III EC. EF (S)

CBCS Scheme

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15MAT31

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Express $f(x)=(\pi-x)^2$ as a Fourier series of period 2π in the interval $0<x<2\pi$. Hence deduce the sum of the series $1+\frac{1}{2^2}+\frac{1}{3^2}+.....$ **(08 Marks)**

b. The turning moment T units of the Crank shaft of a steam engine is a series of values of the crank angle θ in degrees. Find the first four terms in a series of sines to represent T. Also calculate T when $\theta = 75^\circ$. **(08 Marks)**

θ:	0°	30°	60°	90°	120°	150°	180°
T:	0	5224	8097	7850	5499	2626	0

OR

2 a. Find the Fourier Series expansion of the periodic function,

$$f(x)=\begin{cases} l+x, & -l\le x\le 0 \\ l-x, & 0\le x\le l \end{cases}.$$ **(06 Marks)**

b. Obtain a half-range cosine series for $f(x)=x^2$ in $(0, \pi)$. **(05 Marks)**

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

t sec:	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$
A amp:	1.98	1.30	1.05	1.30	-0.88	-0.25

Show that there is a direct current part 0.75 amp in the variable current and obtain the amplitude of the first harmonic. **(05 Marks)**

Module-2

3 a. Find the Fourier transform of $f(x)=\begin{cases} 1 & \text{for } |x|<1 \\ 0 & \text{for } |x|>1 \end{cases}$ and evaluate $\int_0^\infty \left(\frac{\sin x}{x}\right)dx$ **(06 Marks)**

b. Find the Fourier cosine transform of, $f(x)=\begin{cases} x & \text{for } 0<x<1 \\ 2-x & \text{for } 1<x<2 \\ 0 & \text{for } x>2 \end{cases}$. **(05 Marks)**

c. Obtain the inverse Z-transform of the following function, $\frac{z}{(z-2)(z-3)}$. **(05 Marks)**

OR

4 a. Find the Z-transform of $\cos\left(\frac{n\pi}{2}+\alpha\right)$. **(06 Marks)**

b. Solve $u_{n+2}-5u_{n+1}+6u_n=36$ with $u_0=u_1=0$, using Z-transforms. **(05 Marks)**

c. If Fourier sine transform of f(x) is $\frac{e^{-a\alpha}}{\alpha}$, $\alpha\neq 0$. Find f(x) and hence obtain the inverse Fourier sine transform of $\frac{1}{\alpha}$. **(05 Marks)**

Module-3

5 a. Calculate the Karl Pearson's co-efficient for the following ages of husbands and wives: **(06 Marks)**

Husband's age x:	23	27	28	28	29	30	31	33	35	36
Wife's age y:	18	20	22	27	21	29	27	29	28	29

b. By the method of least square, find the parabola $y = ax^2 + bx + c$ that best fits the following data: **(05 Marks)**

x:	10	12	15	23	20
y:	14	17	23	25	21

c. Using Newton-Raphson method, find the real root that lies near x = 4.5 of the equation $\tan x = x$ correct to four decimal places. (Here x is in radians). **(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 $\bar{x}$, $\bar{y}$ and the coefficient of correlation between x and y. **(06 Marks)**

b. Find the curve of best fit of the type $y = ae^{bx}$ to the following data by the method of least squares: **(05 Marks)**

x:	1	5	7	9	12
y:	10	15	12	15	21

c. Find the real root of the equation $xe^x - 3 = 0$ by Regula Falsi method, correct to three decimal places. **(05 Marks)**

Module-4

7 a. From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policies maturing at age of 46: **(06 Marks)**

Age:	45	50	55	60	65
Premium (in Rupees):	114.84	96.16	83.32	74.48	68.48

b. Using Newton's divided difference interpolation, find the polynomial of the given data: **(05 Marks)**

x	3	7	9	10
f(x)	168	120	72	63

c. Using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates. **(05 Marks)**

OR

8 a. Find the number of men getting wages below ₹ 35 from the following data: **(06 Marks)**

Wages in ₹ :	0 – 10	10 – 20	20 – 30	30 – 40
Frequency :	9	30	35	42

b. Find the polynomial f(x) by using Lagrange's formula from the following data: **(05 Marks)**

x:	0	1	2	5
f(x):	2	3	12	147

c. Compute the value of $\int_{0.2}^{1.4} (\sin x - \log_e x + e^x) dx$ using Simpson's $\left(\frac{3}{8}\right)^{th}$ rule. **(05 Marks)**

Module-5

9 a. A vector field is given by $\vec{F} = \sin y\,\hat{i} + x(1+\cos y)\hat{j}$. Evaluate the line integral over a circular path given by $x^2 + y^2 = a^2$, $z = 0$. **(06 Marks)**

b. If C is a simple closed curve in the xy-plane not enclosing the origin. Show that $\int_C \vec{F}.d\vec{R} = 0$, where $\vec{F} = \frac{y\hat{i} - x\hat{j}}{x^2 + y^2}$. **(05 Marks)**

c. Derive Euler's equation in the standard form viz., $\frac{\partial f}{\partial y} - \frac{d}{dx}\left[\frac{\partial f}{\partial y'}\right] = 0$. **(05 Marks)**

OR

10 a. Use Stoke's theorem to evaluate $\int_C \vec{F}.d\vec{R}$ where $\vec{F} = (2x - y)\hat{i} - yz^2\hat{j} - y^2z\hat{k}$ over the upper half surface of $x^2 + y^2 + z^2 = 1$, bounded by its projection on the xy-plane. **(06 Marks)**

b. Show that the geodesics on a plane are straight lines. **(05 Marks)**

c. Find the curves on which the functional $\int_0^1 \left((y')^2 + 12xy\right)dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremized. **(05 Marks)**

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CBCS Scheme

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15EC32

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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 input impedance, output impedance and voltage given for common emitter fixed bias configuration using re model. **(08 Marks)**

b. Draw the graphical symbol and hybrid equivalent model for CE and CB configuration. **(04 Marks)**

c. Calculate DC bias voltage and currents for the Darlington configuration shown in Fig.Q1(c). **(04 Marks)**

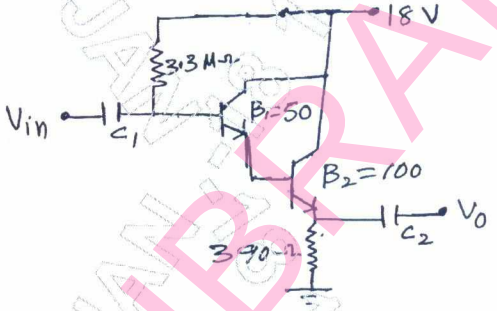

Fig.Q1(c)

OR

2 a. Derive the expression for Z_i, Z_0 and A_V for emitter–follower configuration using re-model. **(08 Marks)**

b. For the network shown in Fig.Q2(b), determine Z_i, Z_0, A_V and A_i. **(08 Marks)**

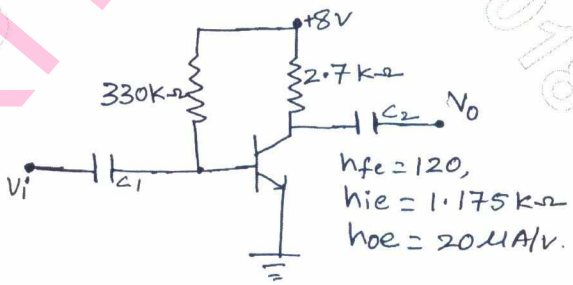

Fig.Q2(b)

Module-2

3 a. Explain the construction and working principle of n-channel JFET and draw the characteristics. **(06 Marks)**

b. Derive an expression for Z_i, Z_0 and A_V of FET self bias configuration with bypassed R_S. **(06 Marks)**

c. Distinguish between depletion type and enhancement type MOSFET. **(04 Marks)**

OR

4 a. Explain the construction and working principle of n-channel depletion type MOSFET and draw the characteristics curve. **(08 Marks)**

b. The source follower circuit shown in Fig,Q4(b) results in $V_{GSQ} = -2.86V$ and $I_{DQ} = 4.56mA$:

i) Determine g_m

ii) Determine Z_i and Z_0

iii) Determine A_V with r_d and without r_d

$I_{DSS} = 16mA$; $V_P = -4V$; $r_d = 40k\Omega$; $g_{OS} = 25\mu S$. **(08 Marks)**

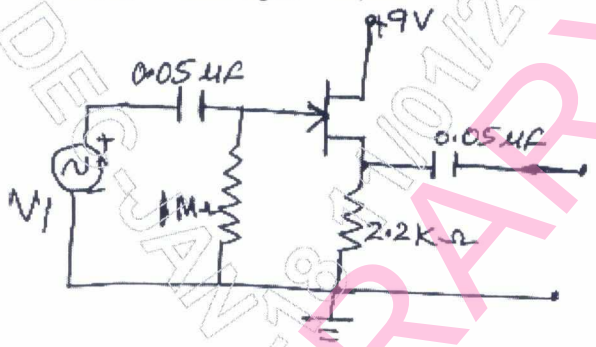

Fig.Q4(b)

Module-3

5 a. Derive the expression for low frequency response of BJT amplifier due to capacitors C_S and C_C. **(08 Marks)**

b. Calculate f_{Hi} and f_{Ho} for amplifier circuit shown in Fig.Q5(b), for the base current $I_B = 14.79\mu A$ and $A_{Vmid} = -102.58$; $\beta = 100$; $C_{be} = 20pF$; $C_{bc} = 4pF$; $h_{ie} = 1100$; $C_{wi} = 6pF$; $C_{wo} = 8pF$; $C_{CE} = 1pF$. **(08 Marks)**

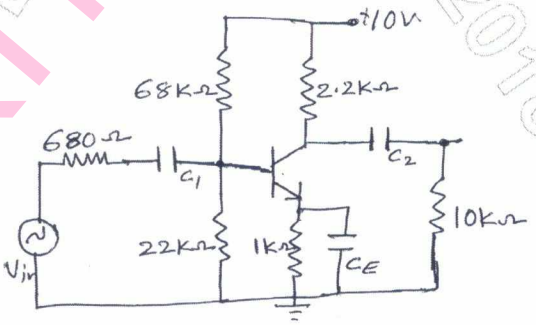

Fig.Q5(b)

OR

6 a. Derive the expression for Miller's input and output capacitance. **(08 Marks)**

b. Obtain the expression for over all lower and higher cut-off frequency for a multistage amplifier. **(08 Marks)**

Module-4

7 a. What are the advantages of negative feedback in amplifier? **(04 Marks)**

b. Derive the expression for Z_{if} and Z_{of} for voltage series feedback connection type. **(06 Marks)**

c. In a transistor Hartley oscillator, the two inductances are 2mH and 20μH while the frequency is to be changed from 950KHz to 2050KHz. Calculate the range over which the capacitor is to be varied. **(06 Marks)**

OR

8 a. Draw the circuit diagram of uni-junction oscillator and explain the principle of operation and draw the characteristics curve. **(06 Marks)**

b. With a neat circuit diagram, explain the working of colpitts oscillator using transistor. **(06 Marks)**

c. A crystal L = 0.4H, C = 0.085PF and C_m = 1PF with R = 5KΩ find :

i) Series resonate frequency

ii) Parallel resonate frequency. **(04 Marks)**

Module-5

9 a. With circuit diagram, explain the operation of transformer coupled class –A power amplifier and show that maximum efficiency is 50%. **(06 Marks)**

b. Calculate the harmonic distortion components for an output signal having a fundamental amplitude of 2.5V, second harmonic amplitude of 0.25V, third harmonic amplitude of 0.1V and fourth harmonic amplitude of 0.05V. Also calculate the total harmonic distortion. **(04 Marks)**

c. Define voltage regulator. Explain series voltage regulator using transistor. **(06 Marks)**

OR

10 a. Explain the operation of a class–B push-pull amplifier and show that maximum conversion efficiency is 78.5%. **(08 Marks)**

b. Explain shunt voltage regulator using transistor, and also find the regulated voltage and circuit currents for the shunt regulator shown in Fig.Q10(b). **(08 Marks)**

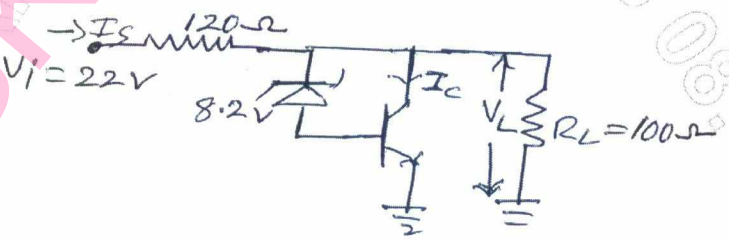

Fig.Q10(b)

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15EC33

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. Identify all prime implicants and essential prime implicants of following function using k – map.
$f(a, b, c, d) = \Sigma m(6, 7, 9, 10\ 13) + d.c(1, 4, 5, 11, 15)$
$f(a, b, c, d) = \pi m(1, 2, 3, 4, 9, 10) + d.c(0, 14, 15)$ **(08 Marks)**

b. Find minimal sum for following Boolean function using Quine –McClusky method :
$f(a, b, c, d) = \Sigma m(7, 9, 12, 13, 14, 15) + d.c(4, 11)$. **(08 Marks)**

OR

2 a. Transform each of following canonical expression into other canonical form in decimal notation.
$f(x, y, z) = \Sigma m(0, 1, 3, 4, 6, 7)$
$f((w, x, y, z) = \pi M(0, 1, 2, 3, 4, 6, 12)$. **(04 Marks)**

b. Find a minimal sum for following Boolean function using decimal QM method and PI table reduction.
$f(a, b, c, d) = \Sigma m(1, 3, 6, 8, 9, 10, 12, 14) + d.c(7, 13)$. **(12 Marks)**

Module-2

3 a. Implement following functions using single 3 : 8 decoder
$f_1(a, b, c) = \pi M(2, 3, 4, 5, 7)$
$f_2(a, b, c) = \Sigma m(1, 3, 5)$. **(04 Marks)**

b. What is magnitude comparator? Design a two bit digital comparator by writing TT, relevant expression and logic diagram. **(12 Marks)**

OR

4 a. Implement $f(a, b, c, d) = \Sigma m(0, 1, 5, 6, 7, 10, 15)$ using
i) 8 : 1 MUX with a, b, c as select lines
ii) 4 : 1 MUX with a, b as select lines. **(08 Marks)**

b. What are the problems associated with basic encoder? Explain how can these problems be overcome by priority encoder considering 8 input lines. **(08 Marks)**

Module-3

5 a. What is flip-flop. Discuss working principle of SR flip-flop with its TT. Also highlight role of SR f/f in switch debouncer circuit. **(08 Marks)**

b. What is significance of edge triggering? Explain working of +ve edge triggered D flip-flop with their functional table. **(08 Marks)**

OR

6 a. Explain the working of M/S JK flip-flop with functional table and timing diagram. Show how race condition is overcome. **(10 Marks)**

b. Obtain characteristic equation for following flip –flops. i) JK ii) SR. **(06 Marks)**

Module-4

7 a. Realize a 3 bit binary synchronous up counter using JK flip-flop. Write excitation table, transition table and logic diagram. **(10 Marks)**

b. Explain SIPO and PISO shift registers with relevant logic diagrams. **(06 Marks)**

OR

8 a. Explain the working principle of 4bit binary ripple counter configured using +ve edge triggered T – F/F. Also draw timing diagram. **(08 Marks)**

b. Explain the operation of universal shift register with a neat diagram. **(08 Marks)**

Module-5

9 a. Distinguish between Moore and Mealy model with necessary block diagram. **(06 Marks)**

b. Construct mealy state diagram that will detect input sequence 10110, when input pattern is detected, z is asserted high. Give state diagram for each state. **(10 Marks)**

OR

10 a. Design a cyclic mod 8 synchronous binary counter using JK flip-flop. Give state diagram, transition table and excitation table. **(08 Marks)**

b. Analyse the following sequential circuit shown in figure and obtain :

i) Flip-flop input and output equation
ii) Transition equation (ch.equ)
iii) Transition table
iv) State table
v) Draw state diagram. **(08 Marks)**

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CBCS Scheme

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15EC34

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Network Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Briefly explain the classification of electrical networks. **(08 Marks)**

b. Use source transformation to convert the circuit in Fig.1(b) to a single current source in parallel with a single resistor. **(08 Marks)**

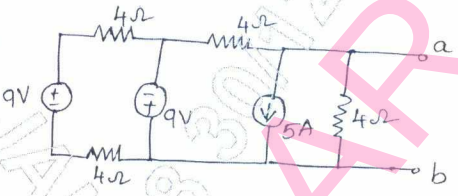

Fig.Q1(b)

OR

2 a. Determine the loop currents I_1, I_2, I_3 and I_4 for the network shown in Fig.Q2(a). **(08 Marks)**

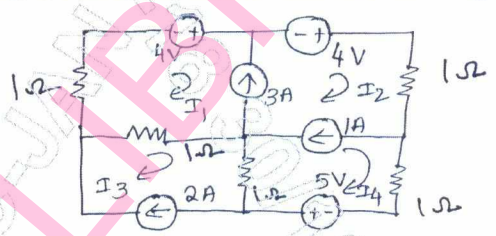

Fig.Q2(a)

b. Find the value of 'V' such that current through 4Ω resistor is zero, using nodal analysis, for the Fig.Q2(b). **(08 Marks)**

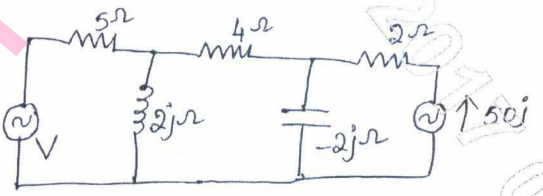

Fig.Q2(b)

Module-2

3 a. State and prove reciprocity theorem. **(07 Marks)**

b. Explain the procedure to find Norton's equivalent resistance in a network which has both dependent and independent sources with an example. **(03 Marks)**

c. Obtain the Thevenin's equivalent for the network shown in Fig.Q3(c). **(06 Marks)**

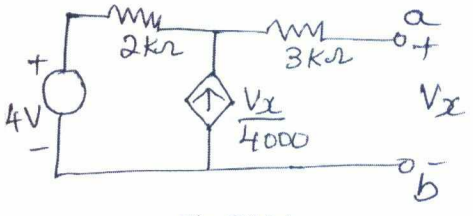

Fig.Q3(c)

OR

4 a. State and prove Miller's theorem. **(08 Marks)**

b. Find the value of Z_x for which maximum power transfer occurs. Also find maximum power for the network shown in Fig.Q4(b). **(08 Marks)**

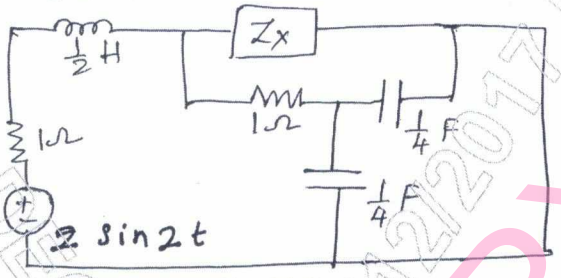

Fig.Q4(b)

Module-3

5 a. In the network shown in Fig.Q5(a), the switch is moved from position 1 to position 2 at t = 0. The steady – state has been reached before switching. Calculate i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. **(08 Marks)**

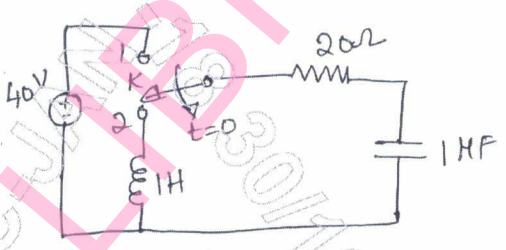

Fig.Q5(a)

b. In the network shown in Fig.Q5(b), $v_1(t) = e^{-t}$ for $t \geq 0$ and is zero for all $t < 0$. If the capacities is initially uncharged, determine the value of $\frac{d^2v_2}{dt^2}$ and $\frac{d^3v_3}{dt^3}$ at $t = 0^+$. **(08 Marks)**

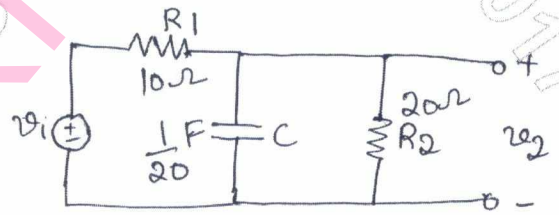

Fig.Q5(b)

OR

6 a. Obtain Laplace transform of i) step function, ii) Ramp function iii) Impulse function. **(09 Marks)**

b. Find the Laplace transform of the periodic signal x(t) as shown in Fig.Q6(b). **(07 Marks)**

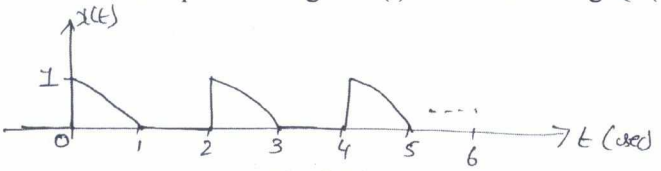

Fig.Q6(b)

Module-4

7 a. What is resonance? Derive an expression for half power cutoff frequency. **(08 Marks)**

b. Define Q-factor, selectivity and bandwidth. **(03 Marks)**

c. A series RLC circuit has R = 4Ω, L = 1mH, C = 10 μF. Calculate resonant frequency, Q-factor, half power frequencies and bandwidth. **(05 Marks)**

OR

8 a. Obtain an expression for resonant frequency in a parallel resonant circuit. **(06 Marks)**

b. Show that a two branch parallel resonant circuit is resonant at all frequencies if :

$R_L = R_C = \sqrt{\frac{L}{C}}$, where R_L = Resistance in the inductor branch, R_C = resistance in the capacitor branch. **(06 Marks)**

c. Find the value of R_L for which the circuit shown in Fig.Q8(c) at resonance condition. **(04 Marks)**

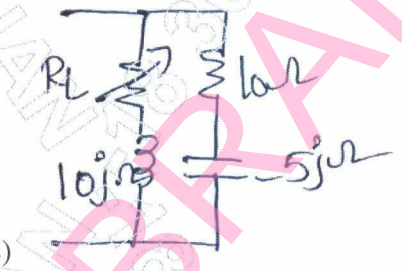

Fig.Q8(c)

Module-5

9 a. Define h-parameters. Express h-parameters in terms of z-parameters. **(08 Marks)**

b. Find y-parameters for the two-port–network shown in Fig.Q9(b). **(08 Marks)**

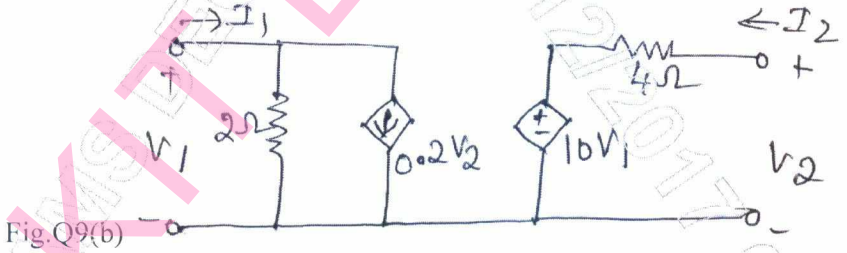

Fig.Q9(b)

OR

10 a. Define ABCD parameters. Express y-parameters in terms of ABCD parameters. **(08 Marks)**

b. Find the ABCD parameters for the circuit shown in Fig.Q10(b). **(08 Marks)**

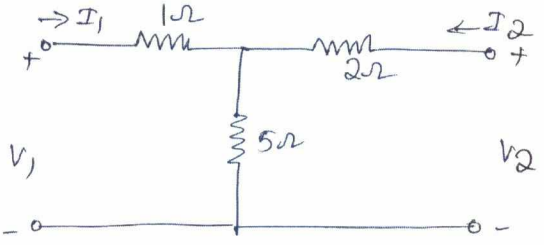

Fig.Q10(b)

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15EC35

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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: i) Absolute error ii) Significant Figures. **(04 Marks)**

b. A component manufacturer constructs certain resistors to be anywhere between 1.14kΩ and 1.26kΩ and classifies them as 1.2kΩ resistors. What tolerance should be stated? If the resistance values are specified at 25°C and the resistors have a temperature coefficient of +500ppm/°C, calculate the maximum resistance of one of these components at 75°C. **(06 Marks)**

c. Design a multirange ammeter with range of 0-1A, 5A, and 10A employing individual shunt at each A D'Arsonval movement with an internal resistance of 500Ω and a full scale deflection of 10mA is available. **(06 Marks)**

OR

2 a. Calculate the value of multiplier resistance on the 50V range of a dc voltmeter that uses a 500μA meter movement with an internal resistance of 1kΩ. **(04 Marks)**

b. Explain true RMS voltmeter with a neat diagram. **(06 Marks)**

c. Two different voltmeters are used to measure the voltage across R_b in the circuit of Fig. 2(c). The meters are as follows :
Meter 1 : S = 1kΩ/V, R_m = 0.2k, range 10V
Meter 2 : S = 20kΩ/V, R_m = 1.5k, range 10V
Calculate :
i) Voltage across R_b without any meter across it
ii) Voltage across R_b when the meter 1 is used
iii) Voltage across R_b when the meter 2 is used
iv) Error in the voltmeters.

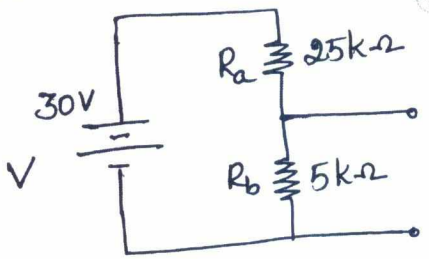

Fig. Q2(c) **(06 Marks)**

Module-2

3 a. Explain the working of successive approximation DVM with the help of block diagram. **(08 Marks)**

b. Draw basic block diagram of a microprocessor based ramp type DVM and explain its operation with waveforms. **(08 Marks)**

OR

4 a. Explain digital frequency meter with the help of block diagram. **(08 Marks)**
b. Explain digital pH meter. **(08 Marks)**

Module-3

5 a. Explain the function of various blocks in CRO with suitable diagram. **(06 Marks)**
b. Explain the working of Time base generator. **(06 Marks)**
c. Discuss frequency measurements with Lissajous figures. **(04 Marks)**

OR

6 a. Explain function generator with suitable diagram. **(08 Marks)**
b. Explain sweep generator with block diagram. **(08 Marks)**

Module-4

7 a. Explain Q-meter with suitable circuit diagram. **(06 Marks)**
b. Explain Basic Megger Circuit. **(06 Marks)**
c. Discuss stroboscope. **(04 Marks)**

OR

8 a. Explain the Wheatstone bridge and using Thevenin's theorem, determines the amount of deflection due to unbalance of Wheatstone Bridge. **(08 Marks)**
b. An inductance comparison bridge is used to measure inductive impedance at a frequency of 5KHz. The bridge constants at balance are L_3 = 10mH, R_1 = 10kΩ, R_2 = 40kΩ, R_3 = 100kΩ. Find the equivalent series circuit of the unknown impendence. **(04 Marks)**
c. Write a note on Wagner's earth connection. **(04 Marks)**

Module-5

9 a. What are the factors to be considered for the selection of better transducer? **(04 Marks)**
b. Derive an expression for gauge factor for Bonded Resistance wire strain Guages. **(08 Marks)**
c. Mention advantages and limitation of thermistor. **(04 Marks)**

OR

10 a. Explain the construction, principle and operation of LVDT. Show characteristics curve. **(10 Marks)**
b. Explain Piezoelectric Transducer. **(06 Marks)**

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CBCS Scheme

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15EC36

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. State and explain Coulomb's law in vector form. **(05 Marks)**

b. Find the electric field $\bar{E}$ at origin, if the following charge distributions are present in free space:
   i) Point charge 12 nc at P(2, 0, 6).
   ii) Uniform line charge of linear charge density 3 nc/m at x = 2, y = 3.
   iii) Uniform surface charge of density $P_s = 0.2$ nc/m^2 at x = 2. **(06 Marks)**

c. Define volume charge density. Also find the total charge within each of the indicated volumes.
   i) $0 \le \rho \le 0.1,\ 0 \le \phi \le \pi,\ 2 \le z \le 4;\ \rho_v = \rho^2 z^2 \sin(0.6\phi)$
   ii) Universe : $\rho_v = \dfrac{e^{-2r}}{r^2}$ **(05 Marks)**

OR

2 a. Define Electric flux and flux density. **(04 Marks)**

b. Given a 60 μC point charge located at the origin, find the total electric flux passing through:
   i) That portion of the sphere r = 26 cm bounded by $0 < \theta < \dfrac{\pi}{2}$ and $0 < \phi < \dfrac{\pi}{2}$.
   ii) The closed surface defined by ρ = 26 cm and z = ±26 cm.
   iii) The plane z = 26 cm. **(07 Marks)**

c. Derive the expression for $\bar{E}$ due to infinite line charge of charge density ρ_L (c/m). **(05 Marks)**

Module-2

3 a. State and prove Gauss law for point charge. **(05 Marks)**

b. State and prove divergence theorem. **(05 Marks)**

c. In each of the following parts, find value for div $\bar{D}$ at the point specified:
   i) $\bar{D} = (2xyz - y^2)\bar{a}_x + (x^2z - 2xy)\bar{a}y + x^2y\bar{a}_z$ c/m^2 at P_A(2, 3, -1).
   ii) $\bar{D} = 2\rho z^2 \sin^2\phi\bar{a}_\rho + \rho z^2 \sin 2\phi\bar{a}_\phi + 2\rho^2 z \sin^2\phi\bar{a}_z$ c/m^2 at $P_B(\rho = 2, \phi = 110^\circ, z = -1)$. **(06 Marks)**

OR

4 a. Define potential difference and absolute potential. **(04 Marks)**

b. A point charge of 6 nc is located at origin in free space, find potential of point p, if p is located at (0.2, -0.4, 0.4) and
   i) V = 0 at infinity
   ii) V = 0 at (1, 0, 0)
   iii) V = 20 V at (-0.5, 1, -1) **(06 Marks)**

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

Module-3

5 a. Derive the expression for Poisson's and Laplace's equation. **(05 Marks)**

b. Two plates of parallel plate capacitors are separated by distance 'd' and maintained at potential zero and V_0 respectively. Assuming negligible fringing effect, determine potential at any point between the plates. **(06 Marks)**

c. State and prove uniqueness theorem. **(05 Marks)**

OR

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

b. Find the magnetic flux density at the centre '0' of a square of sides equal to 5m and carrying 10 amperes of current. **(06 Marks)**

c. At a point p(x, y, z), the components of vector magnetic potential $\bar{A}$ are given as $A_x = 4x + 3y + 2z$, $A_y = 5x + 6y + 3z$ and $A_z = 2x + 3y + 5z$. Determine $\bar{B}$ at point P. **(04 Marks)**

Module-4

7 a. Derive Lorentz force equation. **(05 Marks)**

b. Derive an expression for the force on a differential current element placed in a magnetic field. **(06 Marks)**

c. A conductor 4m long lies along the y-axis with a current of 10 amps in the $\bar{a}_y$ direction. Find the force on the conductor if the field is $\bar{B} = 0.005\,\bar{a}_x$ Telsa. **(05 Marks)**

OR

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

b. Find the magnetization in a magnetic material where

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

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

iii) B = 300 μT and $\chi_m = 15$. **(06 Marks)**

c. Discuss the boundary conditions at the interface between two media of different permeabilities. **(06 Marks)**

Module-5

9 a. State and explain Faraday's law of electromagnetic induction. **(04 Marks)**

b. Find the frequency at which conduction current density and displacement current are equal in a medium with $\sigma = 2 \times 10^{-4}$ ℧/m and $\varepsilon_r = 81$. **(06 Marks)**

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

OR

10 a. Obtain solution of the wave equation for a uniform plane wave in free space. **(06 Marks)**

b. State and prove Poynting theorem. **(06 Marks)**

c. The depth of penetration in a certain conducting medium is 0.1 m and the frequency of the electromagnetic wave is 1.0 MHz. Find the conductivity of the conducting medium. **(04 Marks)**

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CBCS SCHEME

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15MATDIP31

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Express complex numbers $\frac{(5-3i)(2+i)}{4+2i}$ in the form a + ib. **(06 Marks)**

b. If $x = \cos\theta + i\sin\theta$, then show that $\frac{x^{2n}-1}{x^{2n}+1} = i\tan\theta$ **(05 Marks)**

c. Prove that the area of the triangle whose vertices are A, B, C is $\frac{1}{2}[B\times C + C\times A + A\times B]$. **(05 Marks)**

OR

2 a. Find the cube root of $\sqrt{3} + i$. **(06 Marks)**

b. Find the modulus and amplitude of $\frac{3+i}{2+i}$ **(05 Marks)**

c. Prove that the vectors $i - 2j + 3k$, $-2i + 3j - 4k$ and $i - 3j + 5k$ are coplanar. **(05 Marks)**

Module-2

3 a. Find the n^{th} derivative of $e^{ax}\sin(bx + c)$. **(06 Marks)**

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

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

OR

4 a. Find the pedal equation $r = a(1 + \cos\theta)$. **(06 Marks)**

b. Expand $\tan x$ in ascending powers of x. **(05 Marks)**

c. If $u = x + y + z$, $v = y + z$, $w = z$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ **(05 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi/2}\sin^n x\,dx$. **(06 Marks)**

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

c. Evaluate $\int_1^2\int_1^3 xy^2\,dxdy$ **(05 Marks)**

OR

6 a. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2yz\,dx\,dy\,dz$ **(06 Marks)**

b. Evaluate $\int_0^{\pi/6} \cos^4 3x\,dx$. **(05 Marks)**

c. Evaluate $\int_0^2 \frac{x^4}{\sqrt{4-x^2}}\,dx$. **(05 Marks)**

Module-4

7 a. A particle moves on the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$, where t is the time. Find the velocity and acceleration at $t = 1$ in the direction $i - 3j + 2k$. **(06 Marks)**

b. Find the unit vector normal to the surface $x^2 - y^2 + z = 2$ at the point $(1, -1, 2)$. **(05 Marks)**

c. Show that the vector $f = (2x - 5y)i + (x - y)j + (3x - z)k$ is a solenoidal. **(05 Marks)**

OR

8 a. If $f(x, y, z) = 3x^2y - y^3z^2$ then find grad f at the point $(1, -2, -1)$. **(06 Marks)**

b. Evaluate (i) div R, (ii) curl R, if $R = xi + yj + zk$. **(05 Marks)**

c. Find a, if $(axy - z^2)i + (x^2 + 2yz)j + (y^2 - axz)k$ is an irrotational vector. **(05 Marks)**

Module-5

9 a. Solve $(x^2 + y^2)dx + 2xydy = 0$ **(06 Marks)**

b. Solve $(e^x + 1)\cos x\,dx + e^y \sin x\,dy = 0$ **(05 Marks)**

c. Solve $(1 + xy)ydx + (1 - xy)xdy = 0$ **(05 Marks)**

OR

10 a. Solve $(x\log x)\frac{dy}{dx} + y = 2\log x$ **(06 Marks)**

b. Solve $(x + 2y^3)\frac{dy}{dx} = y$ **(05 Marks)**

c. Solve $(1 + e^{x/y})dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0$ **(05 Marks)**

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