CBCS SCHEME

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15MAT31

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Engineering Mathematics - III

Time: 3 hrs. Max. Marks: 80

Note: ***Answer 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. An alternating current after passing through a rectifier has the form,
$$I = \begin{cases} I_0 \sin x & \text{for } 0 < x < \pi \\ 0 & \text{for } \pi < x < 2\pi \end{cases}$$
where I_0 is the maximum current and the period is 2π. Express I as a Fourier series. **(08 Marks)**

b. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data: **(08 Marks)**

x^0	0	45	90	135	180	225	270	315
y	2	1.5	1	0.5	0	0.5	1	1.5

OR

2 a. Obtain the Fourier series expansion of the function, $f(x) = |x|$ in $(-\pi, \pi)$ and hence deduce that,
$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$$
(06 Marks)

b. Find the Fourier series expansion of the function,
$$f(x) = \begin{cases} \pi x & \text{in } 0 \le x \le 1 \\ \pi(2-x) & \text{in } 1 \le x \le 2 \end{cases}$$
(05 Marks)

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

t(sec)	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
A(amplitude)	1.98	1.30	1.05	1.3	−0.88	−0.25	1.98

Show by harmonic analysis that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic. **(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. Find the Fourier sine transform of $\frac{e^{-ax}}{x}$. **(05 Marks)**

c. Compute the inverse z-transforms of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$. **(05 Marks)**

OR

4 a. Find the z-transform of $e^{-an}n + \sin n\frac{\pi}{4}$. **(06 Marks)**

b. Solve $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using z-transform. **(05 Marks)**

c. Find the Fourier cosine transform of, $f(x) = \begin{cases} 4x & 0 < x < 1 \\ 4 - x & 1 < x < 4 \\ 0 & x > 4 \end{cases}$. **(05 Marks)**

Module-3

5 a. Find the Correlation coefficient and equations of regression lines for the following data:

x	1	2	3	4	5
y	2	5	3	8	7

(06 Marks)

b. Fit a straight line to the following data:

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

(05 Marks)

c. Find a real root of the equation $xe^x = \cos x$ correct to three decimal places that lies between 0.5 and 0.6 using Regula-falsi method. **(05 Marks)**

OR

6 a. The following regression equations were obtained from a correlation table.

$y = 0.516x + 33.73$

$x = 0.516y + 32.52$

Find the value of (i) Correlation coefficient (ii) Mean of x's (iii) Mean of y's. **(06 Marks)**

b. Fit a second degree parabola to the following data:

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

(05 Marks)

c. Use Newton-Raphson's method to find a real root of $x\sin x + \cos x = 0$ near $x = \pi$, carry out three iterations. **(05 Marks)**

Module-4

7 a. The following data gives the melting point of an alloy of lead and zinc, where t is the temperature in °C and P is the percentage of lead in the alloy:

P%	60	70	80	90
t	226	250	276	304

Find the melting point of the alloy containing 84% of lead, using Newton's interpolation formula. **(06 Marks)**

b. Apply Lagrange's interpolation formula to find a polynomial which passes through the points $(0, -20)$, $(1, -12)$, $(3, -20)$ and $(4, -24)$ **(05 Marks)**

c. Find the approximate value of $\int_0^{\pi/2} \sqrt{\cos\theta}\, d\theta$ by Simpson's $\frac{3}{8}^{th}$ rule by dividing it into 6 equal parts. **(05 Marks)**

OR

8 a. From the following table :

x°	10	20	30	40	50	60
$\cos x$	0.9848	0.9397	0.8660	0.7660	0.6428	0.5

Calculate $\cos 25^\circ$ using Newton's forward interpolation formula. **(06 Marks)**

b. Use Newton's divided difference formula and find f(6) from the following data:

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

(05 Marks)

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

Module-5

9 a. Find the area between the parabolas $y^2 = 4x$ and $x^2 = 4y$ with the help of Green's theorem in a plane. **(06 Marks)**

b. Solve the variational problem $\delta\int_0^1 (12xy + y'^2)dx = 0$ under the conditions y(0) = 3, y(1) = 6. **(05 Marks)**

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

OR

10 a. A cable hangs freely under gravity from the fixed points. Show that the shape of the curve is a catenary. **(06 Marks)**

b. Use Stoke's theorem to evaluate for $\vec{F} = (x^2 + y^2)i - 2xyj$ taken around the rectangle bounded by the lines $x = \pm a$, $y = 0$, $y = b$. **(05 Marks)**

c. Evaluate $\iint_S (yzi + zxj + xyk).\hat{n}ds$ where S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$ in the first octant. **(05 Marks)**

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15EC32

Third Semester B.E. Degree Examination, Dec.2018/Jan.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. Define h parameters using two port systems. **(05 Marks)**

b. Derive expressions for input impedance, output impedance and voltage gain for common emitter fixed bias configuration using re model. **(07 Marks)**

c. Find Z_i, Z_o, A_v and A_i for the network shown in Fig.Q.1(c). Given data $h_{fb} = -0.99$, $h_{ib} = 14.3\Omega$, $h_{ob} = 0.5\ \mu A/v$. **(04 Marks)**

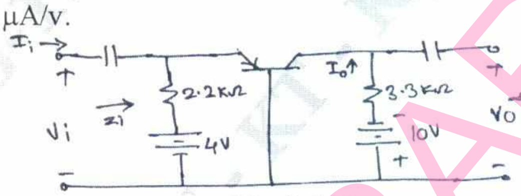

Fig.Q.1(c)

OR

2 a. Explain hybrid π model. **(04 Marks)**

b. Find r_e, Z_i, Z_o and A_v for the circuit shown in Fig.Q.2(b). Given data $B = 90$, $r_o = 50k\Omega$. **(05 Marks)**

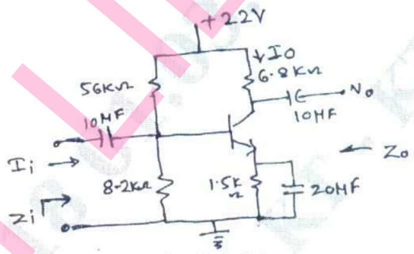

Fig.Q.2(b)

c. Derive the expressions for Z_i, Z_o, A_v and A_i for fixed bias configuration using approximate Cε hybrid equivalent model. **(07 Marks)**

Module-2

3 a. List the differences between JFET and MOSFET. **(04 Marks)**

b. Explain with neat sketches, operation and characteristics of n-channel E-MOSFET. **(08 Marks)**

c. Find: i) input impedance ii) output impedance iii) voltage gain for the circuit shown in Fig.Q.3(c). Given data $g_m = 2ms$, $r_d = 50K\Omega$. **(04 Marks)**

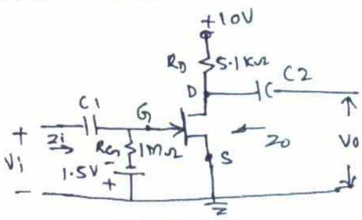

Fig.Q.3(c)

OR

4 a. Find transconductance and drain current for the JFET if I_{DSS} = 20mA, V_P = -5V, V_{GS} = -4V and gmo = 4ms. **(04 Marks)**

b. Derive an expressions for Z_i, Z_o and A_v using small signal JFET amplifier under fixed bias configuration. **(07 Marks)**

c. Sketch the following circuit diagrams:
   i) JFET ac equivalent model of source follower
   ii) Cascaded FET amplifier. **(05 Marks)**

Module-3

5 a. An amplifier rated at a 40W output is connected to a 10Ω speaker, Find:
   i) Input power required for full output if power gain is 25dB
   ii) Input voltage for rated output if the amplifier voltage gain is 40dB. **(04 Marks)**

b. Explain high frequency response of FET amplifier. **(07 Marks)**

c. Explain multistage frequency effects. **(05 Marks)**

OR

6 a. Derive an expressions for Miller input and output capacitor. **(06 Marks)**

b. Determine A_V, Z_i and A_{vs} for the law frequency response of the BJT amplier circuit shown in Fig.Q.6(b). Assume $r_0 = \infty$. **(06 Marks)**

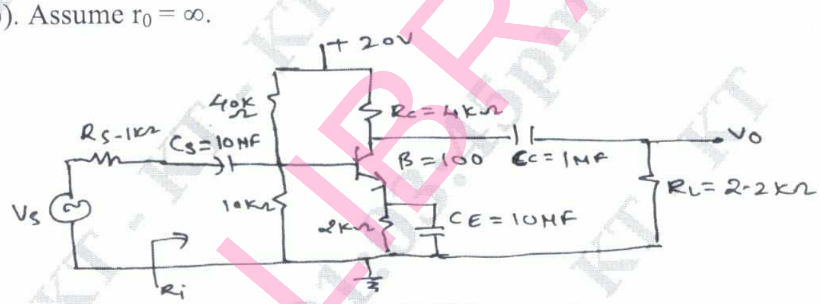

Fig.Q.6(b)

c. Draw the circuit diagram of high frequency response of BJT amplifier under CE mode with capacitances. **(04 Marks)**

Module-4

7 a. List the conditions for sustained oscillations. **(04 Marks)**

b. Determine the voltage gain, input impedance and output impedance with feedback for series voltage feedback having A = -100, R_i = 10KΩ and R_o = 20KΩ for feedback factor β = -0.1. **(05 Marks)**

c. Explain with neat circuit diagram the operation of colpit oscillator. **(07 Marks)**

OR

8 a. Show that gain with feedback in voltage series feedback system reduced by a factor (1 + AB). **(05 Marks)**

b. Explain the operation of FET RC phase oscillator with neat circuit diagram. **(06 Marks)**

c. Design the RC elements of a Wein bridge oscillator for the operation at f = 10kHz and draw the oscillator circuit diagram. **(05 Marks)**

Module-5

9 a. Define class A, class B, class C and class D power amplifiers. **(04 Marks)**

b. Calculate the output voltage and the zener current for the regulator shown in Fig.Q9(b) for $R_L = 1K\Omega$. **(04 Marks)**

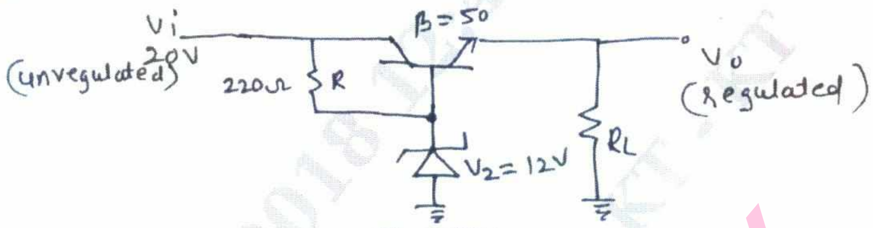

Fig.Q.9(b)

c. Explain with neat diagram and waveforms class B push pull power amplifier. **(08 Marks)**

OR

10 a. Compare the series and shunt voltage regulators. **(04 Marks)**

b. Define the following:
- i) Cross over distortion
- ii) Harmonic distortion
- iii) Percentage load regulation
- iv) Amplifiers efficiency **(04 Marks)**

c. Calculate input power, output power and efficiency of the series fed class A power amplifier circuit shown in Fig.Q10(c). **(08 Marks)**

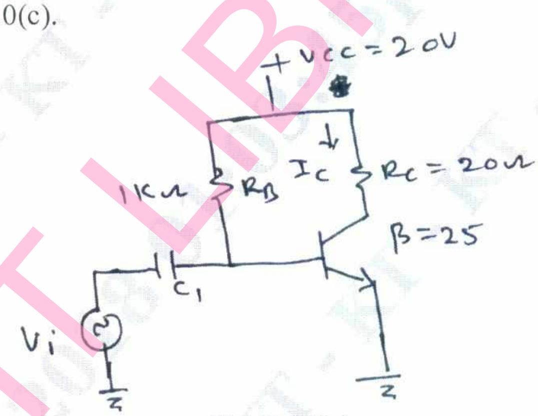

Fig.Q.10(c)

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15EC33

Third Semester B.E. Degree Examination, Dec.2018/Jan.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. Define combinational logic. Design a combinational circuit which takes two, 2 bit binary numbers as its input and generates an output equal to 1, when the sum of the two numbers is even. **(10 Marks)**

b. Simplify using Karnaugh map. Write the Boolean equation and realize using NAND gates. $D = f(w, x, y, z) = \Sigma m(0, 2, 4, 6, 8) + \Sigma d(10, 11, 12, 13, 14, 15)$. **(06 Marks)**

OR

2 a. Define canonical SOP and canonical POS. Expand $f = (\bar{a} + b + \bar{c})(a + c + \bar{d})$ into canonical POS. **(04 Marks)**

b. Solve using Quine-McCluskey tabulation method,
$f(a, b, c, d) = \Sigma m(0, 1, 4, 5, 9, 10, 12, 14, 15) + \Sigma\phi(2, 8, 13)$
Obtain the minimal form of the given function. Verify the result using k–map. **(12 Marks)**

Module-2

3 a. Define decoder. Implement full subtractor using a decodes. Write the truth table. **(08 Marks)**

b. Compare ripple carry adder and look ahead carry adder. Explain the circuit and operation of a 4 bit binary adder with look ahead carry. **(08 Marks)**

OR

4 a. Design and implement one bit comparator. **(04 Marks)**

b. Implement the multiple functions :
$f_1(a, b, c, d) = \Sigma(0, 4, 8, 10, 14, 15)$ and
$f_2(a, b, c, d) = \Sigma(3, 7, 9, 13)$
using two 3 to 8 decoders, i.e. 74138 ICs. **(06 Marks)**

c. Implement full adder circuit using 8 : 1 multiplexer. **(06 Marks)**

Module-3

5 a. What is gated SR Latch? Explain the operation of gated SR Latch, with a logic diagram, truth table and logic symbol. **(08 Marks)**

b. Derive the characteristic equation of SR, JK, D and T flip-flops with the help of function tables. **(08 Marks)**

OR

6 a. Explain the operation of a switch debouncer built using SR Latch. Draw the supporting waveforms. **(04 Marks)**

b. Explain 0s and 1s catching problem of Master Slave JK flip flop with waveform. Suggest the solution for this problem. **(04 Marks)**

c. What is edge triggered flip flop? With a neat circuit diagram, explain the operation of positive edge triggered D flip flop, using NAND gates. **(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. With the help of neat diagram, explain PISO and PIPO operation of unidirectional shift registers. **(08 Marks)**

b. Design a 4 bit binary ripple 'UP' counter using negative edge triggered JK flip flop. Show the up counter execution with the help of timing diagram. **(08 Marks)**

OR

8 a. Implement a Mod 8 twisted ring counter using D flip flops. Give the counting sequence and decoding gate inputs. **(06 Marks)**

b. Design a synchronous MOD-6 counter using JK flip flop for the following count sequence 0, 2, 3, 6, 5, 1 and repeat. Write the transition table, logic equations and the counter implementation diagram. **(10 Marks)**

Module-5

9 a. Compare Mealy and Moore sequential circuit models with suitable example. **(04 Marks)**

b. For the logic diagram shown in Fig.Q9(b), write the state and output equations. Give the transition table and the state diagram. **(12 Marks)**

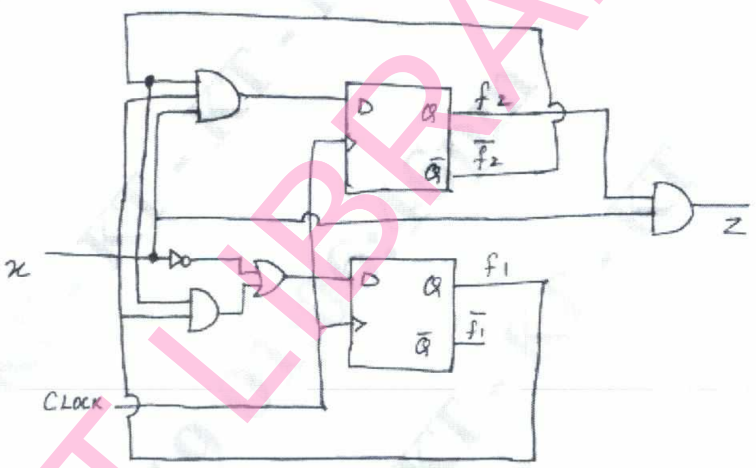

Fig.Q9(b)

OR

10 a. Write the basic recommended steps for the design of a clocked synchronous sequential circuit. **(06 Marks)**

b. How to convert a Mealy machine to a Moore machine? **(02 Marks)**

c. A sequential circuit has one input and one output. The state diagram is shown in Fig.Q10(c). Design a sequential circuit using D flip flop. **(08 Marks)**

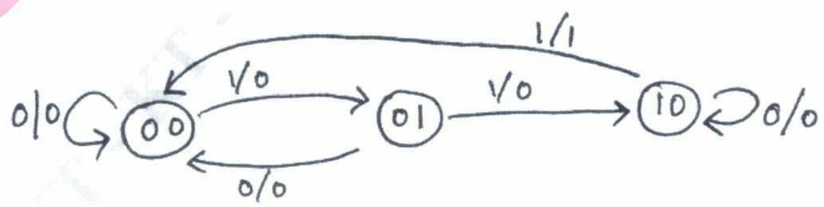

Fig.Q10(c)

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OR

6 a. State and prove the following : i) Initial value theorem ii) Final value theorem. **(08 Marks)**

b. For the waveform shown in Fig.Q6(b), the equation of the waveforms is Sin(t) from 0 to π, and $-\sin(t)$ from π to 2π, show that the Laplace transform of this waveform is :

$$F(s)=\frac{1}{s^2+1}\cot h\left(\frac{\pi S}{2}\right).$$ **(08 Marks)**

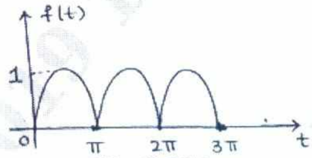

Fig.Q6(b)

Module-4

7 a. Define the following terms :
i) Resonance ii) Bandwidth. **(02 Marks)**

b. Prove that $f_0=\sqrt{f_1 f_2}$ where f_1 and f_2 are the two half power frequencies of a resonant circuits. **(06 Marks)**

c. A series RLC circuit has R = 2Ω, L = 2 mH and C = 10μf calculate Q–factor, bandwidth, Resonant frequency and half power frequencies f_1 and f_2. **(08 Marks**

OR

8 a. Show that a two-branch parallel circuit is resonant at all frequencies if $R_L=R_C=\sqrt{\frac{L}{C}}$. **(08 Marks)**

b. Find the values of L for which the circuit given in Fig.Q8(b) resonates at w = 5000 r/sec. **(08 Marks)**

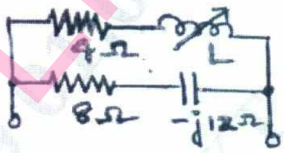

Fig.Q8(b)

Module-5

9 a. Express Z – parameters interms of Y-parameters. **(08 Marks)**

b. Obtain ABCD parameters interms of impedance parameters (Z) and hence show that AD–BC = 1. **(08 Marks)**

OR

10 a. For the network shown in Fig.Q10(a), contains an voltage controlled source and current controlled source, for the elemental values specified, determine Z and Y parameters. **(08 Marks)**

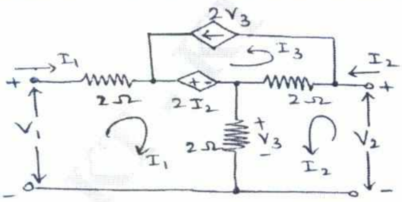

Fig.Q10(a)

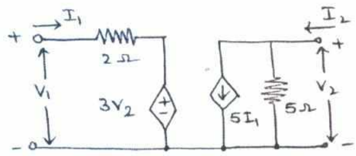

Fig.Q10(b)

b. Determine transmission parameters for the network shown in Fig.Q10(b). **(08 Marks)**

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CBCS SCHEME

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Third Semester B.E. Degree Examination, Dec.2018/Jan.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. Define the following :
i) Accuracy ii) precision iii) sensitivity iv) resolution. **(08 Marks)**

b. Calculate the value of shunt resistance if 5mA meter movement with an internal resistance of 500Ω is to be converted into a 0–500mA. **(04 Marks)**

c. What are the factors to be considered in choosing an analog voltmeter. **(04 Marks)**

OR

2 a. For the following given data calculate :
i) Arithmetic mean
ii) Deviation of each value
iii) Average deviation
iv) Standard deviation. **(08 Marks)**

x_1	x_2	x_3	x_4	x_5
19.7	20.1	20.2	19.6	19.7

b. Define thermocouple instruments and brief about different types of thermocouples. **(08 Marks)**

Module-2

3 a. Explain the operating principle of ramp type DVM with relevant diagrams. **(08 Marks)**

b. With a neat block diagram, explain the operation of a basic digital multimeter. **(08 Marks)**

OR

4 a. A $4\frac{1}{2}$ digit voltmeter is used for voltage measurement :
i) Find its resolution
ii) How would 12.98V be displaced on a 10V range
iii) How would 0.6973V be displaced on 1V and 10V range. **(04 Marks)**

b. Explain the operation of digital phase meter with a neat sketch. **(08 Marks)**

c. Indicate the outstanding qualities/characteristics of a DVM. **(04 Marks)**

Module-3

5 a. With a neat block diagram, describe the working of each stage of CRO. **(08 Marks)**

b. What are the requirements of a pulse? **(04 Marks)**

c. Describe the operation of standard signal generator. **(04 Marks)**

OR

6 a. Explain the operation of digital storage oscilloscope with a neat block diagram. **(08 Marks)**
b. With a neat block diagram, explain the operation of function generator. **(08 Marks)**

Module-4

7 a. Explain in details the working of Megger. State it applications. **(08 Marks)**
b. Explain and derive expression for Maxwell's bridge. If bridge constants are $C_1 = 0.5\mu F$, $R_1 = 1200\Omega$, $R_2 = 700\Omega$, $R_3 = 300\Omega$. Find the resistance and inductance of coil. **(08 Marks)**

OR

8 a. Describe the working principle of an output power meter with a neat sketch. **(08 Marks)**
b. Find the equivalent parallel resistance and capacitance that causes a Wein's bridge to null with the following values. $R_1 = 2.7K\Omega$, $C_1 = 5\mu F$, $R_2 = 22K\Omega$, $R_4 = 100K\Omega$ with $f = 2.2KHz$. **(08 Marks)**

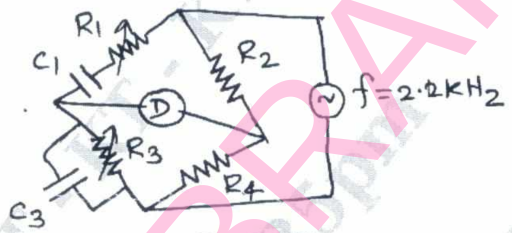

Fig.Q8(b)

Module-5

9 a. Define Gauge factor and prove that $K = 1 + 2\mu$. **(10 Marks)**
b. Explain the operation of semiconductor photo diode and photo transistor. **(06 Marks)**

OR

10 a. List the factors to be considered while selecting a transducer for given application. **(04 Marks)**
b. A displacement transducer with a shaft stroke of 3.0 inch is applied to the circuit. The total resistance of the pot is 5KΩ. The applied voltage V_t is 5V. When the Wipor is 0.9 inch from B, what is the value of the output voltage? **(04 Marks)**
c. Explain the construction and operation of a LVDT with a neat sketch. **(08 Marks)**

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CBCS SCHEME

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15EC36

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

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. State and explain Coulomb's law. **(04 Marks)**

b. A charge Q_A = -20 μc is located $A(-6, 4, 7)_m$ and Q_B = 50 μc at $B(5, 8, -2)_m$ in free space. Find the force exerted on Q_A by Q_B? **(05 Marks)**

c. Define electric field intensity and electric flux density. **(03 Marks)**

d. Calculate the total charge within the volume
$0 \le \rho \le 0.1$, $0 \le \phi \le \pi$, $2 \le z \le 4$, $\rho_v = \rho^2 z^2 \sin 0.6\phi$ **(04 Marks)**

OR

2 a. Obtain an expression for electric field due to infinite line charge. **(06 Marks)**

b. A charge of – 0.3μc is located at A(– 25, 30, 15)cm and a second charge of 0.5 μc is at B(–10, 8, 12)cm. Find E at the origin. **(06 Marks)**

c. A uniform line charge of 2 μc/m is located on the z-axis. Find E in rectangular coordinates at P(1, 2, 3) if the charge exists from $-\infty < z < \infty$. **(04 Marks)**

Module-2

3 a. State and prove Gauss law and derive first Maxwell's equations from it. **(05 Marks)**

b. Given a 60 μc point charge located at the origin. Find the total electric flux passing through the closed surface defined by ρ = 26 cm and z = ± 26 cm. **(04 Marks)**

c. State and prove the Divergence theorem. **(05 Marks)**

d. Given the electric flux density $D = 0.3r^2\,\hat{a}_r$ nc/m² in free space. Find E at the point P(r = 2, θ = 25°, ϕ = 90°). **(02 Marks)**

OR

4 a. Prove that the work done in moving a charge in the electric field is

$$W = -Q\int_{\text{initial}}^{\text{final}} E.dl$$ **(06 Marks)**

b. Calculate the work done in moving a 4C charge from B(1, 0, 0) to A(0, 2, 0) along the path y = 2 – 2x , τ = 0 in the field $E = (5x\,a_x + 5y\,a_y)$ V/m. **(05 Marks)**

c. Show that $\nabla \cdot J = -\dfrac{\partial \rho_v}{\partial t}$ with usual notations. **(05 Marks)**

Module-3

5 a. Starting from Gauss law, derive Poisson's and Laplace's equations. **(04 Marks)**

b. Calculate ρ_v at point P in free space, if $V = 5\rho^2 \cos 2\phi$ at P(3, π/3, 2) **(06 Marks)**

c. State uniqueness theorem. **(02 Marks)**

d. By using Laplace's equation, derive an expression for the capacitance of a parallel plate capacitor. **(04 Marks)**

OR

6 a. State and explain Biot-Savart's law. **(04 Marks)**

b. By using Ampere's law, derive an expression for $\overline{H}$, magnetic field intensity due to a coaxial cable. **(06 Marks)**

c. Evaluate both sides of Stokes theorem for the field, $H = \left(6ay\hat{a}_x - 3y^2a_y\right)$ 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 ds be a_z. **(06 Marks)**

Module-4

7 a. The field $B = (-2a_x + 3a_y + 4\hat{a}_z)$mT is present in free space. Find the vector force exerted on a straight wire carrying a current of 12A in the a_{AB} direction. Given A(1, 1, 1,) and B(2, 1, 1). **(04 Marks)**

b. Two differential current elements, $I_1\Delta L_1 = 3\times10^{-6}$ A-m at $P_1(1, 0, 0)$ and $I_2\Delta L_2 = 3\times10^{-6}\left(-0.5\hat{a}_x + 0.4\hat{a}_y + 0.3\hat{a}_z\right)$A-m at $P_2(2, 2, 2)$ are located in free space. Find the vector force exerted on $I_2\Delta L_2$ by $I_1\Delta L_1$. **(06 Marks)**

c. Find the magnetization in a magnetic material where

(i) $\mu = 1.8\times10^{-5}$ H/m and H = 120 A/m

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

(iii) $B = 300\ \mu T \times \chi_m = 15$. **(06 Marks)**

OR

8 a. Derive the Magnetic Boundary Condition? **(06 Marks)**

b. Let the permittivity is 5 μH/m in the region 1 where x < 0 and 20 μH/m in the region 2 where x > 0, and if $H = \left(300a_x - 400a_y + 500\hat{a}_z\right)$ A/m and if there is a surface current density $K = \left(150\hat{a}_y - 200\hat{a}_z\right)$A/m at x = 0.

Find (i) $|H_{t_1}|$ (ii) $|H_{N_1}|$ (iii) $|H_{t_2}|$ (ii) $|H_{N_2}|$ **(06 Marks)**

c. Derive the expression for the energy density in a magnetic field? **(04 Marks)**

Module-5

9 a. State Faraday's laws of electromagnetic induction. Further derive Maxwell's equation from it. **(04 Marks)**

b. Find the amplitude of the displacement current density due to an automobile antenna where the magnetic field intensity of an FM signal is $H_x = 0.15\cos[3.12(3\times10^8t - y)]$ A/m. **(06 Marks)**

c. State Maxwell's equation in both Point form and in Integral form. **(06 Marks)**

OR

10 a. Derive the wave equation in one dimension for an EM wave travelling in free space. **(06 Marks)**

b. The electric field amplitude of the uniform plane wave in the a_z direction is 250 V/m. If $E = E_xa_x$ and ω = 1.00 Mrad/s, find (i) the frequency (ii) the wavelength (iii) the period (iv) the amplitude of H. **(04 Marks)**

c. State and prove Poynting's theorem. **(06 Marks)**

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CBCS SCHEME

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15MATDIP31

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Find the modulus and amplitude of $\dfrac{(3-\sqrt{2}i)^2}{1+2i}$. **(06 Marks)**

b. Find the cube root of $(1-i)$. **(05 Marks)**

c. Prove that $\left(\dfrac{1+\sin\theta+i\cos\theta}{1+\sin\theta-i\cos\theta}\right)^n = \cos\left(n\dfrac{\pi}{2}-n\theta\right)+i\sin\left(n\dfrac{\pi}{2}-n\theta\right)$. **(05 Marks)**

OR

2 a. For any three vector a, b, c show that
$$\left[\vec{a}+\vec{b},\ \vec{b}+\vec{c},\ \vec{c}+\vec{a}\right] = 2\left[\vec{a}\,\vec{b}\,\vec{c}\right]$$ **(06 Marks)**

b. Find the value of λ so that the vectors $\vec{a}=2\hat{i}-3\hat{j}+\hat{k}$, $\vec{b}=\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{c}=\hat{j}+\lambda\hat{k}$ are coplanar. **(05 Marks)**

c. 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)**

Module-2

3 a. Find the n^{th} derivative of $\cos x\cos 2x\cos 3x$. **(06 Marks)**

b. If $y=a\cos(\log x)+b\sin(\log x)$, prove that $x^2y_{n+2}+(2n+1)xy_{n+1}+(n^2+1)y_n=0$. **(05 Marks)**

c. Find the angle between the radius vector and tangents for the curve $r^2\cos 2\theta = a^2$ **(05 Marks)**

OR

4 a. If $u=e^{ax+by}+(ax-by)$ prove that $b\dfrac{\partial u}{\partial x}+a\dfrac{\partial u}{\partial y}=2abu$. **(06 Marks)**

b. If $u=\sin^{-1}\left(\dfrac{x^2+y^2}{x-y}\right)$ prove that $x\dfrac{\partial u}{\partial x}+y\dfrac{\partial u}{\partial y}=\tan u$. **(05 Marks)**

c. If $x=u(1-v)$, $y=uv$. Find $\dfrac{\partial(x,y)}{\partial(u,v)}$. **(05 Marks)**

Module-3

5 a. Obtain the reduction formula for $\displaystyle\int_0^{\pi/2}\cos^n x\,dx$ (n>0). **(06 Marks)**

b. Evaluate $\displaystyle\int_0^1 x^6\sqrt{1-x^2}\,dx$. **(05 Marks)**

c. Evaluate $\displaystyle\int_0^1\int_0^1\int_0^y xyz\,dx\,dy\,dz$. **(05 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.

OR

6 a. Obtain the reduction formula for $\int_0^{\frac{\pi}{2}} \sin^n x dx$, $n > 0$. **(06 Marks)**

b. Evaluate $\int_0^a x^2(a^2 - x^2)^{\frac{3}{2}} dx$. **(05 Marks)**

c. Evaluate $\int_0^1 \int_0^{\sqrt{x}} xy dy dx$. **(05 Marks)**

Module-4

7 a. A particle moves along a curve $x = e^{-t}$, $y = 2\cos 3t$, $z = 2\sin 3t$ where t is the time. Determine the component of velocity and acceleration vector at t = 0 in the direction of $\hat{i} + \hat{j} + \hat{k}$. **(08 Marks)**

b. Find the value of the constant a, b, such that $\vec{F} = (axy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (bxz^2 - y)\hat{k}$ is irrotational. **(08 Marks)**

OR

8 a. 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)**

b. If $\phi(x, y, z) = x^3 + y^3 + z^3 - 3xyz$ find $\nabla\phi$ at (1, −1, 2). **(05 Marks)**

c. Find the directional derivative $\phi(x, y, z) = x^2yz + 4xz^2$ at (1,−2,−1) in the direction of $2\hat{i} - \hat{j} - 2\hat{k}$. **(05 Marks)**

Module-5

9 a. Solve $\frac{dy}{dx} = \frac{y}{x - \sqrt{xy}}$. **(06 Marks)**

b. Solve $ye^{xy}dx + (xe^{xy} + 2y)dy = 0$ **(05 Marks)**

c. $\frac{dy}{dx} - \frac{2y}{x} = x + x^2$. **(05 Marks)**

OR

10 a. Solve $\frac{dy}{dx} = \frac{y}{x} + \sin\left(\frac{y}{x}\right)$. **(06 Marks)**

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

c. Solve $(1 + y^2)dx + (x - \tan^{-1} y)dy = 0$ **(05 Marks)**

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