CBCS SCHEME

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17MAT31

Third Semester B.E. Degree Examination, Feb./Mar.2022
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Find a Fourier Series to represent $f(x) = x - x^2$ from $x = -\pi$ to $x = \pi$. Hence prove that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} .....$ (08 Marks)

b. Obtain a Fourier series of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 0, & 1 < x < 2 \end{cases}$. (06 Marks)

c. Find the half-range Fourier sine series of $f(x) = e^x$ in $0 < x < 1$. (06 Marks)

OR

2 a. Find the Fourier series expansion upto second harmonic using the following table of values:

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y	1.0	1.4	1.9	1.7	1.5	1.2	1.0

(08 Marks)

b. Express $f(x) = (\pi - x)^2$ as a Fourier series of period 2π in the interval $0 < x < 2\pi$. (06 Marks)

c. Obtain the Half range cosine series of $f(x) = x^2$ in $0 \le x \le \pi$. (06 Marks)

Module-2

3 a. Find the 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 $\int_0^\infty \frac{\sin ax}{x} dx$. (08 Marks)

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

c. Solve $u_n + 3u_{n-1} - 4u_{n-2} = 0$ for $n \ge 2$ given $u_0 = 3$, $u_1 = -2$ using z-transform. (06 Marks)

OR

4 a. Find the Fourier sine transform of e^{-ax}, a>0, x>0 show that $\int_0^\infty \frac{x \sin mx}{a^2 + x^2} dx = \frac{\pi}{2} e^{-am}$, m>0. (08 Marks)

b. Find the z-transform of $\cosh\left(\frac{n\pi}{2} + \theta\right)$. (06 Marks)

c. Find the inverse z-transform of, $\frac{3z^2 + z}{(5z-1)(5z+2)}$. (06 Marks)

Module-3

5 a. Find the correlation coefficient using the following table as values: (08 Marks)

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

b. Obtain an equation of the form $y = ax + b$ given that, (06 Marks)

x	0	5	10	15	20	25
y	12	15	17	22	24	30

c. Apply Regula-Falsi method to find the root of $xe^x = \cos x$ in four approximations with four decimals in (0, 1). (06 Marks)

OR

6 a. Obtain the regression line of y on x for the following table of values: (08 Marks)

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

b. Fit a parabola $y = a + bx + cx^2$ to the following data: (06 Marks)

x	20	40	60	80	100	120
y	5.5	9.1	14.9	22.8	33.3	46

c. Find the root of the equation $x^4 - x - 9 = 0$ by Newton-Raphson method in three approximations with three decimal places. (Take $x_0 = 2$) (06 Marks)

Module-4

7 a. Use Newton's forward interpolation formula to find y(8) from the table of values, (08 Marks)

x	0	5	10	15	20	25
y(x)	7	11	14	18	24	32

b. Determine y at x = 1 using Newton's general interpolation formula given that, (06 Marks)

x	-4	-1	0	2	5
y(x)	1245	33	5	9	1335

c. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Weddle's rule with h = 1. (06 Marks)

OR

8 a. Find f(4) using Newton's Backward interpolation formula given that,

x	0	1	2	3
y = f(x)	1	2	1	10

(08 Marks)

b. Apply Lagrange's interpolation formula to find y (x = 10) given that,

x	5	6	9	11
y(x)	12	13	14	16

(06 Marks)

c. Apply Simpson's $\frac{1}{3}^{rd}$ formula to evaluate $\int_0^{120} V(t)dt$ given that,

t	0	12	24	36	48	60	72	84	96	108	120
V(t)	0	3.60	10.08	18.90	21.60	18.54	10.26	5.40	4.5	5.4	9.0

(06 Marks)

Module-5

9 a. Verify Green's theorem in the plane for $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the boundary of the region defined by $x = 0$, $y = 0$, $x + y = 1$. (08 Marks)

b. Evaluate $\oint_C \vec{F}.\vec{dr}$ by Stoke's theorem with $\vec{F} = y^2\hat{i} + x^2\hat{j} - (x+z)\hat{k}$ and C is the boundary of the triangle with vertices at, (0, 0, 0), (1, 0, 0) and (1, 1, 0). (06 Marks)

c. Show that the geodesies on a plane are straight lines. (06 Marks)

OR

10 a. Find $\iint_S \vec{F}.\vec{dS}$, where $F = (2x+3z)\hat{i} - (xz+y)\hat{j} + (y^2+2z)\hat{k}$ and S is the surface of the sphere having center at (3, -1, 2) and radius 3. (Use Gauss divergence theorem). (08 Marks)

b. Derive Euler's equation with usual notations as, $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. (06 Marks)

c. Find the extremals of the functional,

$$\int_{x_0}^{x_1} \left(\frac{y'^2}{x^3}\right) dx.$$

(06 Marks)

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17MATDIP31

Third Semester B.E. Degree Examination, Feb./Mar. 2022
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 a unit vector normal to the vectors $\vec{a} = 2\hat{i}+2\hat{j}-\hat{k}$ and $\vec{b} = 6\hat{i}-3\hat{j}+2\hat{k}$. Also find the sine of the angle between them. **(08 Marks)**

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

c. Express $\sqrt{3}+i$ in the polar form and hence find its modulus and amplitude. **(06 Marks)**

OR

2 a. Simplify $\frac{(\cos 3\theta + i\sin 3\theta)^4 (\cos 4\theta - i\sin 4\theta)^5}{(\cos 4\theta + i\sin 4\theta)^3 (\cos 5\theta + i\sin 5\theta)^{-4}}$. **(08 Marks)**

b. If $\vec{a} = 3\hat{i}-7\hat{j}+2\hat{k}$, $\vec{b} = 2\hat{i}-5\hat{j}+10\hat{k}$. Find $(\vec{a}+\vec{b})\times(\vec{a}-\vec{b})$. **(06 Marks)**

c. Prove that the vectors $\hat{i}-2\hat{j}+3\hat{k}$, $-2\hat{i}+3\hat{j}-4\hat{k}$ and $\hat{i}-3\hat{j}+5\hat{k}$ are co-planar. **(06 Marks)**

Module-2

3 a. If $y = e^{a\sin^{-1}x}$ then prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+a^2)y_n = 0$. **(08 Marks)**

b. Find the angle between the curves $r = \frac{a}{1+\cos\theta}$ and $r = \frac{b}{1-\cos\theta}$. **(06 Marks)**

c. If $u = \log\left(\frac{x^4+y^4}{x+y}\right)$ then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3$. **(06 Marks)**

OR

4 a. Using Maclaurin's series expand $\sin x$ upto the term containing x^5. **(08 Marks)**

b. Find the pedal equation of the curve $r^m \cos m\theta = a^m$. **(06 Marks)**

c. If $u = x + y + z$, $v = y + z$, $w = z$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$. **(06 Marks)**

Module-3

5 a. Obtain a reduction formula for $\int_0^{\pi/2} \cos^n x \, dx (n > 0)$. **(08 Marks)**

b. Evaluate $\int_0^1 \frac{x^6}{\sqrt{1-x^2}} dx$ by taking $x = \sin\theta$. **(06 Marks)**

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

6 a. Obtain a reduction formula for $\int_0^{\pi/2} \sin^n x\, dx \ (n > 0)$ **(08 Marks)**

b. Evaluate $\int_0^{\pi/2} \cos^4 \theta\, d\theta$ using reduction formula. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^2 xy\, dy\, dx$. **(06 Marks)**

Module-4

7 a. A particle moves along the curve $x = t^3 + 1$, $y = t^2$, $z = 2t + 3$ where t is the time. Find the components of its velocity and acceleration at $t = 1$ in the direction $\hat{i} + \hat{j} + 3\hat{k}$. **(08 Marks)**

b. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point (1, –2, 1) in the direction of the vector $2\hat{i} - \hat{j} + 2\hat{k}$. **(06 Marks)**

c. Show that $\vec{F} = \dfrac{xi + yj}{x^2 + y^2}$ is solenoidal. **(06 Marks)**

OR

8 a. Find $\text{div}\vec{F}$ and $\text{crul}\vec{F}$, where $\vec{F} = (3x^2 - 3yz)\hat{i} + (3y^2 - 3xz)\hat{j} + (3z^2 - xy)\hat{k}$. **(08 Marks)**

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

c. Find the constants a, b, c such that the vector,
$\vec{F} = (x + y + az)\hat{i} + (bx + 2y - z)\hat{j} + (x + cy + 2z)\hat{k}$ is irrotational. **(06 Marks)**

Module-5

9 a. Solve : $(x^2 - y^2)dx - xy\, dy = 0$. **(08 Marks)**

b. Solve : $(1 + y^2)dx = (\tan^{-1}y - x)dy$. **(06 Marks)**

c. Solve : $(x^2 + y^2 + 1)dx + 2xy\, dy = 0$. **(06 Marks)**

OR

10 a. Solve : $x^2y\, dx - (x^3 + y^3)dy = 0$. **(08 Marks)**

b. Solve : $\left\{y\left(1 + \frac{1}{x}\right) + \cos y\right\}dx + (x + \log x - x\sin y)dy = 0$. **(06 Marks)**

c. Solve : $(x + 1)\dfrac{dy}{dx} - ye^{3x}(x + 1)^2\dfrac{dy}{dx} + \dfrac{y}{x} = 1$. **(06 Marks)**

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17EC33

Third Semester B.E. Degree Examination, Feb./Mar. 2022
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. Obtain the expressions for Z_i, Z_0 and A_v for fixed bias transistor circuit using r_e model. (10 Marks)

b. What is Darlington Connection? Calculate the DC bias voltage and currents in the Darlington emitter follower circuit given.

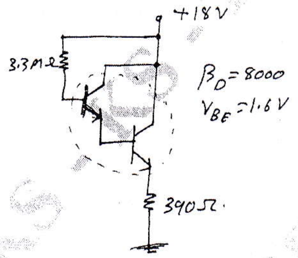

Fig.Q1(b) (05 Marks)

c. For a fixed bias circuit with $R_B = 330K\Omega$, $R_C = 2.7K\Omega$ and $V_{CC} = 8V$. Find Z_i, Z_o and A_V if transistor used has $h_{fe} = 120$, $h_{ie} = 1.175K\Omega$ and $h_{oe} = 20\mu A/v$. (05 Marks)

OR

2 a. Obtain expression for Z_i, Z_0 and A_V for Emitter follower circuit (CC – configuration of transistor) with $r_0 = \infty$. (10 Marks)

b. For the voltage divider bias circuit with $R_1 = 56K\Omega$, $R_2 = 8.2K\Omega$, $R_C = 6.8K\Omega$, $R_E = 1.5K\Omega$. Find : Z_i, Z_0 and A_V if transistor used has $h_{fe} = 120$, $h_{ie} = 1.175K\Omega$ and $h_{oe} = 20\mu A/v$. (06 Marks)

c. Draw and explain Hybrid – II model of transistor in CE configuration. (04 Marks)

Module-2

3 a. Explain the construction and working of N-channel JFET. Also explain the drain the transfer characteristics of JFET with neat diagrams. (10 Marks)

b. The fixed bias configuration shown in Fig.Q3(b), has $V_{GSQ} = -2V$, $I_{DSS} = 10mA$, $I_{DQ} = 5.6mA$, $V_P = -8V$, $Y_{os} = 40\mu s$. Find Q_m, r_d, Z_i, Z_0 and A_V.

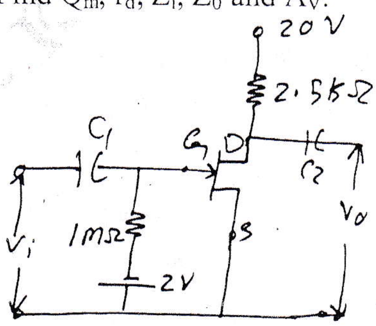

Fig.Q3(b) (05 Marks)

c. With necessary equivalent circuit obtain the expression for Z_i, Z_0 and A_V for self Bias configuration with Bypass capacitor of JFET. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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OR

4 a. With necessary equivalent circuit obtain the expression for Z_i, Z_0 and A_V for a JFET common gate configuration. **(10 Marks)**

b. Find Z_i, Z_0 and output voltage if $g_m = 2.6mS$ of both stages.

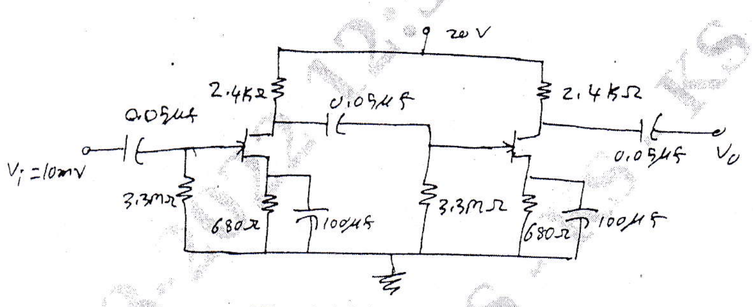

Fig.Q4(b) **(06 Marks)**

c. Identify the differences between enhancement and repletion MOSFET (any two). **(04 Marks)**

Module-3

5 a. What is Miller effect? Derive expression for Miller capacitance for an amplifier. **(08 Marks)**

b. Determine $f_{L_G}, f_{L_C}, f_{L_S}, f_{H_i}$ and f_{H_o} for the given FET amplifier circuit with

$C_{W_i} = 5pf$, $C_{W_o} = 6pf$, $C_G = 0.01\mu f$, $C_C = 0.5\mu f$, $C_S = 2\mu f$,

$I_{DSS} = 8mA$, $V_P = -4V$, $r_d = \infty$, $V_{DD} = 20\,V$, $V_{GS} = -2V$

$C_{gd} = 2pf$, $C_{gs} = 4pf$, $C_{ds} = 0.5pf$.

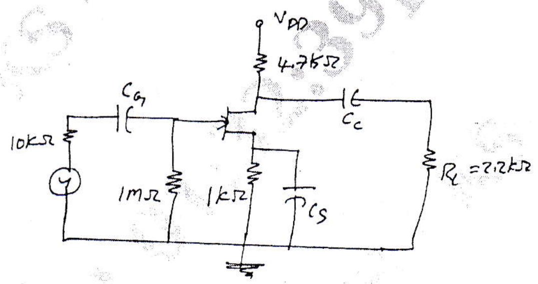

Fig.Q5(b) **(12 Marks)**

OR

6 a. Derive the expressions for low frequency cut-offs for a voltage divider transistor with R_S and R_L. **(08 Marks)**

b. The input power to a device is 10000W at a voltage of 1000V. The output power is 500W and the output impedance is 20Ω. Find : i) power gain in dB ii) voltage gain in dB. **(04 Marks)**

c. For the given circuit of transistor amplifier find f_{β}, f_{H_i} and f_{H_o}.

Given $r_0 = \infty$, $C_{be} = 36pf$, $C_{bc} = 4pf$, $C_{ce} = 1pf$, $C_{Wi} = 6p$, $C_{wo} = 8pf$, and $r_e = 15.76\Omega$.

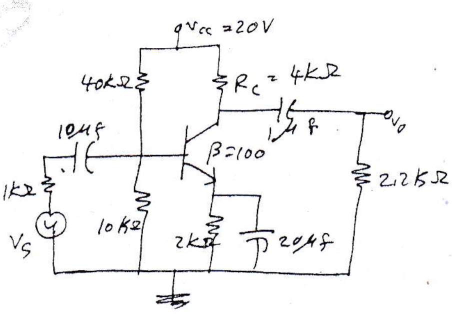

Fig.Q6(c) **(08 Marks)**

Module-4

7 a. Derive expressions for voltage gain, Z_{if} and Z_{of} of voltage series feedback amplifier with necessary feedback connections. (08 Marks)

b. With neat diagram and necessary expressions explain tuned Hartely Oscillators. Using transistor. (06 Marks)

c. Describe the working of series crystal oscillator. (06 Marks)

OR

8 a. For a practical current series feedback circuit drive expression for A_{Vf}, Z_{If} and Z_{Of}. (08 Marks)

b. With neat diagram and necessary expressions explain :
i) Wien bridge Oscillator
ii) UJT Oscillator. (12 Marks)

Module-5

9 a. Calculate the efficiency of a transformer coupled class A amplifier for supply of 12V and output of $V_p = 6V$. (05 Marks)

b. With neat diagram explain the working of transformer – coupled push – pull amplifier. (08 Marks)

c. Describe with block diagram the series type of voltage regulator. (07 Marks)

OR

10 a. Calculate the output voltage and the Zener current in the regulator circuit given for $R_L = 1k\Omega$.
$R = 220\Omega$, $V_z = 12V$, $\beta = 50$.

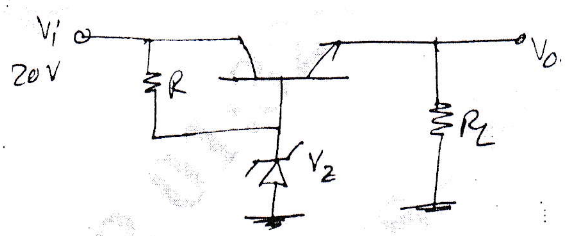

Fig.Q10(a) (05 Marks)

b. Explain the working of class D amplifier with block diagram and necessary waveforms. (07 Marks)

c. With necessary circuit diagram and characteristics curve, show that the maximum efficiency of a series fed class A amplifier is 25%. (08 Marks)

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CBCS SCHEME

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17EC35

Third Semester B.E. Degree Examination, Feb./Mar. 2022
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 expression for Delta to star network. (06 Marks)

b. Find the power delivered by the 5A current source in the network shown in Fig.Q1(b), using node analysis.

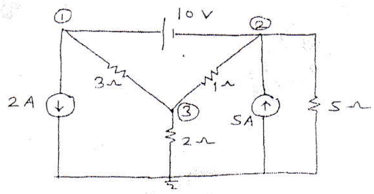

Fig.Q1(b) (07 Marks)

c. Determine the current through 6Ω resistance shown in Fig.Q1(c), using loop analysis.

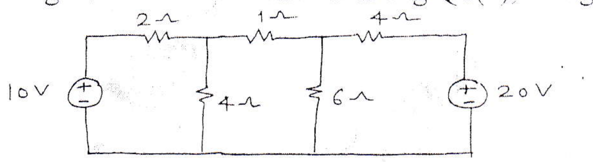

Fig.Q1(c) (07 Marks)

OR

2 a. For the networks shown in Fig.Q2(a), determine the voltage V using source shift and /or source transformation techniques only.

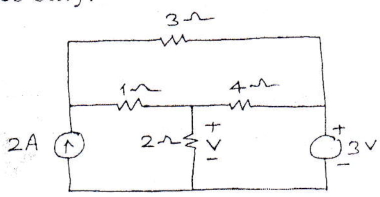

Fig.Q2(a) (06 Marks)

b. Use mesh current method to find the power delivered by the dependent voltage source in the network shown in Fig.Q2(b).

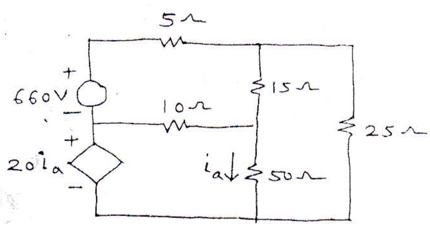

Fig.Q2(b) (07 Marks)

c. Find the value of V such that current through 4Ω resistance is zero, using nodal analysis for the circuit shown in Fig.Q2(c).

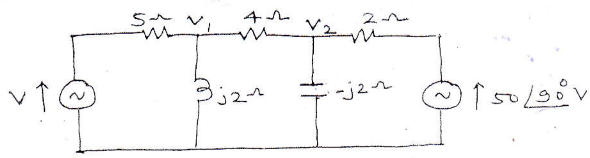

Fig.Q2(c) (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-2

3 a. State and prove Reciprocity theorem. (06 Marks)

b. Find the Thevenin's equivalent for the circuit shown in Fig.Q3(b) with respect to terminals a – b.

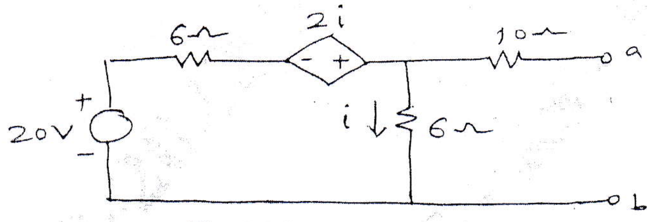

Fig.Q3(b) (07 Marks)

c. State Millman's theorem. Using the same calculate the current through load R_L in the circuit shown in Fig.Q3(c).

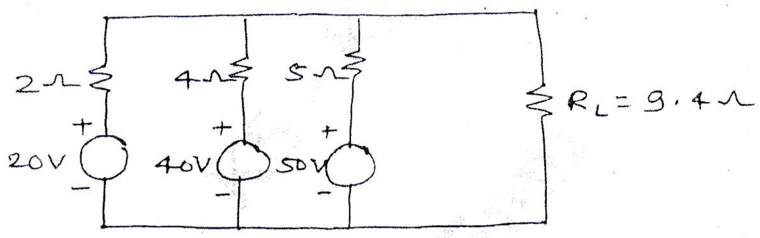

Fig.Q3(c) (07 Marks)

OR

4 a. State and prove maximum power transfer theorem. (06 Marks)

b. Find I_x for the circuit shown in Fig.Q4(b) using superposition theorem.

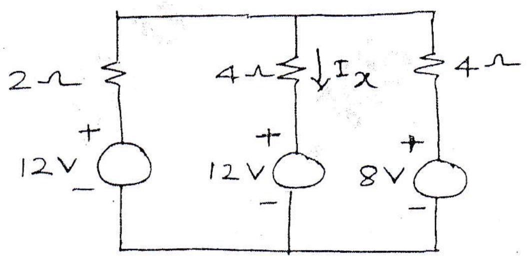

Fig.Q4(b) (07 Marks)

c. Determine the current through 1Ω resistance connected between X, Y of the network shown in Fig.Q4(c) using Norton's theorem.

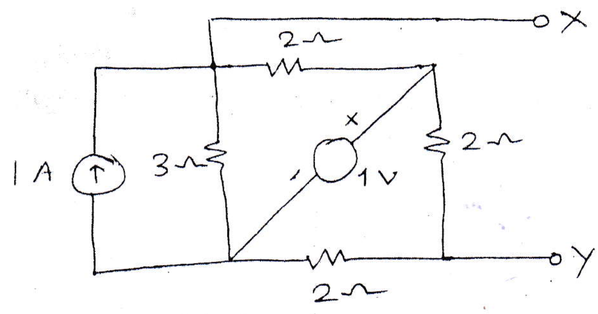

Fig.Q4(c) (07 Marks)

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 $t = 0^+$.

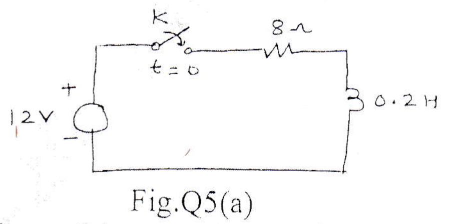

Fig.Q5(a)

(10 Marks)

b. Determine the Laplace transform of the waveform shown in Fig.Q5(b).

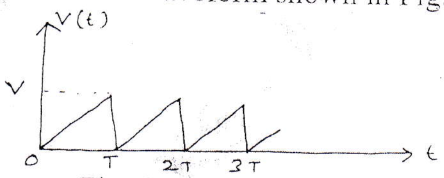

Fig. Q5(b)

(10 Marks)

OR

6 a. In the network shown in Fig.Q6(a), the switch is moved from position 1 to position 2 at $t = 0$. The steady state has been reached before switching, calculate :

i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$.

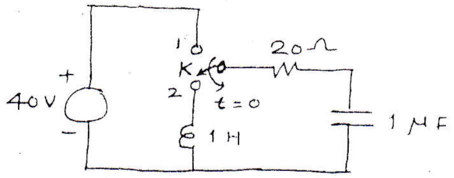

Fig.Q6(a)

(10 Marks)

b. Obtain the Laplace transform of the square wave train shown in Fig.Q6(b).

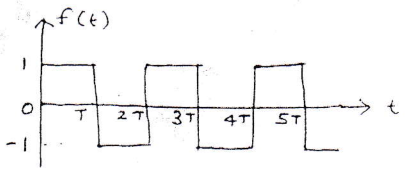

Fig.Q6(b)

(10 Marks)

Module-4

7 a. Derive expression for frequency at which voltage across the capacitor is maximum.

(07 Marks)

b. For the circuit shown in Fig.Q7(b), find for what value of R_C the circuit resonates.

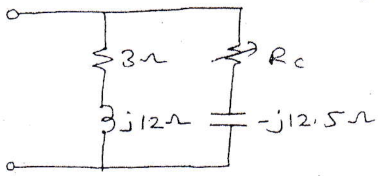

Fig.Q7(b)

(07 Marks)

c. A series RLC circuit has $R = 10\Omega$, $L = 0.01H$ and $C = 0.01\ \mu F$ and it is connected across 10mV supply. Calculate : i) f_0 ii) Q_0 iii) Band width.

(06 Marks)

OR

8 a. Derive an expression for resonant frequency of parallel resonant circuit. (7 Marks)

b. A series RLC circuit has a quality factor of 5 at 50r/sec. The current flowing through the circuit at resonance is 10A and the supply voltage is 100V. The total impedance of the circuit is 20Ω. Find the circuit constants. (06 Marks)

c. Find the value of L at which the circuit resonates at a frequency of 1000 r/sec in the circuit shown in Fig.Q8(c).

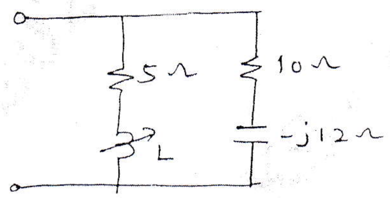

Fig.Q8(C) (07 Marks)

Module-5

9 a. Express Z parameters in terms of Y parameters and h parameters. (10 Marks)

b. Determine the z parameters of the network shown in Fig.Q9(b).

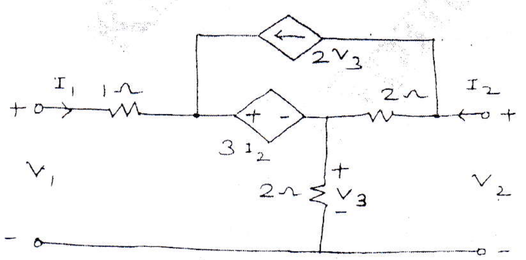

Fig.Q9(b) (10 Marks)

OR

10 a. Express Y parameters in terms of Z parameters and ABCD parameters. (10 Marks)

b. Find the h parameters of the network shown in Fig.Q10(b) and draw the h parameter equivalent circuit.

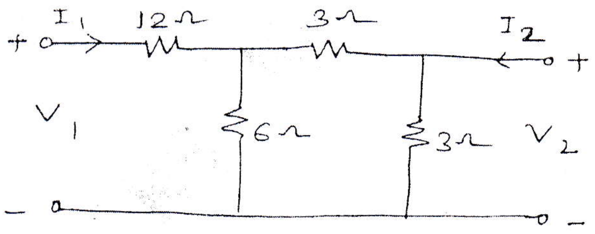

Fig.Q10(b) (10 Marks)

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CBCS SCHEME

USN | | | | | | | | | | | 17EC36

Third Semester B.E. Degree Examination, Feb./Mar.2022
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. State and explain Coulomb's law in vector form. **(07 Marks)**

b. Let a point charge of $Q_1 = 20\ \eta C$ be located at A(3,–1,5) and a charge of $Q_2 = 40\ \eta C$ be located at B(–2, 3, 0). Find force $\bar{F}$ at C(1, 2, 3) having charge of Q_3 of 10 μC in free space. **(08 Marks)**

c. Define electric field intensity $\bar{E}$ and explain the method of obtaining $\bar{E}$ at a point in Cartesian co-ordinate system due to point charge Q. **(05 Marks)**

OR

2 a. Obtain the expression for electric field $\bar{E}$ due to infinite line change with charge density of ρ_L C/m, at point P on y-axis at a distance 'r' from the origin. The line is placed along z-axis. **(08 Marks)**

b. Define electric flux density $\bar{D}$. Obtain the expression for $\bar{D}$ due to point charge and infinite line charge. **(06 Marks)**

c. Find $\bar{D}$ at P(6, 8, -10) m due to uniform infinite line charge with charge density (ρ_L) of 40 μC/m on z-axis. **(06 Marks)**

Module-2

3 a. State and prove Gauss's law. **(08 Marks)**

b. Find div $\bar{D}$ for the following field,

(i) $\bar{D} = (2xy - y^2)\bar{a}_x + (x^2z - 2xy)\bar{a}_y + x^2y\,\bar{a}_z$ C/m² at $P_1(2,3,-1)$.

(ii) $\bar{D} = 2rz^2\sin^2\phi\bar{a}_r + rz^2\sin 2\phi\bar{a}_\phi + 2r^2z\sin^2\phi\,\bar{a}_z$ C/m²
at $P_2(r = 2, \phi = 110^\circ, z = -1)$ **(06 Marks)**

c. State and Prove divergence theorem. **(06 Marks)**

OR

4 a. Obtain the expression for potential difference by bringing a unit positive charge from Point B to Point A. The point B is at r_B distance and point A is at r_A from the origin. **(06 Marks)**

b. Show that the energy required to assemble 'n' number of point charges in an empty space is, $W_E = \frac{1}{2}\sum_{m=1}^{n} Q_m V_m$. **(08 Marks)**

c. Find the workdone in moving +2C charge from B(2, 0, 0) m to A(0, 2, 0) m along the straight line joining the two points. Assume that the electric field $\bar{E}$ is $12x\bar{a}_x - 4y\bar{a}_y$ V/m. **(06 Marks)**

Module-3

5 a. Starting from Gauss's law in point form, deduce Poisson's and Laplace's equations. **(06 Marks)**

b. Two plates of parallel plate capacitor or are separated by the distance of 'd' m and maintained at zero and V_0 voltages respectively. Determine capacitance between these two plates. **(08 Marks)**

c. State and explain Biot-Savart law. **(06 Marks)**

OR

6 a. Obtain the expression for $\overline{H}$ in all the regions if a cylindrical conductor carries a direct current I and its radius is 'R' m. Plot the variation of $\overline{H}$ against the distance r from the centre of the conductor. **(08 Marks)**

b. Given the general vector $\overline{A} = \sin 2\phi \overline{a}_\phi$ in cylindrical co-ordinate system. Find curl of $\overline{A}$ at $\left(2, \frac{\pi}{4}, 0\right)$. **(06 Marks)**

c. Explain the concept of scalar and vector magnetic potentials. **(06 Marks)**

Module-4

7 a. Derive Lorentz force equation. **(06 Marks)**

b. Obtain the expression for magnetic force between two current elements and hence for current loops. **(08 Marks)**

c. A current element of 2 m in length lies along y axis centred at origin. The current is 5A in $\overline{a}_y$ direction. If it experience a force $1.5\frac{(\overline{a}_x + \overline{a}_z)}{\sqrt{2}}$ N due to uniform field $\overline{B}$. Determine $\overline{B}$. **(06 Marks)**

OR

8 a. In certain region, the magnetic flux density of magnetic material with $X_m = 6$ is given by $\overline{B} = 0.005y^2 \overline{a}_x T$. At y = 0.4 m, find the magnitude of $\overline{J}$. **(06 Marks)**

b. Derive the expression for the energy density in the magnetostatic fields. **(08 Marks)**

c. Tabulate the similarities of the electric and magnetic circuits. **(06 Marks)**

Module-5

9 a. A conductor of 1 cm in length is parallel to z-axis and rotates at radius of 25 cm at 1200 rpm. Find induced voltage if the radial field is given by, $\overline{B} = 0.5\overline{a}_r T$. **(06 Marks)**

b. Derive Maxwell's equation in point form from Ampere's circuit law and Gauss's law for static field. **(08 Marks)**

c. List Maxwell's equation in point form and integral form. **(06 Marks)**

OR

10 a. Derive the General Wave equation starting from Maxwell's equations. **(08 Marks)**

b. A 300 MHz uniform plane wave propagates through fresh water for which $\sigma = 0$, $\mu_r = 1$ and $\epsilon_r = 78$. Calculate attenuation constant, phase constant, wavelength and intrinsic impedance. **(06 Marks)**

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

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