CBCS Scheme

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15MAT31

Third Semester B.E. Degree Examination, June/July 2017
Engineering Mathematics - III

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Obtain the Fourier series expansion of

$$f(x) = \begin{cases} \pi x & 0 \le x \le 1 \\ \pi(2-x) & 1 \le x \le 2 \end{cases}$$ **(08 Marks)**

and deduce that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\ldots=\frac{\pi^2}{8}$.

b. Obtain the constant term and first sine and cosine terms in the Fourier expansion of y from the following table. **(08 Marks)**

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

OR

2 a. Expand $f(x) = |x|$ as a Fourier series in $-\pi \le x \le \pi$ and deduce that **(06 Marks)**

$$\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\ldots=\frac{\pi^2}{8}.$$

b. Obtain the half range cosine series for the function $f(x) = x \sin x$ in $0 < x < \pi$. **(05 Marks)**

c. The following table gives variations of periodic current over a period T. Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic. **(05 Marks)**

t(sec)	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$
A (amp)	1.98	1.3	1.05	1.3	-0.88	-0.25

Module-2

3 a. Find the Fourier Transform of

$$f(x) = \begin{cases} 1-x^2 & |x| \le 1 \\ 0 & |x| > 1 \end{cases}$$ **(06 Marks)**

Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3} \cos \frac{x}{2}\, dx$.

b. Find the Fourier cosine transform of

$$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2-x & \text{for } 1 < x < 2 \\ 0 & \text{for } x > 2 \end{cases}$$ **(05 Marks)**

c. Find the inverse Z – transform of

$$\frac{3z^2+2z}{(5z-1)(5z+2)}.$$ **(05 Marks)**

OR

4 a. Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a > 0$. **(06 Marks)**

b. Find the Z – transform of i) $\cosh n\theta$ ii) n^2. **(05 Marks)**

c. Solve the difference equation $y_{n+2} + 4y_{n+1} + 3y_n = 3^n$ with $y_0 = 0$, $y_1 = 1$. **(05 Marks)**

Module-3

5 a. Find the coefficient of correlation and two regression lines for the following data : **(06 Marks)**

x	1	2	3	4	5	6	7	8	9	10
y	10	12	16	28	25	36	41	49	40	50

b. Fit a curve of the form $y = ae^{bx}$ for the following data : **(05 Marks)**

x	5	6	7	8	9	10
y	133	55	23	7	2	2

c. Use Newton – Raphson method to find a real root of the equation $x \sin x + \cos x = 0$ near $x = \pi$. **(05 Marks)**

OR

6 a. In a partially destroyed lab record, only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively. Calculate $\bar{x}$, $\bar{y}$ and coefficient of correlation between x and y. **(06 Marks)**

b. Fit a second degree parabola to the following data : **(05 Marks)**

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

c. Use the regula – falsi method to obtain a root of the equation $2x - \log_{10}x = 7$ which lies between 3.5 and 4. Carryout 2 iterations. **(05 Marks)**

Module-4

7 a. The population of a town is given by the table **(06 Marks)**

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

Using Newton's forward and backward interpolation formula, calculate the increase in the population from the year 1955 to 1985.

b. Use Lagrange's interpolation formula to find y at x = 10, given **(05 Marks)**

x	5	6	9	11
y	12	13	14	16

c. Given the values

x	2	4	5	6	8	10
y	10	96	196	350	868	1746

Construct the interpolating polynomial using Newton's divided difference interpolation formula. **(05 Marks)**

OR

8 a. From the following table, estimate the number of students who obtained marks between 40 and 45. **(06 Marks)**

Marks	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

b. Apply Lagrange's formula inversely to obtain the root of the equation f(x) = 0, given f(30) = -30 , f(34) = -13 , f(38) = 3 , f(42) = 18. **(05 Marks)**

c. Use Simpson's $\frac{1}{3}$ rule to find $\int_0^{0.6} e^{-x^2} dy$ by taking 7 ordinates. **(05 Marks)**

Module-5

9 a. Find the work done in moving a particle in the force field $\vec{F} = 3x^2 i + (2xz - y)j + z k$ along the curve defined by $x^2 = 4y$, $3x^3 = 8z$ from x = 0 to x = 2. **(06 Marks)**

b. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)i - 2xy j$ around the rectangle $x = \pm a$, $y = 0$, $y = b$. **(05 Marks)**

c. Solve the Euler's equation for the functional $\int_{x_0}^{x_1} (1 + x^2 y^1) y^1 dx$. **(05 Marks)**

OR

10 a. Verify Green's theorem for $\int_c (xy + y^2)dx + x^2 dy$, where e is bounded by y = x and $y = x^2$. **(06 Marks)**

b. Evaluate the surface integral $\iint_s \vec{F}$. Nds where $\vec{F} = 4xi - 2y^2 j + z^2 k$ and s is the surface bounding the region $x^2 + y^2 = 4$, z = 0 and z = 3. **(05 Marks)**

c. Show that the shortest distance between any two points in a plane is a straight line. **(05 Marks)**

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15EC32

Third Semester B.E. Degree Examination, June/July 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. Draw r_e and h-parameter models of a transistor in common – emitter configuration. Also give relation between r_e and h-parameter **(05 Marks)**

b. Draw the emitter follower circuit. Derive expressions for i) Z_i ii) Z_0 iii) Av using r_e model. **(06 Marks)**

c. Draw and explain the hybrid-π model of transistor in CE configuration mentioning significance of each component in model. **(05 Marks)**

OR

2 a. Derive expressions for Z_i, Z_0, Av and A_I for common–emitter fixed bias configuration using hybrid equivalent model. **(08 Marks)**

b. For the circuit shown below, taking $r_0 = \infty\Omega$ calculate i) r_e ii) Z_i iii) Z_0 iv) Av. **(08 Marks)**

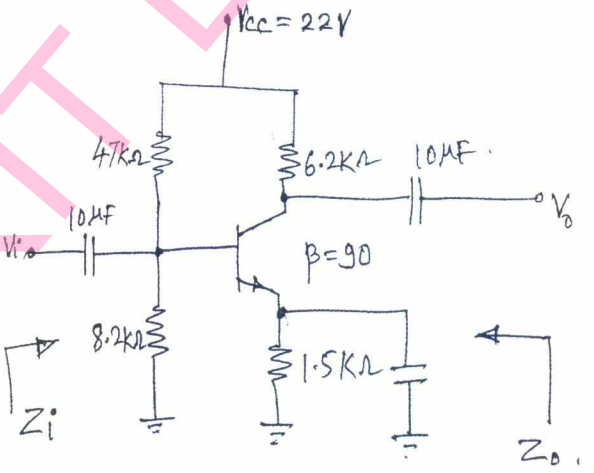

Fig.Q2(b)

Module-2

3 a. With circuit diagram of JFET small signal model, determine g_m and r_d. **(08 Marks)**

b. For the JFET common-source amplifier using fixed-bias configuration. Derive expressions for Z_i , Z_0 and Av using AC equivalent circuit. **(08 Marks)**

OR

4 a. For the JFET common-gate configuration shown below, calculate Z_i, Z_0 and Av. **(08 Marks)**

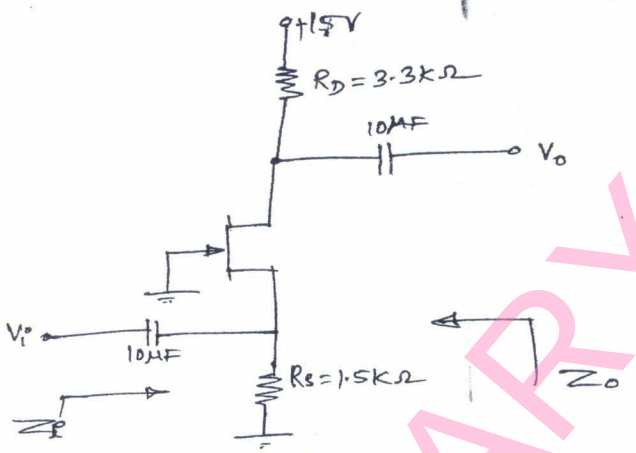

Fig.Q4(a)

b. With neat diagram, explain construction of n-channel JFET, and also draw its characteristics. **(08 Marks)**

Module-3

5 a. Describe Miller-effect and derive an equation for miller input and output capacitance. **(08 Marks)**

b. Discuss low frequency response of BJT amplifier and give expressions for low frequency due to input coupling capacitor C_S and output coupling capacitor C_C. **(08 Marks)**

OR

6 a. Explain high-frequency response of FET amplifier, and derive expression for cutoff frequencies defined by input and output circuits(f_{Hi} and f_{H0}). **(08 Marks)**

b. For the circuit shown.

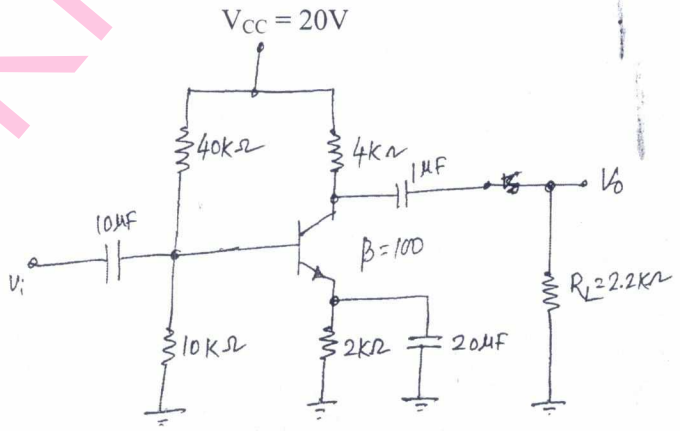

Fig.Q6(b)

$r_0 = \infty\Omega$, C_π(cbe) = 36pF, C_u (cbc) = 4pF, C_{ce} = 1 pF, C_{wi} = 6 pF, C_{w0} = 8pF

i) determine f_{Hi} and f_{H0}

ii) find f_β and f_T. **(08 Marks)**

Module-4

7 a. What is Barkhausen criterion? Explain how oscillations start in an oscillator. **(04 Marks)**

b. With the help of a neat circuit diagram, explain transistor colpitts oscillator. Write the expression for frequency of oscillations. **(08 Marks)**

c. A quartz crystal has L = 0.12H, C = 0.04 pF C_M = 1pF and R = 9.2 kΩ, Find :
i) series resonant frequency ii) Parallel resonant frequency. **(04 Marks)**

OR

8 a. Explain characteristics of a quartz crystal. With a neat diagram explain the crystal oscillator in parallel resonant mode. **(08 Marks)**

b. The following component values are given for the Wein-bridge oscillator of the circuit of $R_1 = R_2 = 33k\Omega$ $C_1 = C_2 = 0.001\mu F$ $R_3 = 47\ k\Omega$, $R_4 = 15k\Omega$.
i) Will this circuit oscillate?
ii) Calculate the resonant frequency. **(08 Marks)**

Module-5

9 a. Explain series – fed class – A power amplifier. Show that its maximum conversion efficiency is 25%. **(08 Marks)**

b. Explain with circuit diagram the operation of Class-B push-Pull amplifier using complementary–symmetry transistor pair. Also mention advantages and disadvantages of the circuit. **(08 Marks)**

OR

10 a. An ideal class –B push-pull power amplifier with input and output transformers has V_{CC} = 20V, $N_2 = 2N_1$ and $R_L = 20\Omega$. The transistors has $h_{fe} = 20$. Let the input be sinusoidal. For the maximum output signal at $V_{CE(P)} = V_{CC}$, determine :
i) The output signal power
ii) The collector dissipation in each transistor
iii) Conversion efficiency. **(08 Marks)**

b. The following distortion readings are available for a power amplifier,
$D_2 = 0.2$, $D_3 = 0.02$, $D_4 = 0.06$, with $I_1 = 3.3A$ and $R_C = 4\Omega$.
i) Calculate the total harmonic distortion
ii) Determine the fundamental power component
iii) Calculate the total power. **(08 Marks)**

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15EC33

Third Semester B.E. Degree Examination, June/July 2017
Digital Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Convert the given Boolean function into
i) $Y = f(a, b, c) = (a + b)(a + c)$ minterm canonical form **(04 Marks)**
ii) $P = f(a, b, c) = (a + b)(b + c)(\overline{c} + a)$ maxterm canonical form. **(04 Marks)**

b. Using K-map determine the minimal sum of product expression and realize the simplified expression using only NAND gates.
$M = f(W, X, Y, Z) = \sum (1, 4, 5, 6, 11, 12, 13, 14, 15)$. **(08 Marks)**

OR

2 a. Simplify the given Boolean function using Quine – McCluskey method :
$Y = f(a, b, c, d) = \sum (0, 2, 3, 5, 8, 10, 11)$. Verify the result using k-map. **(12 Marks)**

b. Distinguish between prime implicant and Essential prime implicant. **(04 Marks)**

Module-2

3 a. Define Decoder. Implement the following multiple output function using IC 74138 and external gates. Also write the truth table.
$P = f_1(X, Y, Z) = \sum (1, 2, 5, 6)$
$Q = f_2(X, Y, Z) = \pi (3, 5, 6, 7)$. **(06 Marks)**

b. Implement the following Boolean function using 8:1 multiplexer :
$Y = f(A, B, C, D) = \overline{A}B\overline{D} + ACD + \overline{B}C\overline{D} + \overline{A}CD$ **(10 Marks)**

OR

4 a. Design and implement 4-bit look ahead carry adder. **(08 Marks)**

b. Design and implement BCD to Excess-3 code converter. **(08 Marks)**

Module-3

5 a. Explain the working principle of gated SR latch. **(06 Marks)**

b. Explain the working of master slave JK flip-flop with the help of a logic diagram, function table, logic symbol and timing diagram. **(10 Marks)**

OR

6 a. With a neat logic diagram, explain the working of positive edge triggered D flip-flop. Also draw the timing diagram. **(08 Marks)**

b. Derive the characteristic equation for JK and T flip-flop. **(08 Marks)**

Module-4

7 a. Describe the working principle of universal shift register with the help of logic diagram and mode control table. **(08 Marks)**

b. Illustrate the operation of 4-bit binary ripple counter using logic diagram and timing diagram. **(08 Marks)**

OR

8 a. Design a synchronous Mod-6 counter using clocked T flip-flop. **(10 Marks)**

b. Explain Mod-4 ring counter using D flip-flop. **(06 Marks)**

Module-5

9 a. Explain Mealy and Moore sequential circuit models. **(04 Marks)**

b. For the logic diagram shown in Fig Q 9(b).

i) Write input and output equations

ii) Construct transition table

iii) Draw state diagram. **(12 Marks)**

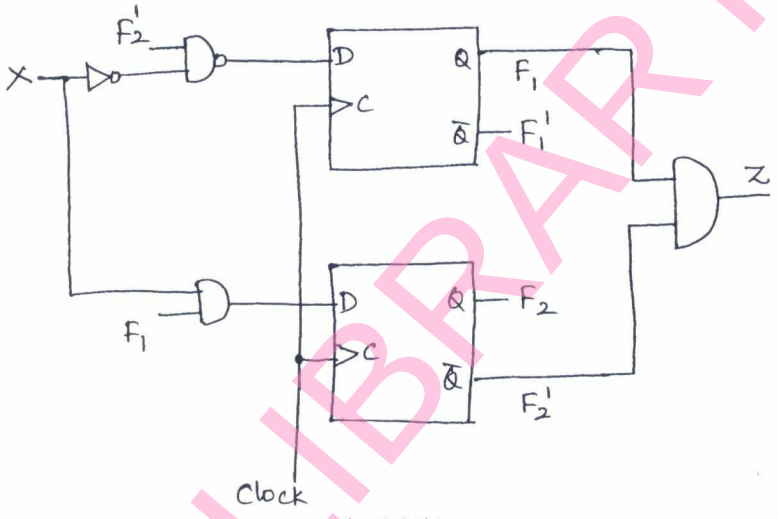

Fig Q9(b)

OR

10 a. Define the terms as applied to sequential circuit :
Input variable, output variable, Excitation variable and state variable. **(04 Marks)**

b. Design a sequential circuit for a state diagram shown in Fig Q 10(b). **(12 Marks)**

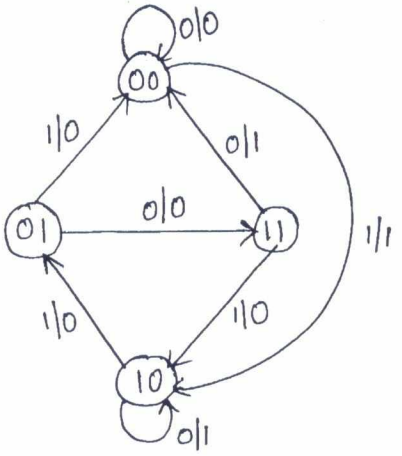

Fig Q10(b)

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15EC34

Third Semester B.E. Degree Examination, June/July 2017
Network Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Calculate the current through 2Ω resistor for the circuit shown in Fig.Q1(a) using source transformation. **(08 Marks)**

b. Use mesh analysis to determine the three mesh currents I_1, I_2 and I_3 in the circuit shown in Fig.Q1(b). **(08 Marks)**

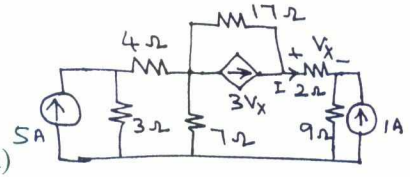

Fig.Q1(a)

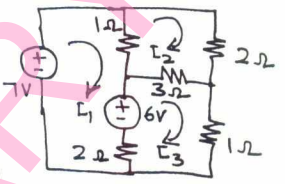

Fig.Q1(b)

OR

2 a. Find the equivalent resistance R_{AB} using star and delta transformation for network shown in Fig.Q2(a). **(08 Marks)**

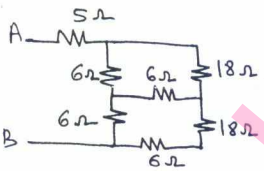

Fig.Q2(a)

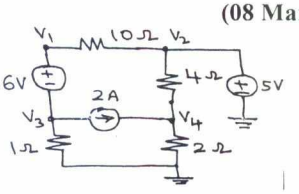

Fig.Q2(b)

b. For the circuit shown in Fig.Q2(b), determine all node voltages. **(08 Marks)**

Module-2

3 a. Using Millman's theorem, find the current through load resistance R_L for the circuit shown in Fig.Q3(a). **(08 Marks)**

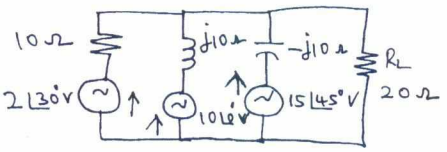

Fig.Q3(a)

b. State the maximum power transfer theorem and also prove that $P_{max} = \frac{V_{th}^2}{4R_L}$, where V_{th} = thevenins voltage. **(08 Marks)**

OR

4 a. Obtain the Thevenin's equivalent of the circuit shown in Fig.Q4(a). **(08 Marks)**

b. Using superposition theorem, find the current in 6Ω resistor in the network shown in Fig.Q4(b). **(08 Marks)**

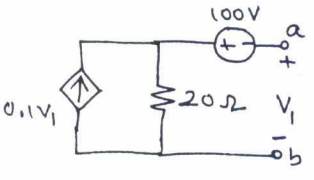

Fig.Q4(a)

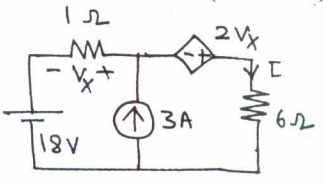

Fig.Q4(b)

Module-3

5 a. In the network shown in Fig.Q5(a), the switch is closed at t = 0, determine i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. **(08 Marks)**

b. For the network shown in Fig.Q5(b), the switch 's' is opened at t = 0 solve for V, DV and D^2V at $t = 0^+$. **(08 Marks)**

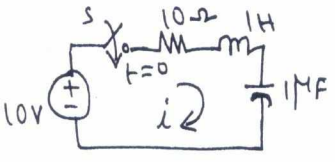

Fig.Q5(a)

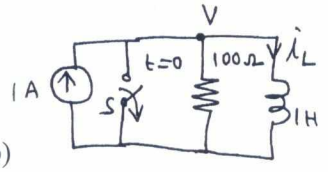

Fig.Q5(b)

OR

6 a. Find the Laplace transform of the periodic signal x(t) shown in Fig.Q6(a). **(08 Marks)**

b. Given the signal $x(t) = \begin{cases} 3, & t < 0 \\ -2 & 0 < t < 1 \\ 2t - 4 & t > 1 \end{cases}$

Express x(t) interms of singularity functions. Also find the Laplace transform of x(t). **(08 Marks)**

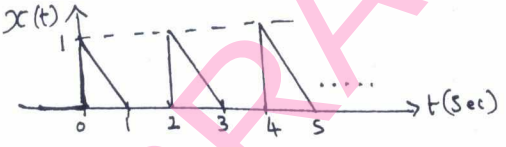

Fig.Q6(a)

Module-4

7 a. Derive the expressions of half power frequencies W_1 and W_2 and also bandwidth of a series resonance circuit. **(09 Marks)**

b. Find the values of L at which the circuit shown in Fig.Q7(b) resonates at a frequency of 500 r/s. **(07 Marks)**

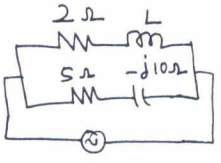

Fig.Q7(b)

OR

8 a. Derive the expressions of a resonance frequency and dynamic impedance of a parallel resonance circuit. **(09 Marks)**

b. A coil has a R = 20Ω, L = 80mH and C = 100pF are connected in series. Determine : i) impedance at resonance ii) resonance frequency iii) quality factor iv) circuit current if supply voltage is 50V. **(07 Marks)**

Module-5

9 a. Derive the expression of Z-parameters in term of h-parameter. **(07 Marks)**

b. Find the ABCD – parameters for the network shown in Fig.Q9(b). **(09 Marks)**

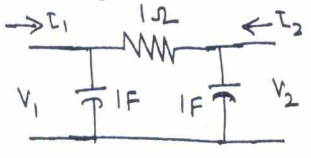

Fig.Q9(b)

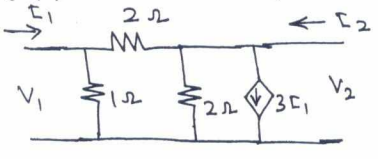

Fig.Q10(a)

OR

10 a. Find the Y-parameter for the two port network shown in Fig.Q10(a). **(08 Marks)**

b. Obtain the expression of h-parameters interms of Y-parameters. **(08 Marks)**

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15EC35

Third Semester B. E Degree Examination, June/July 2017

Electronic Instrumentation

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define types of static errors. How do you avoid them? **(06 Marks)**

b. Design a multi-range ammeter with range of 0 – 1A, 5A and 10A employing individual shunt in each A D'Arsonval movement with an internal resistance of 500Ω and a full scale deflection of 10mA is available. **(05 Marks)**

c. Define principle operation of thermocouple, and also explain types of thermocouple. **(05 Marks)**

OR

2 a. What is loading effect? **(02 Marks)**

b. Calculate series connected multiplier resistances with a D'Arsonval movement with an internal resistance of 100Ω and a full scale deflection of 10mA into a multirange dc voltmeter with ranges from 0-5V, 0-50V and 0-100V. **(04 Marks)**

c. Explain Differential voltmeter with circuit. **(05 Marks)**

d. Explain the working of a true RMS voltmeter with the help of a suitable block diagram. **(05 Marks)**

Module-2

3 a. With neat block diagram explain Dual slope integrating meter, and also derive the unknown voltage equation. **(08 Marks)**

b. An integrator contains a 100KΩ and 1μF capacitor, if the voltage applied to the integrator input is 1V, what voltage will be present at the output of the integrator after 1sec? **(02 Marks)**

c. With block diagram, explain principle operation of staircase ramp **(06 Marks)**

OR

4 a. With neat circuit diagram, explain basic frequency measurement operation. **(06 Marks)**

b. Explain with block diagram Digital phase meter operation. **(06 Marks)**

c. Define Tachometer and pH meter. **(04 Marks)**

Module-3

5 a. With neat circuit diagram explain time base generator with waveform. **(06 Marks)**

b. Explain in detail the working of digital storage oscilloscope and list advantages. **(10 Marks)**

OR

6 a. Explain with diagram conventional standard signal generator. **(08 Marks)**

b. Explain in detail the working of a function generator. **(08 Marks)**

Module-4

7 a. With circuit diagram explain Q – meter and its purpose. **(05 Marks)**

b. Self capacitance of a coil is measured, if the first measurement is at f_1 = 1MHz and C_1 = 500pf. The second measurement is at f_2 = 2MHz and C_2 = 110pf. Find the distributed capacitance also calculate the value of L. **(04 Marks)**

c. Define Megger instrument. With circuit diagram explain megger. **(07 Marks)**

OR

8 a. Define use of Maxwell's bridge. With circuit diagram derive and explain Maxwell's bridge equation. **(08 Marks)**

b. A wein bridge circuit consists of the following components R_1 = 4.7 KΩ, C_1 = 5nf, R_2 = 20KΩ, C_3 = 10nf, R_3 = 10KΩ, R_4 = 100KΩ. Determine the frequency of the circuit. **(02 Marks)**

c. Explain in detail with circuit Wagner's earth connection. **(06 Marks)**

Module-5

9 a. What are the factors to be considered for the selection of transducer? **(06 Marks)**

b. Explain principle operation of resistive position transducer. **(04 Marks)**

c. Explain resistive thermometer, list the advantages. **(06 Marks)**

OR

10 Briefly write a note on :

a. Strain gauges **(04 Marks)**

b. Differential output transducer **(04 Marks)**

c. Piezoelectrical transducer **(04 Marks)**

d. Semiconductor photo diode. **(04 Marks)**

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CBCS Scheme

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15EC36

Third Semester B.E. Degree Examination, June/July 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. State vector form of Coloumb's law of force between two point charges and indicate the units of the quantities in the equation. **(04 Marks)**

b. Let a point charge $Q_1 = 25nC$ be located at A(4, −2, 7) and charge $Q_2 = 60nC$ be at B(−3, 4, −2). Find $\vec{E}$ at C(1, 2, 3) and find the direction of $\vec{E}$. **(10 Marks)**

c. Define electric field intensity due to number of point charge in a vector form. **(02 Marks)**

OR

2 a. Derive an expression for the electric field intensity due infinite line charge. **(06 Marks)**

b. Define electric flux density. Find $\vec{D}$ in Cartesian co-ordinate system at a point p(6, 8, −10) due to a point charge of 40mC at the origin and a uniform line charge of $\rho_L = 40\mu C/m$ on the z-axis. **(10 Marks)**

Module-2

3 a. State and prove Gauss law as applied to an electric field. **(06 Marks)**

b. Given that $\vec{A} = 30e^{-r}\hat{a}_r - 2z\hat{a}_z$ in the cylindrical co-ordinates. Evaluate both sides of the divergence theorem for the volume enclosed by r = 2, z = 0 and z = 5. **(10 Marks)**

OR

4 a. Define the electric scalar potential. Derive an expression for potential due to point charge. **(06 Marks)**

b. A point charge of 6nC is located at the origin in free space find potential of point P if P is located at (0.2, −0.4, 0.4) and i) V =0 at infinity ii) V = 0 at (1, 0, 0) iii) V = 20V at (−0.5, 1, −1). **(10 Marks)**

Module-3

5 a. Starting with point form of Gauss law deduce Poisson's and Laplace's equation. **(03 Marks)**

b. State and Prove uniqueness theorem **(05 Marks)**

c. Find V at (2, 1, 3) for the field of
   i) 2 co-axial conducting cylinders V = 20V at ρ = 3m
   ii) 2 concentric conducting spheres V = 50V at r = 3m and V = 20V at r = 5m. **(08 Marks)**

OR

6 a. State and explain Biot – Savart's law. **(04 Marks)**

b. Evaluate both sides of the Stoke's theorem for the field $\vec{H} = 6xy\hat{a}_x - 3y^2\hat{a}_y$ A/m and the rectangular path around the region, $2 \le x \le 5, -1 \le y \le 1, z = 0$. Let the positive direction of $\vec{ds}$ be $\hat{a}_z$. **(08 Marks)**

c. At a point p(x, y, z) the components of vector magnetic potential $\vec{A}$ are given as $A_x = 4x + 3y + 2z$, $A_y = 5x + 6y + 3z$ and $A_z = 2x + 3y + 5z$. Determine $\vec{B}$ at point P. **(04 Marks)**

Module-4

7 a. A point charge of $Q = -1.2C$ has velocity $\vec{V} = (5\hat{a}_x + 2\hat{a}_y - 3\hat{a}_z)$ m/s. Find the magnitude of the force exerted on the charge if

i) $\vec{E} = -18\hat{a}_x + 5\hat{a}_y - 10\hat{a}_z$ V/m

ii) $\vec{B} = -4\hat{a}_x + 4\hat{a}_y + 3\hat{a}_z$ T

iii) Both are present simultaneously. **(08 Marks)**

b. Derive an expression for the force on a differential current element placed in a magnetic field. **(04 Marks)**

c. A conductor 4m long lies along the y-axis with a current of 10.0A in the $\hat{a}_y$ direction. Find the force on the conductor if the field in the region is $\vec{B} = 0.005\hat{a}_x$ T. **(04 Marks)**

OR

8 a. If $\vec{B} = 0.05x\hat{a}_y$ T in a material for which $\chi_m = 2.5$. Find

i) μ_r ii) μ iii) $\vec{H}$ iv) $\vec{M}$ v) $\vec{J}$ vi) $\vec{J}_b$ **(08 Marks)**

b. Write a on magnetic circuits **(04 Marks)**

c. Write a note on forces on magnetic materials. **(04 Marks)**

Module-5

9 a. Explain Displacement current density and conduction current density. **(04 Marks)**

b. List Maxwell's equations for steady and time varying fields in
i) Point form ii) Integral from. **(06 Marks)**

c. Do the fields $\vec{E} = E_m \sin x \sin t\,\hat{a}_y$ and $\vec{H} = \frac{E_m}{\mu_o}\cos x \cos t\,\hat{a}_z$ satisfy Maxwell's equations? **(06 Marks)**

OR

10 a. What is Forward travelling wave and Backward travelling wave in free space? **(02 Marks)**

b. A uniform plane wave in free space is given by $E_s = 200\ \underline{|30^\circ} \cdot e^{-j250z}\ \hat{a}_x$ V/m.

Find β, w, f, λ, η, $|\vec{H}|$ **(06 Marks)**

c. State and prove Poynting theorem **(08 Marks)**

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CBCS Scheme

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15MATDIP31

Third Semester B.E. Degree Examination, June/July 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. Express $\frac{3+4i}{3-4i}$ in the form x + iy. **(06 Marks)**

b. Express $\sqrt{3}+i$ in the polar form and hence find their modulus and amplitudes. **(05 Marks)**

c. Find the sine of the angle between $\vec{a} = 2i - 2j + k$ and $\vec{b} = i - 2j + 2k$. **(05 Marks)**

OR

2 a. Simplify **(06 Marks)**

$$\frac{(\cos 3\theta + i\sin 3\theta)^4 (\cos 4\theta + i\sin 4\theta)^5}{(\cos 4\theta + i\sin 4\theta)^3 + (\cos 5\theta + i\sin 5\theta)^{-4}}$$

b. If $\vec{a} = i + 2j - 3k$ and $\vec{b} = 3i - j + 2k$, then show that $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$ are orthogonal. **(05 Marks)**

c. Find the value of λ, so that the vectors $\vec{a} = 2i - 3j + k$, $\vec{b} = i + 2j - 3k$ and $\vec{c} = j + \lambda k$ are co-planar. **(05 Marks)**

Module-2

3 a. If $y = \cos(m \log x)$ then prove that $x^2 y_{n+2} + (2n+1)x y_{n+1} + (m^2 + n^2) y_n = 0$. **(06 Marks)**

b. With usual notation prove that

$$\tan\phi = \frac{rd\theta}{dr}.$$ **(05 Marks)**

c. If $u = \log_e\left(\frac{x^4 + y^4}{x + y}\right)$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3$. **(05 Marks)**

OR

4 a. Find the Pedal equation of $r = a[1 - \cos\theta]$. **(06 Marks)**

b. Expand $\log_e(1+x)$ in ascending powers of x as far as the term containing x^4. **(05 Marks)**

c. Find the total derivative of $Z = xy^2 + x^2y$, where $x = at^2$ $y = 2at$. **(05 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi/6} \sin^6 3x\, dx$ using Reduction formula. **(06 Marks)**

b. Evaluate $\int_0^1 x^6\sqrt{1-x^2}\, dx$ – using Reduction formula. **(05 Marks)**

c. Evaluate $\int_1^2 \int_0^{2-y} xy\, dx\, dy$. **(05 Marks)**

OR

6 a. Evaluate $\int_0^{\pi/2} \sin^3 x \cos^7 x \, dx$. **(06 Marks)**

b. Evaluate $\int_0^{\pi} x \cos^6 x \, dx$. **(05 Marks)**

c. Evaluate $\int_0^3 \int_0^2 \int_0^1 (x + y + z) \, dz \, dx \, dy$. **(05 Marks)**

Module-4

7 a. A particle moves along the curve $\vec{r} = (1-t^3)\hat{i} + (1+t^2)\hat{j} + (2t - 5)\hat{k}$. Determine the velocity and acceleration. **(06 Marks)**

b. Find the directional derivative of $\phi = xy^2 + yz^3$ at the point (2,-1, 1) in the direction of the vector $i + 2j + 2k$. **(05 Marks)**

c. Find the constant a, b, c. Such that the vector $\vec{F} = (x + y + az)\,\hat{i} + (x + cy + 2z)\,\hat{k} + (bx + 2y - z)\,\hat{j}$ is irrotational. **(05 Marks)**

OR

8 a. Find the angle between the tangents to the curve $\vec{r} = t^2\,\hat{i} + 2t\,\hat{j} - t^3\,\hat{k}$ at the points $t = \pm 1$. **(06 Marks)**

b. Find the divergence and curl of the vector $\vec{F} = (xyz + y^2z)\,\hat{i} + (3x^2 + y^2z)\,\hat{j} + (xz^2 - y^2z)\,\hat{k}$. **(05 Marks)**

c. If $\vec{F} = (ax + 3y + 4z)\,\hat{i} + (x - 2y + 3z)\,\hat{j} + (3x + 2y - z)\,\hat{k}$ is solenoidal, find a. **(05 Marks)**

Module-5

9 a. Solve $\frac{dy}{dx} = \frac{y}{x - \sqrt{xy}}$. **(06 Marks)**

b. Solve $\frac{dy}{dx} + y \cot x = \sin x$. **(05 Marks)**

c. Solve $\frac{dy}{dx} = \frac{x + 2y - 1}{x + 2y + 1}$. **(05 Marks)**

OR

10 a. Solve $(x^2 - y^2)\,dx = 2xy\,dy$. **(06 Marks)**

b. Solve $x\frac{dy}{dx} + y = x^3 y^6$. **(05 Marks)**

c. $(1 + xy)\,ydx + (1 - xy)\,xdy = 0$. **(05 Marks)**

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