CBCS SCHEME

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15MAT31

Third Semester B.E. Degree Examination, June/July 2019
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 series for the function :
$$f(x)=\begin{cases}-\pi & \text{in } -\pi<x<0\\ x & \text{in } 0<x<\pi\end{cases}$$
Hence deduce that $\sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}=\frac{\pi^2}{8}$. **(08 Marks)**

b. Express y as a Fourier series up to the second harmonics, given :

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y	1.98	1.30	1.05	1.30	–0.88	–0.25	1.98

(08 Marks)

OR

2 a. Obtain the Fourier series for the function $f(x)=2x-x^2$ in $0\le x\le 2$. **(08 Marks)**

b. Obtain the constant term and the first two coefficients in the only Fourier cosine series for given data :

x	0	1	2	3	4	5
y	4	8	15	7	6	2

(08 Marks)

Module-2

3 a. Find the Fourier transform of $xe^{-|x|}$. **(06 Marks)**

b. Find the Fourier sine transform of $\frac{e^{-ax}}{x}, a>0$. **(05 Marks)**

c. Obtain the z – transform of $\sin n\theta$ and $\cos n\theta$. **(05 Marks)**

OR

4 a. Find the inverse cosine transform of $F(\alpha)=\begin{cases}1-\alpha, & 0\le\alpha\le 1\\ 0, & \alpha>1\end{cases}$.

Hence evaluate $\int_0^{\infty}\frac{\sin^2 t}{t^2}dt$. **(06 Marks)**

b. Find inverse Z – transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$ **(05 Marks)**

c. Solve the difference equation $y_{n+2}+6y_{n+1}+9yl=2^n$ with $y_0=0, y_1=0$, using z – transforms. **(05 Marks)**

Module-3

5 a. Find the lines of regression and the coefficient of correlation for the data :

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

(06 Marks)

b. Fit a second degree polynomial to the data :

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(05 Marks)

c. Find the real root of the equation $x\sin x + \cos x = 0$ near $x = \pi$, by using Newton – Raphson method upto four decimal places. (05 Marks)

OR

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

b. Fit a curve of the type $y = ae^{bx}$ to the data :

x	5	15	20	30	35	40
y	10	14	25	40	50	62

(05 Marks)

c. Solve $\cos x = 3x - 1$ by using Regula – Falsi method correct upto three decimal places, (Carryout two approximations). (05 Marks)

Module-4

7 a. Give $f(40) = 184$, $f(50) = 204$, $f(60) = 226$, $f(70) = 250$, $f(80) = 276$, $f(90) = 304$. Find $f(38)$ using Newton's forward interpolation formula. (06 Marks)

b. Find the interpolating polynomial for the data :

x	0	1	2	5
y	2	3	12	147

By using Lagrange's interpolating formula. (05 Marks)

c. Use Simpson's $\frac{3}{8}$th rule to evaluate $\int_0^{0.3} (1-8x^3)^{1/2}\,dx$ considering 3 equal intervals. (05 Marks)

OR

8 a. The area of a circle (A) corresponding to diameter (D) is given below :

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

Find the area corresponding to diameter 105, using an appropriate interpolation formula. (06 Marks)

b. Given the values :

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

Evaluate f(9) using Newton's divided difference formula. (05 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2}\,dx$ by Weddle's rule taking seven ordinates. (05 Marks)

Module-5

9 a. Using Green's theorem, evaluate $\int_c (2x^2 - y^2)dx + (x^2 + y^2)dy$ where C is the triangle formed by the lines x = 0, y = 0 and x + y = 1. **(06 Marks)**

b. Verify Stoke's theorem for $\vec{f} = (2x - y)i - yz^2 j - y^2 zk$ for the upper half of the sphere $x^2 + y^2 + z^2 = 1$. **(05 Marks)**

c. Find the extermal of the functional $\int_{x_1}^{x_2} \left\{ y^2 + (y^1)^2 + 2ye^x \right\} dx$. **(05 Marks)**

OR

10 a. Using Gauss divergence theorem, evaluate $\int_s \vec{f} \cdot \hat{n}\, ds$, where $\vec{f} = 4xzi - y^2 j + yzk$ and s is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z = 1. **(05 Marks)**

b. A heavy cable hangs freely under the gravity between two fixed points. Show that the shape of the cable is a Catenary. **(06 Marks)**

c. Find the extermal of the functional $\int_0^{\pi/2} \left\{ (y^1)^2 - y^2 + 4y\cos x \right\} dx$, give that y = 0 = y(π/2). **(05 Marks)**

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CBCS SCHEME

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15EC32

Third Semester B.E. Degree Examination, June/July 2019
Analog Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive the expression for Z_{in}, Z_0, A_v and A_I for voltage divider bias CE amplifier with R_E unbypassed using re-model. **(10 Marks)**

b. Write a note on hybrid π model. **(06 Marks)**

OR

2 a. For a emitter bias circuit with $R_B = 470k\Omega$, $R_C = 3.3\Omega$, $R_E = 1.2k\Omega$, $C_{C_1} = C_{C_2} = 0.1\mu F$, $h_{fe} = 120$, $h_{ie} = 1k\Omega$, $h_{oe} = 50\mu\mho$. Find A_I, A_V, Z_{in} and Z_0 if R_E is unbypassed. Also write the hybrid model. **(08 Marks)**

b. Derive the expression for Z_{in}, Z_0, A_V and A_I for common collector configuration amplifier using approximate hybrid model. **(08 Marks)**

Module-2

3 a. Derive the expression for transconductance also relate I_D and g_m. **(06 Marks)**

b. Obtain the expression for Z_{in} and A_V for a JFET common gate amplifier. Write the small signal model. **(10 Marks)**

OR

4 a. For a common drain configuration amplifier if $R_G = 2\mu\Omega$, $R_S = 2.2k\Omega$, $V_{DD} = 20V$, $C_{C_1} = C_{C_2} = 0.1\mu F$. Find Z_{in}, Z_0 and A_V given. $I_{DSS} = 10mA$, $V_p = -5V$, $r_d = 40k\Omega$, $V_{GSQ} = -2.85V$. **(06 Marks)**

b. With a neat diagram, explain the construction and operation of D–MOSFET and E–MOSFET. Also write the drain and transfer characteristics. **(10 Marks)**

Module-3

5 a. State Miller's theorem and also obtain the expression for input and output capacitances. **(08 Marks)**

b. Derive the expressions for low frequency response of BJT amplifier due to input and output coupling capacitors and also due to bypass capacitor. **(08 Marks)**

OR

6 a. Determine the higher frequency response of the amplifier circuit shown in Fig.Q6(a) below, also plot the graph.

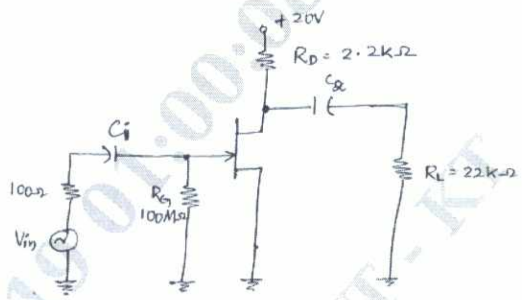

Fig.Q6(a)

Given $V_{GS} = -8V$, $I_{GSS} = 80mA$, $g_m = 6ms$, $C_{gs} = 4pF$, $C_{gd} = 2pF$. **(08 Marks)**

b. Obtain the expression for overall tower and upper cutoff frequency of multistage amplifier. **(08 Marks)**

Module-4

7 a. Prove that input and output impedances in voltage shunt feedback amplifier decreases. **(06 marks)**

b. With the help of neat block diagram, deduce the conditions for sustained oscillations. **(04 marks)**

c. Explain the important advantages of negative feedback. **(06 marks)**

OR

8 a. For a Wein bridge oscillator, if $R_i = 1k\Omega$ and $R_F = 2.5k\Omega$. Find frequency of oscillation for $R = 2k\Omega$ and $C = 10mF$. Is oscillations sustained? **(04 Marks)**

b. Derive the expression for frequency of oscillation in Hartley oscillator with the help of neat circuit diagram. **(06 Marks)**

c. Explain the construction and operation of UJT. **(06 Marks)**

Module-5

9 a. Explain push pull amplifier with a neat circuit diagram. Show that its maximum conversion efficiency is 78.5%. **(12 Marks)**

b. Write a note on class C amplifiers. **(04 Marks)**

OR

10 a. Explain services and shunt voltage regulator. **(10 marks)**

b. For the circuit shown in Fig.Q10(b) below, if peak base circuit is 1mA. Calculate :
i) $P_{0(ac)}$ ii) $P_{in(dc)}$ iii) $\eta(\%)$. **(06 Marks)**

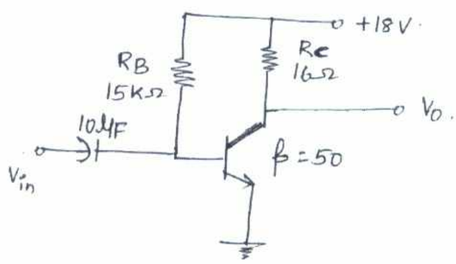

Fig.Q10(b)

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CBCS SCHEME

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15EC33

Third Semester B.E. Degree Examination, June/July 2019
Digital Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Write the switching equation for a digital circuit with four inputs and whose output is '1' if majority of its inputs are '1'. **(04 Marks)**

b. Place the following equations into proper canonical forms and write its decimal notations also :

i) $P = f(a,b,c) = a\bar{b} + a\bar{c} + bc$

ii) $Q = f(x,y,z) = (x + \bar{y})(\bar{y} + z)$. **(06 Marks)**

c. Solve using k – map and implement using only NAND gates

$B = f(w,x,y,z) = \Sigma(1,2,3,4,9) + \Sigma d(10, 11, 12, 13, 14, 15)$. **(06 Marks)**

OR

2 a. Solve using K Map

$A = f(w, x, y, z) = \pi(1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 14, 15)$

and implement using NOR gates only. **(06 Marks)**

b. Simplify using Quine Mc Clusky method :

$D = f(a, b, c, d) = \Sigma(0, 1, 2, 3, 6, 7, 8, 9\ 14, 15)$

Show the prime implicant table to determine the EPIs. **(10 Marks)**

Module-2

3 a. Design a combinational circuit that multiplies two 2bit binary values, and produces 4-bit product. Get the minterms for P_0, P_1, P_2 and P_3. Simplify only for P_2. **(08 Marks)**

b. Design a 4 to 16 decoder using 3 to 8 decoders (74LS138) only and realize the function :

$P = f(w, x, y, z) = \Sigma(1, 4, 8, 13)$

$Q = f(w, x, y, z) = \Sigma(2, 7, 13, 14)$. **(08 Marks)**

OR

4 a. Design a 2 bit magnitude comparator and get an expression for A < B only, which is the minimal expression. **(08 Marks)**

b. Explain a carry look ahead adder with a neat diagram and relevant expressions. **(08 Marks)**

Module-3

5 a. Explain an SR latch using NOR gates with circuit diagram function table and timing diagram. **(06 Marks)**

b. Explain a positive edge triggered D flip flop with circuit diagram, function table and timing diagram. **(10 Marks)**

OR

6 a. What is race around? How is it overcome in master slave JK F/F. Explain MS JK with relevant circuit diagram, function table. **(10 Marks)**

b. Derive the characteristics equation for :
i) SR F/F ii) JK F/F iii) D F/F iv) T F/F. **(06 Marks)**

Module-4

7 a. Given an universal shift register, sketch its diagram only for left shift operates and explain its working. **(08 Marks)**

b. What is a twisted ring counter? Sketch its diagram and explain its counting sequence and also give the bits that determine a state uniquely. **(08 Marks)**

OR

8 a. Design a model synchronous counter for the sequence, using a D flip-flop [Refer Fig.Q8(a)].

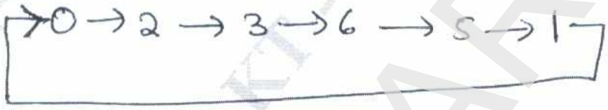

Fig.Q8(a) **(08 Marks)**

b. Explain with net diagram, the counting sequence and timing diagram, the working of a 4 bit binary ripple counter, using positive edge triggered T flip flop. **(08 Marks)**

Module-5

9 a. Draw and explain the Mealy and Moore sequential circuit models. **(06 Marks)**

b. Analyze the following sequential circuit and draw its state diagram.[Refer Fig.Q9(b)]. **(10 Marks)**

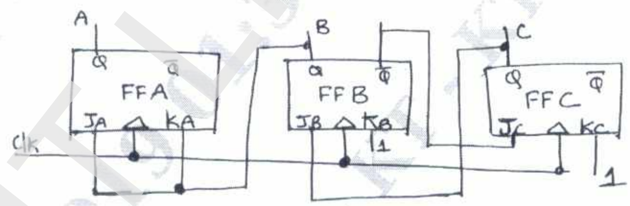

Fig.Q9(b)

OR

10 a. Represent a Moore circuit notation of a JK flip-flop through state diagram and explain. **(06 Marks)**

b. Design a modulo 8 synchronous counter with :
i) state diagram ii) state table iii) transition table iv) excitation table, kmap and logic diagram **(10 Marks)**

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CBCS SCHEME

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15EC34

Third Semester B.E. Degree Examination, June/July 2019
Network Analysis

Time: 3 hrs. Max. Marks: 80

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. Explain E-shift and I-shift with an example. **(08 Marks)**

b. Find the voltage across the capacitor of 10 Ω reactance of the network shown in Fig.Q1(b) by loop current method.

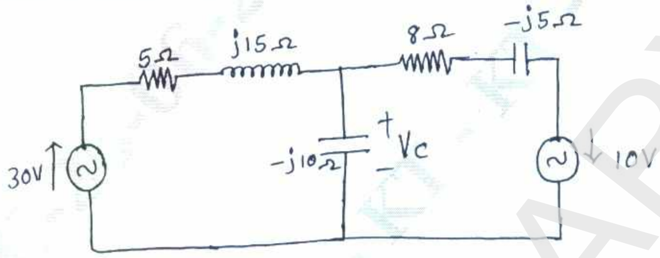

Fig.Q1(b) **(08 Marks)**

OR

2 a. Determine the equivalent resistance between the terminals A and B in the network of Fig.Q2(a) using star-delta transformation.

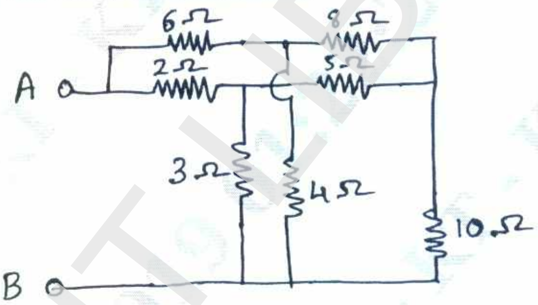

Fig.Q2(a) **(08 Marks)**

b. Find the voltages at nodes 1, 2, 3 and 4 for the network shown in Fig.Q2(b) using nodal analysis.

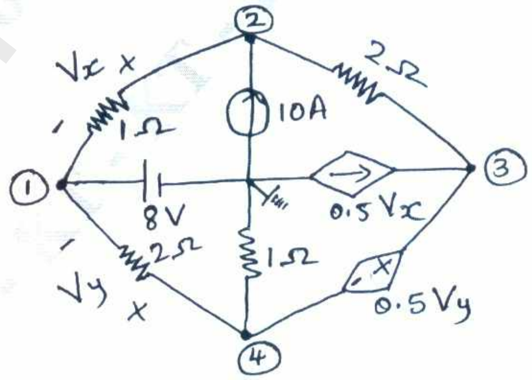

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. State and explain superposition theorem. **(08 Marks)**

b. Obtain Thevenin's equivalent circuit across A and B for the network shown in Fig.Q3(b).

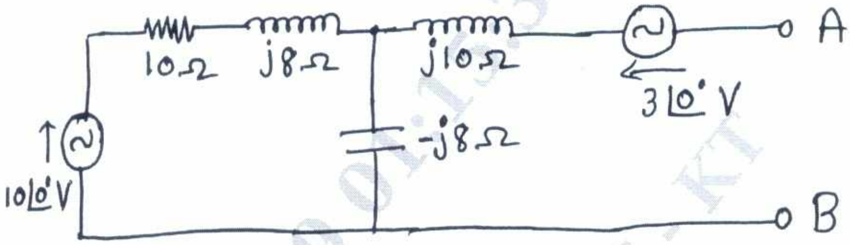

Fig.Q3(b) **(08 Marks)**

OR

4 a. State and explain Millman's theorem. **(08 Marks)**

b. Find the value of Z_L in the circuit shown in Fig.Q4(b) using maximum power transfer theorem and hence the maximum power.

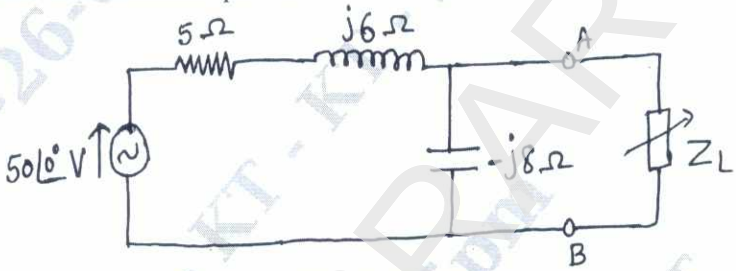

Fig.Q4(b) **(08 Marks)**

Module-3

5 a. State and prove initial value theorem and final value theorem. **(08 Marks)**

b. In the network shown in Fig.Q5(b), 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 = 100 Ω, L = 0.1 H and C = 0.25 μF and V = 100 V. Assume that the capacitor is initially uncharged.

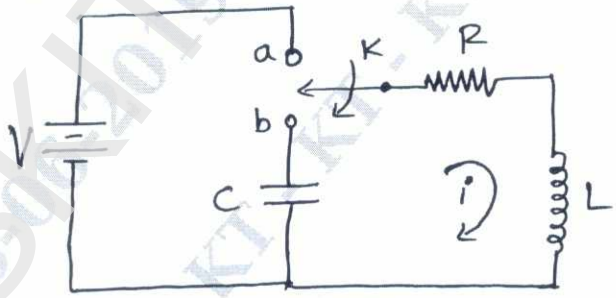

Fig.Q5(b) **(08 Marks)**

OR

6 a. What is the significance of initial conditions? Write a note on initials and final conditions in basic circuit elements. **(08 Marks)**

b. Find the Laplace transform of (i) f(t) = u(t) (ii) f(t) = t. **(08 Marks)**

Module-4

7 a. Derive an expression for half power frequencies for a series resonant circuit, **(08 Marks)**

b. For the network shown in Fig.Q7(b), find the value of L at which circuit resonates at a frequency of 600 rad/sec.

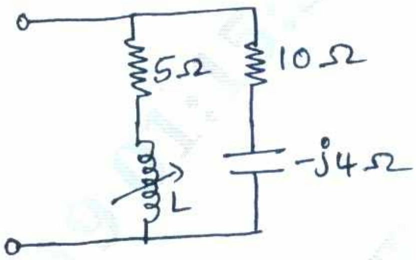

Fig.Q7(b) **(08 Marks)**

OR

8 a. Obtain the expression for the resonant frequency and the dynamic impedance of a parallel resonant circuit. **(08 Marks)**

b. An RLC series resonant circuit draws a maximum current of 10 Amps, when connected to 230 V, 50 Hz supply. If the Q-factor is 5, find the parameters of the circuit. **(08 Marks)**

Module-5

9 a. Derive the Y-parameters in terms of ABCD parameters. **(08 Marks)**

b. Obtain the h-parameters for the circuit shown in Fig.Q9(b).

Fig.Q9(b) **(08 Marks)**

OR

10 a. Express h-parameters interms of z-parameters. **(08 Marks)**

b. Find the y-parameters for the circuit shown in Fig.Q10(b). The use parameter relationships to find h-parameter.

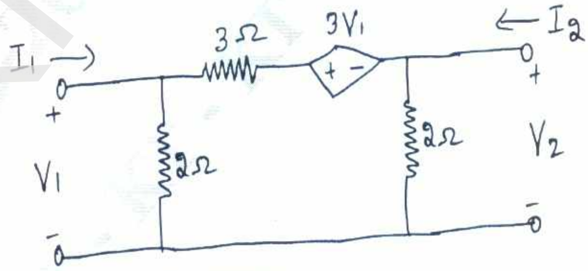

Fig.Q10(b) **(08 Marks)**

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CBCS SCHEME

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Third Semester B.E. Degree Examination, June/July 2019
Electronic Instrumentation

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1 a. Explain different types of static errors of a measuring instrument. **(08 Marks)**

b. What is a thermocouple? Explain different type of thermocouple. **(08 Marks)**

OR

2 a. Explain the operation of true RMS voltmeter with diagram. **(08 Marks)**

b. Two different voltmeters are used to measure the voltage across R_b in the circuit of Fig.Q2(b)

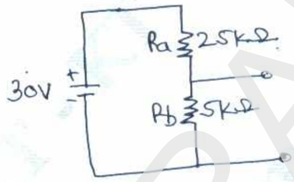

Fig.Q2(b)

The meters are as follows:

meter1 : $S = 1\ k\Omega/V$ Range = 10V

meter2

: $S = 20\ k\Omega/V$ Range = 10V

Calculate :

(i) The voltage across R_b without any meter across it.

(ii) The voltage across R_b when meter1 is used.

(iii) The voltage across R_b when meter2 is used.

(iv) Error in the voltmeters. **(08 Marks)**

Module-2

3 a. Describe the principle operation of successive approximation DVM. **(08 Marks)**

b. Explain the operation of a microprocessor based instrument with a block diagram. **(08 Marks)**

OR

4 a. Explain the working of Dual-Slope integrating type DVM with the block diagram. **(08 Marks)**

b. With the help of diagram, explain the operation of a Digital Tachometer. **(08 Marks)**

Module-3

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

b. Explain the principle of operation of square and pulse generator with its block diagram. **(08 Marks)**

OR

6 a. Explain the operation of a digital read out oscilloscope with block diagram. **(08 Marks)**

b. Describe the operation of a AF sine and square wave generator with diagram. **(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-4

7 a. Explain the operation of an Analog pH meter using hydrogen electrode. **(08 Marks)**

b. Derive the balance equation for Wheatstone's bridge and mention its advantages and limitations. **(08 Marks)**

OR

8 a. Explain Wagner's earth connection. **(08 Marks)**

b. Explain the principle operation of a field strength meter with its block diagram. **(08 Marks)**

Module-5

9 a. Explain the operation of a Resistive Position Transducer with block diagram. **(08 Marks)**

b. Explain construction and principle operation of LVDT. **(08 Marks)**

OR

10 a. Explain the operation of a resistance thermometer and mention its advantages and limitations. **(08 Marks)**

b. Write note on:
(i) Piezoelectric Transducers (ii) Strain Gauges. **(08 Marks)**

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CBCS SCHEME

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15EC36

Third Semester B.E. Degree Examination, June/July 2019

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. Four point charges each 20μc are on x-y axes at ± 4m. find the force on a 100μc point charge at (0, 0, 3)m. **(06 Marks)**

b. Define electric field intensity $(\vec{E})$ and using Coulomb's law derives the expression for $\vec{E}$ due to a point charge. **(04 Marks)**

c. A line charge of density $\rho_\ell = 24$ n c/m is located in free space on the line y = 1, z = 2. Find electric filed intensity $\vec{E}$ at $P(6, -1, 3)$. **(06 Marks)**

OR

2 a. Derive an expression for Electric field Intensity $\vec{E}$ due to an infinite line charge of density ρ_ℓ c/m. **(08 Marks)**

b. A point charge of 6μc is located at origin and a uniform line charge of density 180nc/m lies along x – axis,

i) Find electric flux density D at (1, 2, 4)

ii) Calculate the total electric flux leaving the surface of a sphere of 4m radius centered at origin. **(08 Marks)**

Module-2

3 a. A charge of Q coulombs is uniformly distributed throughout the volume of a sphere of radius 'R' meters. Using Gauss law Find electric field intensity 'E' everywhere. Plot the variation of E with radial distance. **(08 Marks)**

b. Given that $D = \frac{5r^2}{4} a_r$ in spherical co-ordinates evaluate both sides of Divergence Theorem for the volume enclosed between r = 1m and r = 2m. **(08 Marks)**

OR

4 a. Find the work done in moving a 5μc point charge from origin to $p(2, -1, 4)$ through $E = 2xyz\, a_x + x^2 z\, a_y + x^2 y\, a_z$ v/m via the path

i) Straight line segment (0, 0, 0) to (2, 0, 0) to $(2, -1, 0)$ to $(2, -1, 4)$

ii) Straight line $x = -2y$, $z = 2x$. **(10 Marks)**

b. Given potential function $V = 50x^2yz + 20y^2$ V in free space find

i) Voltage at p(1, 2, -3)

ii) E at P

iii) a_N at P **(06 Marks)**

Module-3

5 a. Using Laplace Equation derive the expression for capacitance of co-axial cylindrical capacitor. Assume the potential is a function of 'ρ' only. The boundary condition are $V = 0$ at $\rho = b$ and $V = V_0$ at $\rho = a$ $(b > a)$ **(08 Marks)**

b. Conducting planes at $\phi = 10°$ and $\phi = 0°$ in cylindrical co-ordinates have voltages of 75V and 0 V respectively. Obtain the expression for Electric flux density 'D' in the region between the planes which contains a material for which $E_r = 1.65$. **(08 Marks)**

OR

6 a. Using Biot - Savart's law derive an expression for magnetic field intensity 'H' due to an infinite current carrying conductor at any point P. **(08 Marks)**

b. In cylindrical co-ordinates magnetic field $H = (2\rho - \rho^2)\, a\phi$ A/m. for $0 \le \rho \le I$.
   i) Determine current density 'J'
   ii) What total current passes through a surface $z = 0, 0 \le \rho \le 1$. **(08 Marks)**

Module-4

7 a. Derive Lorentz force equation for a moving charge in both electric and magnetic fields. **(04 Marks)**

b. The point charge Q = 18nc has a velocity of 5×10^6 m/s in the direction $q_v = 0.60\, a_x + 0.75\, a_y + 0.30 a_z$. Calculate magnetic force exerted on the charge by
   i) $B = -3ax + 4ay + 6az$ MT
   ii) $E = -3ax + 4ay + 6az$ KV/m **(06 Marks)**

c. The magnetization in a magnetic material for which $\chi_m = 8$ is given in a certain region as $150z^2\, a_x$ A/m. At z = 4cm, find the magnitude of J and J_b. **(06 Marks)**

OR

8 a. Derive the expression for boundary conditions for magnetic flux density B, magnetic field intensity H and magnetization M for both normal and tangential field. **(08 Marks)**

b. Let $\mu_1 = 5\ \mu$H/m in region A where $x < 0$ and $\mu_2 = 20\mu$H/m in region B where $x > 0$. If there is a surface current density $K = 150\ a_y - 200\ a_z$ A/m at $x = 0$ and if $H_A = 300\ a_x - 400 a_y + 500 a_z$ A/m find (i) $|H_{tA}|$ (ii) $|H_{NA}|$ (iii) $|H_{tB}|$ (iv) $|H_{NB}|$ **(08 Marks)**

Module-5

9 a. What was the inconsistency of Ampere's law with continuity equation? How was it modified by Maxwell? **(06 Marks)**

b. Show that the displacement current in the dielectric of parallel plate capacitor is equal to conduction current between the two plates. **(04 Marks)**

c. Given $E = E_m \sin(wt - \beta z)\, a_y$ V/m in free space find, D, B and H. **(06 Marks)**

OR

10 a. Show that the intrinsic impedance defined as $\eta = \frac{|E|}{|H|}$ is equal to $\sqrt{\frac{\mu}{\epsilon}}$ for a perfect dielectric and hence prove that for free space $\eta = 377\Omega$. **(08 Marks)**

b. A wave propagation in a lossless dielectric has the components
   $E = 500 \cos(10^7 t - \beta z)\, a_x$ V/m
   $H = 1.1 \cos(10^7 t - \beta z)\, a_y$ A/m
   If the wave is travelling at $v = 0.5C$, where 'C' is velocity of light in free space find μ_r, ϵ_r, β, λ. **(08 Marks)**

CBCS SCHEME

USN

15MATDIP31

Third Semester B.E. Degree Examination, June/July 2019
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 80

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. Express the complex number $\frac{(1+i)(1+3i)}{1+5i}$ in the form a + ib. **(05 Marks)**

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

c. Show that $(a+ib)^n+(a-ib)^n = 2(a^2+b^2)^{n/2}\cos\left(n\tan^{-1}\left(\frac{b}{a}\right)\right)$ **(06 Marks)**

OR

2 a. If $\vec{A} = i-2j+3k$ and $\vec{B} = 2i+j+k$, find the unit vector perpendicular to both $\vec{A}$ and $\vec{B}$. **(05 Marks)**

b. Show that the points $-6i+3j+2k$, $3i-2j+4k$, $5i+7j+3k$ and $-13i+17j-k$ are coplan. **(05 Marks)**

c. Prove that $\left[\vec{B}\times\vec{C},\ \vec{C}\times\vec{A},\ \vec{A}\times\vec{B}\right] = \left[\vec{A}\,\vec{B}\,\vec{C}\right]^2$ **(06 Marks)**

Module-2

3 a. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$. **(05 Marks)**

b. Find the angle of intersection of the curves $r = a(1+\cos\theta)$ and $r = b(1-\cos\theta)$. **(05 Marks)**

c. Obtain the Maclourin series expansion of the function sin x upto the term containing x^4. **(06 Marks)**

OR

4 a. Show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y} = 2u\log u$ where $\log u = \frac{x^3+y^3}{3x+4y}$. **(05 Marks)**

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

c. If $u = x+3y^2-z^3$, $v = 4x^2yz$, $w = 2z^2-xy$, evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at (1, −1, 0). **(06 Marks)**

Module-3

5 a. Obtain the reduction formula for $\int \sin^n x\,dx$. Hence evaluate $\int_0^{\pi/2}\sin^n x\,dx$. **(05 Marks)**

b. Evaluate $\int_0^{\infty}\frac{x^6}{(1+x^2)^7}dx$. **(05 Marks)**

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

OR

6 a. Evaluate $\int_0^{2a}\int_0^{x^2/4a} xy\,dy\,dx$. **(05 Marks)**

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

c. Evaluate $\int_0^a \frac{x^7 dx}{\sqrt{a^2-x^2}}$ by using reduction formula. **(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 velocity and acceleration at t = 1 in the direction of $i+j+3k$. **(05 Marks)**

b. Find $\operatorname{div}\vec{F}$ and $\operatorname{curl}\vec{F}$ where $\vec{F} = \operatorname{grad}(x^3+y^3+z^3-3xyz)$. **(05 Marks)**

c. Prove that $\operatorname{div}(\operatorname{curl}\vec{F}) = 0$. **(06 Marks)**

OR

8 a. Find the directional derivative of $f(x,y,z) = xy^3+yz^3$ at (2, −1, 1) in the direction of $i+2j+2k$. **(08 Marks)**

b. Prove that $\nabla^2\left(\frac{1}{r}\right) = 0$ where $r = \sqrt{x^2+y^2+z^2}$. **(08 Marks)**

Module-5

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

b. Solve $\left[y\left(1+\frac{1}{x}\right)+\cos y\right]dx + (x+\log x - x\sin y)dy = 0$. **(05 Marks)**

c. Solve $\frac{dy}{dx} - \frac{y}{1+x} = e^{3x}(x+1)$. **(06 Marks)**

OR

10 a. Solve $(xy^3+y)dx + 2(x^2y^2+x+y^4)dy = 0$. **(08 Marks)**

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

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