CBCS SCHEME

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17MAT31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the Fourier series expansion of $f(x) = x - x^2$ in $(-\pi, \pi)$, hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \text{----}$. **(08 Marks)**

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

c. Express y as a Fourier series upto first harmonics given :

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

(06 Marks)

OR

2 a. Obtain the Fourier series for the function :

$$f(x) = \begin{cases} 1 + \frac{4x}{3} & \text{in } \frac{-3}{2} < x \le 0 \\ 1 - \frac{4x}{3} & \text{in } 0 \le x < \frac{3}{2} \end{cases}$$

Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \text{---}$. **(08 Marks)**

b. If $f(x) = \begin{cases} x & \text{in } 0 < x < \pi/2 \\ \pi - x & \text{in } \pi/2 < x < \pi \end{cases}$

Show that the half range sine series as

$$f(x) = \frac{4}{\pi}\left[\sin x - \frac{\sin 3x}{3^2} - \frac{\sin 5x}{5^2} - \text{---}\right].$$ **(06 Marks)**

c. Obtain the Fourier series upto first harmonics given :

x	0	1	2	3	4	5	6
y	9	18	24	28	26	20	9

(06 Marks)

Module-2

3 a. Find the complex Fourier transform of the function :

$$f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$$ and hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(08 Marks)**

b. Find the Fourier cosine transform of e^{-ax}. **(06 Marks)**

c. Solve by using z – transforms $u_{n+2} - 4u_n = 0$ given that $u_0 = 0$ and $u_1 = 2$. **(06 Marks)**

OR

4 a. Find the Fourier sine and Cosine transforms of :

$$f(x) = \begin{cases} x & 0 < x < 2 \\ 0 & \text{elsewhere} \end{cases}.$$ **(08 Marks)**

b. Find the Z – transform of : i) n^2 ii) ne^{-an}. **(06 Marks)**

c. Obtain the inverse Z – transform of $\frac{2z^2 + 3z}{(z+2)(z-4)}$. **(06 Marks)**

Module-3

5 a. Obtain the lines of regression and hence find the co-efficient of correlation for the data :

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

(08 Marks)

b. Fit a parabola $y = ax^2 + bx + c$ in the least square sense for the data :

x	1	2	3	4	5
y	10	12	13	16	19

(06 Marks)

c. Find the root of the equation $xe^x - \cos x = 0$ by Regula – Falsi method correct to three decimal places in (0, 1). **(06 Marks)**

OR

6 a. If $8x - 10y + 66 = 0$ and $40x - 18y = 214$ are the two regression lines, find the mean of x's, mean of y's and the co-efficient of correlation. Find σ_y if $\sigma_x = 3$. **(08 Marks)**

b. Fit an exponential curve of the form $y = ae^{bx}$ by the method of least squares for the data :

No. of petals	5	6	7	8	9	10
No. of flowers	133	55	23	7	2	2

(06 Marks)

c. Using Newton–Raphson method, find the root that lies near x = 4.5 of the equation $\tan x = x$ correct to four decimal places. **(06 Marks)**

Module-4

7 a. From the following table find the number of students who have obtained marks :
i) less than 45 ii) between 40 and 45.

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

(06 Marks)

b. Using Newton's divided difference formula construct an interpolating polynomial for the following data :

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

and hence find f(8). **(08 Marks)**

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

OR

8 a. In a table given below, the values of y are consecutive terms of a series of which 23.6 is the 6^{th} term. Find the first and tenth terms of the series by Newton's formulas.

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

(08 Marks)

b. Fit an interpolating polynomial of the form x = f(y) for data and hence find x(5) given :

x	2	10	17
y	1	3	4

(06 Marks)

c. Use Simpson's $\frac{1}{3}^{rd}$ rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking 6 sub-intervals. **(06 Marks)**

Module-5

9 a. Verify Green's theorem in the plane for $\phi_c(3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the closed curve bounded by $y = \sqrt{x}$ and $y = x^2$. **(08 Marks)**

b. Evaluate $\int_c xydx + xy^2dy$ by Stoke's theorem where C is the square in the x – y plane with vertices (1, 0)(–1, 0)(0, 1)(0, –1). **(06 Marks)**

c. Prove that Catenary is the curve which when rotated about a line generates a surface of minimum area. **(06 Marks)**

OR

10 a. If $\vec{F} = 2xy\,\hat{i} + yz^2\,\hat{j} + xz\,\hat{k}$ and S is the rectangular parallelepiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1, z = 3 evaluate $\iint_s \vec{F}.\hat{n}\,ds$. **(08 Marks)**

b. Derive Euler's equation in the standard form viz $\frac{\partial f}{\partial y} - \frac{d}{dx}\left[\frac{\partial f}{\partial y'}\right] = 0$. **(06 Marks)**

c. Find the external of the functional $I = \int_0^{\pi/2} (y^2 - y^{12} - 2y\sin x)dx$ under the end conditions y(0) = y(π/2) = 0. **(06 Marks)**

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17MATDIP31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the modulus and amplitude of $\frac{3+i}{2+i}$ **(07 Marks)**

b. If $x = \cos\theta + i\sin\theta$, then show that $\frac{x^{2n}-1}{x^{2n}+1} = i\tan n\theta$. **(07 Marks)**

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

OR

2 a. Find the sine of the angle between $\vec{A} = 2\hat{i} + 2\hat{j} - \hat{k}$ and $\vec{B} = 6\hat{i} - 3\hat{j} + 2\hat{k}$. **(07 Marks)**

b. Find the value of λ, so that the vectors $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{c} = \hat{i} + \lambda\hat{k}$ are coplanar. **(07 Marks)**

c. Prove that $\vec{a}\times(\vec{b}\times\vec{c}) + \vec{b}\times(\vec{c}\times\vec{a}) + \vec{c}\times(\vec{a}\times\vec{b}) = 0$. **(06 Marks)**

Module-2

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

b. 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)**

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

OR

4 a. Find the pedal equation of $r^n = a^n\cos n\theta$. **(07 Marks)**

b. Expand $\log_e(1 + x)$ in ascending powers of x as for as the term containing x^4. **(07 Marks)**

c. If $x = r\cos\theta$, $y = r\sin\theta$, find $\frac{\partial(x,y)}{\partial(r,\theta)}$ **(06 Marks)**

Module-3

5 a. Evaluate $\int_0^1\int_{y^2}^{y}(1+xy^2)\,dx\,dy$ **(07 Marks)**

b. Evaluate $\int_0^{2\pi}\sin^4 x\cos^6 x\,dx$ **(07 Marks)**

c. Evaluate $\int_0^2\frac{x^4}{\sqrt{4-x^2}}dx$ **(06 Marks)**

OR

6 a. Evaluate $\int_1^2 \int_3^4 (xy + e^y)\, dydx$ **(07 Marks)**

b. Evaluate $\int_0^{\pi} x \sin^8 x \, dx$ **(07 Marks)**

c. Evaluate $\int_1^2 \int_0^1 \int_{-1}^1 (x^2 + y^2 + z^2)\, dxdydz$ **(06 Marks)**

Module-4

7 a. If particle moves on the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where t is the time. Find the velocity and acceleration at $t = 1$. **(07 Marks)**

b. Find the angle between the tangents to the curve $\vec{r} = t^2\hat{i} + 2t\hat{j} - t^3\hat{k}$ at the point $t = \pm 1$. **(07 Marks)**

c. If $\vec{F} = (3x^2y - z)\hat{i} + (xz^3 + y^4)\hat{j} - 2x^3z^2\hat{k}$ find grad(div $\vec{F}$) at (2, –1, 0). **(06 Marks)**

OR

8 a. Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at (2, –1, 2) along $2\hat{i} - 3\hat{j} + 6\hat{k}$ **(07 Marks)**

b. Find the unit normal to the surface $x^2y + 2xz = 4$ at (2, –2, 3). **(07 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. **(06 Marks)**

Module-5

9 a. Solve $\frac{dy}{dx} = \sin(x + y)$ **(07 Marks)**

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

c. Solve $(x - y + 1)dy - (x + y - 1)dx = 0$ **(06 Marks)**

OR

10 a. Solve $(1 + e^{x/4})dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0$. **(07 Marks)**

b. Solve $(x^3\cos^2 y - x\sin 2y)\, dx = dy$. **(07 Marks)**

c. Solve $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$ **(06 Marks)**

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17EC32

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Electronic Instrumentation

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the following terms briefly:
i) Accuracy
ii) Precision
iii) Resolution and significant errors. **(07 Marks)**

b. Explain the operation of the multirange ammeter with suitable circuit. **(05 Marks)**

c. Explain the operation of the RF Ammeter (Thermocouple) considering the different types with suitable diagrams. **(08 Marks)**

OR

2 a. With suitable diagrams, explain briefly the operation of the multirange voltmeter. **(07 Marks)**

b. Calculate the value of the multiplier resistance on the 50V range of a dc voltmeter, that uses a 200μA meter measurement with an internal resistance of 100Ω. **(05 Marks)**

c. With block diagram approach, explain the operation of the true RMS voltmeter. **(08 Marks)**

Module-2

3 a. Explain the operation of the ramp type digital voltmeter with voltage to time conversion waveform and block diagram. **(08 Marks)**

b. Explain the operation of the 3½ digit display with suitable diagram. **(05 Marks)**

c. With block diagram approach explain the operation of the digital phase meter. **(07 Marks)**

OR

4 a. With block diagram, approach explain the operation of the digital PH meter. **(06 Marks)**

b. Explain the operation of the digital frequency meter with suitable block diagram. **(07 Marks)**

c. With block diagram approach, explain the operation of the successive approximation digital voltmeter. **(07 Marks)**

Module-3

5 a. With block diagram of oscilloscope, explain the operation of CRO. And also mention the functions of each block. **(07 Marks)**

b. Explain the operation of the sweep or time base generator with suitable circuit and relevant Sawtooth output waveform. **(07 Marks)**

c. Explain the operation of the conventional standard signal generator with relevant block diagram. **(06 Marks)**

OR

6 a. With block diagram approach, explain the operation of the AF sine and square wave generator. **(06 Marks)**

b. Explain the operation of the function generator with relevant block diagram. **(06 Marks)**

c. Briefly explain the operation of digital storage oscilloscope with relevant block diagram. **(08 Marks)**

Module-4

7 a. Explain the operation of the phase meter which detects the phase for the positive half and negative half using different circuits. **(07 Marks)**

b. Explain the operation of the field strength meter using diode circuit. **(06 Marks)**

c. A capacitance comparison bridge is used to measure a capacity impedance at a frequency of 2kHz. The bridge constants at balance are $C_3 = 100\mu F$, $R_1 = 10K\Omega$, $R_2 = 50K\Omega$, $R_3 = 100K\Omega$. Find the equivalent series circuit of the unknown impedance. **(07 Marks)**

OR

8 a. With Maxwell's bridge circuit, explain the balance condition. And derive an expression for the R_x and L_x. **(07 Marks)**

b. Find the equivalent parallel resistance and capacitance that causes a Wein bridge with the following component values $R_1 = 3.1K\Omega$, $C_1 = 5.2\mu F$, $R_2 = 25K\Omega$, $f = 2.5K\Omega$, $R_4 = 100K\Omega$. **(07 Marks)**

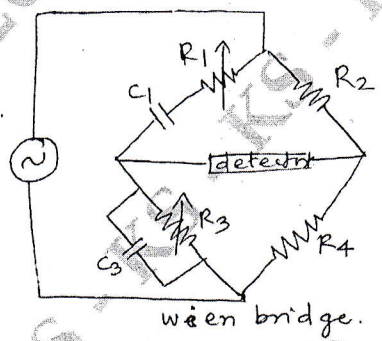

Fig.Q.8(b)

c. Explain the operation of the basic Megger circuit with neat diagram. **(06 Marks)**

Module-5

9 a. Explain the different types of resistive transducers with figure. Mention the advantages and disadvantages. **(07 Marks)**

b. Explain the operation of the Industrial platinum resistance thermometer with bridge circuit. **(07 Marks)**

c. Explain the operation of the photo transistor with construction, symbol, output characteristics and photo transistor with relay circuit. **(06 Marks)**

OR

10 a. Explain the Thermistor with resistance Vss temperature graph, and various configurations of thermistor. And also mention the advantages and limitations. **(07 Marks)**

b. Explain the operation of the linear variable differential transducer with construction, various core position of LVDT and variation of output voltage with displacement. **(07 Marks)**

c. Explain the operation of the piezoelectrical transducer with construction and equivalent circuit. **(06 Marks)**

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17EC33

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Analog Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive the expression for input impedance, output impedance, voltage gain and current gain for common emitter voltage divider bias configuration using re model. **(10 Marks)**

b. For the emitter-follower circuit shown in Fig.Q.1(b). Determine:
i) Input impedance
ii) Output resistance
iii) Voltage gain
iv) Current gain.

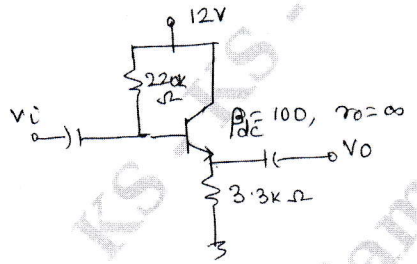

Fig.Q.1(b)

(10 Marks)

OR

2 a. Derive the expression for voltage gain, current gain, input resistance, output resistance CE transistor amplifier using hybrid parameters. **(10 Marks)**

b. Describe the hybrid π-model. **(04 Marks)**

c. Determine Z_i, Z_o, A_v, A_i for the circuit shown in Fig.Q.2(c) using approximate hybrid model. Given data $h_{ie} = 1.1K\Omega$, $h_{fe} = 100$, $h_{oe} = 20\mu A/V$ **(06 Marks)**

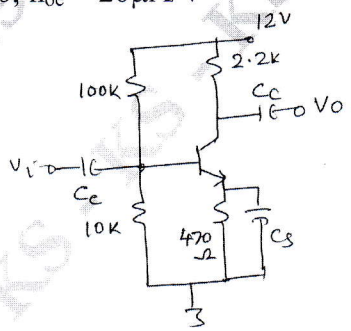

Fig.Q.2(c)

Module-2

3 a. Indicate various operating regions of JFET. Also determine parameters from the characteristics. **(06 Marks)**

b. Analyze self bias configuration of JFET and derive the expression for voltage gain, output impedance and input impedance. **(07 Marks)**

c. Compute g_m, z_i, z_o and A_v for the circuit shown in Fig.Q.3(c). Given V_{GSQ} = -2.2V, I_{DQ} = 2.03mA, I_{DSS} = 10mA, V_p = -4V and r_d = 40KΩ. **(07 Marks)**

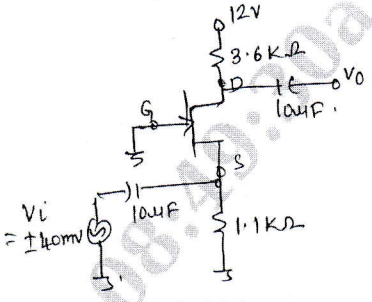

Fig.Q.3(c)

OR

4 a. Explain the characteristics of enhancement type MOSFET. Also indicate various operating regions. **(06 Marks)**

b. Derive the expression voltage gain, input resistance and output resistance of the source follower. **(07 Marks)**

c. Evaluate z_i, z_o and A_v for the JFET circuit shown in Fig.Q.4(c). Given: I_{DSS} = 12mA, V_p = -3V, g_m = 2m℧, r_d = 40KΩ **(07 Marks)**

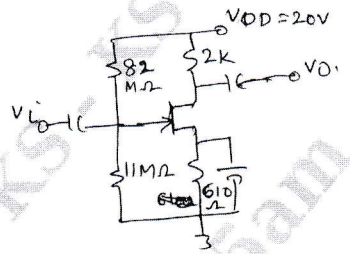

Fig.Q.4(c)

Module-3

5 a. Derive the expression for cut-off frequency due to source capacitor and coupling capacitor of a BJT amplifier. **(06 Marks)**

b. If the applied ac power to a system is 5μw at 100mV and the output power is 48W, Determine: i) Power gain in dB ii) The voltage gain in dB if the output impedance is 40KΩ iii) The input impedance. **(06 Marks)**

c. Derive an expression for Miller input and output capacitance. Also draw the equivalent circuit. **(08 Marks)**

OR

6 a. Derive the expression f_L' and f_H' for the multistage amplifier. **(06 Marks)**

b. For the circuit shown in Fig.Q.6(b) determine f_{Hi} and f_{Ho}, given C_{wi} = 3pF, C_{wo} = 5pF, C_{gd} = 4pF, C_{gs} = 6pF, C_{ds} = 1pF, I_{DSS} = 6mA, V_p = -6V r_d = ∞ and g_m = 2m℧. **(08 Marks)**

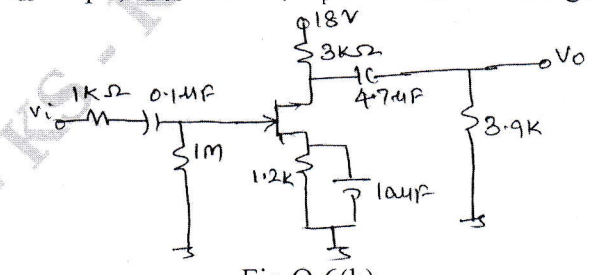

Fig.Q.6(b)

c. Determine overall lower 3dB and upper 3dB frequency for a four stage amplifier having an individual value of $f_1 = 40Hz$ and $f_2 = 2.5MHz$. Also calculate overall bandwidth. **(06 Marks)**

Module-4

7 a. Explain the concept of feed back using block diagram. **(06 Marks)**

b. Derive the expression for input resistance and output resistance of a voltage series feedback amplifier. **(08 Marks)**

c. If the gain of an amplifier changes from a value of -1000 by 10%, calculate the gain change, if the amplifier used in a feedback circuit having $\beta = \frac{-1}{20}$. **(06 Marks)**

OR

8 a. Explain the operation of FET phase shift oscillator. **(08 Marks)**

b. Describe the Wein bridge oscillator for the oscillating frequency $f_0 = 2.2kHz$. Also draw the circuit diagram. **(06 Marks)**

c. Determine the oscillating frequency of the Colpitts oscillator for the given specifications $C_1 = 750pF$, $C_2 = 2500pF$ and $L = 40\mu H$. Also calculate the feedback factor of the Colpitts oscillator. **(06 Marks)**

Module-5

9 a. Derive an expression for conversion efficiency of transformer coupled class-A amplifier. **(08 Marks)**

b. Calculate the second harmonic distortion for an output waveform having measured values of $V_{CEmin} = 2.4V$ $V_{CEQ} = 10V$ and $V_{CEmax} = 20V$. **(04 Marks)**

c. Explain with the help of neat circuit diagram, voltage series regulator operation. **(08 Marks)**

OR

10 a. Derive an expression for conversion efficiency of class B push pull amplifier. **(08 Marks)**

b. A transformer coupled class-A amplifier drives a 16Ω speaker through 4:1 transformer using a power supply of $V_{cc} = 36V$, the circuit delivers 2W to the load. Calculate : i) P(ac) across transformer primary ii) V_L(ac). **(06 Marks)**

c. Calculate the harmonic distortion components for an output signal having fundamental amplitude of 2.1V, second harmonic component amplitude of 0.3V, third harmonic component of 0.1V and fourth harmonic component of 0.05V. Also calculate total harmonic distortion. **(06 Marks)**

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17EC34

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Digital Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Express the following functions into a canonical form:
i) $f_1 = a + bc + bcd$
ii) $f_2 = a(b + c)(b + c + d)$ **(08 Marks)**

b. Represent the number of days in a month for a non-leap year by a truth cable, indicating the output of a invalid inputs if any by '0'. **(06 Marks)**

c. Simplify the given function using K-map method
$f(abcd) = \sum m(1, 2, 4, 11, 13, 14, 15) + d(0, 5, 7, 8, 10)$. **(06 Marks)**

OR

2 a. Find all prime implicants of the function using Quine-industry method and verify the same by K-map method .$f(abcd) = \sum m(0, 2, 3, 4, 8, 10, 12, 13, 14)$ **(10 Marks)**

b. Find minimal sum and minimal product for the incomplete Boolean function using K-map $f(abcd) = \sum m(6, 7, 9, 10, 13) + d\sum(1, 4, 5, 11, 15)$. **(10 Marks)**

Module-2

3 a. Design two bit magnitude comparator. **(10 Marks)**

b. Design 4:2 priority encoder with a valid output where highest priority is given to the highest bit position. **(10 Marks)**

OR

4 a. Design and realize the Boolean function using IC-74139.
$f_1(ab) = \sum(0, 2)$, $f_2(abc) = \sum(1, 3, 5, 7)$. **(05 Marks)**

b. Explain how look ahead carry adder circuit will reduce the propagation delay with the help of carry propagate and carry generate function. **(08 Marks)**

c. Implement the Boolean function $f(abcd) = \sum(0, 2, 4, 5, 7, 9, 10, 14)$ using multiplexers with two 4:1 MUX with variable 'a' and 'b' are connected to their select lines in first level and one 2:1 MUX with variable 'c' connected to its select line in second level. **(07 Marks)**

Module-3

5 a. With the help of logic circuit and waveforms. Explain switch bouncing applications using SR latch. **(06 Marks)**

b. Write the characteristics equation for SR, JK flip flop. **(06 Marks)**

c. With neat logic diagram, and waveform. Explain the operation of master-slave J-K flip-flop. **(08 Marks)**

OR

6 a. List the difference between combinational and sequentional circuit. **(06 Marks)**

b. Explain the operation of clocked SR flip-flop using NAND-gate. s **(06 Marks)**

c. What is the significance of Edge triggering? Explain the working of positive edge triggered D flip-flop with their function table. **(08 Marks)**

Module-4

7 a. With neat diagram, explain the operation of universal shift register. **(08 Marks)**

b. Design 3 bit binary synchronous down counter using JK Flip Flop. Write excition table, transition table, and logic diagram. **(12 Marks)**

OR

8 a. What is register? With heat circuit diagram, explain the operation of 4-bit ring counter. **(07 Marks)**

b. With logic diagram, sequence table, decoding logic. Explain the operation of mod-7 twisted ring counter. **(07 Marks)**

c. Explain the working of 4 bit binary ripple counter using positive edge triggered T-flip-flop also draw timing diagram, truth table. **(06 Marks)**

Module-5

9 a. Write the difference between Moore and Mealy model with necessary block diagram. **(08 Marks)**

b. Design asynchronous circuit using positive edge triggered J-K flip-flop with minimal combinational gating to generate the following sequence. 0-1-2-0: if input X = 0 and 0 – 2 – 1 – 0; if input X = 1, provide an output which goes high to indicate the non-zero state in the 0-1-2-0 sequence. Is this a mealy machine? **(12 Marks)**

OR

10 a. Design a cyclic mod-8 synchronous binary counter using JK flip-flop. **(10 Marks)**

b. Analyze the given sequential circuit show in Fig.Q.10(b) and obtain.

i) Flip-flop Input and Output Equation
ii) Transition Equation
iii) Transition Table (N)
iv) State Table
v) State Diagram.

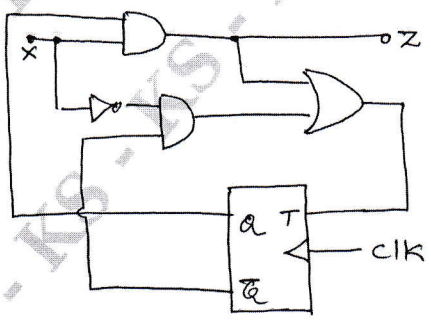

Fig.Q.10(b)

(10 Marks)

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CBCS SCHEME

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Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Network Analysis

Time: 3 hrs. Max. Marks: 100

Note: Answer any 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. Calculate the voltage across the 6Ω resistor in the network of Fig.Q1(b) using source shifting technique.

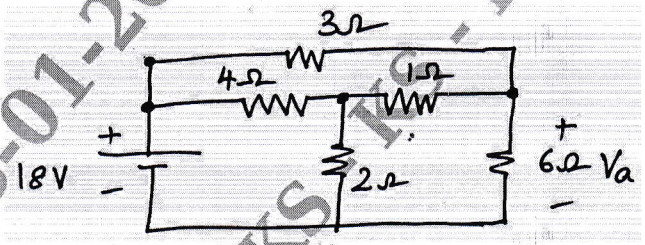

Fig.Q1(b) **(10 Marks)**

OR

2 a. Determine the resistance between the terminals A and B of the network shown in Fig.Q2(a).

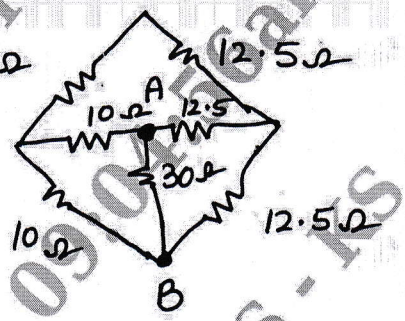

Fig.Q2(a) **(10 Marks)**

b. Find currents in all the branches of the network shown in Fig.Q2(b) using mesh analysis.

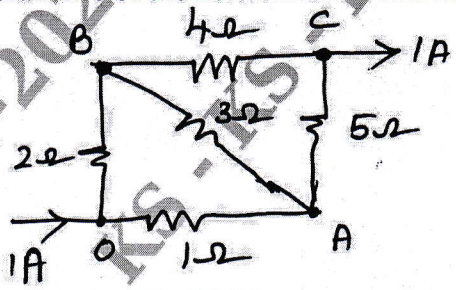

Fig.Q2(b) **(05 Marks)**

c. Find voltages V_1 and V_2 in the network shown in Fig.Q2(c) using node analysis method.

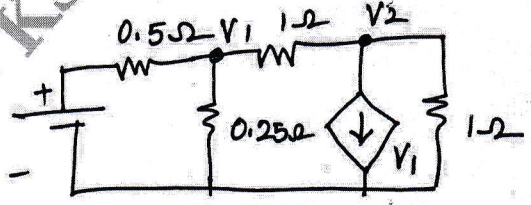

Fig.Q2(c) **(05 Marks)**

Module-2

3 a. Obtain Thevenin's equivalent network for Fig.Q3(a).

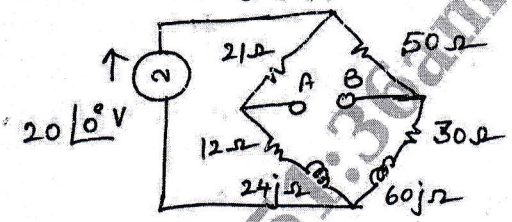

Fig.Q3(a) **(08 Marks)**

b. State and prove Millman's theorem. **(06 Marks)**

c. For the circuit shown in Fig.Q3(c), find the voltage V_x and verify reciprocity theorem.

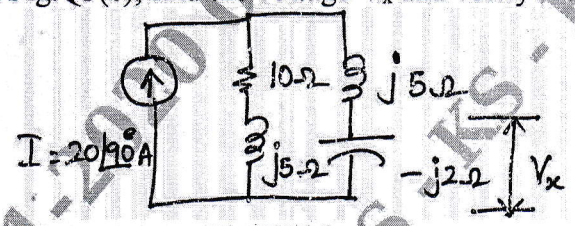

Fig.Q3(c) **(06 Marks)**

OR

4 a. State and prove maximum power transfer theorem for AC circuits (when R_L and X_L are varying) **(10 Marks)**

b. Find 'V' in the circuit shown in Fig.Q4(b) using super position theorem.

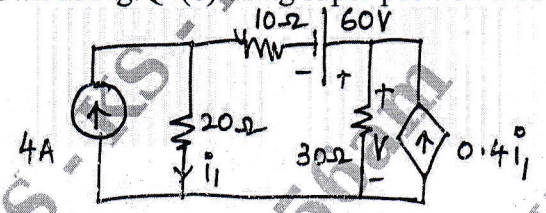

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. What is the significance of initial conditions? Write a note on initial and final conditions for basic circuit elements. **(05 Marks)**

b. In the network shown in Fig.Q5(b) switch 'S' is changed from A to B at t = 0 having already established a steady state in position A shown that at $t = 0^+$, $i_1 = i_2 = \frac{-V}{R_1 + R_2 + R_3}$ and $i_3 = 0$.

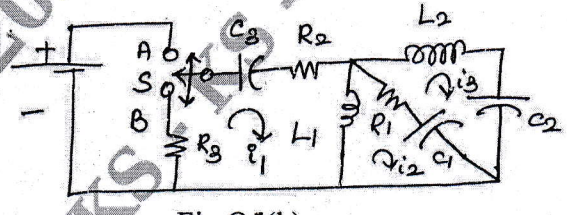

Fig.Q5(b) **(10 Marks)**

c. In the network of Fig.Q5(c) switch 'S' is closed at t = 0 with zero initial current in the inductor. Find i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$ if R = 10 Ω, L = 1 H and V = 10 Volts.

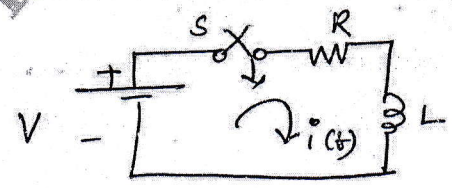

Fig.Q5(c) **(05 Marks)**

OR

6 a. Obtain Laplace transform of:
(i) Step function
(ii) Ramp function
(iii) Impulse function **(10 Marks)**

b. Find the Laplace transform of the waveform shown in Fig.Q6(b).

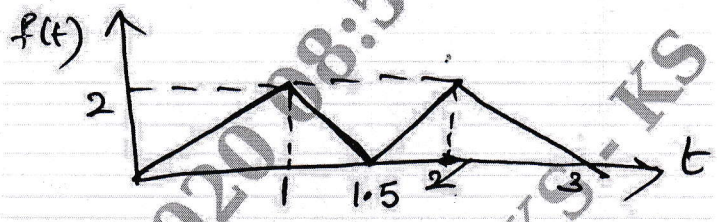

Fig.Q6(b) **(10 Marks)**

Module-4

7 a. Derive the relation between bandwidth and quality factor B.W = f_0/Q. **(10 Marks)**

b. Show that the value of capacitance for max voltage across the capacitor in case of capacitor tuning series resonance is given by $C = \frac{L}{R^2 + X_L^2}$.

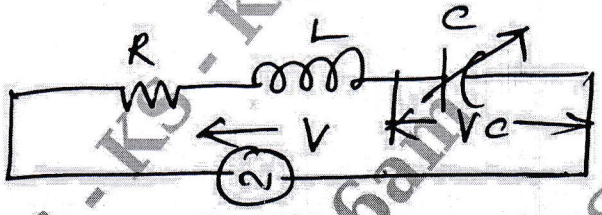

Fig.Q7(b) **(10 Marks)**

OR

8 a. Derive for f_0 for parallel resonance circuit when the resistance of the capacitance is considered.

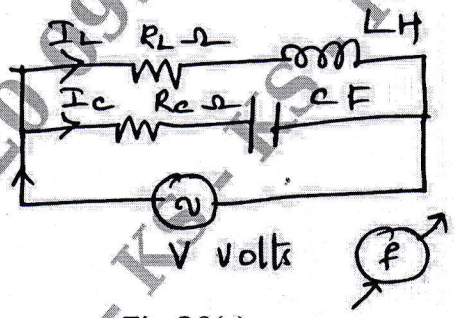

Fig.Q8(a) **(10 Marks)**

b. Find the value of L for which the circuit in Fig.Q8(b) resonates at ω = 5000 rad/sec.

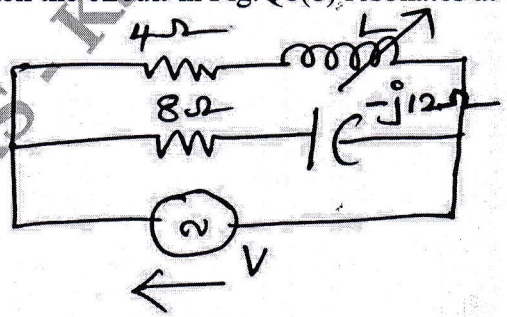

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Derive the expression of Z parameters in terms of Y parameters. **(10 Marks)**

b. Determine Y and Z parameters for the network shown in Fig.Q9(b).

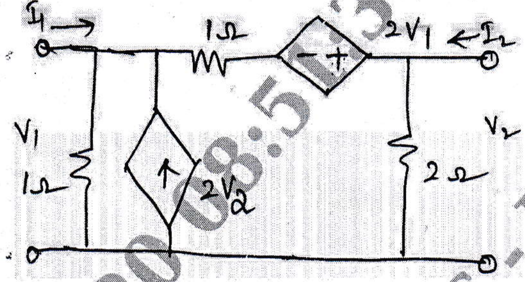

Fig.Q9(b) **(10 Marks)**

OR

10 a. Derive the expression of h parameters in terms of ABCD parameters. **(10 Marks)**

b. Find ABCD constants and show that AD – BC = 1 for the network shown in Fig.Q10(b).

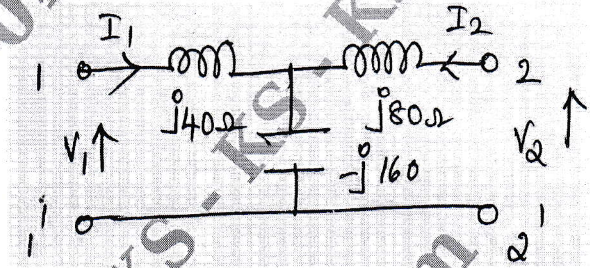

Fig.Q10(b) **(10 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

17EC36

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Obtain an expression for electric field intensity at any given point due to 'n' number of point charges. **(04 Marks)**

b. Four 10 nC positive charges are located in the z = 0 plane at the corners of a square 8 cm on a side. A fifth 10 nC positive charge is located at a point 8 cm distant from the other charges. Calculate the magnitude of the total force on this fifth charge for $\epsilon = \epsilon_0$. **(08 Marks)**

c. Find the total charge contained in a 2 cm length of the electron beam for 2 cm < z < 4 cm, ρ = 1 cm and $\rho_v = -5\, e^{-100\rho z}$ $\mu c/m^3$. **(08 Marks)**

OR

2 a. Define electric flux and electric flux density, and also, obtain the relationship between electric flux density and electric field intensity. **(06 Marks)**

b. Infinite uniform line charges of 5 nC/m lie along the (positive and negative) x and y axes in free space, Find $\vec{E}$ at P(1, 2, 3). **(10 Marks)**

c. Given a 60 μC point charge located at the origin, find the total electric flux passing through:

(i) That portion of the sphere r = 26 cm bounded by $0 < \theta < \frac{\pi}{2}$ and $0 < \phi < \frac{\pi}{2}$.

(ii) The closed surface defined by ρ = 26 cm and z = ±26 cm. **(04 Marks)**

Module-2

3 a. State and obtain mathematical formulation of Gauss law. **(07 Marks)**

b. Given $\vec{D} = 6\rho \sin\left(\frac{\phi}{2}\right)\hat{a}_\rho + 1.5\rho\cos\left(\frac{\phi}{2}\right)\hat{a}_\phi$ C/m^2. Evaluate both sides of divergence theorem for the region bounded by ρ = 2m, ϕ = 0, $\phi = \pi$ rad, z = 0 and z = 5m. **(08 Marks)**

c. Derive the point form of current continuity equation. **(05 Marks)**

OR

4 a. Given the non-uniform field $\vec{E} = y\hat{a}_x + x\hat{a}_y + 2\hat{a}_z$ V/m, determine the work expended in carrying 2C from B(1, 0, 1) to A(0.8, 0.6, 1), along the shorter arc of the circle; $x^2 + y^2 = 1$, z = 1. **(07 Marks)**

b. Derive the expression for potential field resulting from point charge in free-space. **(07 Marks)**

c. Find the value of volume charge density at p(r = 1.5 m, θ = 30°, ϕ = 50°), when $\vec{D} = 2r\sin\theta\cos\phi\,\hat{a}_r + r\cos\theta\cos\phi\,\hat{a}_\theta - r\sin\phi\,\hat{a}_\phi$ C/m^2. **(06 Marks)**

Module-3

5 a. Using Gauss law derive Poisson and Laplace equations. **(05 Marks)**

b. State and prove uniqueness theorem. **(10 Marks)**

c. Calculate $\Delta\vec{H}_2$ at P_2(4, 2, 0) resulting from $I_1\Delta\vec{L}_1 = 2\pi\hat{a}_z$ μAm at P_1(0, 0, 2). **(05 Marks)**

OR

6 a. Show that $\nabla^2 V = 0$, for $V = (5\rho^4 - 6\rho^{-4})\sin 4\phi$. **(05 Marks)**

b. Evaluate both sides of 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 positive direction of $d\vec{s}$ be $\hat{a}_z$. **(08 Marks)**

c. State and explain Ampere's circuital law. Using the same, obtain the expression for $\vec{H}$ at any given point due to the infinite length filamentary conductor, carrying current I. **(07 Marks)**

Module-4

7 a. Obtain an expression for Lorentz force equation. **(05 Marks)**

b. Obtain the relationship between magnetic fields at the boundary of two different magnetic media. **(09 Marks)**

c. Derive the expression for force between two infinitely long. Straight, parallel filamentary conductors, separated by distance d, carrying equal and opposite currents, I. **(06 Marks)**

OR

8 a. Given a ferrite material which operates in a linear mode with B = 0.05 T, calculate values for magnetic susceptibility, magnetization and magnetic field intensity. Given $\mu_r = 50$. **(05 Marks)**

b. Obtain expressions for magneto motive force (mmf) and reluctance in magnetic circuits by making use of analogy between electric and magnetic circuits. **(08 Marks)**

c. Two differential current elements, $I_1\Delta\vec{L}_1 = 3(10^{-6})\hat{a}_y$ Am at $P_1(1, 0, 0)$ and $I_2\Delta\vec{L}_2 = 3(10^{-6})(-0.5\hat{a}_x + 0.4\hat{a}_y + 0.3\hat{a}_z)$ Am at $P_2(2, 2, 2)$ are located in free space. Find vector force exerted on $I_2\Delta\vec{L}_2$ by $I_1\Delta\vec{L}_1$. **(07 Marks)**

Module-5

9 a. Explain the inadequacy of Ampere's circuital law for time-varying fields. Obtain a suitable correction for the same, which will remain consistent for both time and non-time-varying fields. **(05 Marks)**

b. Let $\mu = 10^{-5}$ H/m, $\epsilon = 4 \times 10^{-9}$ F/m, $\sigma = 0$ and $\rho_v = 0$. Find K (including units) so that the following pair of fields satisfy Maxwell's equations: $\vec{E} = (20y - Kt)\hat{a}_x$ V/m, $\vec{H} = (y + 2\times10^6 t)\hat{a}_z$ A/m. **(05 Marks)**

c. Starting from Maxwell's curl equation, obtain the equation of Poynting's theorem and interpret the same. **(10 Marks)**

OR

10 a. Express Maxwell's equations in phasor form as applicable to free-space. Using the same, obtain vector Helmholtz equation in free space. **(09 Marks)**

b. Obtain an expression for skin depth when an electromagnetic wave enters a conducting medium. Also, calculate the skin depth when a 160 MHz plane wave propagates through aluminum of conductivity 10^5 ℧/m, $\epsilon_r = \mu_r = 1$ **(05 Marks)**

c. Starting from equation of Faraday's law, obtain the point form of Maxwell's equation concerning spatial derivative of $\vec{E}$ and time derivative of $\vec{H}$. **(06 Marks)**

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