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10MAT31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
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 in $(-\pi, \pi)$ for $f(x) = x\cos x$. **(07 Marks)**

b. Obtain the Fourier half range sine series,

$$f(x) = \begin{cases} \frac{1}{4} - x & \text{in } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{in } \frac{1}{2} < x < 1 \end{cases}.$$ **(07 Marks)**

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

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

2 a. Find the Fourier transforms of $f(x) = \begin{cases} 1 - x^2 & \text{for } |x| < 1 \\ 0 & \text{for } |x| \geq 1 \end{cases}$ and hence evaluate

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

b. Find the Fourier sine transform of $e^{-|x|}$. **(07 Marks)**

c. Find the inverse Fourier sine transform of $\hat{f}_s(\alpha) = \frac{e^{-a\alpha}}{\alpha}$, $a > 0$. **(06 Marks)**

3 a. Solve the wave equation $u_{tt} = c^2 u_{xx}$ given that $u(0,t) = 0 = u(2l,t)$, $u(x, 0) = 0$ and $\frac{\partial u}{\partial t}(x,0) = a\sin^3\frac{\pi x}{2l}$ **(07 Marks)**

b. Solve the boundary value problem $\frac{\partial u}{\partial t} = c^2\frac{\partial^2 u}{\partial x^2}$ $0 < x < l$, $\frac{\partial u}{\partial x}(0,t) = 0$, $\frac{\partial u}{\partial x}(l,t) = 0$, $u(x, 0)=x$. **(07 Marks)**

c. Obtain the D'Almbert's solution of the wave equation, $u_{tt} = C^2 u_{xx}$ subject to the conditions $u(x,0) = f(x)$ and $\frac{\partial u}{\partial t}(x,0) = 0$. **(06 Marks)**

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

x	0	1	2	3	4
y	1	1.8	1.3	2.5	2.3

b. Solve by using graphical method the L.P.P.
Minimize $z = 30x + 20y$
Subject to the constraints: $x - y \leq 1$
$x + y \geq 3$, $y \leq 4$
and $x \geq 0$, $y \geq 0$ **(07 Marks)**

c. Maximize $z = 3x + 4y$
subject to the constraints $2x + y \leq 40$, $2x + 5y \leq 180$,
$x \geq 0, y \geq 0$ using simplex method. **(06 Marks)**

PART – B

5 a. Find the fourth root of 12 correct to three decimal places by using regula Falsi method. **(07 Marks)**

b. Solve $9x-2y+z=50$, $x+5y-3z=18$, $-2x+2y+7z=19$ by relaxation method obtaining the solution correct to two decimal places. **(07 Marks)**

c. Find the largest eigen value and the corresponding eigen vector of, $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ by using power method by taking initial vector as $[1 \quad 1 \quad 1]^T$. **(06 Marks)**

6 a. The table gives the values of tan x for $0.10 \le x \le 0.30$ **(07 Marks)**

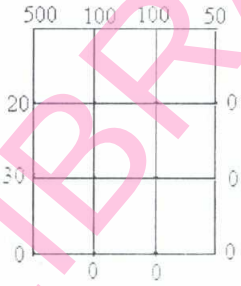
x	0.10	0.15	0.20	0.25	0.30
tanx	0.1003	0.1511	0.2027	0.2553	0.3093

b. Using Newton's forward and backward interpolation formula, calculate the increase in population from the year 1955 to 1985. The population in a town is given by. **(07 Marks)**

Year	1951	1961	1971	1981	1991
Population in thousands	19.96	39.65	58.81	77.21	94.61

c. Evaluate $\int_0^1 \frac{dx}{1+x}$ taking seven ordinates by applying Simpson's $\frac{3}{8}^{th}$ rule. Hence deduce the value of $\log_e 2$. **(06 Marks)**

7 a. Solve the Laplace's equation $u_{xx}+u_{yy}=0$, given that **(07 Marks)**



b. Solve $\frac{\partial^2 u}{\partial t^2}=4\frac{\partial^2 u}{\partial x^2}$ subject to $u(0,t)=0$; $u(4,t)=0$; $u(x,0)=x(4-x)$. Take h = 1, K = 0.5 upto Four steps. **(07 Marks)**

c. Solve the equation $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ subject to the condition $u(x, 0) = \sin \pi x$, $0 \le x \le 1$, $u(0,t)=u(1,t)=0$ using Schmidt's method. Carry out computations for two levels, taking $h=\frac{1}{3}$, $K=\frac{1}{36}$. **(06 Marks)**

8 a. Find the z-transform of, (i) $\cosh n\theta$ (ii) $\sinh n\theta$ **(07 Marks)**

b. Obtain the inverse z-transform of, $\frac{4z^2-2z}{z^3-5z^2+8z-4}$. **(07 Marks)**

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

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10ES32

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
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 static and dynamic resistance of the diode. **(04 Marks)**

b. For the circuit shown in Fig. Q1 (b). Find I_D, V_1, V_2 and V_0. Assume silicon diode. **(08 Marks)**

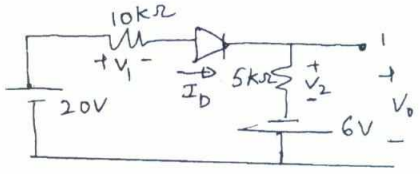

Fig. Q1 (b)

c. For the clipping circuit shown in Fig. Q1 (c). Draw the transfer characteristics and output voltage waveforms. Assume silicon diodes. **(08 Marks)**

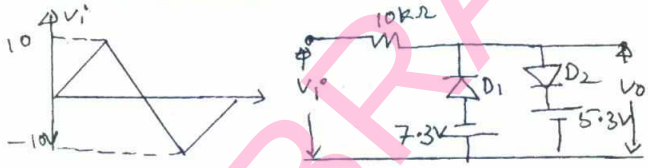

Fig. Q1 (c)

2 a. For a emitter bias circuit shown in Fig. Q2 (a). Find

i) Quiescent values of base and collector currents. ii) Quiescent values of V_{CE}.

iii) Voltage at base to ground and collector to ground. iv) Base to collector voltage.

Assume $V_{BE} = 0.7$ V, $\beta = 60$ **(10 Marks)**

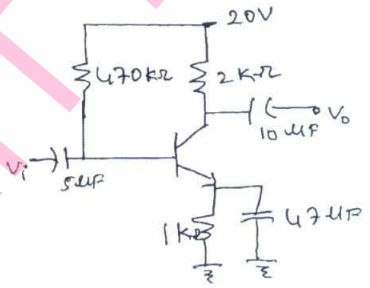

Fig. Q2 (a)

b. For the voltage divider bias configuration. Derive expression for I_C and V_{CE} and expression for collector current when it is in saturation. Comment on stability factor. **(10 Marks)**

3 a. Describe how transistor behaves as switch. Also describe transistor switching time. **(06 Marks)**

b. For common base npn transistor configuration with $I_E = 4$ mA, $\alpha = 0.98$ and ac signal of 2 mV applied between base and emitter terminals. Determine:

i) Input impedance ii) The voltage gain of load 0.56 KΩ is connected to output terminals.

iii) Output impedance. iv) Current gain. **(06 Marks)**

c. Explain common emitter fixed bias configuration. Derive expression for the input impedance, output impedance, voltage gain and current gain. **(08 Marks)**

4 a. Explain low frequency response of BJT amplifier. Derive the expression for lower cut-off frequency considering the effect of input coupling capacitor C_S. **(10 Marks)**

b. For the circuit shown in Fig. Q4 (b). Calculate (i) f_{Hi} and f_{Ho}. (ii) f_β and f_T

Take $C_{be} = 35$ P.F, $C_{bc} = 5$ P.F, $C_{ce} = 1$ PF, $C_{Wi} = 6$ PF, $C_{WO} = 10$ P.F, $\beta = 100$ and $V_0 = \infty$. **(10 Marks)**

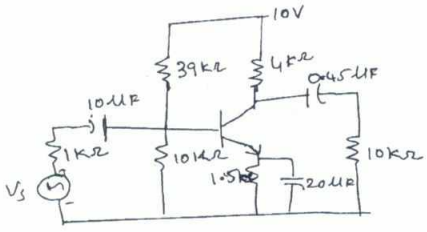

Fig. Q4 (b)

PART – B

5 a. Explain Darlington emitter follower. Draw the equivalent circuit. Derive expression for input impedance (Z_I), current gain (A_I), Voltage gain A_V and output impedance (Z_0). **(10 Marks)**

b. Determine the voltage gain, input and output impedance with voltage series feedback having $A = -100$, $R_i = 10$ KΩ, $R_0 = 20$ KΩ for feedback factor β = -0.1. **(06 Marks)**

c. Discuss the advantages of negative feedback. **(04 Marks)**

6 a. Describe FET amplifier with voltage series feedback. Derive the expression for gain. **(10 Marks)**

b. Explain the principles of class B amplifier operation. Derive expression for
(i) input dc power (ii) Output ac power (iii) η-efficiency
(iv) power dissipated by output transistor. **(10 Marks)**

7 a. Write the basic principle of oscillator. Also state the conditions for oscillation. **(04 Marks)**

b. Describe any one type of tunned oscillator with relevant diagram. Write expression for frequency of oscillations. **(08 Marks)**

c. RC phase shift oscillator $R_C = 5$ kΩ and $R = 3.3$ kΩ. Find the range of values of capacitor if it is required to vary frequency from 100 Hz to 20 kHz. **(08 Marks)**

8 a. Explain common gate JFET configuration with relevant circuit diagram. Draw equivalent circuit. Derive expression for Z_i, Z_0 and A_V. **(08 Marks)**

b. The self biased configuration of JFET has operating point defined by $V_{GSQ} = -2.6$ V and $I_{DQ} = 22.6$ mA and $I_{DSS} = 8$ mA and $V_P = -6$ V the value of $Y_{OS} = 20\,\mu$S as shown in Fig.Q8 (b). Find (i) g_m (ii) r_d (iii) Z_i (iv) Z_0 **(06 Marks)**

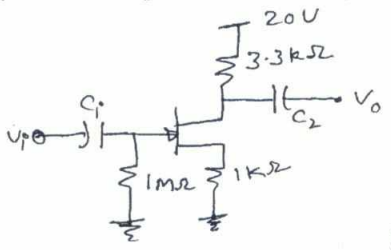

Fig. Q8 (b)

c. Differentiate depletion type MOSFET and enhancement type MOSFET. **(06 Marks)**

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10ES33

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. A logic circuit has 4 inputs P, Q, R, S and 2 outputs Y_1, Y_2.
i) Y_1 is '1' when majority of inputs are '1' (equal numbers of '0' and '1' are treated don't care)
ii) Y_2 is '1' when two adjacent inputs are '1' (P and S are treated adjacent)
Design the circuit using NAND gates only. **(12 Marks)**

b. Determine minimal POS and SOP for $f(E, F, G, H) = \pi (0, 1, 2, 7, 11, 13) \cdot d(4, 5, 8, 10, 14)$. **(08 Marks)**

2 a. Using Quine – McCluskey technique simplify the Boolean expression.
$f(A, B, C, D) = \Sigma(0, 5, 7, 8, 9, 10, 11, 14, 15)$. **(10 Marks)**

b. Simplify and realize the given function using MEV technique taking lest significant variable as map entered variable.
$f(a, b, c, d, e) = \Sigma(1, 3, 4, 6, 9, 11, 12, 14, 17, 19, 20, 22, 25\ 27, 28, 30)$. **(10 Marks)**

3 a. With the help of logic diagram, truth table and circuit diagram, explain 3–to–8 line decoder with active low outputs. Using the same implement the functions :
$f_1 = \pi(0, 3, 5, 6)$
$f_2 = \pi(2, 3, 4, 5, 7)$. **(10 Marks)**

b. What are the limitations of basic encoder? Design a 4–2 priority encoder with validity output. **(10 Marks)**

4 a. Explain how look Ahead carry adder speeds up operation of addition over basic parallel adder. **(10 Marks)**

b. Implement $f(A, B, C, D) = \Sigma m(0, 1, 3, 4, 8, 9, 15)$ using i) 74151 (8–1 MUX) ii) 74153 (dual 4–1 mux). **(06 Marks)**

c. Define Dmux, design 1–4 Dmux. **(04 Marks)**

PART – B

5 a. Explain the application of SR Latch as switch de-bouncer. **(06 Marks)**

b. Explain the operation of asynchronous inputs of flip-flop with waveforms. **(06 Marks)**

c. Write the logic circuit and truth table of D and T FFS. Draw the output waveforms for the input shown for :
i) D latch ii) Gated D latch iii) +ve edge TFF iv) –ve edge TFF. **(08 Marks)**

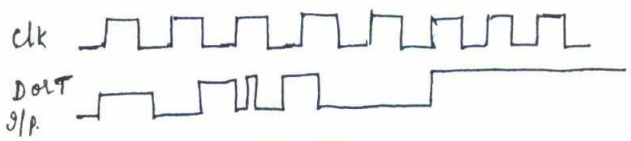

Fig. Q5(c)

6 a. Design a mod16 asynchronous down counter using D flip–flops. **(10 Marks)**

b. Explain the operation of : i) parallel in serial out shift register ii) twisted ring counter. **(10 Marks)**

7 a. Differentiate between Moore and Mealy models. **(05 Marks)**

b. Construct the transition table, state table and state diagram for the Moore sequential circuit shown. **(15 Marks)**

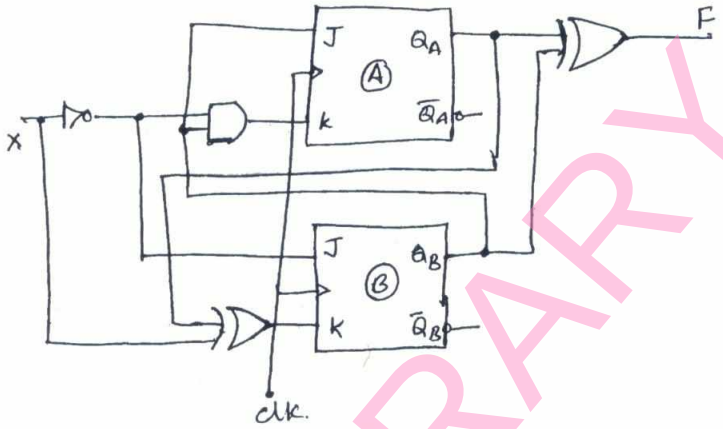

Fig. Q7(b)

8 a. Explain lockout condition. How do you eliminate it? Design a synchronous counter for : $4 \rightarrow 6 \rightarrow 7 \rightarrow 3 \rightarrow 1 \rightarrow 4$.
Avoid lockout condition. Use JK flip-flop. **(12 Marks)**

b. A sequential circuit has one input and one output. The state diagram is as shown in Fig. Q8(b). Design the circuit using D FF. **(08 Marks)**

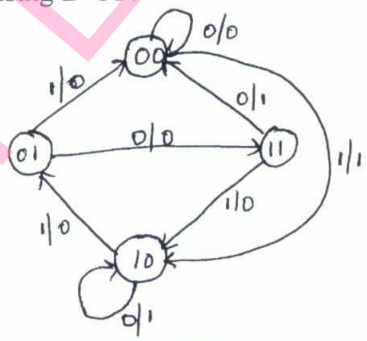

Fig. Q8(b)

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10ES34

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Network Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Using source transformation and shifting, obtain the power consumed in 8Ω resistance of the network shown in Fig.Q1(a). **(06 Marks)**

b. Determine all the node voltages of the circuit shown in Fig.Q1(b) using nodal analysis. **(06 Marks)**

c. Find the value of Vs such that the current in –j11Ω is zero, use mesh analysis assuming all the loop currents are in clockwise directions. Refer Fig. 1(c). **(08 Marks)**

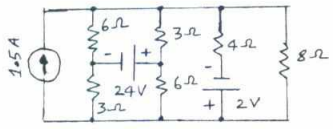

Fig. Q1(a)

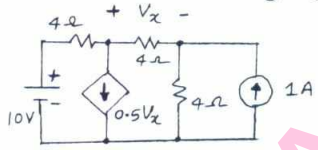

Fig. Q1(b)

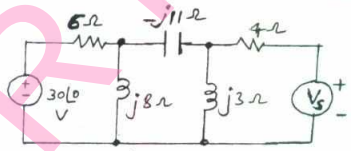

Fig. Q1(c)

2 a. Draw the dual of the network shown in Fig. 2(a). Write the corresponding equations for both networks. **(08 Marks)**

b. Draw the graph of the network shown in Fig. Q2(b), select links as the branches containing voltage sources. Write tie-set schedule and there from obtain all the branch currents and voltages. **(12 Marks)**

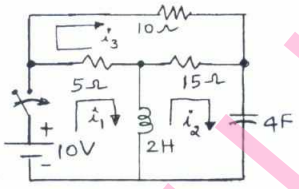

Fig.Q2(a)

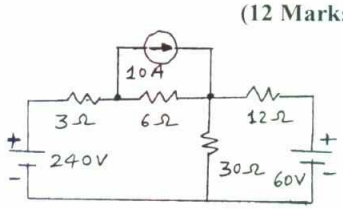

Fig. Q2(b)

3 a. Determine the current and voltage across 4Ω resistance of the network shown in Fig. Q3(a), using superposition theorem. **(06 Marks)**

b. Apply Millman's theorem to find V_0 and I_0 for the circuit shown in Fig. 3(b). **(08 Marks)**

c. State and explain the reciprocity theorem. **(06 Marks)**

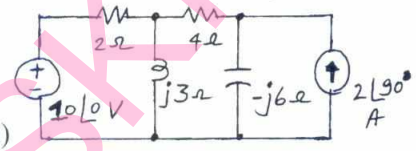

Fig.Q3(a)

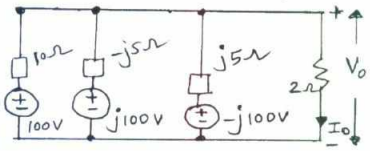

Fig.Q3(b)

4 a. A linear bilateral network consisting of passive elements is shown in Fig. 4(a), with $V_s = 10V$, V_{ab} is 5V. If 'ab' is shorted, $I_{ab} = 1A$ for $V_s = 15V$. Determine the current when $R_{ab} = 2.5\Omega$ with $V_s = 12V$. **(04 Marks)**

b. Determine the Norton's equivalent of the circuit shown in Fig. 4(b). **(08 Marks)**

c. What value of impedance Z_L results in maximum power transfer condition for the network shown in Fig. Q4(c)? Also determine the corresponding power. **(08 Marks)**

Fig. Q4(a)

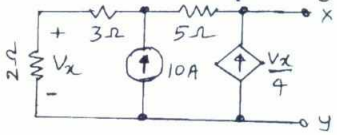

Fig. Q4(b)

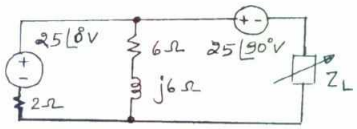

Fig. Q4(c)

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. A series R – L – C circuit is fed with 50 V rms supply. At resonance, the current through the circuit is 25A and the voltage across inductor is 1250 volts. If G = 4 μF, determine the values of R, L Q, resonant frequency, bandwidth and half power frequencies. **(12 Marks)**

b. Obtain the condition for resonance of elements as shown in Fig. 5(b). Derive the expression for total impedance at resonance. **(08 Marks)**

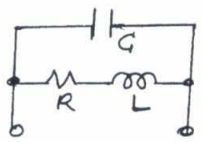

Fig. Q5(b)

6 a. The switch 'K' in the circuit shown in Fig. 6(a) is in open position for a long time and at time t = 0, it is closed. Determine the values of i_1 and i_2 along with their first and second derivatives at t = 0+. **(10 Marks)**

b. The switch 'S' is changed from position 1 to 2 at time t = 0. The circuit was under steady state before this action. Determine the value of v and i at t = 0+ and their first and second derivatives also. Refer Fig. 6(b). **(10 Marks)**

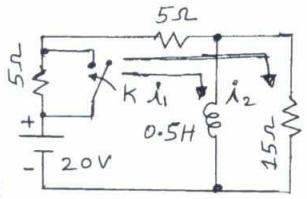

Fig. Q6(a)

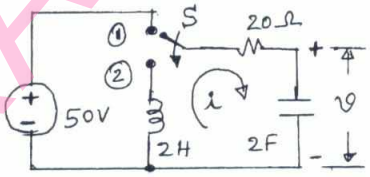

Fig. Q6(b)

7 a. Using Laplace transformation method obtain the expression for i(t). The capacitor charge is zero initially. Also obtain the expression for capacitor voltage in 'S' domain, refer Fig. 7(a). **(10 Marks)**

b. Using standard waveforms, express the waveform given (periodic) in Fig. 7(b) and obtain its Laplace transform. **(10 Marks)**

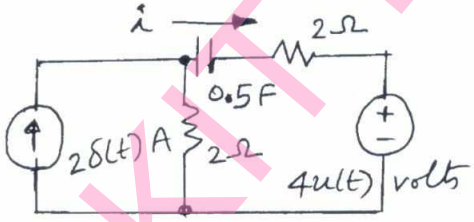

Fig. Q7(a)

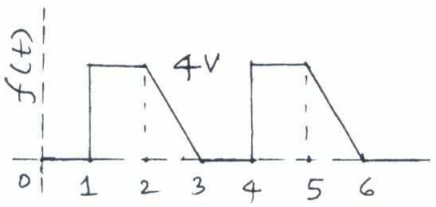

Fig. Q7(b)

8 a. Determine the Y–parameters of the network shown in Fig. Q8(a), **(10 Marks)**

b. Replace the circuit shown in Fig. 8(b) with its hybrid parameter equivalent network. **(10 Marks)**

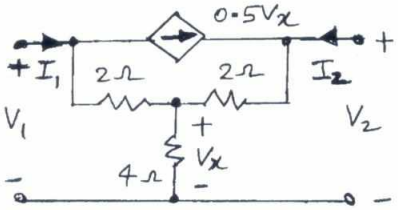

Fig. Q8(a)

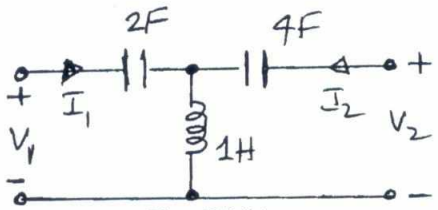

Fig. Q8(b)

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10IT35

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Discuss briefly : (i) Gross error (ii) Systematic error. **(04 Marks)**
b. Explain with neat circuit diagram full wave rectifier type AC voltmeter. **(08 Marks)**
c. Explain the working of true RMS voltmeter, with a neat block diagram. **(08 Marks)**

2 a. Write the advantages of digital instruments over analog instruments. **(04 Marks)**
b. Explain the ramp type digital voltmeter with the help of a block diagram. **(08 Marks)**
c. With a neat block diagram explain the digital frequency meter. **(08 Marks)**

3 a. Explain the function of various controls on the front panel of a CRO. **(04 Marks)**
b. With neat block diagram, explain dual trace oscilloscope. **(10 Marks)**
c. With the help of basic block diagram explain the working principle of electronic switch. **(06 Marks)**

4 a. Explain the operation of digital storage oscilloscope with the help of a block diagram. Mention the advantages. **(10 Marks)**
b. With a neat block diagram explain the sampling oscilloscope. **(10 Marks)**

PART – B

5 a. Explain in detail the working of sine and square wave generator. **(10 Marks)**
b. Explain with neat block diagram operating principle of function generator. **(10 Marks)**

6 a. Explain the Wheatstone bridge and derive the balance equation for Wheatstone bridge. Mention the limitations. **(12 Marks)**
b. With a neat block diagram explain the Wagner's earth connection. **(08 Marks)**

7 a. What are the factors to be considered for the selection of better transducer? Explain. **(08 Marks)**
b. Explain the construction, principle and operation of LVDT. **(12 Marks)**

8 a. Compare LED displays and LCD displays (Any four). **(04 Marks)**
b. Explain the procedure of measuring power using a Bolometer in a bridge circuit. **(10 Marks)**
c. Write an explanatory note on signal conditioning. **(06 Marks)**

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10ES36

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
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 Coulombs law for the Force between any two point charges and indicate the units of Quantities in the force equation. **(06 Marks)**

b. On the line described by x = 2m, y = –4m there is uniform charge distribution of density $\rho_L = 20$ nc/m. Determine Electric field at P(–2, –1, 4)m. **(04 Marks)**

c. State and prove Gauss – Divergence theorem. **(10 Marks)**

2 a. Given the potential field $V = (50x^2yz + 20y^2)$ Volts in free space.
Find : i) V at P(–2, 3, 6) ii) $\overline{E}_p$ and iii) $\hat{a}r$ at P **(06 Marks)**

b. Derive an expression for energy expended by moving a point charge arbitrarily in an uniform electric field. **(06 Marks)**

c. Derive Laplace and Poisson's equations starting from the differential form of Gauss law. Express Laplace equation in all the three co-ordinate systems. **(08 Marks)**

3 a. Derive expression for energy stored in a capacitor and an expression after energy density in an electrostatic field. **(08 Marks)**

b. In cylindrical coordinate system planes are insulated along 'z' axis as shown in Fig 3(b). Neglect fringing effect and find expressions for $\vec{E}$ between the planes assuming a potential of 100V for $\phi = \alpha$ and a zero reference at $\phi = 0$. **(06 Marks)**

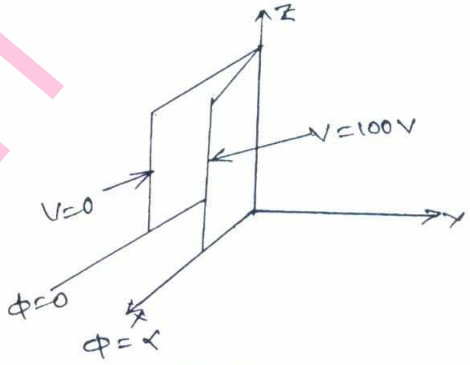

Fig Q3(b)

c. State and prove uniqueness theorem. **(06 Marks)**

4 a. An air cored torroid having a cross sectional area of $6cm^2$ and mean radium 15cm is wound uniformly with 500 turns carrying a current of 4A. Determine the magnetic flux density and field intensity of torroid. **(06 Marks)**

b. Derive an expression for Magnetic flux density at any point on the axis of Solenoid. **(08 Marks)**

c. State and explain Amperes circuital law. **(06 Marks)**

PART – B

5 a. Explain the concept of scalar and vector magnetic potential. **(08 Marks)**

b. Derive the boundary conditions at the interface between two different magnetic materials. **(06 Marks)**

c. Find the magnetic field intensity at the point P for the Fig Q5(c) shown below. **(06 Marks)**

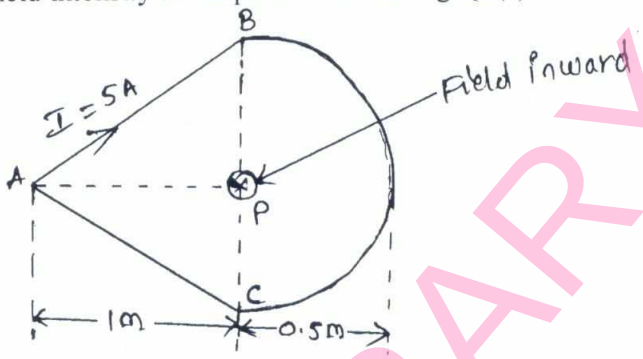

Fig Q5(c)

6 a. List out Maxwell's equations in point and integral forms for both static and time varying fields. **(08 Marks)**

b. Describe the continuity equation of current in differential form. **(06Marks)**

c. Show that conduction current in the wire is equal to the displacement current in the dielectric of a capacitor subjected to a time varying field. **(06 Marks)**

7 a. Explain how uniform plane wave is transverse in nature. Describe the skin depth or depth of penetration. **(10 Marks)**

b. A wave propagating in a Lossless dielectric has the Components.
$\vec{E} = 500\cos[10^7 t - \beta z]\,\hat{a}_z$ V/m and $\vec{H} = 1.1\cos[10^7 t - \beta z]\hat{a}_y$ A/m of the wave is travelling at V = 0.5C. Find : i) μ_r ii) ϵ_r iii) β iv) λ v) z. **(10 Marks)**

8 a. Derive the expressions for transmission co-efficient and reflection co-efficient of a uniform plane wave for normal incidence. **(10 Marks)**

b. Define SWR and derive the relationship between SWR and reflection coefficient. **(10 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Advanced Mathematics - I

Time: 3 hrs. Max. Marks:100

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

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

b. Find the cube roots of 1 - i. **(07 Marks)**

c. Prove that $\left(\frac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i \sin n\theta$. **(07 Marks)**

2 a. Find the nth derivative of $e^{ax}\cos(bx + c)$. **(07 Marks)**

b. Find the nth derivative of $\frac{x}{(x-1)(2x+3)}$. **(06 Marks)**

c. If $y = a\cos(\log x) + b\sin(\log x)$ prove that $x^2y_{n+2} + (2n + 1)xy_{n+1} + (n^2 + 1)y_n = 0$. **(07 Marks)**

3 a. With usual notations P.T $\tan\phi = \frac{rd\theta}{dr}$. **(06 Marks)**

b. Find the angle between the pairs of curves

$r = a\log\theta \quad r = \frac{a}{\log\theta}$. **(07 Marks)**

c. Find the Pedal equation to the curve $r = a(1+\sin\theta)$. **(07 Marks)**

4 a. State and prove Euler's theorem of Homogeneous functions. **(06 Marks)**

b. If $u = f(x-y, y-z, z-x)$

P.T $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$. **(07 Marks)**

c. If $u = \tan^{-1}x + \tan^{-1}y$, $V = \frac{x+y}{1-xy}$

S.T $\frac{\partial(u,v)}{\partial(x,y)}=0$. **(07 Marks)**

5 a. Obtain the Reduction formula for $\int \sin^m x \cos^n x\, dx$. Where m, n are positive integers. **(07 Marks)**

b. Evaluate $\int_1^2\int_0^{2-y} xy\, dx\, dy$. **(06 Marks)**

c. Evaluate $\int_0^3\int_0^2\int_0^1 (x+y+z)\, dz\, dx\, dy$. **(07 Marks)**

6 a. Prove that $\left[\left(\frac{1}{2}\right)\right] = \sqrt{\pi}$. **(06 Marks)**

b. Prove that $\int_0^\infty x^2e^{-x^4}dx \times \int_0^\infty e^{-x^4}dx = \frac{\pi}{8\sqrt{2}}$. **(07 Marks)**

c. Evaluate the Integral $\int_0^1 x^5(1-x)^6\,dx$. **(07 Marks)**

7 a. Solve $(D^3 - 3D - 2)y = 0$. **(06 Marks)**

b. Solve $(y'' + y) = e^{-x} + \cos x + x^3$. **(07 Marks)**

c. Solve $y'' - 2y' + y = xe^x \sin x$. **(07 Marks)**

8 a. Solve $\frac{dy}{dx} = \frac{x(2\log x + 1)}{\sin y + y\cos y}$. **(06 Marks)**

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

c. Solve $(2xy + y - \tan y)\,dx + (x^2 - x\tan^2 y + \sec^2 y)\,dy = 0$. **(07 Marks)**

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