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17MAT31

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
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 for the periodic function f(x), if in one second

$$f(x)=\begin{cases}0; & -\pi<x<0\\ x; & 0<x<\pi\end{cases}.$$ **(08 Marks)**

b. Expand the function $f(x) = x(\pi - x)$ over the interval $(0, \pi)$ in half range Fourier cosine series. **(06 Marks)**

c. The following value of function y gives the displacement in inches of a certain machine part for rotations x of a flywheel. Expand y-in terms of Fourier series upto the second harmonic.

Rotations	x	0	$\pi/6$	$2\pi/6$	$3\pi/6$	$4\pi/6$	$5\pi/6$	π
Displacement	y	0	9.2	14.4	17.8	17.3	11.7	0

(06 Marks)

OR

2 a. Find the Fourier series expansion for the function :

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

and deduce $\frac{\pi^2}{8}=\sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}$. **(08 Marks)**

b. Expand in Fourier series $f(x) = (\pi - x)^2$ over the interval $0 \le x \le 2\pi$. **(06 Marks)**

c. The following table gives the variations of periodic current over a period T.

t (secs)	0	T/6	T/3	T/2	2T/3	5T/6	T
A (Amps)	1.98	1.30	1.05	1.30	–0.88	–0.25	1.98

Expand the function (periodic current) by Fourier series and show that there is a direct current part of 0.75 amp and also obtain amplitude of first harmonic. **(06 Marks)**

Module-2

3 a. Find Fourier transform of $f(x)=\begin{cases}1-x^2; & |x|<1\\ 0; & |x|>1\end{cases}$

and hence evaluate $\int_0^{\infty}\frac{x\cos x-\sin x}{x^3}dx$. **(08 Marks)**

b. Find Fourier Cosine transform of the function :

$$f(x)=\begin{cases}4x; & 0<x<1\\ 4-x; & 1<x<4\\ 0; & x>4\end{cases}$$ **(06 Marks)**

c. Find z-transforms of : i) $a^n \sin n\theta$ ii) $a^{-n}\cos n\theta$. **(06 Marks)**

OR

4 a. Find Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate : $\int_0^\infty \frac{x \sin mx}{1+x^2} dx, m > 0$. **(08 Marks)**

b. Find z-transform of $u_n = \cos h\left(\frac{n\pi}{2} + 0\right)$. **(06 Marks)**

c. Solve the difference equation using z-transforms $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ .Given $u_0 = u_1 = 0$. **(06 Marks)**

Module-3

5 a. If θ - is the acute angle between the two regression lines relating the variables x and y, show that $\text{Tan}\theta = \left(\frac{1-r^2}{r}\right)\left(\frac{\sigma_x \sigma_y}{\sigma_x^2 \sigma_y^2}\right)$. **(08 Marks)**

Indicate the significance of the cases $r = \pm 1$ and $r = 0$.

b. Fit a straight line $y = ax + b$ for the data.

x	12	15	21	25
y	50	70	100	120

(06 Marks)

c. Find a real root of the equation by using Newton-Raphson method near x = 0.5, $xe^x = 2$, perform three iterations. **(06 Marks)**

OR

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

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

(08 Marks)

b. The Growth of an organism after x – hours is given in the following table :

x (hours)	5	15	20	30	35	40
y (Growth)	10	14	25	40	50	62

Find the best values of a and b in the formula $y = ae^{bx}$ to fit this data. **(06 Marks)**

c. Find a real root of the equation cos x = 3x – 1 correct to three decimals by using Regula – False position method, given that root lies in between 0.6 and 0.7. Perform three iterations. **(06 Marks)**

Module-4

7 a. Find y(8) from y(1) = 24, y(3) = 120, y(5) = 336, y(7) = 720 by using Newton's backward difference interpolation formula. **(08 Marks)**

b. Define f(x) – as a polynomial in x for the following data using Newton's divided difference formula. **(06 Marks)**

x	–4	–1	0	2	5
f(x)	1245	33	5	9	1335

c. Evaluate the integral $I = \int_0^6 \frac{dx}{4x+5}$ using Simpson's $\frac{1}{3}$rd rule using 7 ordinates. **(06 Marks)**

OR

8 a. For the following data calculate the differences and obtain backward difference interpolation polynomial. Hence find f(0.35). **(08 Marks)**

x	0.1	0.2	0.3	0.4	0.5
f(x)	1.40	1.56	1.76	2.0	2.28

b. Using Lagrange's interpolation find y when x = 10.

x	5	6	9	11
y	12	13	14	16

(06 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2}\,dx$ by Weddle's rule considering seven ordinates. **(06 Marks)**

Module-5

9 a. Verify the Green's theorem in the plane for $\int_C (x^2+y^2)dx + 3x^2y\,dy$ where C – is the circle $x^2+y^2 = 4$ traced in positive sense. **(08 Marks)**

b. Evaluate $\int_C (\sin z.dx - \cos x dy + \sin y dx)$ by using Stokes theorem, where C – is the boundary of the rectangle $0 \le x \le \pi$, $0 \le y \le 1$ and $z = 3$. **(06 Marks)**

c. Find the curve on which the functional : $\int_0^1 [y'^2 + 12xy]dx$ with y(0) = 0, y(1) = 1 can be extremised. **(06 Marks)**

OR

10 a. Given $f = (3x^2 - y)i + xzj + (yz - x)k$ evaluate $\int_C f \cdot dr$ from (0, 0, 0) to (1, 1, 1) along the paths $x = t$, $y = t^2$ and $z = t^3$. **(08 Marks)**

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

c. Prove that the shortest distance between two points in a plane is a straight line. **(06 Marks)**

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17MATDIP31

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Additional Mathematics – I

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. Prove that $(1 + \cos\theta + i\sin\theta)^n + (1 + \cos\theta - i\sin\theta)^n = 2^{n+1}\cos^n\left(\frac{\theta}{2}\right)\cos\left(\frac{n\theta}{2}\right)$ **(08 Marks)**

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

c. Find the sine of the angle between vectors $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 3\hat{j} + 2\hat{k}$ **(06 Marks)**

OR

2 a. Express $\frac{3+4i}{3-4i}$ in the form x + iy. **(08 Marks)**

b. If the vector $2\hat{i} + \lambda\hat{j} + \hat{k} = 0$ and $4\hat{i} - 2\hat{j} - 2\hat{k}$ are perpendicular to each other, find λ. **(06 Marks)**

c. Find λ, such that the vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} - 3\hat{k}$, $3\hat{i} + \lambda\hat{j} + 5\hat{k}$ are coplanar. **(06 Marks)**

Module-2

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

b. With usual notations, prove that $\tan\phi = r\frac{d\theta}{dr}$. **(06 Marks)**

c. If $u = \log_e \frac{x^3 + y^3}{x^2 + y^2}$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 1$. **(06 Marks)**

OR

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

b. Find the pedal equation of $r = a(1 - \cos\theta)$. **(06 Marks)**

c. If $u = x + 3y^2 - z^3$, $v = 4x^2yz$ and $w = 2z^2 - xy$, find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at (1, –1, 0). **(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 $\int_0^a \frac{x^7}{\sqrt{a^2 - x^2}}dx$ **(06 Marks)**

c. Evaluate $\int_1^2 \int_1^3 xy^2\,dx\,dy$ **(06 Marks)**

OR

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

b. Evaluate $\int_0^{2a} x^2\sqrt{2ax - x^2}\,dx$ **(06 Marks)**

c. Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x + y + z)\,dx\,dy\,dz$ **(06 Marks)**

Module-4

7 a. A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$ and $z = 3t - 5$, where 't' is the time. Find its velocity and acceleration vectors and also magnitude of velocity and acceleration at $t = 1$. **(08 Marks)**

b. In which direction of the directional derivative of x^2yz^3 is maximum at (2, 1, –1) and find the magnitude of this maximum. **(06 Marks)**

c. Show that $\vec{F} = (y + z)\hat{i} + (x + z)\hat{j} + (x + y)\hat{k}$ is irrotational. **(06 Marks)**

OR

8 a. If $\phi = xy^2z^3 - x^3y^2z$, find $\nabla\phi$ and $|\nabla\phi|$ at $(1, -1, 1)$. **(08 Marks)**

b. If $\vec{F} = (x + y + 1)\hat{i} + \hat{j} - (x + y)\hat{k}$, show that $\vec{F} \cdot \text{Curl}\,\vec{F} = 0$. **(06 Marks)**

c. If $x = t^2 + 1$, $y = 4t - 3$, $z = 2t^2 - 6t$ represents the parametric equation of a curve, find the angle between the tangents at $t = 1$ and $t = 2$. **(06 Marks)**

Module-5

9 a. Solve : $\left(x\tan\frac{y}{x} - \frac{y}{x}\sec^2\frac{y}{x}\right)dx = x\sec^2\frac{y}{x}dy$ **(08 Marks)**

b. Solve : $xy(1 + xy^2)\frac{dy}{dx} = 1$ **(06 Marks)**

c. Solve : $\frac{dy}{dx} + \frac{y\cos x + \sin y + y}{\sin x + x\cos y + x} = 0$ **(06 Marks)**

OR

10 a. Solve : $(3y + 2x + 4)dx - (4x + 6y + 5)dy = 0$ **(08 Marks)**

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

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

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17EC32

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Define the following terms:
i) Accuracy and precision
ii) Grass error and systematic error. **(06 Marks)**

b. Draw the block diagram of a true RMS volt meter and explain its operation. **(07 Marks)**

c. Calculate series connected multiplier resistance with a D'Arsonval movement with an internal resistance of 50Ω and full scale deflection current of 2mA in to a multi range d.c. voltmeter with range from 0 – 10V, 0 – 50V, 0 – 100V and 0 – 250V. **(07 Marks)**

OR

2 a. State different types of thermocouple used for RF current measurement and explain each one of them in brief. **(07 Marks)**

b. Sketch and explain the operation of a Multirange Ammeter and Aryton shunt. **(07 Marks)**

c. The expected value of the voltage across a resistor is 75V, But measurement gives a value of 74V, calculate:
i) Absolute error
ii) % error
iii) Relative accuracy and
iv) % of accuracy. **(06 Marks)**

Module-2

3 a. Describe with a diagram the operation of a successive approximation type DVM. **(07 Marks)**

b. Explain with a diagram the working of digital pH meter. **(07 Marks)**

c. A 4½ digits DVM is used for voltage measurements. Find:
i) Resolution
ii) How would 67.50V be displayed on 5V range
iii) How would 0.716V be displayed on 10V range. **(06 Marks)**

OR

4 a. Describe with the help of a diagram the operation of universal counter. **(07 Marks)**

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

c. With the block diagram, explain the digital frequency meter. **(07 Marks)**

Module-3

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

b. Sketch the block diagram and explain AF Sine and square wave generator. **(07 Marks)**

c. Discuss the important features of Cathode Ray Tube (CRT). **(05 Marks)**

OR

6 a. With block diagram, explain the working of DSO and list the advantages of it. **(08 Marks)**

b. Explain the function generator with suitable diagram. **(07 Marks)**

c. Discuss frequency measurement with Lissajous figure. **(05 Marks)**

Module-4

7 a. With circuit diagram, explain Q-meter and mention its application. **(06 Marks)**

b. Draw the circuit of a Wheatstone's bridge and explain how it can be used to measure unknown resistance. **(06 Marks)**

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

OR

8 a. What is Meggar? Explain the basic Meggar circuit. **(08 Marks)**

b. With neat diagram, explain the working of Wien's bridge? How it can be used as oscillator. **(08 Marks)**

c. A capacitance comparison bridge is used to measure a capacitive impedance at a frequency of 2kHz the bridge constants at balance are $C_3 = 100\mu F$, $R_1 = 10K\Omega$, $R_2 = 50K\Omega$ and $R_3 = 100K\Omega$. Find the equivalent series circuit of the unknown impedance. **(04 Marks)**

Module-5

9 a. List the factors to be considered while selecting transducers. **(06 Marks)**

b. Explain principle operation of resistive position transducer. **(06 Marks)**

c. Derive an expression for gauge factor for Bonded resistance wire strain gauges. **(08 Marks)**

OR

10 a. Explain the construction and operation of LVDT show the characteristic curve. **(08 Marks)**

b. Explain Piezoelectric transducer. **(06 Marks)**

c. Explain semiconductor photo diode and photo transistor. **(06 Marks)**

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17EC33

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
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 an expression for input impedance, output impedance, voltage gain and current gain of un bypassed RE common emitter amplifier using r_e model. **(10 Marks)**

b. For the network of Fig.Q1(b), determine : i) r_e ii) Z_i iii) Z_0, ($r_0 = \infty\Omega$) iv) A_V($r_0 = \infty\Omega$) v) the parameters of parts ii through iv if $r_0 = 50K\Omega$ for $R_1 = 56K\Omega$, $R_2 = 8.2K\Omega$, $C_1 = 10\mu f$, $C_2 = 10\mu f$, $R_E = 1.5K\Omega$, $C_E = 20\mu f$, $R_C = 6.8K\Omega$, $\beta = 90$ and $V_{CC} = 22V$. **(10 Marks)**

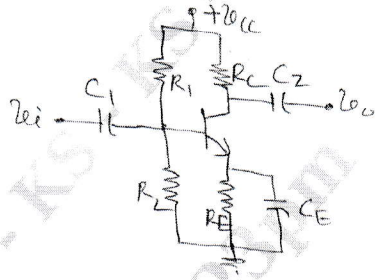

Fig.Q1(b)

OR

2 a. Derive an expression of input impedance, output impedance, voltage gain and current gain of fixed bias CE amplifier using h-parameter. **(10 Marks)**

b. Determine r_e, h_{fe}, h_{ie}, Z_i, Z_0, A_V and A_i for the circuit shown in Fig.Q2(b) using hybrid equivalent model. **(10 Marks)**

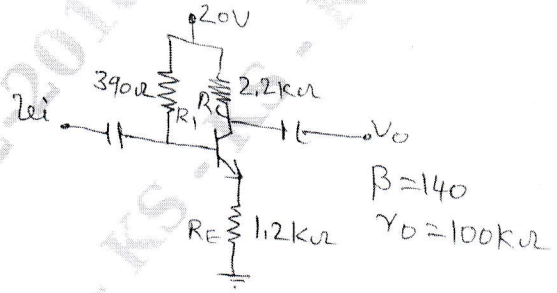

Fig.Q2(b)

Module-2

3 a. Explain the working principle of JFET, and explain the transfer characteristics of JFET. **(08 Marks)**

b. Derive an expression for input impedance, output impedance, voltage gain and current gain of fixed bias FET amplifier. **(08 Marks)**

c. Distinguish between JFET and MOSFET. **(04 Marks)**

OR

4 a. With neat diagram explain construction and working principle of n-channel depletion type MOSFET. **(10 Marks)**

b. Derive an expression for input impedance, output impedance and voltage gain of common – Gate FET amplifier. **(10 Marks)**

Module-3

5 a. Derive an expression for low frequency response of BJT amplifier due to capacitors C_S, C_E and C_C. **(10 Marks)**

b. Determine the lower cutoff frequency for the network of Fig.Q5(b) using the following parameters $C_i = 10\mu f$, $C_E = 20\mu f$, $C_C = 1\mu f$, $R_S = 1k\Omega$, $R_1 = 40\ K\Omega$, $R_2 = 10K\Omega$, $R_E = 2K\Omega$, $R_C = 4K\Omega$, $R_L = 2.2K\Omega$, $\beta = 100$, $r_0 = \infty\Omega$ and $V_{CC} = 20V$, plot the response. **(10 Marks)**

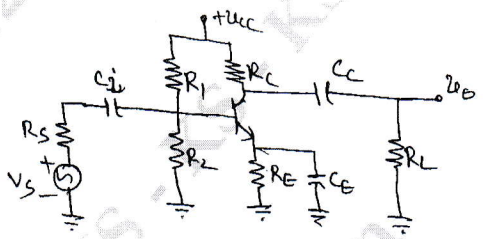

Fig.Q5(b)

OR

6 a. Define Miller's theorem, determine equivalent input and output capacitances of the circuit. **(10 Marks)**

b. Determine the lower cutoff frequency for the network of Fig.Q6(b) using the following parameters. $C_G = 0.01\mu f$, $C_C = 0.5\mu f$, $C_S = 2\mu f$, $R_{Sig} = 10K\Omega$, $R_G = 1M\Omega$, $R_0 = 4.7K\Omega$, $R_S = 1K\Omega$, $R_L = 2.2K\Omega$, $I_{DSS} = 8mA$, $V_P = -4V$, $r_d = \infty\Omega$, $V_{DD} = 20V$, $V_{GSQ} = -2V$ and $I_{DQ} = 2mA$. Plot the frequency response. **(10 Marks)**

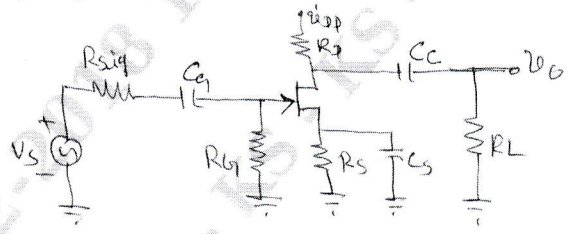

Fig.Q6(b)

Module-4

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

b. Determine the voltage, input and output impedance with feedback for voltage series feedback having $A = 100$, $R_i = 10K\Omega$ and $R_0 = 20K\Omega$ for feedback of i) $\beta = 0.1$ ii) $\beta = 0.5$. **(07 Marks)**

c. Explain the characteristics of negative feedback amplifier. **(07 Marks)**

OR

8 a. What is Barkhasen criteria for sustained oscillation? Explain basic principle of operation of oscillators. **(08 Marks)**

b. Explain the working of Wein bridge oscillator. Write the equation for frequency of oscillations. **(08 Marks)**

c. For the colpitts oscillators, $C_1 = 0.005\mu f$, $C_2 = 0.01\ \mu f$, $L = 100\mu H$, $L_{PFc} = 0.5mH$, $C_C = 10\mu f$ and $h_{fe} = 110$.

i) Calculate frequency of oscillation

ii) Check the condition for oscillation is satisfied. **(04 Marks)**

Module-5

9 a. Explain the operation of transformer coupled class – A power amplifier and show that the maximum percentage efficiency is 50%. **(07 Marks)**

b. Explain with neat circuit diagram, the working of a complementary symmetry class – B amplifier. **(07 Marks)**

c. Derive an expression for second harmonic distortion using 3 – point method. **(06 Marks)**

OR

10 a. Define voltage regulator. Explain the operation of series regulator circuit. **(07 Marks)**

b. Explain the operation of shunt regulator using OP-Amp with neat circuit diagram. **(07 Marks)**

c. Calculate the output voltage and Zener current in the regulator circuit of Fig.Q10(c) for $R_L = 1K\Omega$, $V_z = 12V$, $R = 220\Omega$, $v_i = 20V$ and $\beta = 50$. **(06 Marks)**

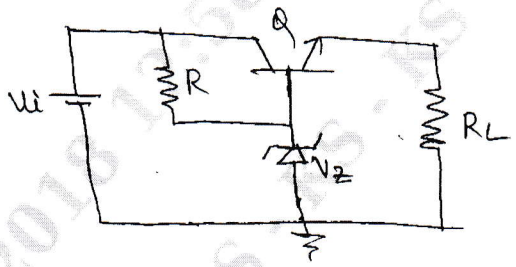

Fig.Q10(c)

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17EC34

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019

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. Convert $x = \bar{a}b + bc$ to canonical SOP form. **(02 Marks)**

b. Simplify $G = f(w,x,y,z) = \pi M(1,3,8,10,12,13,14,15)$ in POS form and implement using NOR gates. **(08 Marks)**

c. Simplify the following using Quine-McClusky's minimization technique.
$V = f(a, b, c, d) = \sum m(1, 3, 4, 5, 6, 9, 11, 12, 13, 14)$ **(10 Marks)**

OR

2 a. Convert $P = (\overline{w} + x)(y + \overline{z})$ to canonical POS form. **(03 Marks)**

b. Simplify $P = f(a, b, c, d) = \sum m(2, 3, 4, 5, 13, 15) + \sum d(8, 9, 10, 11)$ in SOP form and implement using NAND gates. **(07 Marks)**

c. Simplify using Quine-McClusky's minimization technique:
$V = f(a, b, c, d) = \sum m(1, 5, 7, 9, 13, 15) + \sum d(8, 10, 11, 14)$ **(10 Marks)**

Module-2

3 a. Implement $f_1(a, b, c) = \sum m(1, 3, 5)$; $f_2(a, b, c) = \sum m(0, 1, 6)$ using 74138, 3:8 decoder. **(06 Marks)**

b. With a neat circuit diagram explain the carry look ahead adder with relevant expressions. **(10 Marks)**

c. Design a one-bit comparator, implement using suitable gates. **(04 Marks)**

OR

4 a. Using 74151, 8:1 Mux, realize the Boolean function $F(a, b, c, d) = \sum m(0, 1, 5, 6, 7, 10, 15)$ with b, c, d as select lines. **(04 Marks)**

b. With neat circuit diagram, explain the keypad interface using 74147, 10 line to BCD encoder. **(10 Marks)**

c. Design a full subtractor and implement using logic gates. **(06 Marks)**

Module-3

5 a. Discuss the working principle of Gated SR latch with its truth Table. **(06 Marks)**

b. Explain the operation of Switch debouncer built using SR latch with the help of circuit and waveforms. **(08 Marks)**

c. Obtain the characteristic equations of JK flip flop and SR flip flop. **(06 Marks)**

OR

6 a. What is race around condition? How it can be overcome? **(02 Marks)**

b. Explain the working of MS-JK flip flop with logic symbol and timing diagram. **(10 Marks)**

c. Explain the working of +ve edge triggered D flip flop with the functional table. **(08 Marks)**

Module-4

7 a. Explain the working of four bit ripple counter using +ve edge triggered T flip-flops with the counting sequence table and timing diagram. **(10 Marks)**

b. Explain the SIPO and SISO operation of shift register with relevant logic diagram and the truth table. **(06 Marks)**

c. Explain the operation of ring counter using logic diagram and truth table. **(04 Marks)**

OR

8 a. Explain Universal Shift Register with the help of logic diagram and mode control table. **(10 Marks)**

b. Realize a three-bit binary synchronous up counter using JK flip flops. **(10 Marks)**

Module-5

9 a. Construct a Mealy state diagram that will detect input sequence 10110, when input pattern is detected Z is asserted high. Write the state diagram. **(10 Marks)**

b. Design a synchronous counter using T flip flops to count the sequence 0, 2, 3, 6, 5, 1, 0, 2, … Write the excitation table and state diagram and logic diagram. **(10 Marks)**

OR

10 a. Explain Mealy and Moore model of clocked synchronous sequential circuit with the block diagram. **(08 Marks)**

b. For the logic diagram given in Fig.Q10(b):

i) Derive the excitation and output equations

ii) Write the state equations

iii) Construct transition table and state table

iv) Draw the state diagram

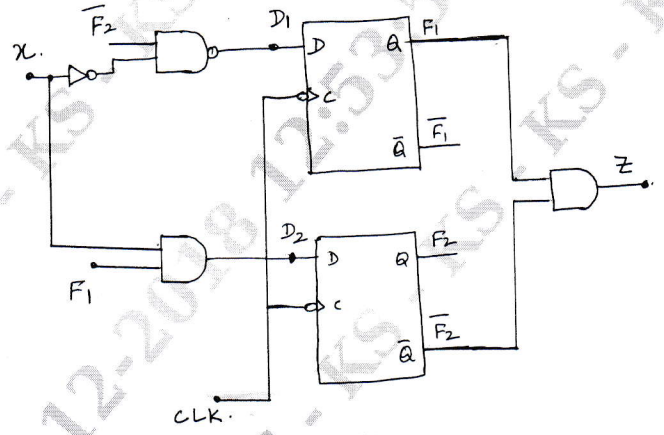

Fig.Q10(b) **(12 Marks)**

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CBCS SCHEME

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17EC35

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Reduce the Network shown in Fig Q1(a) to a single voltage source in series with a resistance using source shift and source transformation. **(07 Marks)**

b. Use mesh analysis to determine the three mesh currents I_1, I_2 and I_3 in the circuit show in Fig Q1(b). **(05 Marks)**

c. Find current in 30Ω resistor using nodal analysis for the circuit shown in Fig Q1(c). **(08 Marks)**

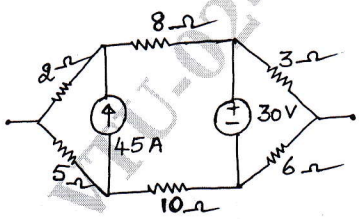

Fig Q1(a)

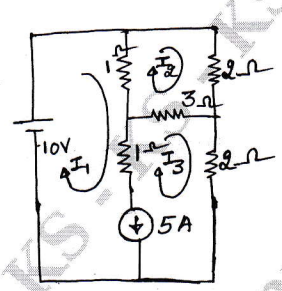

Fig Q1(b)

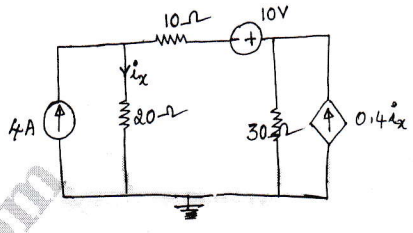

Fig Q1(c)

OR

2 a. Find the equivalent resistance between a and b using star delta transformation for the network shown in Fig Q2(a). **(05 Marks)**

b. For the circuit shown in Fig Q2(b), determine I_x and other loop currents. **(07 Marks)**

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

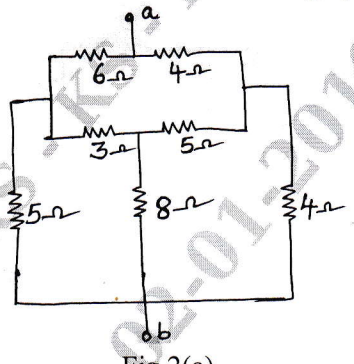

Fig 2(a)

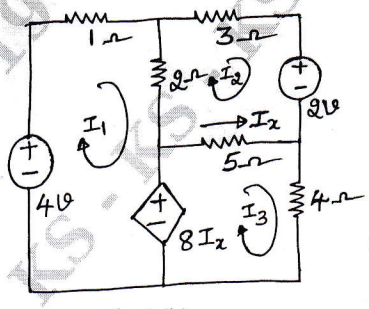

Fig 2(b)

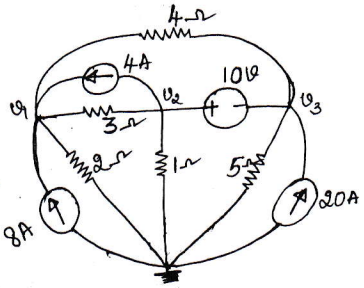

Fig 2(c)

Module-2

3 a. For the circuit shown in Fig Q3(a), find the current I_x using super position theorem. **(07 Marks)**

b. Verify Reciprocity theorem by calculating 'I' for the network shown in Fig Q3(b). **(05 Marks)**

c. Obtain the Thevenin's equivalent of the circuit shown in Fig Q 3(c) **(08 Marks)**

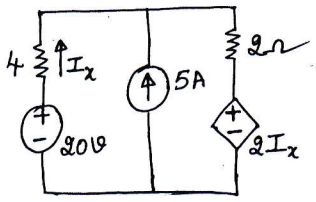

Fig Q3 (a)

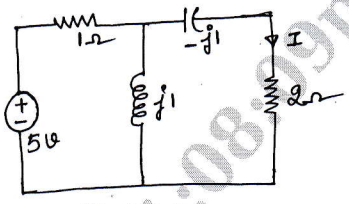

Fig Q3 (b)

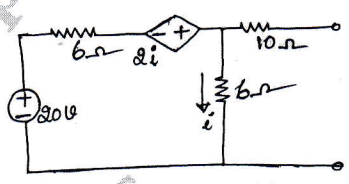

Fig Q3 Q(c)

OR

4 a. For the circuit shown in Fig Q4(a), find the current in $(6 + j8)\Omega$ impedance using Millman's theorem. **(05 Marks)**

b. For the Network shown in Fig Q4(b), determine Norton's equivalent across A and B. Find the current thorough the impedance $(6 - j8)\ \Omega$ connected to the terminals A and B. **(05 Marks)**

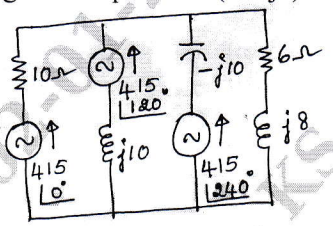

Fig Q4(a)

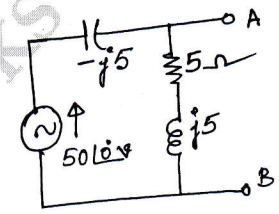

Fig Q4(b)

c. State and prove maximum power transfer theorem for AC circuit, where both R_L and X_L are varying. **(10 Marks)**

Module-3

5 a. In the Network shown in Fig Q5(a), a steady state is reached with the switch K open. At t = 0, the switch K is closed. Obtain the initial values of (i) i_1 (ii) i_2 (iii) v_c iv) $\frac{di_1}{dt}$ v) $\frac{di_2}{dt}$ and $\frac{di_1}{dt}$ at $t = \infty$. **(10 Marks)**

b. For the given circuit in Fig Q5(b), find the value of the loop currents, their first derivatives and their 2nd derivatives, all evaluated at $t = 0^+$, given that $V_c(0^-) = 1$ volt, $i_2(0^-) = 0$ amp. At t = 0, sw_1 and sw_2 are closed. **(10 Marks)**

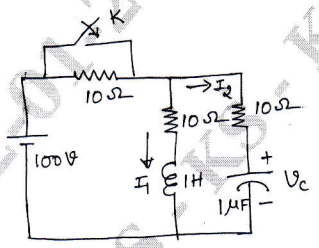

Fig Q5(a)

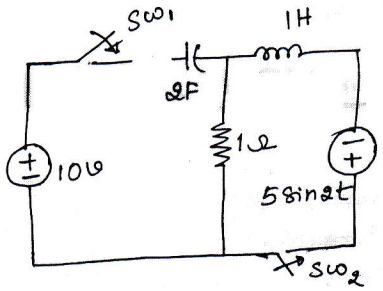

Fig Q5(b)

OR

6 a. In the circuit of Fig Q6(a), the source voltage is v(t) = 50sin 250t. Using Laplace transforms, determine the current when switch K is closed at t = 0. **(08 Marks)**

b. Synthesize the periodic waveform shown in Fig Q6(b) and find its Laplace transform and prove any formula used. **(12 Marks)**

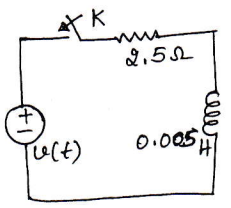

Fig Q6(a)

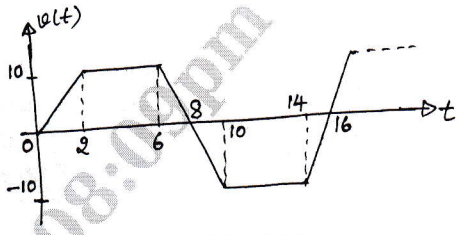

Fig Q6(b)

Module-4

7 a. Show that resonant frequency of series resonant circuit is equal to the geometric mean of two half power frequencies. **(05 Marks)**

b. A coil is connected in series with a variable capacitor across v(t) = 10 cos 1000t. The current is maximum when c = 10μF. When C = 12.5μF, the current is 0.707 times the maximum value. Find L, R, and Q of the coil. **(08 Marks)**

c. A coil has resistance of 400Ω and inductance of 318μH. Find the capacitance of capacitor which when connected in parallel with the coil will produce resonance with a supply frequency of 1MHz. If a second capacitor of capacitance 23.42pF is connected in parallel with the first capacitor, find the frequency at which resonance will occur. **(07 Marks)**

OR

8 a. Derive the expression for the resonant frequency of the circuit shown in Fig Q8(a). Also show that the circuit will resonate at all frequencies if $R_L = R_c = \sqrt{\frac{L}{C}}$. **(12 Marks)**

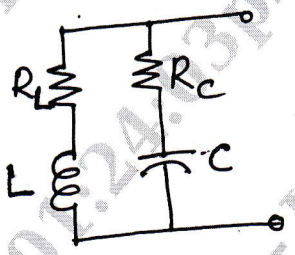

Fig Q8(a)

b. A coil of 10Ω resistance 0.2H inductance is connected in parallel with a variable condenser across 220V, 50Hz supply. Determine: (i) Capacitance of condenser so that current drawn may be in phase with the supply voltage (ii) Effective impedance of the circuit (iii) Power absorbed at resonance (iv) Current magnification factor. **(08 Marks)**

Module-5

9 a. Z-parameters of a Network are obtained from an experiment. Explain how y-parameters and transmission parameter can be computed from the experimental data. **(10 Marks)**

b. Find Z and Y parameters of the network shown in Fig Q9(b).

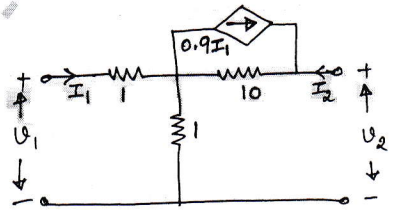

Fig Q9(b) **(10 Marks)**

OR

10 a. Find Z and h-parameters for the network shown in Fig Q10(a). **(12 Marks)**

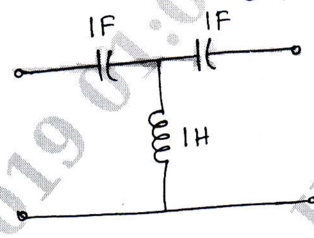

Fig Q10(a)

b. Write a note on hybrid p's with its equivalent circuit. **(04 Marks)**

c. Explain symmetry and reciprocal property of 2-port Networks. **(04 Marks)**

* * * * *

CBCS SCHEME

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17EC36

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. State and explain Coulomb's law in complete form. **(06 Marks)**

b. Two particles having charges 2nc and 5nc are spaced 80cm apart. Determine the $\overline{E}$ at a point is situated at a distance of 0.5m from each of the two particles. Use $\varepsilon r = 5$. (Use Bakelite medium). **(06 Marks)**

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

OR

2 a. Derive expression for E due to infinite line charge from first principle. **(08 Marks)**

b. Two uniform line charges of density 4n c/m and 6n c/m lie in x = 0 plane at y = +5m and – 6m respectively. Find E at $(4, 0, 5)^m$. **(06 Marks)**

c. Define E and D, Hence establish the relation between D and E. **(06 Marks)**

Module-2

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

b. If $D = \frac{5r^2}{4}\hat{a}_r\ c/m^2$. (in spherical system) then evaluates both sides of the divergence theorem for the volume enclosed by r = 4m, and $\theta = \pi/4$ radians. **(08 Marks)**

c. Prove that $\rho_v = \nabla \cdot D$. **(06 Marks)**

OR

4 a. Establish relation $E = -\nabla V$ **(06 Marks)**

b. Electrical potential at an arbitrary point in free space is given as $V = (x+1)^2 + (y+2)^2 + (z+3)^2$ Volts at p(2, 1, 0). Find :

i) V ii) $\overline{E}$ iii) $|\overline{E}|$ iv) $|\overline{D}|$ v) ρ_v **(08 Marks)**

c. Derive continuity of current equation. **(06 Marks)**

Module-3

5 a. Derive Laplace and Poisson's equations and write Laplace Equation in all 3 co-ordinate systems. **(08 Marks)**

b. State and prove uniqueness theorem. **(07 Marks)**

c. Calculate the numerical values for V and ρ_v at P in free space if $V = \frac{4yz}{x^2+1}$ at P(1, 2,3). **(05 Marks)**

OR

6 a. An assembly of two concentric spherical shells is considered. The inner spherical shell is at a distance of 0.1m and is at a potential of 0 volts. The outer spherical shell is at a distance of 0.2m and at a potential of 100V. The medium between them is a free space. Find $\overline{E}$ and $\overline{D}$ using spherical co-ordinate system. **(06 Marks)**

b. State and prove Ampers circuital law. **(08 Marks)**

c. At a point P(x, y, z) the components of vector magnetic potential $\overline{A}$ are given as

$Ax = 4x + 3y + 2z$

$Ay = 5x + 6y + 3z$ and

$Az = 2x + 3y + 5z$

Determine $\overline{B}$ at point P and state its nature. **(06 Marks)**

Module-4

7 a. Derive an expression for the force on a differential current element placed in a magnetic field and deduce the result for straight conductor in a uniform magnetic field. **(08 Marks)**

b. A point charge Q = 18nc has a velocity of 5×10^6 m/s in the direction $\overline{a}_v = 0.6\hat{a}_x + 0.75\hat{a}_y + 0.3\hat{a}_z$.

Calculate the magnitude of the force exerted on the charge by the field

i) $\overline{E} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ K v/m

ii) $\overline{B} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ MT

iii) $\overline{B}$ & $\overline{E}$ acting together. **(06 Marks)**

c. State and explain Lorentz force equation. **(06 Marks)**

OR

8 a. Define : i) Magnetization ii) Permeability. **(04 Marks)**

b. If $\overline{B} = 0.05$ x $\hat{a}_y$ T in a material for which magnetic susceptibility $X_m = 2.5$. Find

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

c. Discuss the boundary conditions at the interface between two media of different permiabities? **(08 Marks)**

Module-5

9 a. Derive Maxwell's Equations in point form and Integral form for Time varying fields. **(08 Marks)**

b. For a lossy dielectric $\sigma = 5$ s/m, $\varepsilon_r = 1$ the electric filed intensity is E = 100 sin 10^{10} t. Find J_c and J_d and frequency at which both have Equal Magnitudes. **(04 Marks)**

c. Starting from Maxwell's Equation Derive the wave equation for a uniform plane wave travelling in free space. **(08 Marks)**

OR

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

b. Deduce the expressions for α and β for a uniform plane wave propagation in good conducting medium. **(06 Marks)**

c. Wet Marshy soil is characterized by $\sigma = 10^{-2}$ s/m, $\varepsilon_r = 15$ and $\mu_r = 1$. At the frequencies 60Hz, 1 MHz, 100 MHz and 10 GHz indicate whether the soil may be considered a conducting dielectric or neither. **(06 Marks)**