III EC, EE (S)

CBCS Scheme

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15MAT31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Expand $f(x) = x - x^2$ as a Fourier series in the interval $(-\pi, \pi)$. **(08 Marks)**

b. Obtain the half-range cosine series for the function $f(x) = x(l - x)$ in the interval $0 \le x \le l$. **(08 Marks)**

OR

2 a. Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$. Hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots$. **(06 Marks)**

b. Find the half-range sine series for the function

$$f(x) = \begin{cases} \frac{1}{4} - x & \text{in } 0 < x < 1/2 \\ x - \frac{3}{4} & \text{in } 1/2 < x < 1 \end{cases}.$$ **(05 Marks)**

c. Compute the constant term and the coefficient of the 1st sine and cosine terms in the Fourier series of y as given in the following table:

x:	0	1	2	3	4	5
y:	4	8	15	7	6	2

(05 Marks)

Module-2

3 a. If $f(x) = \begin{cases} 1 - x^2; & |x| < 1 \\ 0; & |x| \ge 1 \end{cases}$. Find the Fourier transform of f(x) and hence find the value of $\int_0^\infty \frac{x\cos x - \sin x}{x^3} dx$. **(06 Marks)**

b. Find the Fourier sine and cosine transform of

$$f(x) = \begin{cases} x, & 0 < x < 2 \\ 0, & \text{elsewhere} \end{cases}.$$ **(05 Marks)**

c. Solve using Z-transform $y_{n+2} - 4y_n = 0$ given that $y_0 = 0$, $y_1 = 2$. **(05 Marks)**

OR

4 a. Obtain the inverse Fourier sine transform of $F_S(\alpha) = \frac{e^{-a\alpha}}{\alpha}$, $a > 0$. **(06 Marks)**

b. Find the Z-transform of $2n + \sin\left(\frac{n\pi}{4}\right) + 1$. **(05 Marks)**

c. If $U(z) = \frac{z}{z^2 + 7z + 10}$, find the inverse Z-transform. **(05 Marks)**

Module-3

5 a. Obtain the coefficient of correlation for the following data:

x :	10	14	18	22	26	30
y :	18	12	24	6	30	36

(06 Marks)

b. By the method of least square find the straight line that best fits the following data:

x :	1	2	3	4	5
y :	14	27	40	55	68

(05 Marks)

c. Use Newton-Raphson method to find a root of the equation $\tan x - x = 0$ near $x = 4.5$. Carry out two iterations. **(05 Marks)**

OR

6 a. Find the regression line of y on x for the following data:

x :	1	3	4	6	8	9	11	14
y :	1	2	4	4	5	7	8	9

Estimate the value of y when $x = 10$. **(06 Marks)**

b. Fit a second degree parabola to the following data:

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(05 Marks)

c. Solve $xe^x - 2 = 0$ using Regula – Falsi method. **(05 Marks)**

Module-4

7 a. From the data given in the following table. Find the number of students who obtained less than 70 marks.

Marks :	0-19	20-39	40-59	60-79	80-99
Number of students :	41	62	65	50	17

(06 Marks)

b. Find the equation of the polynomial which passes through the points (4, -43), (7, 83), (9, 327) and (12, 1053). Using Newton's divided difference interpolation. **(05 Marks)**

c. Compute the value of $\int_{0.2}^{1.4} (\sin x - \log x + e^x)dx$ using Simpson's $\frac{3}{8}^{th}$ rule taking six parts.

(05 Marks)

OR

8 a. Using Newton's backward interpolation formula find the interpolating polynomial for the function given by the following table:

x :	10	11	12	13
f(x) :	22	24	28	34

Hence fine f(12.5). **(06 Marks)**

b. The following table gives the premium payable at ages in years completed. Interpolate the premium payable at age 35 completed. Using Lagrange's formula.

Age completed :	25	30	40	60
Premium in Rs. :	50	55	70	95

(05 Marks)

c. Evaluate $\int_{4}^{5.2} \log_e x \, dx$ taking 6 equal strips by applying Waddles rule. **(05 Marks)**

Module-5

9 a. Verify Green's theorem for $\oint (xy + y^2)dx + x^2 dy$ where c is the closed curve of the region bounded by y = x and y = xz. **(06 Marks)**

b. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)i - 2xy\,j$ taken round the rectangle bounded by the lines x = ±a, y = 0 and y = b. **(05 Marks)**

c. A heavy cable hangs freely under gravity between two fixed points. Show that the shape of the cable is a catenary. **(05 Marks)**

OR

10 a. Use divergence theorem to evaluate $\iint_S \vec{F}\,\hat{n}\,ds$ over the entire surface of the region above XoY plane bounded by the cone $z^2 = x^2 + y^2$, the plane z = 4 where $\vec{F} = 4xz^1\hat{i} + xyz^2\hat{j} + 3z\hat{k}$. **(06 Marks)**

b. Find the extremal of the functional $\int_{x_1}^{x_2} [(y^1)^2 - y^2 + 2y \sec x]dx$. **(05 Marks)**

c. Prove that the shortest distance between two points in a plane is along the straight line joining them. **(05 Marks)**

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CBCS Scheme

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15EC32

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Analog Electronics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Derive an expression for input impedance, output impedance, voltage gain and current gain of un bypassed R_E common emitter amplifier using r_e model. **(08 Marks)**

b. Write the re-model of a Darlington emitter follower. Also determine input impedance, output impedance and voltage gain for the circuit. **(08 Marks)**

OR

2 a. Derive an expression for input impedance, output impedance, voltage gain and current gain of transistor amplifier using h-parameters. **(08 Marks)**

b. Determine voltage gain and current gain of emitter follower. Where $V_{CC} = 10V$, $R_B = 100K$, $R_E = 1K\Omega$, $h_{ie} = 1.1K\Omega$, $h_{fe} = 100$. Use approximate hybrid model. **(04 Marks)**

c. Design common emitter amplifier shown in Fig.Q.2(c) hfe = 100, $V_{CE} = 5V$. **(04 Marks)**

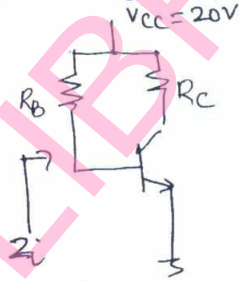

Fig.Q.2(c)

Module-2

3 a. Explain the working principle of JFET. Determine JFET parameters from characteristics. **(06 Marks)**

b. Derive an expression for output resistance and voltage gain of fixed bias FET amplifier. **(06 Marks)**

c. Calculate voltage gain of self bias FET amplifier. The circuit uses $R_D = 2K\Omega$, $R_S = 1K\Omega$, $r_d = 40K\Omega$, $g_m = 2mA/V$, $R_G = 2M\Omega$. **(04 Marks)**

OR

4 a. Explain construction and working principle of enhancement type MOSFET. **(06 Marks)**

b. Derive an expression for output impedance input impedance and voltage gain of common gate amplifier. **(07 Marks)**

c. Distinguish between JFET and enhancement type MOSFET. **(03 Marks)**

Module-3

5 a. Derive an expression for low frequency response of BJT amplifier due to capacitors C_S, C_E and C_C. **(08 Marks)**

b. Estimate F_{LG}, F_{LS} and F_{LC} of the circuit shown in Fig.Q.5(b). The circuit uses R_{sig} = 10KΩ, R_G = 1MΩ, R_D = 2.2K, R_L = 4.7KΩ, r_d = ∞, R_S = 1KΩ, g_m = 2ms, C_G = 0.01μF, C_S = 0.47 μF, C_C = 0.1 μF. Plot the response. **(08 Marks)**

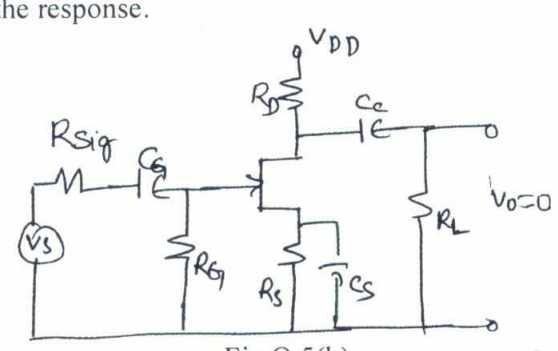

Fig.Q.5(b)

OR

6 a. Define Miller's theorem. Determine equivalent input and output capacitances of the circuit. **(08 Marks)**

b. Calculate the f_{Hi} of BJT amplifier. The transistor amplifier uses silicon transistor with V_{CC} = 20V, R_1 = 90KΩ, R_2 = 10KΩ, R_C = 5K, R_L = 5KΩ, R_E = 1.5KΩ, C_S = C_C = C_E = 0.1μF, r_0 = r_{ce} = ∞, C_{be} = 100pF, C_{bc} = 3pF, C_{ce} = 5pF, c_{wi} = C_{wo} = 6pF, β = 100, R_S = 10KΩ. **(08 Marks)**

Module-4

7 a. Determine input resistance and output resistance of voltage series feedback amplifier. **(06 Marks)**

b. Briefly explain characteristics of negative feedback amplifier. **(06 Marks)**

c. An amplifier without feedback gives a fundamental output 36V with 7 percent second-harmonic distortion when the input is 0.028V. If 1.2 percent of the output is feedback into the input in a negative voltage series feedback circuit. Determine the output voltage. **(04 Marks)**

OR

8 a. Explain FET phase shift oscillator with neat diagram and necessary equation. **(06 Marks)**

b. Explain the working of wein bridge oscillator. **(06 Marks)**

c. Calculate the oscillator frequency for an FET Hartley oscillator with tank circuit elements C = 250pF, L_1 = 1.5mH and L_2 = 2.5mH. Also calculate the gain of an amplifier. **(04 Marks)**

Module-5

9 a. Derive and expression for second harmonic distortion. **(05 Marks)**

b. Show that maximum conversion gain of transformer coupled class A amplifier is 50%. **(06 Marks)**

c. Calculate the harmonic distortion components for an output signal having fundamental amplitude of 2.1V, second harmonic amplitude of 0.3V, third harmonic component of 0.1V and fourth harmonic component of 0.05V. Also calculate the total harmonic distortion. **(05 Marks)**

OR

10 a. Derive an expression for conversion gain of class B push full amplifier with neat circuit diagram and waveform. **(08 Marks)**

b. Define voltage regulator. Explain the server voltage regulator using transistor. **(08 Marks)**

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CBCS Scheme

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15EC33

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Digital Electronics

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define the following: i) TVUM Table; ii) Combinational circuit; iii) Cannonical SOP; iv) Cannonical POS. **(04 Marks)**

b. Obtain minimal expression using k-map for the following incompletely specified function: $F(a, b, c, d) = \sum_{m}(0,1,4,6,7,9,15) + \sum_{d}(3,5,11,13)$ and draw the circuit diagram using gates. **(06 Marks)**

c. Write the truth table and design a circuit to generate o/p using K-map for the problem statement given: o/p of a combinational circuit having 4 inputs and an o/p, becomes logical '1' when two or more inputs goto logic level '1'. **(06 Marks)**

OR

2 a. Define K-map, incompletely specified function, essential prime implicants and grey code. **(04 Marks)**

b. Obtain minimal logical expression for the given maxterm expression using K-map. $f(a,b,c,d) = \pi_{M}(0,1,4,5,6,7,9,14).\pi_{d}(13,15)$. **(04 Marks)**

c. Use Quine McCluskey's method of minimization to obtain essential prime implicants and minimal expression for the following minterm expression: $f(a, b, c, d) = \sum_{m}(0, 1, 4, 5, 7, 8, 13, 15) + \sum_{d}(2)$. **(08 Marks)**

Module-2

3 a. Define encoder, decoder, priority encoder and multiplexer. **(04 Marks)**

b. Write block diagram representation of a full adder using 3:8 decoders. **(04 Marks)**

c. Design full adder using i) 8:1 MUX and ii) 4:1 MUX. **(08 Marks)**

OR

4 a. Explain Carry look ahead adder with neat diagram and relevant expressions. **(08 Marks)**

b. Design 2-bit comparator and briefly explain. **(08 Marks)**

Module-3

5 a. Define bistable element, latch, flip-flop and function table. **(04 Marks)**

b. Sketch timing diagrams for JK flipflop and D-flip-flop. **(06 Marks)**

c. Explain M/S JK flip-flop with the help of circuit diagram and waveforms. **(06 Marks)**

OR

6 a. Find characteristic equations for T and SR-flip-flops with the help of function tables. **(06 Marks)**

b. Write circuit diagram for the edge triggered D-flip-flop and provide explanation for different input condition. **(06 Marks)**

c. Explain the operation of a switch debouncer built using SR-latch with the help of waveforms. **(04 Marks)**

Module-4

7 a. Define register, asynchronous ripple counter synchronous counter and ring counter. **(04 Marks)**

b. Design mod-8 counter using right shift register. Use D-flip-flop to build register circuit. Explain the operation using function table. **(06 Marks)**

c. Write timing diagrams, counting sequence and the logic diagram for 4-bit ripple counter and briefly explain. **(06 Marks)**

OR

8 a. Explain PIPO and SIPO operations using single diagram. **(06 Marks)**

b. Design Mod-6 synchronous counter using JK flip-flop. The sequence is 000, 001, 011, 100, 101, 111…000. **(07 Marks)**

c. Write state diagram for Mod-5 self correcting counter and briefly explain. The sequence is 000, 001, 101, 110, 111, 000. **(03 Marks)**

Module-5

9 a. What are Melay and Moore models of a sequential circuit? Briefly explain with diagrams. **(04 Marks)**

b. Write characteristic/excitation table for JK flip-flop and explain. **(03 Marks)**

c. Analyze the following sequential circuit. Writ excitation equations K-maps and state diagrams to analyze. **(09 Marks)**

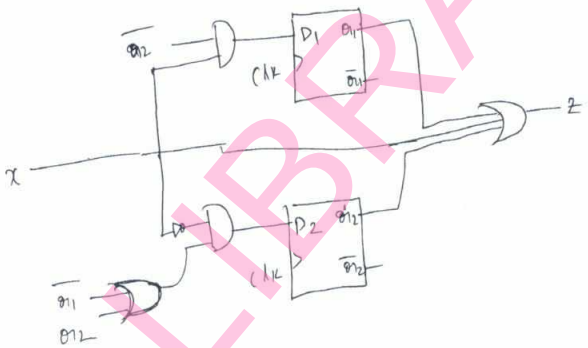

Fig.Q.9(c)

OR

10 a. Write state diagrams for a four state machine using Melay and Moore models and briefly explain. **(04 Marks)**

b. What is a state table? Give an example. **(02 Marks)**

c. Design a counter circuit for the following state table. Follow the standard steps for design. **(10 Marks)**

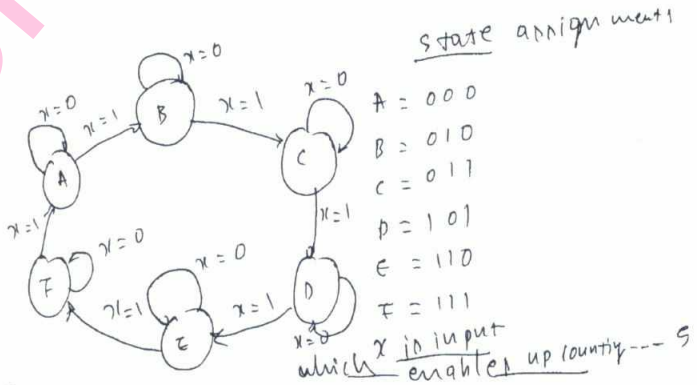

Fig.Q.10(c)

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CBCS Scheme

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15EC34

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

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Derive the expression for i) Δ to Y transformation ii) Y to Δ transformation. **(10 Marks)**

b. Using source Transformation, find power delivered by 50V source. Shown in Fig Q1(b). **(06 Marks)**

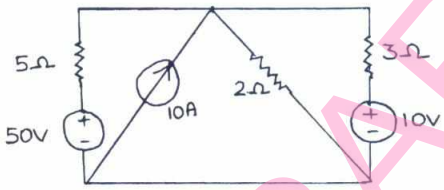

Fig Q1(b)

OR

2 a. Find the voltage across 20Ω resistor in the Network. Shown in Fig Q2(a) by Mesh analysis. **(08 Marks)**

b. Find i, using nodal analysis for the circuit shown in Fig Q2(b). **(08 Marks)**

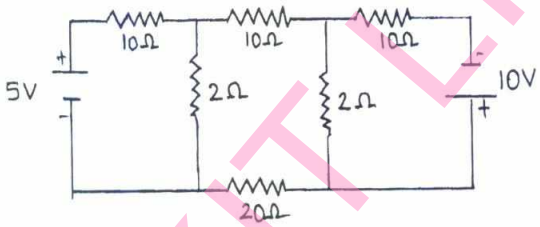

Fig Q2(a)

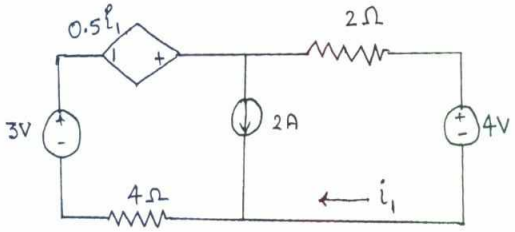

Fig Q2(b)

Module-2

3 a. State and prove maximum power transfer Theorem for AC circuits. **(08 Marks)**

b. For the network shown in Fig Q3(b), obtain the Thevenin's equivalent as seen from terminals p and q. **(08 Marks)**

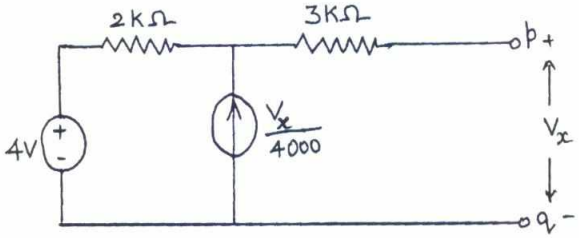

Fig Q3(b)

OR

4 a. State and explain Millman's theorem. **(08 Marks)**

b. Verify reciprocity theorem for the circuit shown in Fig Q4(b). **(08 Marks)**

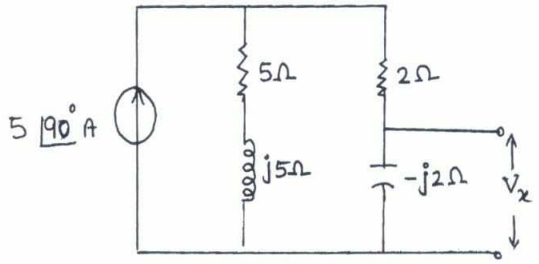

Fig Q4(b)

Module-3

5 a. Stat and prove initial value Theorem and final value theorem. **(08 Marks)**

b. In the circuit shown in Fig Q5(b) V = 10V, R = 10Ω, L = 1H, C = 10μF and V_c = 0. Find $i(0^+)$, $\frac{di}{dt}(0^+)$ and $\frac{d^2i}{dt^2}(0^+)$, it switch K is closed at t = 0. **(08 Marks)**

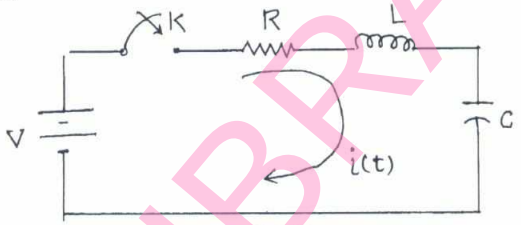

Fig Q5(b)

OR

6 a. In the network shown in Fig Q6(a), a steady state is reached with the switch K open. At t = 0, the switch is closed. For the element values given, determine the values of $V_a(0^-)$ and $V_a(0^+)$. **(08 Marks)**

b. Obtain the Laplace Transform of saw tooth waveform shown in Fig Q6(b). **(08 Marks)**

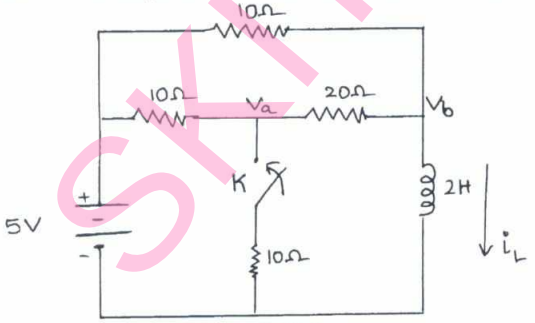

Fig Q6(a)

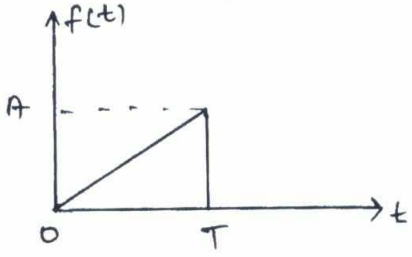

Fig Q6(b)

Module-4

7 a. Prove that $f_0 = \sqrt{f_1 f_2}$ where f_1 and f_2 are the two half power frequencies of a resonant circuits. **(08 Marks)**

b. A series RLC circuit consists of R = 10Ω, L = 0.01H and C = 0.01μF is connected across a supply of 10mV. Determine, i) f_0 ii) Q-factor iii) BW iv) f_1 and f_2 and v) I_0. **(08 Marks)**

OR

8 a. Obtain the expression for the resonant frequency for the circuit shown in Fig Q8(a) **(08 Marks)**

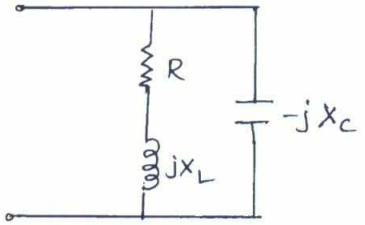

Fig Q8(a)

b. An RLC series circuit has an inductive coil of 'R' Ω resistance and inductance of 'L' H is in series with a capacitor 'C' F. The circuit draws a maximum current of 15A when connected to 230V, 50Hz supply. If the Q-factor is 5, find the parameter of the circuit. **(08 Marks)**

Module-5

9 a. Derive the z-parameters in terms of Y parameters. **(08 Marks)**

b. Determine Y parameter of the two – port network shown in Fig Q9(b). **(08 Marks)**

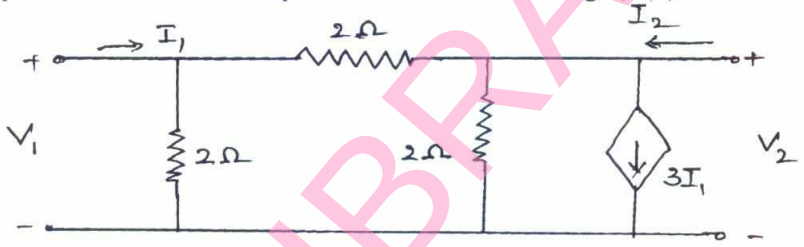

Fig Q9(b)

OR

10 a. Obtain hybrid parameters (h) in terms of impedance parameters (z). **(08 Marks)**

b. Find the Y parameters for the circuit shown in Fig Q10 (b). Then use the parameter relationship to find ABCD parameters. **(08 Marks)**

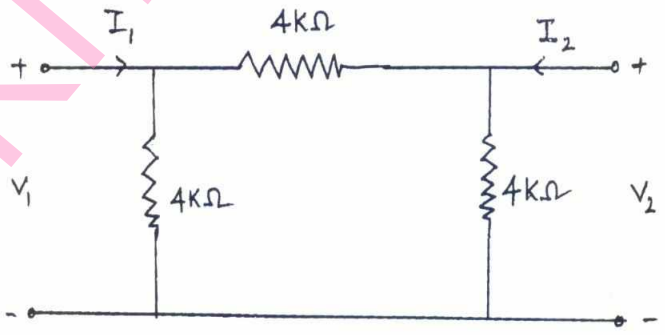

Fig Q10(b)

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CBCS Scheme

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15EC35

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

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Convert a basic D'Arsonval movement into a dc voltmeter and derive the resistance equation. **(04 Marks)**

b. The expected value of the voltage across a resistor is 80 V. However the measurement gives a value of 79 V calculate (i) absolute error (ii) % error (iii) Relative accuracy (iv) % of accuracy. **(04 Marks)**

c. State different types of thermocouples used for RF current measurement and explain each one of them in brief. **(08 Marks)**

OR

2 a. Explain with diagram the operation of true RMS voltmeter. **(08 Marks)**

b. Explain with diagram the operation of a dc differential voltmeter. **(08 Marks)**

Module-2

3 a. Describe with a diagram, the operation of a voltage to time conversion type DVM. **(08 Marks)**

b. Explain with a diagram, the working of digital pH meter. **(08 Marks)**

OR

4 a. Describe with a diagram the operation of a successive approximation type DVM. **(08 Marks)**

b. Describe with the help of a diagram the operation of universal counter-timer. **(08 Marks)**

Module-3

5 a. Draw the basic block diagram of an oscilloscope and explain the function of each block. **(08 Marks)**

b. Describe with the help of neat block diagram the operation of modern laboratory signal generator. Explain the technique used to improve stability. **(08 Marks)**

OR

6 a. Sketch the block diagram and explain the AF sine and square wave generator. List the various controls on the front panel of AF sine and square wave generation. **(08 Marks)**

b. Discuss the important features of cathode ray tube (CRT). **(08 Marks)**

Module-4

7 a. Derive the balance equation for wheat stone bridge and mention the limitation. **(06 Marks)**

b. Determine the value of unknown resistance R_x in a wheat stone bridge if $R_1 = 10\ k\Omega$, $R_2 = 20\ k\Omega$ and $R_3 = 40\ k\Omega$. **(02 Marks)**

c. What is Meggar? Explain basic Meggar circuit. **(08 Marks)**

OR

8 a. Draw the circuit diagram and obtain balance condition for Maxwell's bridge, if bridge constants are $C_1 = 0.5\ \mu F$, $R_1 = 1200\ \Omega$, $R_2 = 700\ \Omega$, $R_3 = 300\ \Omega$, find resistance and inductance of the coil. **(08 Marks)**

b. Explain with a diagram the operation of stroboscope. **(08 Marks)**

Module-5

9 a. What is a thermistor? Explain different types of thermisters. **(08 Marks)**

b. List the factors to be considered while selecting transducers. **(08 Marks)**

OR

10 a. Explain with a diagram the operation of resistive pressure transducer. **(08 Marks)**

b. Explain construction, principle and working of LVDT. **(08 Marks)**

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CBCS Scheme

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15EC36

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Point charges of 50 nano-coulomb each are located at A(1, 0, 0), B(–1, 0, 0), C(0, 1, 0) and D(0, –1, 0) in free space. Find the total force on the charge at A. **(08 Marks)**

b. Define electric field intensity and electric flux density. **(04 Marks)**

c. A uniform line charge of infinite length with $\rho_L = 40$ nc/m lies along z axis. Find $\bar{E}$ at (–2, 2, 8) in air. **(04 Marks)**

OR

2 a. Derive the expression for electric field intensity due to infinite line charge. **(08 Marks)**

b. Two particles having charges 2nano-coulomb and 5nano-coulomb are spaced 80 cm apart. Determine the electric field intensity at point "A" situated at a distance of 0.5 m from each of the two particles. Assume dielectric constant of 5. **(08 Marks)**

Module-2

3 a. Evaluate both sides of the divergence theorem for the field $\bar{D} = 2xy\,\hat{a}_x + x^2\,\hat{a}_y \text{ c/m}^2$ and the rectangular parallel piped formed by the planes x = 0 and 1, y = 0 and 2, and z = 0 and 3. **(08 Marks)**

b. Derive the expression for equation of continuity. **(06 Marks)**

c. Give the vector density $J = 10\rho^2 z\,\hat{a}_\rho - 4\rho\cos^2\phi\,\hat{a}_\rho \text{ mA/m}^2$. Determine the total current flowing outward through the circular band. $\rho = 3$, $0 < \phi < 2\pi$, $2 < z < 2.8$. **(02 Marks)**

OR

4 a. State and explain Gauss law in point form. **(05 Marks)**

b. Given the electric field $\bar{E} = 2x\,\hat{a}_x - 4y\,\hat{a}_y$ v/m. Find the work done in moving a point charge +2C from (2, 0, 0,) to (0, 0, 0) and then form (0, 0, 0) to (0, 2, 0). **(05 Marks)**

c. A potential field in free space is expressed as $V = \frac{60\sin\theta}{r^2}$ v. Find the electric flux density at the point (3, 60°, 25°) in spherical co-ordinates. **(06 Marks)**

Module-3

5 a. State and explain uniqueness theorem. **(08 Marks)**

b. Determine the magnetic field intensity $\bar{H}$ at point P(0.4, 0.3, 0), if the 8A current in a conductor inward from infinity to origin on the x axis and outward to infinity along y axis. **(08 Marks)**

OR

6 a. Find the potential and volume charge density at P(0.5, 1.5, 1)m in free space given the potential field $V = 6\rho\phi Z$ volts. **(08 Marks)**

b. Explain the concepts of scalar and vector magnetic potential. **(08 Marks)**

Module-4

7 a. Derive an equation for the magnetic force between two differential current elements. **(06 Marks)**

b. Find the magnetization in a material where : i) $\mu = 1.8 \times 10^{-5}$ H/m and H = 120 A/m ii) $\mu_r = 22$. There are 8.3×10^{28} atom/m^3 and each atom has a dipole moment of 4.5×10^{-27} A/m^2. iii) B = 300 μT and $X_{on} = 15$. **(06 Marks)**

c. A conductor 4m long lies along the y axis with a current of 10A in the $\overline{ay}$ direction. Find the force on the conductor if the field in the region is $\overline{B} = 0.005\overline{ax}$ Tesla. **(04 Marks)**

OR

8 a. Find the expression for force on differential current element moving in a steady magnetic field. Deduce the result to a straight conductor in a uniform magnetic field. **(08 Marks)**

b. For region 1, $\mu_1 = 4\mu$H/m and for region 2, $\mu_2 = 6\mu$ H/m. The regions are separated by z = 0 plane. The surface current density at the boundary is $\overline{K} = 100\overline{ax}$ A/m. Find $\overline{B}_2$ if $\overline{B}_1 = 2\hat{a}x - 3\hat{a}y + \hat{a}z$ militesla for z > 0. **(08 Marks)**

Module-5

9 a. For the given medium $\varepsilon = 4 \times 10^{-9}$ F/m and σ = 0. Find 'K' so that the following pair of fields satisfy Maxwell's equation :

$\overline{E} = (20y - kt)\overline{ax}$ v/m

$\overline{H} = (y + 2\times10^6 t)\overline{az}$ A/m **(08 Marks)**

b. A plane wave of 16 GHz frequency and E = 10 v/m propagates through the body of salt water having constants ε = 100, $\mu_r = 1$ and σ = 100 S/m. Determine attenuation constant, phase shift, phase velocity and intrinsic impedance of the medium and depth of penetration. **(08 Marks)**

OR

10 a. State and explain Poynthing theorem. **(08 Marks)**

b. Find the amplitude of displacement current density in the free space within a large power distribution transformer where $\overline{H} = 10^6 \cos(377t + 1.2566\times10^{-6} z)\hat{ay}$ A/m. **(05 Marks)**

c. The depth of penetration in a conducting medium is 0.1m and the frequency of the electromagnetic wave is 1 MHz. Find the conductivity of the conducting medium. **(03 Marks)**

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CBCS Scheme

USN | 1 | K | T | 1 | 6 | E | C | 4 | 0 | 3 |

15MATDIP31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Simplify $\frac{(\cos 3\theta - i\sin 3\theta)^2(\cos 4\theta + i\sin 4\theta)^5}{(\cos\theta + i\sin\theta)^3(\cos 2\theta - i\sin 2\theta)^4}$. **(06 Marks)**

b. Determine λ such that $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - 4\hat{k}$ and $\vec{c} = \hat{i} + \lambda\hat{j} + 3\hat{k}$ are coplanar. **(05 Marks)**

c. Find sine angle of two vectors $4\hat{i} + 3\hat{j} + \hat{k}$ and $2\hat{i} - \hat{j} + 2\hat{k}$. **(05 Marks)**

OR

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

b. Find modulus and amplitude of $1 + \cos\theta + i\sin\theta$. **(05 Marks)**

c. If $\vec{a} = 3\hat{i} + 7\hat{j} - 2\hat{k}$, $\vec{b} = 2\hat{i} + 5\hat{j} + 10\hat{k}$ find $(\vec{a} + \vec{b}) \times (\vec{a} - \vec{b})$. **(05 Marks)**

Module-2

3 a. If $y = a\cos(\log x) + b\sin(\log x)$ show that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$. **(06 Marks)**

b. With usual notation prove that $\tan\varphi = r\frac{d\theta}{dr}$. **(05 Marks)**

c. If $u = e^{ax+by} f(ax - by)$ prove that $b\frac{\partial u}{\partial x} + a\frac{\partial u}{\partial y} = 2abu$. **(05 Marks)**

OR

4 a. Find n^{th} derivative of $y = e^x \sin 4x \cos x$ **(06 Marks)**

b. Find pedal equation of $r = a(1 + \cos\theta)$. **(05 Marks)**

c. If $u = f(x - y, y - z, z - x)$ show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. **(05 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi} \sin^5(x/2)dx$. **(06 Marks)**

b. Evaluate $\int_0^{2a} x^2\sqrt{2ax - x^2}\,dx$. **(05 Marks)**

c. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy\,dy\,dx$. **(05 Marks)**

OR

6 a. Evaluate $\int_0^a \frac{x^3 dx}{\sqrt{a^2 - x^2}}$. **(06 Marks)**

b. Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y \, dx \, dy$. **(05 Marks)**

c. Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} \, dz \, dy \, dx$. **(05 Marks)**

Module-4

7 a. A particle moves along the curve c : $x = t^3 - 4t$, $y = t^2 + 4t$, $z = 8t^2 - 3t^3$ where t denotes time. Find velocity and acceleration at t = 2. **(06 Marks)**

b. Find unit normal vector to surface $Q = x^2yz + 4xz^2$ at (1, -2, -1). **(05 Marks)**

c. Show that $\vec{f} = (2xy^2 + yz)\hat{i} + (2x^2y + xz + 2yz^2)\hat{j} + (2y^2z + xy)\hat{k}$ is irrotational. **(05 Marks)**

OR

8 a. A particle moves along the curve c : $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where 't' is the time. Find the components of velocity and acceleration at t = 1 in the direction $\hat{i} - 3\hat{j} + 2\hat{k}$. **(06 Marks)**

b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at (2, -1, 2). **(05 Marks)**

c. If $\phi = 2x^3y^2z^4$ find div(gradϕ). **(05 Marks)**

Module-5

9 a. Solve : $\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0$. **(06 Marks)**

b. Solve : $x^2y \, dx - (x^3 + y^3) \, dy = 0$. **(05 Marks)**

c. Solve : $(y^3 - 3x^2y) \, dx - (x^3 - 3xy^2) \, dy = 0$. **(05 Marks)**

OR

10 a. Solve : $\frac{dy}{dx} = \frac{y}{x} + \sin\left(\frac{y}{x}\right)$. **(06 Marks)**

b. Solve : $(x^2 + y^2 + x)dx + xy \, dy = 0$. **(05 Marks)**

c. Solve : $\frac{dy}{dx} + y \cot x = \cos x$. **(05 Marks)**

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