(04 Marks)**

c. For the circuit shown in Fig.Q.3(c), the transistor parameters are $h_{ib} = 22\Omega$, $h_{fb} = -0.98$, $h_{ob} = 0.49$ MA/V and $h_{rb} = 2.9 \times 10^{-4}$. Calculate: i) Input resistance; ii) Output resistance; iii) Current gain; iv) Voltage gain; v) Overall voltage and current gain. **(10 Marks)**

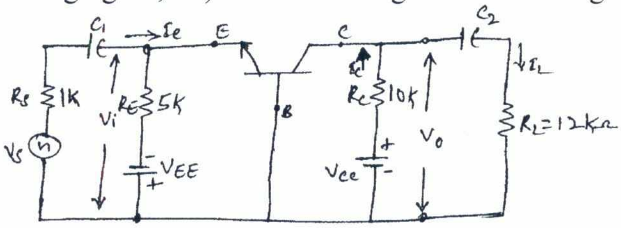


Fig.Q.3(c)

4 a. Explain the low frequency and high frequency response of a RC coupled amplifier. **(10 Marks)**

b. Describe Miller's effect and derive an equation for Miller input and output capacitance. **(06 Marks)**

c. Calculate the overall lower 3db and upper 3db frequency for a 3 stage amplifier having an individual frequency $f_1 = 40$ Hz and $f_2 = 2$ MHz. **(04 Marks)**

PART – B

5 a. Explain and analyze with the help of circuit a cascade BJT amplifier and list its advantages. **(10 Marks)**

b. What are the effects of negative feedback in amplifier? Show how bandwidth of an amplifier increases with negative feedback. **(10 Marks)**

6 a. Explain the operation of a class B push-pull amplifier and also show that its efficiency is 78.50% and max power dissipation condition. **(10 Marks)**

b. With a neat circuit diagram, explain the operation of a transformer coupled class A power amplifier. **(10 Marks)**

7 a. State Barkhausen criteria for sustained oscillations, apply this to a transistorized Weinbridge oscillator and explain its operation. **(10 Marks)**

b. Explain working of a Hartley oscillator. In a Hartley oscillator L1 = 20 MH, L2 = 2mH and C is a variable. Find the range of C for frequency is to be varied from 1MHz to 2.5 MHz. **(10 Marks)**

8 a. List the difference between: i) FET and BJT and ii) Enhancement and depletion MOSFET ; iii) JFET and MOSFET. **(10 Marks)**

b. For the circuit shown in Fig.Q.8(b) $V_{GSQ} = -2.5V$ and $I_{DQ} = 2.5$ mA find: i) g_m; ii) r_d; iii) z_i iv) z_o and v) A_v. Assume $I_{DSS} = 8mA$, $V_P = -6V$ and $Y_{OS} = 20$ m℧. **(10 Marks)**

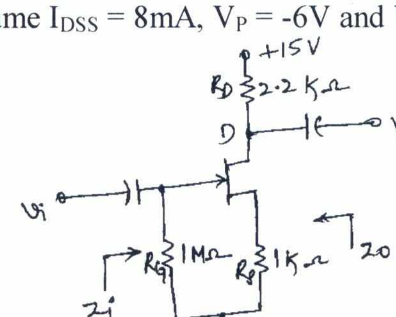


Fig.Q.8(b)

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Third Semester B.E. Degree Examination, June/July 2013
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Simplify the following expression using Karnaugh map. Implement the simplified expression using the gates as indicated.
$f(a, b, c, d) = \Sigma m(0, 1, 2, 5, 6, 7, 8, 9, 10, 13, 14, 15)$ using only NAND gates
$f(A, B, C, D) = \pi m(0, 3, 4, 7, 8, 10, 12, 14) + \Sigma d(2, 6)$ using only NOR gates. **(12 Marks)**

b. Design a logic circuit that has 4 inputs, the output will only be high, when the majority of the inputs are high, use K map to simplify. **(08 Marks)**

2 a. Simplify using the Quine – Mcclusky minimization technique. Implement the simplified expression using basic gates
$V = f(a, b, c, d) = \Sigma(2, 3, 4, 5, 13, 15) + \Sigma d(8, 9, 10, 11)$. **(12 Marks)**

b. Simplify the logic function given below using variable entered mappings (VEM) technique
$f(A, B, C, D) = \Sigma m(0, 1, 3, 5, 6, 11, 13) + \Sigma d(4, 7)$. **(08 Marks)**

3 a. With the aid of block diagram, clearly distinguish between a decoder and encoder. **(04 Marks)**

b. Design a combinational logic circuit that will convert a straight BCD digit to an excess – 3 BCD digits
i) Construct the truth – table
ii) Simplify each output function using k map and write the reduced equations
iii) Draw the resulting logic diagram. **(12 Marks)**

c. Implement a full substractor using a decoder and NAND gates. **(04 Marks)**

4 a. Implement the following Boolean function using 4 : 1 multiplexer
$F(A, B, C) = \Sigma m(1, 3, 5, 6)$ **(04 Marks)**

b. Design a 2 bit comparator. **(08 Marks)**

c. What is a look ahead carry adder? Explain the circuit and operation of a 4 bit binary adder with look ahead carry. **(08 Marks)**

PART – B

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

b. Explain with timings diagram the workings of a SR latch as a switch debouncer. **(08 Marks)**

c. Explain the workings of a master – slave JK flip flop with functional table and timings diagram. **(08 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 rings counter. **(08 Marks)**

b. Explain the workings of 4 – bit asynchronous counter. **(04 Marks)**

c. Derive the characteristic equation of SR, JK, D and T flip – flops. **(08 Marks)**

7 a. With a suitable example, explain the mealy and Moore model of a sequential circuit. **(10 Marks)**

b. Design a synchronous counter using JK flip–flops to count the sequence 0, 1, 2, 4, 5, 6, 0, 1, 2 use static diagram and state table. **(10 Marks)**

8 a. Design a clocked sequential circuit that operates according to the state diagram shown. Implement the circuit using D – flip – flop. **(12 Marks)**

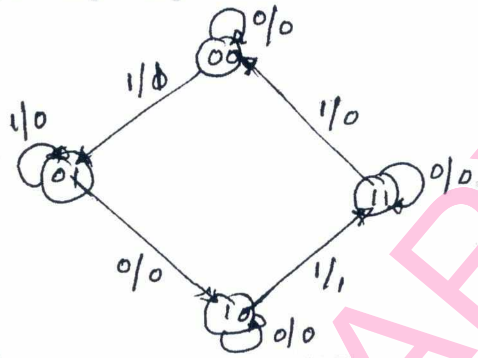

Fig. Q8(a)

b. With a suitable, example and appropriate state diagram, explain how to recognize a particular sequence. EX 1011. **(08 Marks)**

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10ES34

Third Semester B.E. Degree Examination, June/July 2013
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 be suitable assumed.

PART – A

1 a. Find the voltage across resistance R in the networking Fig. Q1(a) by mesh analysis. **(08 Marks)**

b. For the network of Fig. Q1(b) determine the node voltage by nodal analysis. **(06 Marks)**

c. Determine V_{23} by mesh analysis in the network of Fig. Q1(c). **(06 Marks)**

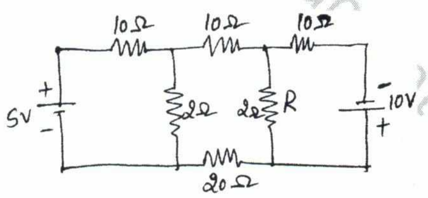

Fig. Q1(a)

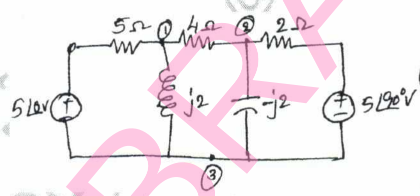

Fig. Q1(b)

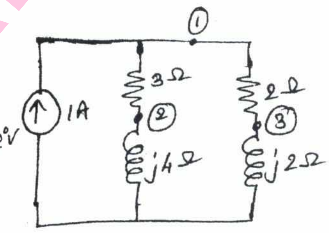

Fig. Q1(c)

2 a. Solve for loop and branch currents for the circuit of Fig. Q2(a) using tie set schedule and network equilibrium equations on the loop basis. Take OA, OB and OC as tree branches. **(10 Marks)**

b. Write the f-cut set matrix and solve for tree branch voltages. Take OA, OB and OC as the tree branches for the network of Fig. Q2(b). **(06 Marks)**

c. Draw the dual of the network of Fig. Q2(c). **(04 Marks)**

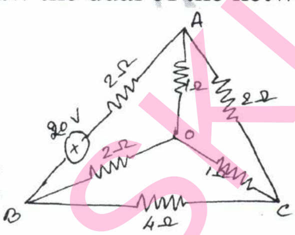

Fig. Q2(a)

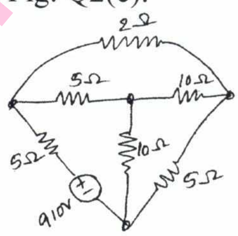

Fig. Q2(b)

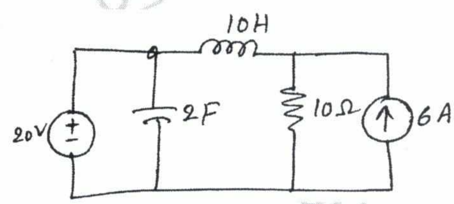

Fig. Q2(c)

3 a. State and explain super position theorem. **(06 Marks)**

b. Find the load current I in the circuit of Fig. Q3(b) by using Millman's theorem. **(06 Marks)**

c. Verify reciprocity theorem for the network of Fig. Q3(c) with response I_3. **(08 Marks)**

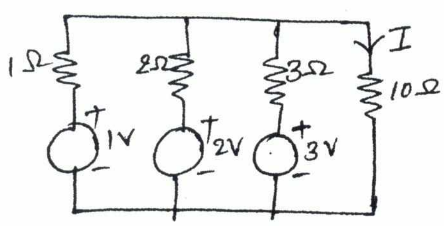

Fig. Q3(b)

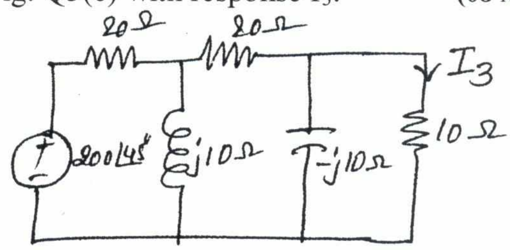

Fig. Q3(c)

4 a. State and explain Thevenin's theorem. **(07 Marks)**

b. Obtain Norton equivalent of the network of Fig. Q4(b) between terminals A and B. **(07 Marks)**

c. Find the value of Z_L for maximum power transfer through Z_L in the network of Fig. Q4(c). **(06 Marks)**

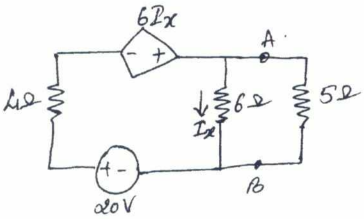

Fig. Q4(b)

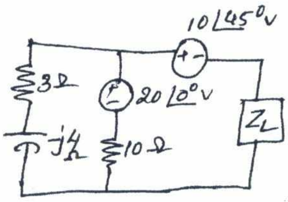

Fig. Q4(c)

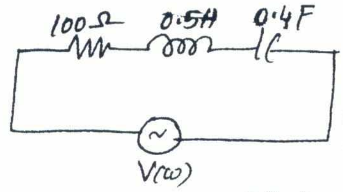

Fig. Q5(a)

PART – B

5 a. For the series RLC circuit of Fig. Q5(a) find the resonant frequency, half power frequencies, band width and quality factor. **(10 Marks)**

b. Derive expression for f_r, Q and bandwidth of a parallel resonant circuit with lossless capacitor in parallel with a coil of resistance R and inductance L. **(10 Marks)**

6 a. In the circuit of Fig. Q6(a), switch K is changed from position 1 to 2 at t = 0, steady state condition having reached before switching. Find i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. **(08 Marks)**

b. In the circuit of Fig. Q6(b), switch k is opened at t = 0. Find the values of v, $\frac{dv}{dt}$ and $\frac{d^2v}{dt^2}$ at $t = 0^+$. **(06 Marks)**

c. In the circuit of Fig. Q6(c) switch k is closed at t = 0. Find the value of v_1, v_2 and v_3 at $t = 0^+$. The circuit is initially relaxed. **(06 Marks)**

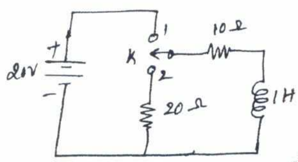

Fig. Q6(a)

Fig. Q6(b)

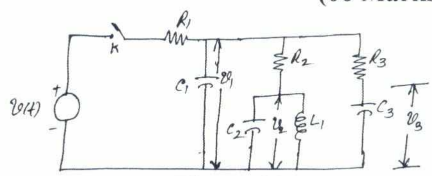

Fig. Q6(c)

7 a. Using Laplace transform obtain an expression for the current i(t) in the network of Fig. Q7(a). Assume zero critical conditions. **(06 Marks)**

b. For the critically related network of Fig. Q7(b) obtain expression for the current i(t). Use Laplace transform. **(06 Marks)**

c. Determine the Laplace transform of the periodic saw tooth waveform of Fig. Q7(c). Use gate function. **(08 Marks)**

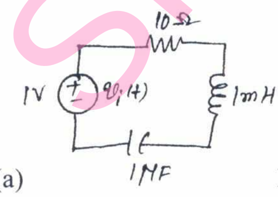

Fig. Q7(a)

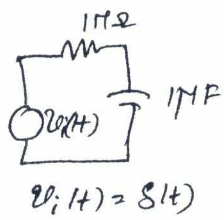

Fig.Q7(b)

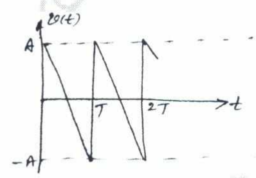

Fig. Q7(c)

8 a. For the network of Fig. Q8(a) obtain the Z – parameters. Also draw the Z – parameter equivalent circuit. **(12 Marks)**

b. Determine the transmission parameters of the network of Fig. Q8(b). **(08 Marks)**

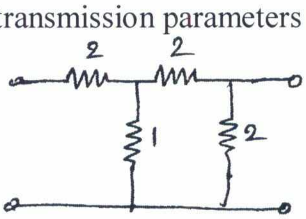

Fig. Q8(a)

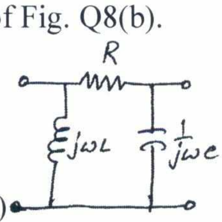

Fig. Q8(b)

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Third Semester B.E. Degree Examination, June/July 2013
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. Explain with suitable example accuracy and precision. **(05 Marks)**

b. A Permanent Magnet Moving Coil instrument (PMMC) with Full Scale Deflection (FSD) of 100 μA and coil resistance is 1 KΩ is to be connected into a voltmeter. Determine the required multiplier resistance if the voltmeter is to be measure 50 V at full scale. Also calculate the applied voltage when the instrument indicates 0.8, 0.5 and 0.2 of FSD. **(08 Marks)**

c. Explain with neat circuit diagram and wave forms full wave rectifier type AC voltmeter. **(07 Marks)**

2 a. Explain basic operation of digital multimeter with neat block diagram. **(07 Marks)**

b. Suppose the converter can measure a maximum of 5 V. i.e. 5 V corresponds to the maximum count of 11111111, if the test voltage is V_{in} = 1 V. Show the steps take place in the table format in the measurement for the successive approximation type Digital Volt Meter (DVM). **(06 Marks)**

c. Explain with neat block diagram Digital Frequency Meter. **(07 Marks)**

3 a. Explain sweep or time base generator with neat circuit diagram and wave forms, for a continuous sweep CRO and triggered sweep CRO. **(12 Marks)**

b. Explain dual trace oscilloscope with neat block diagram. **(08 Marks)**

4 a. Discuss need for delayed sweep in digital storage oscilloscope. **(04 Marks)**

b. Explain basic principle of sampling oscilloscope with neat diagram and wave forms. **(06 Marks)**

c. Explain two types of storage techniques used in storage oscilloscope with neat diagram. **(10 Marks)**

PART – B

5 a. Explain with neat block diagram, operating principle of function generator. **(08 Marks)**

b. Elaborate with neat block diagram, conventional standard signal generator. **(06 Marks)**

c. Explain with neat block diagram and waveforms, frequency synthesizer in signal generators. **(06 Marks)**

6 a. Derive an expression for galvanometer current (Ig) when the wheatstones bridge is unbalanced. **(05 Marks)**

b. An unbalanced wheat stones bridge is shown in Fig. Q6 (b). Calculate current in the galvanometer. **(05 Marks)**

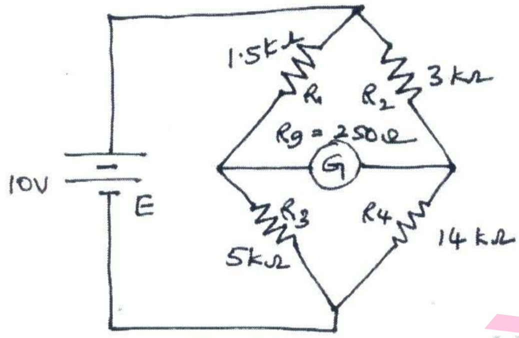

Fig. Q6 (b)

c. Derive an expression for Lx and Rx which is a series impedance in the Maxwell's bridge. And find series equivalent unknown impedance, when C_1=0.01 μf, R_1=470 KΩ, R_2=5.1 KΩ, R_3 = 100 KΩ **(10 Marks)**

7 a. List at least five advantages of electrical transducer. **(05 Marks)**

b. A displacement transducer with a shaft stroke of 3.0 inch, is applied to the circuit as shown in Fig. Q7 (b) below. The total resistance of the potentiometer is 5 KΩ, the applied voltage Vt is 5 V. When the wiper is at 0.9 inch from B. What is the value of output voltage V_0. **(05 Marks)**

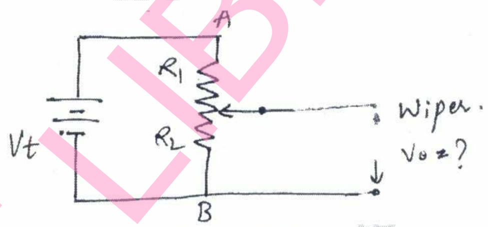

Fig. Q7 (b)

c. Define Gauge factor. Derive expression for gauge factor of bounded resistance wire strain gauge. **(10 Marks)**

8 a. Explain photo transistor. With neat diagram and output characteristics. How is it used as a transducer? **(05 Marks)**

b. List at least five classifications of digital displays. **(05 Marks)**

c. List out the requirement of a dummy load. And explain measurement of power by means of a bolometer bridge. **(10 Marks)**

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Third Semester B.E. Degree Examination, June/July 2013
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. State and prove Gauss's Divergence theorem. **(06 Marks)**
b. State and explain the electric field intensity and obtain an expression for electric field intensity due to an infinitely long line charge. **(08 Marks)**
c. A charge of -0.3 μC is located at A(25, -30, 15) cm, and a second charge of 0.5 μC at B(-10, 8, 12) cm. Find E at i) the origin ii) P(15, 20, 50) cm. **(06 Marks)**

2 a. Discuss with relevant equations the potential field of a system of charges and hence obtain the potential field of a ring of uniform line charge density. **(08 Marks)**
b. Discuss current and current density and derive the expression for continuity equation. **(06 Marks)**
c. Given the field $E = 40\,xya_x + 20x^2a_y + 2a_z$ V/m, calculate the potential between the two points P(1, -1, 0) and Q(2, 1, 3). **(06 Marks)**

3 a. State and prove the uniqueness theorem. **(08 Marks)**
b. Derive Poisson's and Laplace's equations. **(05 Marks)**
c. Calculate numerical values for V and S_V at point P in free space if $V = \frac{4yz}{x^2+1}$ at P(1, 2, 3). **(07 Marks)**

4 a. Derive an expression for magnetic field intensity at a point P due to an infinitely long straight filament carrying a current I. Also obtain the magnetic field intensity caused by a finite length current filament on the z-axis. **(08 Marks)**
b. In an infinitely long coaxial cable carrying a uniformely current I in the inner conductor and –I in the outer conductor, find the magnetic field intensity is a function of radius and sketch the field intensity variation. **(07 Marks)**
c. Discuss the scalar and vector magnetic potentials. **(05 Marks)**

PART – B

5 a. Discuss the force on a differential current element and also obtain the expression for force. **(08 Marks)**
b. Given a ferrite material which we shall specify to be operating in a linear mode with B = 0.05 T, let us assume $\mu_r = 50$, and calculate values for x_m, M and H. **(06 Marks)**
c. Define inductance and derive the expression for inductance of a torodial coil of N turns and a current I. **(06 Marks)**

6 a. List the Maxwell's equations in point and integral forms for time varying field. **(06 Marks)**

b. Explain the retarded potentials. **(08 Marks)**

c. Let $\mu = 10^5$ H/m, $\epsilon = 4 \times 10^{-9}$ F/m, $\sigma = 0$ and $S_V = 0$. Find K so that each of the following pair of fields satisfies Maxwell's equations:

i) $D = (6a_x - 2ya_y + 2za_z nC/m^2)$

$H = (Kxa_x + 10ya_y - 25za_z)$ A/m

ii) $E = (20y - Kt)a_x$ V/m

$H = (y + 2 \times 10^6 t)\ a_z$ A/m **(06 Marks)**

7 a. Starting from Maxwell's equations, obtain the wave equations in free space. **(07 Marks)**

b. Derive an expression for depth of penetration. **(07 Marks)**

c. Find the depth of penetration at a frequency of 1.6 MHz in aluminium, where $\sigma = 38.2$ Mz/m and $\mu_r = 1$. Also find γ, λ and V_P. **(06 Marks)**

8 a. Derive the expressions for reflection and transmission coefficients for normal incidence at the boundary between two dielectrics. **(09 Marks)**

b. Write a note on standing wave ratio. **(06 Marks)**

c. A uniform plane wave in air partially reflects from the surface of a material whose properties are unknown. Measurements of the electric field in the region in front of the interface yield a 1.5 m spacing between maxima, with the first maximum occurring 0.75 m from the interface. A standing wave ratio of 5 is measured. Determine the intrinsic impedance η_u of the unknown material. **(05 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, June/July 2013

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Find modulus and amplitude of $1+\cos\theta+i\sin\theta$. **(06 Marks)**

b. If n is positive integer, prove that $(\sqrt{3}+i)^n+(\sqrt{3}-i)^n=2^{n+1}\cos\left(\frac{n\pi}{2}\right)$. **(07 Marks)**

c. Find the cube root of $1+i$ and represent them in the Argand diagram. **(07 Marks)**

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

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

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

3 a. Prove that $\tan\phi=r\frac{d\theta}{dr}$ with usual notations. **(06 Marks)**

b. Find the pedal equation for the curve $r=a(1+\cos\theta)$. **(07 Marks)**

c. Expand $f(x)=\sqrt{1+\sin 2x}$ using Maclaurin's series upto 4^{th} term. **(07 Marks)**

4 a. If $u=\tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u$. **(06 Marks)**

b. If $u=f(x-y, y-z, z-x)$, prove that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$. **(07 Marks)**

c. If $u=\tan^{-1}x+\tan^{-1}y$ and $V=\frac{x+y}{1-xy}$, find the value of $\frac{\partial(u,v)}{\partial(x,y)}$. **(07 Marks)**

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

b. Evaluate $\int_0^2 x^{5/2}\sqrt{2-x}\,dx$. **(07 Marks)**

c. Evaluate $\int_1^2\int_3^4(xy+e^y)dydx$. **(07 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.

6 a. Evaluate $\int_0^1\int_0^1\int_0^1 e^{x+y+z}\,dxdydz$. **(06 Marks)**

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

c. Show that $\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta \times \int_0^{\pi/2}\frac{1}{\sqrt{\sin\theta}}\,d\theta=\pi$ **(07 Marks)**

7 a. Solve $xy\frac{dy}{dx}=1+x+y+xy$. **(06 Marks)**

b. Solve $\left[x\tan\left(\frac{y}{x}\right)-y\sec^2\left(\frac{y}{x}\right)\right]dx+x\sec^2\left(\frac{y}{x}\right)dy=0$ **(07 Marks)**

c. Solve $\frac{dy}{dx}+y\cot x=4x\,\mathrm{cosec}\,x$. **(07 Marks)**

8 a. Solve $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=2e^{3x}$. **(06 Marks)**

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

c. Solve $\frac{d^2y}{dx^2}+4y=1+x^2$ **(07 Marks)**

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