CBCS SCHEME

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15MAT31

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Obtain the Fourier expansion of the function f(x) = x over the interval $(-\pi, \pi)$. Deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots$ **(08 Marks)**

b. The following table gives the variations of a periodic current A over a certain period T:

t (sec)	0	T/6	T/3	T/2	2T/3	5T/6	T
A (amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75amp in the variable current and obtain the amplitude of the first harmonic. **(08 Marks)**

OR

2 a. Obtain the Fourier series for the function $f(x) = 2x - x^2$ in $0 \le x \le 2$. **(06 Marks)**

b. Represent the function

$$f(x) = \begin{cases} x, & \text{for } 0 < x < \pi/2 \\ \pi/2 & \text{for } \pi/2 < x < \pi \end{cases}$$

in a half range Fourier sine series. **(05 Marks)**

c. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data:

x°	0	45	90	135	180	225	270	315
y	2	3/2	1	1/2	0	1/2	1	3/2

(05 Marks)

Module-2

3 a. Find the complex Fourier transform of the function

$$f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$$ Hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(06 Marks)**

b. If $\bar{u}(z) = \frac{2z^2 + 3z + 12}{(z-1)^4}$ show that $u_0 = 0 \quad u_1 = 0 \quad u_2 = 2 \quad u_3 = 11$. **(05 Marks)**

c. Obtain the Fourier cosine transform of the function

$$f(x) = \begin{cases} 4x, & 0 < x < 1 \\ 4 - x, & 1 < x < 4 \\ 0 & x > 4 \end{cases}$$ **(05 Marks)**

OR

4 a. Obtain the Z-transform of $\cos n\theta$ and $\sin n\theta$. **(06 Marks)**

b. Find the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx \quad m > 0$. **(05 Marks)**

c. Solve by using Z-transforms $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = 0 = y_1$. **(05 Marks)**

Module-3

5 a. Fit a second degree parabola $y = ax^2 + bx + c$ in the least square sense for the following data and hence estimate y at x = 6. **(06 Marks)**

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

b. Obtain the lines of regression and hence find the coefficient 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

(05 Marks)

c. Use Newton-Raphson method to find a real root of $x\sin x + \cos x = 0$ near $x = \pi$. Carryout the iterations upto four decimal places of accuracy. **(05 Marks)**

OR

6 a. Show that a real root of the equation $\tan x + \tanh x = 0$ lies between 2 and 3. Then apply the Regula Falsi method to find third approximation. **(06 Marks)**

b. Compute the coefficient of correlation and the equation of the lines of regression for the data:

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

(05 Marks)

c. Fit a curve of the form $y = ae^{bx}$ for the data:

x	0	2	4
y	8.12	10	31.82

(05 Marks)

Module-4

7 a. From the following table find the number of students who have obtained:

i) Less than 45 marks

ii) Between 40 and 45 marks.

Marks	30-40	40-50	50-60	60-70	70-80
Number of students	31	42	51	35	31

(06 Marks)

b. Construct the interpolating polgnomial for the data given below using Newton's general interpolation formula for divided differences and hence find y at x = 3.

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

(05 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by Weddle's rule. Taking seven ordinates. Hence find $\log_e 2$. **(05 Marks)**

OR

8 a. Use Lagrange's interpolation formula to find f(4) given below. **(06 Marks)**

x	0	2	3	6
f(x)	-4	2	14	158

b. Use Simpson's 3/8th rule to evaluate $\int_1^4 e^{1/x} dx$. **(05 Marks)**

c. The area of a circle (A) corresponding to diameter (D) is given by

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the area corresponding to diameter 105 using an appropriate interpolation formula. **(05 Marks)**

Module-5

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

b. Find the extremal of the functional $\int_a^b \left(x^2 + y^2 + 2y^2 + 2xy\right) dx$. **(05 Marks)**

c. Varity Stoke's theorem for $\vec{F} = (2x - y)\hat{i} - yz^2\hat{j} - y^2 z\hat{k}$ where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ C is its boundary. **(05 Marks)**

OR

10 a. Derive Euler's equation in the standard form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y1}\right) = 0$. **(06 Marks)**

b. If $\vec{F} = 2xy\hat{i} + y^2 z\hat{j} + xz\hat{k}$ and S is the rectangular parallelepiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1, z = 3. Evaluate $\iint_S \vec{F}.\hat{n}\, ds$. **(05 Marks)**

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

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CBCS SCHEME

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15MATDIP31

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

b. Express $\dfrac{3+4i}{3-4i}$ in $a+ib$ form. **(05 Marks)**

c. Find the value of 'λ' so that the points A(–1, 4, –3), B(3, 2, –5), C(–3, 8, –5) and D(–3, λ, 1), may lie on one plane. **(06 Marks)**

OR

2 a. Find the angle between the vectors $\vec{a}=5\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}-3\hat{j}+6\hat{k}$. **(05 Marks)**

b. Prove that $\left[\vec{a}\times\vec{b},\ \vec{b}\times\vec{c},\ \vec{c}\times\vec{a}\right]=\left[\vec{a}\,\vec{b}\,\vec{c}\right]^2$. **(05 Marks)**

c. Find the real part of $\dfrac{1}{1+\cos\theta+i\sin\theta}$. **(06 Marks)**

Module-2

3 a. Obtain the n^{th} derivative of $\sin(ax+b)$. **(05 Marks)**

b. Find the pedal equation of $r^n=a^n\cos n\theta$. **(05 Marks)**

c. If $u=\dfrac{yz}{x}$, $v=\dfrac{zx}{y}$, $w=\dfrac{xy}{z}$, show that $\dfrac{\partial(u,v,w)}{\partial(x,y,z)}=4$. **(06 Marks)**

OR

4 a. If $u=\log\left(\dfrac{x^4+y^4}{x+y}\right)$ show that $x\dfrac{\partial u}{\partial x}+y\dfrac{\partial u}{\partial y}=3$. **(05 Marks)**

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

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

Module-3

5 a. Evaluate $\displaystyle\int_0^{\pi} x\sin^8 x\,dx$. **(05 Marks)**

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

c. Evaluate $\displaystyle\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dz\,dy\,dx$. **(06 Marks)**

OR

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

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

c. Evaluate $\int_0^\infty \frac{x^4}{(1+x^2)^4}\,dx$. **(06 Marks)**

Module-4

7 a. If $\vec{r} = (t^2+1)\hat{i} + (4t-3)\hat{j} + (2t^2-6t)\hat{k}$, find the angle between the tangents at t = 1 and t = 2. **(05 Marks)**

b. If $\vec{r} = e^{-t}\hat{i} + 2\cos 3t\,\hat{j} + 2\sin 3t\,\hat{k}$, find the velocity and acceleration at any time t, and also their magnitudes at t = 0. **(05 Marks)**

c. Show that $\vec{F} = (y+z)\hat{i} + (z+x)\hat{j} + (x+y)\hat{k}$ is irrotational. Also find a scalar function 'φ' such that $\vec{F} = \nabla\phi$. **(06 Marks)**

OR

8 a. Find the unit normal vector to the surface $x^2y + 2xz = 4$ at (2, –2, 3). **(05 Marks)**

b. If $\vec{F} = xz^3\hat{i} - 2x^2yz\hat{j} + 2yz^4\hat{k}$ find $\nabla\cdot\vec{F}$ and $\nabla\times\vec{F}$ at (1, –1, 1). **(05 Marks)**

c. If $\frac{d\vec{a}}{dt} = \vec{w}\times\vec{a}$ and $\frac{d\vec{b}}{dt} = \vec{w}\times\vec{b}$, then show that $\frac{d}{dt}(\vec{a}\times\vec{b}) = \vec{w}\times(\vec{a}\times\vec{b})$ **(06 Marks)**

Module-5

9 a. Solve $\sec^2 x \tan y\,dx + \sec^2 y \tan x\,dy = 0$. **(05 Marks)**

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

c. Solve $\frac{dy}{dx} + \frac{y}{x} = xy^2$. **(06 Marks)**

OR

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

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

c. Solve $y(x+y)dx + (x+2y-1)dy = 0$ **(06 Marks)**

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CBCS SCHEME

USN

15EC32

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Draw the circuit diagram of common Emitter fixed bias configuration. Derive the expression for Z_i Z_o, A_v using r_e model. **(08 Marks)**

b. For the network shown in Fig. Q1 (b), determine Z_i Z_o, A_v and A_i. Given h_{ie} = 1.175 KΩ, h_{fe} = 120, h_{oe} = 20 μA/v using approximate hybrid equivalent model. **(08 Marks)**

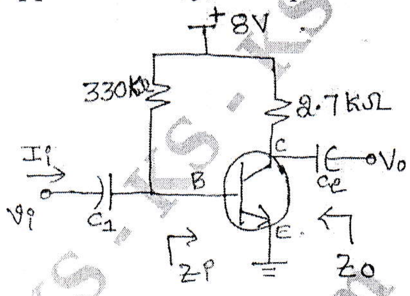

Fig. Q1 (b)

OR

2 a. Draw 'r_e' and 'h'-parameter models for a transistor in common Emitter configuration. Also give relation between 'r_e' and 'h'-parameter. **(05 Marks)**

b. For the circuit shown below, calculate r_e, Z_i Z_o and A_v, while consider $r_0 = \infty$. **(08 Marks)**

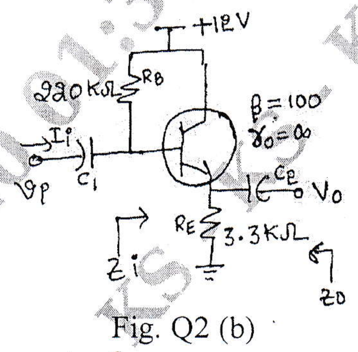

Fig. Q2 (b)

c. What are the advantages of h-parameters? **(03 Marks)**

Module-2

3 a. Explain the small signal model of the FET. **(04 Marks)**

b. Derive the expression for Z_i Z_o and A_v for FET voltage divider bias circuit. **(08 Marks)**

c. Compare JFET and MOSFET. **(04 Marks)**

OR

4 a. Explain the n-channel enhancement type MOSFETs, with their characteristics curves. **(08 Marks)**

b. Derive the expression for Z_i Z_o and A_v for FET self biased configuration (with R_s bypassed). **(08 Marks)**

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-3

5 a. Prove that

Input capacitance is $C_{Mi} = (1 - A_v)C_f$ and

Output capacitance is $C_{MO} = \left(1 - \frac{1}{A_v}\right)C_f$ using miller effect. (08 Marks)

b. Describe the factors that affect the low frequency response of a BJT-CE amplifier. (08 Marks)

OR

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

b. Determine the lower cut off frequency for the network shown in Fig. Q6 (b), using following parameters $g_m = 2$ ms, $r_d = \infty\,\Omega$, $I_{DSS} = 8$ mA, $V_P = -4V$, $V_{DD} = 20$ V. (08 Marks)

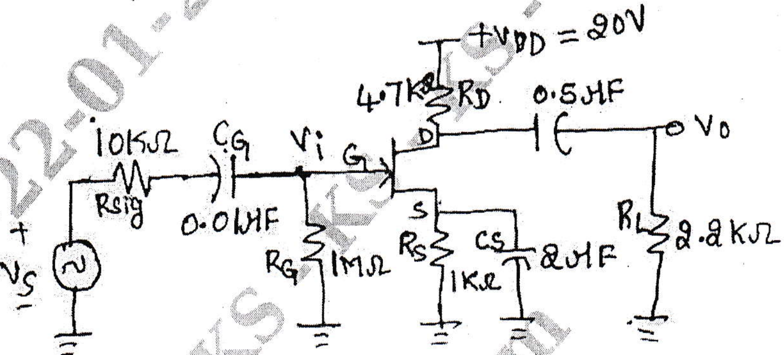

Fig. Q6 (b)

Module-4

7 a. With the help of a neat circuit diagram, explain the working of Hartley oscillator. (08 Marks)

b. The following data for Colpitts oscillator are as follows : $C_1 = 1$ nF, $C_2 = 99$ nF, L = 1.5 mH and $h_{fe} = 110$. Calculate frequency of oscillation for the same. (04 Marks)

c. Explain the important advantages of a negative feedback amplifier. (04 Marks)

OR

8 a. Mention the types of feedback connections. Draw their block diagrams indicating input and output signal. (08 Marks)

b. Obtain expression for Z_{if}, Z_{of} for a voltage series feedback. (08 Marks)

Module-5

9 a. Explain the operation of a class B push-pull amplifier and also show that its efficiency 78.50%. (08 Marks)

b. With a neat circuit diagram, explain the operation of a transformer coupled class A power amplifier. (08 Marks)

OR

10 a. For a harmonic distortion reading of $D_2 = 0.1$, $D_3 = 0.02$ and $D_4 = 0.01$, with $I_1 = 4$ A and $R_C = 8\,\Omega$, calculate the total harmonic distortion, fundamental power and total power. (04 Marks)

b. What are the classification of power amplifiers, based on the location of Q – point? Discuss them briefly. (08 Marks)

c. With the help of neat block diagram, explain the working of shunt voltage regulator. (04 Marks)

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CBCS SCHEME

USN | | | | | | | | | | 15EC34

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

Time: 3 hrs. Max. Marks: 80

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Missing data, if any, may be suitably assumed.

Module-1

1 a. Derive expression for converting star to delta. **(08 Marks)**

b. Using Mesh current find V_2 which result a zero current in 4 ohm resistor in the network shown in Fig.Q1(b). **(08 Marks)**

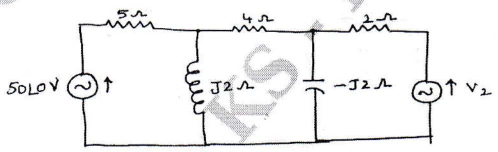

Fig.Q1(b)

OR

2 a. For the network of Fig.Q2(a), determine the v_1 and v_2 by nodal analysis. **(08 Marks)**

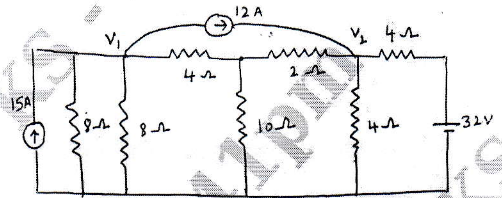

Fig.Q2(a)

b. Find the current I in 28Ω resistor by Mesh analysis in Fig.Q2(b). **(08 Marks)**

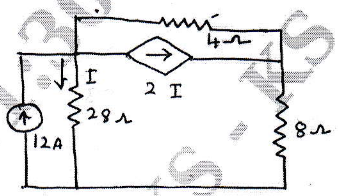

Fig.Q2(a)

Module-2

3 a. State and prove superposition theorem. **(06 Marks)**

b. Using Milliman's theorem, find I_L through R_L for the network shown in Fig.Q3(b). **(04 Marks)**

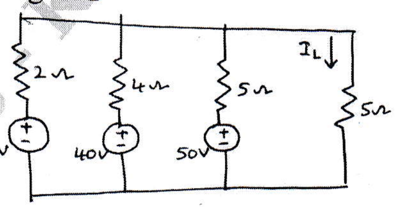

Fig.Q3(b)

c. Obtain Norton equivalent of the network of Fig.Q3(c) between terminals A and B. **(06 Marks)**

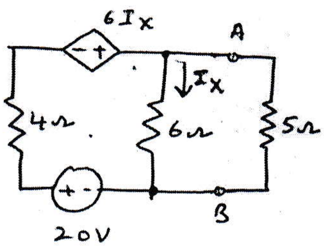

Fig.Q3(c)

OR

4 a. State maximum power transfer theorem. Prove that $Z_L = Z_0^*$ for AC circuits. **(08 Marks)**

b. Verity reciprocity theorem to find value of V_X in the circuit shown Fig.Q4(b). **(08 Marks)**

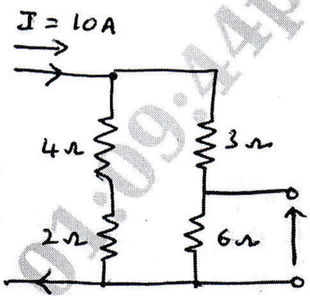

Fig.Q4(b)

Module-3

5 a. In the network shown in Fig.Q5(a), K is changed from position a to b at t = 0. Solve for i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at t = 0^+, if R = 1000Ω, L = 1H, C = 0.1μF and V = 100V. Assume that the capacitor is initially uncharged. **(08 Marks)**

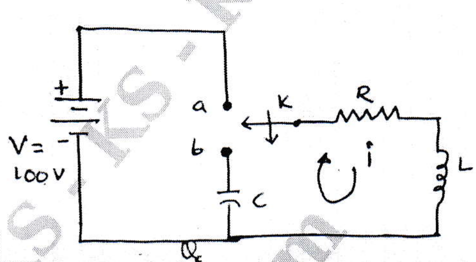

Fig.Q5(a)

b. Determine the response current i(t) in the circuit shown in Fig.Q5(b) using Laplace transform. **(08 Marks)**

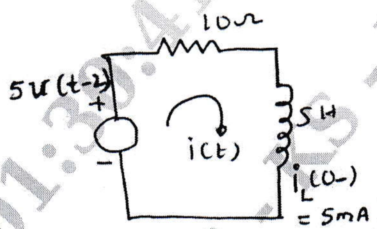

Fig.Q5(b)

OR

6 a. Synthesis the waveform shown in Fig.Q6(a) and find the Laplace transform of the periodic waveform. **(08 Marks)**

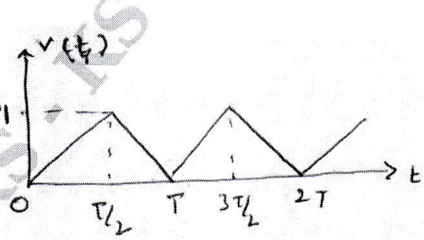

Fig.Q6(a)

b. Determine v, $\frac{dv}{dt}$ and $\frac{d^2v}{dt^2}$ at t = 0^+ when the switch k is opened at t=0 in Fig.Q6(b). **(08 Marks)**

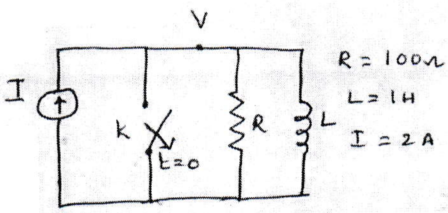

Fig.Q6(b)

Module-4

7 a. What is resonance? Show that $f_0 = \sqrt{f_1 f_2}$ for series resonance circuit. **(08 Marks)**

b. Find the values of c for which the circuit given in Fig.Q7(b) resonates at 750Hz. **(08 Marks)**

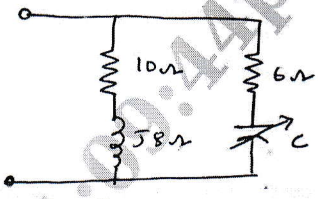

Fig.Q7(b)

OR

8 a. A series RLC circuit has R = 4Ω, L = 1mH, and C = 10μF, calculate Q – factor, bandwidth, resonant frequency and the half power frequencies f_1 and f_2. **(08 Marks)**

b. Derive expression for fr, Q and bandwidth of a parallel resonant circuit with lossless capacitor in parallel with a coil of resistance R and inductance L. **(08 Marks)**

Module-5

9 a. Derive Y parameters and transmission parameters of a circuit interms of its z-parameters. **(08 Marks)**

b. Find the z-parameters for the network shown in Fig.Q9(b). **(08 Marks)**

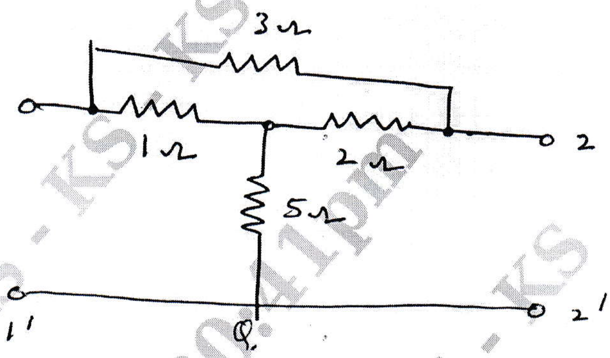

Fig.Q9(b)

OR

10 a. The z parameters of a two port network are z_{11} = 20Ω, z_{22} = 30Ω, z_{12} = z_{21} = 10Ω. Find Y and ABCD parameters. **(08 Marks)**

b. Determine Y parameters of the two port network shown in Fig.Q10(b). **(08 Marks)**

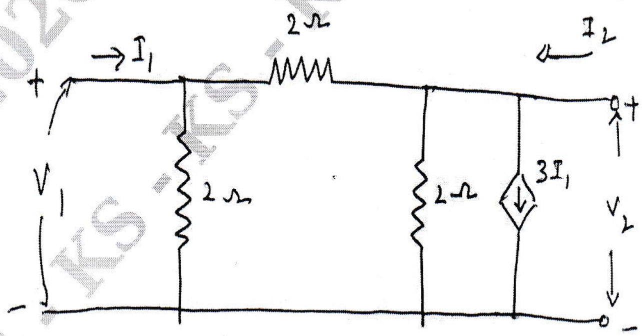

Fig.Q10(b)

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CBCS SCHEME

USN

15EC36

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Define electric field intensity and electric flux density and derive the expression for D due to point charge. **(05 Marks)**

b. Identical point charges of 3μC are located at the four corners of the square of 5cm side, find the magnitude of force on any one charge. **(08 Marks)**

c. On the line described x = 4m, y = -2m there is uniform charge distribution of density ρ_l = 10nc/m. Find $\overline{E}$ at (4, 2, -1)m. **(03 Marks)**

OR

2 a. State and explain Coulomb's law of force between two point charges in vector form and mention the units of quantities in the force equation. **(08 Marks)**

b. Three point charges Q_1 = -1μc, Q_2 = -2μc and Q_3 = -3μc are placed at the corners of an equilateral triangle of side 1m, find the magnitude of the electric field intensity at the point bisecting the line joining Q_1 and Q_2. **(08 Marks)**

Module-2

3 a. In the region r ≤ 2, $\overline{D} = \frac{7r^2}{3}\hat{a}r$ and in the region r > 2, $\overline{D} = \frac{120}{r^2}\hat{a}r$ in spherical coordinate system calculate the charge density. **(08 Marks)**

b. Derive the expression for continuity of current. **(04 Marks)**

c. Derive Maxwell's first equation in electrostatic. **(04 Marks)**

OR

4 a. Obtain the boundary condition at the interface between a dielectric material and a conductor. **(08 Marks)**

b. State and explain Gauss law in point form. **(04 Marks)**

c. If the potential field V = $3x^2 + 3y^2 + 2z^3$ volts, find: i) V ii) E iii) $\overline{P}$ at P(-4, 5, 4). **(04 Marks)**

Module-3

5 a. State and explain Biot-Savart's law. **(05 Marks)**

b. Two parallel conducting discs are separated by distance 5mm at z = 0 and z = 5mm. If v = 0 at z = 0 and v = 100v at z = 5mm, find the charge densities on the discs. **(05 Marks)**

c. Using Poisson's equation obtain the expression for the junction potential in a p-n junction. **(06 Marks)**

OR

6 a. Derive Laplace and Poisson's equation starting from the Gauss's law and also write Laplace's equation in Cartesian, cylindrical and spherical coordinate system. **(08 Marks)**

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

Module-4

7 a. Obtain the expression for reluctance in a series of magnetic circuits. **(04 Marks)**

b. A point charge of Q = -1.2C has velocity, $\overline{V} = (5\hat{a}x + 2\hat{a}y - 3a\hat{z})m/s$. Find the magnitude of the force exerted on the charge if,

i) $\overline{E} = -18\hat{a}x + 5\hat{a}y - 10\hat{a}z$ v/m

ii) $\overline{B} = -4\hat{a}x + 4\hat{a}y + 3\hat{a}z$ T

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

c. Two infinitely long straight conductors are located at x = 0, y = 0 and x = 0, y = 10m. Both carry current of 10A in positive $\hat{a}_z$ direction. Determine force experienced per meter between them. **(04 Marks)**

OR

8 a. State and explain Lorentz force equation. **(08 Marks)**

b. Find the magnetization in a magnetic material where,

i) $\mu = 1.8 \times 10^5$ (H/m) and M = 120 (A/M)

ii) $\mu_r = 22$, there are 8.3×10^{28} atoms/m^3 and each atom has a dipole moment of $4.5 \times 10^{-27}(A/m^2)$ and

iii) B = 300μT and $\chi_m = 15$. **(08 Marks)**

Module-5

9 a. Starting from Maxwell's equation derive wave equation in E and H for a uniform plane wave travelling in free space. **(08 Marks)**

b. A homogeneous material has $\epsilon = 2 \times 10^9$ F/m and $\mu = 1.25 \times 10^{-6}$H/m and $\sigma = 0$. Electric field intensity is given as $\overline{E} = 400\cos(10^9 t - kz)\ \hat{a}n$ v/m, if all the fields vary sinusoidally find $\overline{D}$, $\overline{B}$ and $\overline{H}$. Also find k using Maxwell's equations. **(08 Marks)**

OR

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

b. A 15GHZ plane wave travelling in a medium has an amplitude E_0 = 20v/m. Find phase velocity, propagation constant and impedance. Assume $\epsilon_r = 2$ and $\mu_r = 5$. **(06 Marks)**

c. 8 watts/m^2 is the pointing vector of a plane wave travelling in free space. What is the average energy density? **(04 Marks)**

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