CBCS SCHEME

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15MAT31

Third Semester B.E. Degree Examination, Jan./Feb. 2021
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 Fourier series expansion of $f(x) = |x|$ in the intercal $(-\pi , \pi)$ and hence deduce $\pi^2/8 = \sum_1^\infty 1/(2n-1)^2$. **(08 Marks)**

b. Obtain half range cosine series of
$$f(x) = \begin{cases} x, & 0 < x < \pi/2 \\ \pi - x, & \pi/2 < x < \pi \end{cases}.$$ **(08 Marks)**

OR

2 a. Obtain Fourier series expansion of
$$f(x) = \frac{\pi - x}{2}, \ 0 \le x \le 2\pi.$$ **(06 Marks)**

b. Obtain half range sine series of $f(x) = x^2$ in the interval $(0, \pi)$. **(05 Marks)**

c. Obtain the Fourier series for the following function neglecting the terms higher than first harmonic. **(05 Marks)**

x :	0	1	2	3	4	5
y :	9	18	24	28	26	20

Module-2

3 a. Find the Fourier transform of $f(x) = \begin{cases} 1 - |x|, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$ and hence deduce $\int_0^\infty \frac{\sin^2 x}{x^2} dx = \pi/2$. **(06 Marks)**

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

c. Find the Inverse Z – transform of
$$\frac{8z^2}{(2z-1)(4z-1)}.$$ **(05 Marks)**

OR

4 a. 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)**

b. Find the Z – transform of i) $\sinh n\theta$ ii) n^2. **(06 Marks)**

c. Solve the difference equation : $U_{n+2} - 5U_{n+1} + 6U_n = 2$, $U_0 = 3$, $U_1 = 7$. **(05 Marks)**

Module-3

5 a. Compute the coefficient of correlation and the equation of lines of regression 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 parabola $y = ax^2 + bx + c$ for the following data :

x	0	1	2	3	4	5	6
y	14	18	27	29	36	40	46

(05 Marks)

c. Using Newton Raphson method, find a real root of $x \sin x + \cos x = 0$ near $x = \pi$, corrected to four decimal places. (05 Marks)

OR

6 a. Obtain the lines of regression and hence find coefficient of correlation for the following data

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

(06 Marks)

b. By the method of Least square, find a straight line that best fits the following data :

x	5	10	15	20	25
y	16	19	23	26	30

(05 Marks)

c. Using Regula – Falsi method to find a real root of $x \log_{10} x - 1.2 = 0$, carry out 3–iterations. (05 Marks)

Module-4

7 a. Find the interpolating formula f(x), satisfying f(0) = 0, f(2) = 4, f(4) = 56, f(6) = 204, f(8) = 496, f(10) = 980 and hence find f(3). (06 Marks)

b. Use Newton's divided difference formula to find f(9), given

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

(05 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by applying Simpson's ⅜ th rule, taking 7 ordinates. (05 Marks)

OR

8 a. Using Newton's backward interpolation formula, find f(105), given

x	80	85	90	95	100
f(x)	5026	5674	6362	7088	7854

(06 Marks)

b. Apply Lagrange formula to find root of the equation f(x) = 0, given f(30) = -30, f(34) = -13, f(38) = 3 and f(42) = 18. (05 Marks)

c. Evaluate $\int_0^{0.3} \sqrt{1-8x^3}\, dx$, taking 6 – equal strips by applying Weddle's rule. (05 Marks)

Module-5

9 a. If $\vec{F} = (3x^2 + 6y)i - 14yzj + 20xz^2k$, evaluate $\int \vec{F}.d\vec{r}$ from (0, 0, 0) to (1, 1, 1) along the curve given by $x = t$, $y = t^2$, $z = t^3$. **(06 Marks)**

b. Find the extremal of the functional $\int_0^{\pi/2} (y^2 - y'^2 - 2y\sin x)dx, y(0) = y(\pi/2) = 0$. **(05 Marks)**

c. Prove that geodesics on a plane are straight lines. **(05 Marks)**

OR

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

b. Verify Stoke's theorem for $\vec{F} = yi + zj + xk$. Where S is the upper half of the sphere $x^2 + y^2 + z^2 = 1$ and C is it boundary. **(05 Marks)**

c. A heavy chain hangs freely under the gravity between two fixed points. Show that the shape of the chain is a Catenary. **(05 Marks)**

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CBCS SCHEME

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15EE32

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Electric Circuit Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Passive and Active Elements with example. **(06 Marks)**

b. Determine R_{AB} using star – Delta transformation in the network show Fig Q1(b).

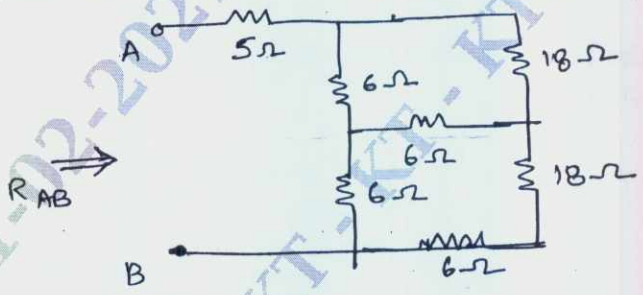


Fig Q1(b) **(10 Marks)**

OR

2 a. A series RLC circuit consists of a resistance is 1kΩ and an inductance of 100mA in series with capacitance is 10pF. If 100V is applied as input across the combination determine :
i) Resonant Frequency ii) Maximum current in the circuit iii) Q factor of the circuit iv) Half power frequencies. **(08 Marks)**

b. Use nodal analysis to obtain current I in the Network shown Fig Q2(b).

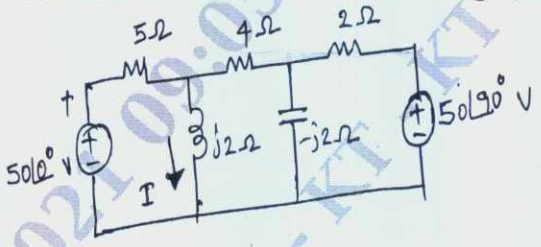


Fig Q2(b) **(08 Marks)**

Module-2

3 a. Using Millmans theorem calculate the current through the load (Ref. Fig Q3(a))

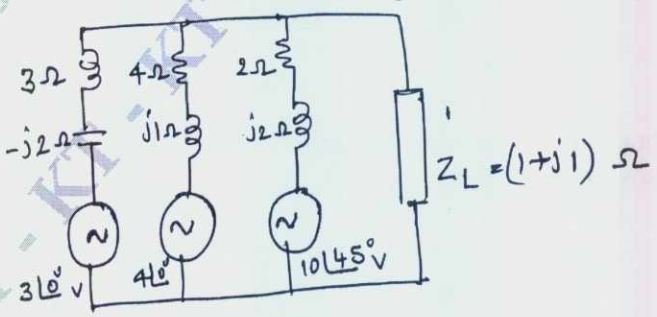


Fig Q 3(a) **(08 Marks)**

b. Using superposition Theorem find the current I for the network shown Fig Q3(b).

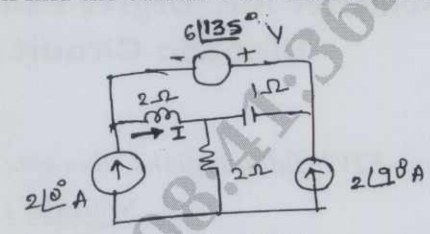


Fig Q3(b) **(08 Marks)**

OR

4 a. In the circuit shown below Q4(a), find the current through $R_L = 7.5\Omega$, using superposition theorem.

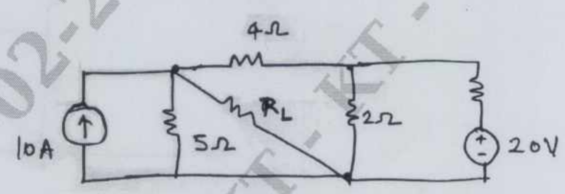
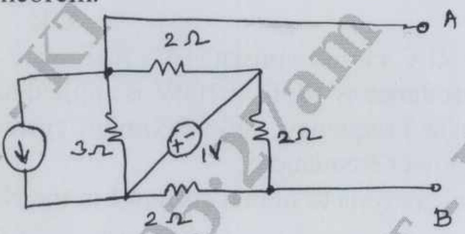


Fig Q4(a) **(08 Marks)**

b. Determine the current through 1Ω resistor connected across AB in the network shown Fig Q4(b). Using Norton's Theorem.



Q4(b) **(08 Marks)**

Module-3

5 a. In the circuit shown in Fig Q5(a), switch 'K' is kept at position A for long time. At t = 0, switch is moved to position B. Find the expression for current for t > 0. Find the value of the current at t = 13.334 msec.

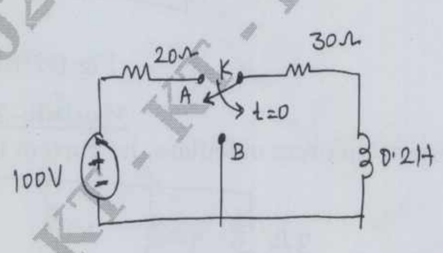


Fig Q5(a) **(08 Marks)**

b. Obtain the expression for current i(t) for $t \geq 0$, using time domain approach for the circuit shown in Fig Q5(b).

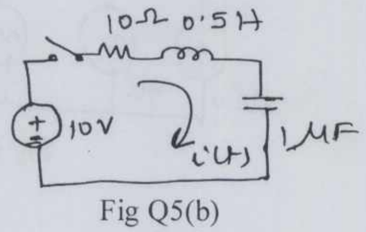


Fig Q5(b) **(08 Marks)**

OR

6 a. The Network shown Fig Q6(a), is under steady state condition with switch K is at position 1 find expression for i(t), if switch K is moved to position 2.

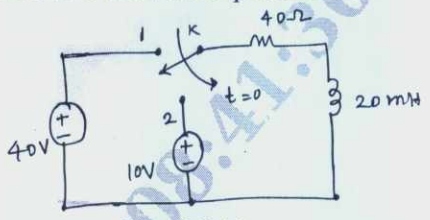


Fig Q6 (a) **(08 Marks)**

b. Find the expression for current in a series RLC circuit fed by a d.c voltage of 20V with $R = 4\Omega$, $L = 1H$, $C = \frac{1}{4}F$. Assume initial conditions to be zero.

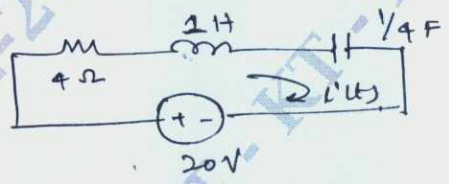


Fig Q6(b) **(08 Marks)**

Module-4

7 a. Express the wave from shown Fig Q7(a), is using of step function

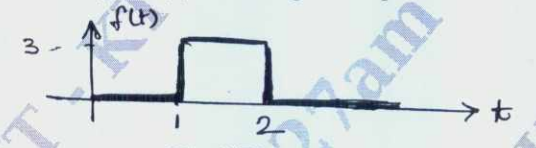


Fig Q7(a) **(06 Marks)**

b. In the series R-C circuit shown Fig Q7 (b), the switch is closed at t = 0. Obtain the expression for current.

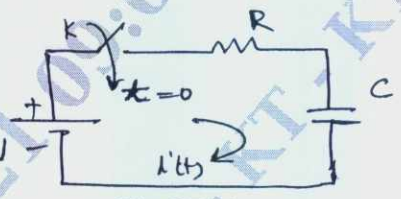


Fig Q7(b) **(10 Marks)**

OR

8 a. Express the waveform shown in Fig Q8(a) in term of standard functions

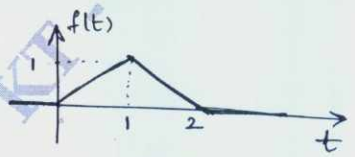


Fig Q8(a) **(08 Marks)**

b. In the circuit shown Fig Q8(b) the switch is closed at t = 0, derive the expression of the resulting current using Laplace Transform

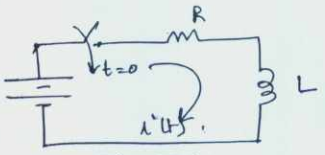


Fig Q8(b) **(08 Marks)**

Module-5

9 a. The balanced load shown in Fig Q9(a), is fed by a balanced three phase system having $V_{ab} = 230 \angle 0^\circ\ V_{rms}$, and position phase sequence, find the reading in each wattmeter and total power drawn by the load.

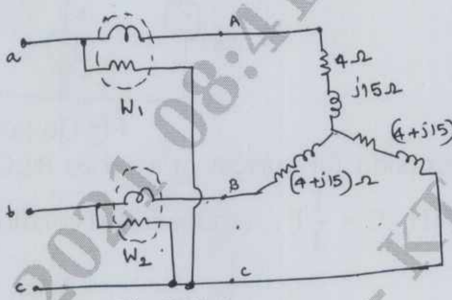


Fig Q9(a) **(08 Marks)**

b. Find the z- parameters for the network shown Fig Q9(b).

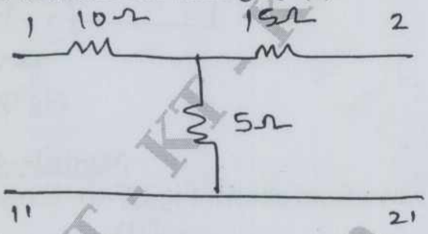


Fig Q9(b) **(08 Marks)**

OR

10 a. For the circuit shown in Fig Q10(a), the loads are $Z_A = 25 \angle 60^\circ\ \Omega$, $Z_B = 50 \angle -60^\circ\ \Omega$, $Z_C = 50 \angle 60^\circ\ \Omega$, $V_{AB} = 600 \angle 0^\circ\ V_{rms}$, and locate point 'x' at C, find P_A, P_B, P_C

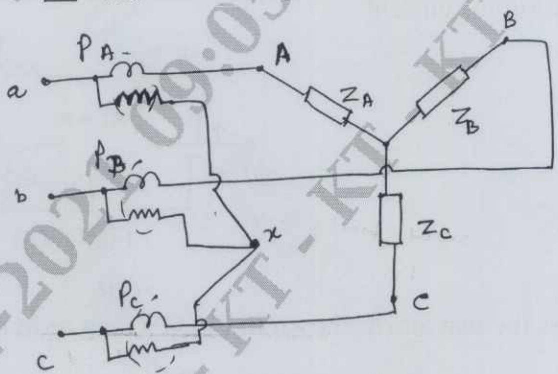


Fig Q10(a) **(08 Marks)**

b. Find Y parameter of the two port Network shown in Fig.Q10(b).

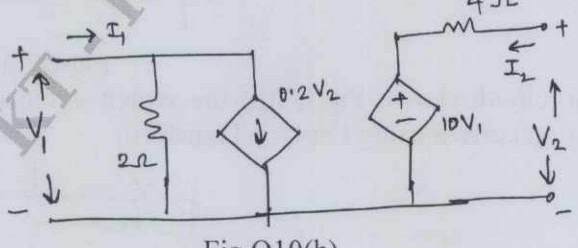


Fig Q10(b) **(08 Marks)**

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15EE34

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Analog Electronic Circuits

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Show the output waveform for the network shown in Fig Q1(a). If the peak value of ac input is 15V. Show all the voltage levels in the output. Assume ideal diode.

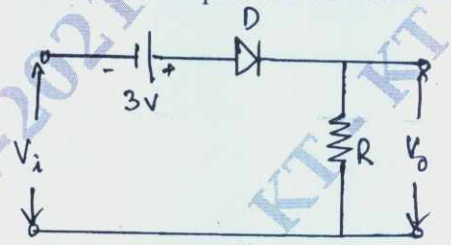

Fig Q1(a) **(05 Marks)**

b. With circuit diagram, explain emitter stabilized bias circuit. Write the necessary equations. **(05 Marks)**

c. For the circuit shown in Fig Q1(c), calculate I_C, V_B and $S_{(ICO)}$. Given $\beta = 100$ and $V_C = 12V$.

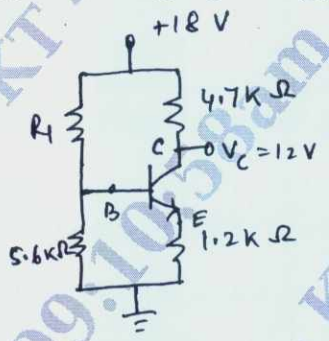

Fig Q1(c) **(06 Marks)**

OR

2 a. Explain the operation of positive clamper circuit. **(05 Marks)**

b. Consider a fixed bias circuit of a BJT. Obtain expression for stability factors $S_{(I_{CO})}$, $S_{(V_{BE})}$ and S_β. **(06 Marks)**

c. Design the emitter bias circuit shown in Fig Q2(c), for operating point given as $V_{CEQ} = 10V$, $I_{CQ} = 1.5mA$.

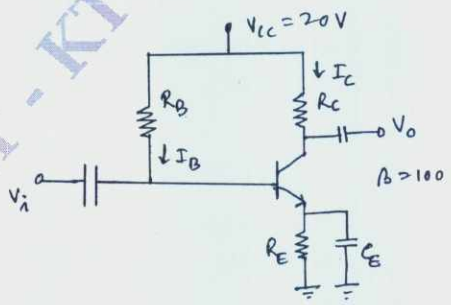

Fig Q2(c) **(05 Marks)**

Module-2

3 a. Draw the circuit diagram of common emitter configuration of BJT fixed bias amplifier. Derive expression for A_V, A_i, Z_i and Z_o. **(10 Marks)**

b. A 2 stage cascaded amplifier system is built with stage voltage gains 25 and 40. Both stages have the same bandwidth of 220KHz with identical lower cutoff frequency of 500Hz. Find overall gain band width product. **(06 Marks)**

OR

4 a. Describe Miller effect and derive an equation for Miller input and output capacitances. **(06 Marks)**

b. For the common base configuration shown in Fig 4(b), the transistor parameters are $h_{ib} = 22\Omega$, $h_{fb} = -0.98$, $h_{ob} = 0.49\,\mu A/V$, $h_{rb} = 2.9 \times 10^{-4}$. Calculate the values of input resistance, output resistance, current gain and voltage gain for the given circuit.

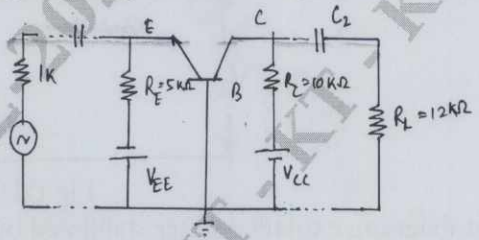

Fig Q4(b) **(10 Marks)**

Module-3

5 a. For a Darlington emitter follower circuit $R_B = 1.2\mu\Omega$, $r_i = 5k\Omega$, $\beta_D = 8000$, $V_{BE} = 1.6V$, $R_E = 330\Omega$. Calculate Z_i, Z_o, A_i and A_V. Derive the necessary equations. **(08 Marks)**

b. Derive expression for output resistance for a current shunt feedback amplifier. **(08 Marks)**

OR

6 a. Mention the types of feedback connections; draw their block diagram indicating input and output signals. **(04 Marks)**

b. If an amplifier has a bandwidth of 200KHz and a voltage gain of 80, what will be the new bandwidth and gain if a negative feedback of 5% introduced? **(04 Marks)**

c. Explain the operation of cascade connection with the help of neat diagram. **(08 Marks)**

Module-4

7 a. Draw the circuit diagram and explain the operation of class B push pull amplifier. **(08 Marks)**

b. Explain the characteristics of quartz crystal. **(04 Marks)**

c. In a Hartley oscillator, $L_1 = 20\mu H$, $L_2 = 2mH$, C is variable. Find the range of C if frequency is to be varied from 1.5MHz to 2.5MHz. **(04 Marks)**

OR

8 a. Calculate the maximum efficiency of the class A amplifier as shown in Fig Q8(a). Assume transformer has 80% efficiency. **(08 Marks)**

$V_{CC} = +13V$
$R_E = 1k\Omega$
$\beta = 25$

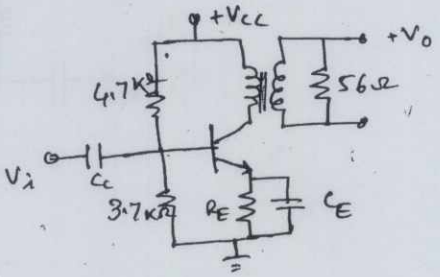

Fig Q8(a)

b. What is Barkhausen criterion for sustained oscillations? Explain basic principle of operation of oscillator. (04 Marks)
c. With circuit diagram explain RC phase shift oscillator using BJT. (04 Marks)

Module-5

9 a. With necessary equivalent circuit derive the expression for A_v, Z_{in} and Z_o for a fixed bias JFET amplifier. (08 Marks)
b. Explain depletion and enhancement types MOSFETs and their characteristics. (08 Marks)

OR

10 a. Calculate the transconductance g_m of a JFET having values of I_{DSS} = 12mA, V_P = -4V at bias points i) V_{GS} = 0V ii) V_{GS} = -1.5V. (04 Marks)
b. List the differences between JFET and MOSFET. (05 Marks)
c. Explain voltage divider biasing of n channel enhancement types MOSFET. (07 Marks)

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CBCS SCHEME

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15EE35

Third Semester B.E. Degree Examination, Jan./Feb.2021
Digital System Design

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 terms with an example:
(i) Minterm (ii) Canonical product of sums. **(04 Marks)**

b. Expand $f_1(x,y,z) = \left[x + \bar{x}\bar{z}(y+\bar{z})\right]$ into minterms and $f_2(a,b,c) = (a+b)(b+c)(\bar{c}+a)$ into maxterms. **(06 Marks)**

c. Simplify the following functions using K-map :
(i) $P = f(a,b,c,d) = \sum m(2,3,4,5,13,15) + \sum d(8,9,10,11)$
(ii) $R = f(a,b,c,d) = \prod M(0,1,2,5,8,9,10)$ **(06 Marks)**

OR

2 a. Find a minimal sum for the following Boolean function using Quine-McCluskey minimization technique
$f(w, x, y, z) = \sum m(2, 4, 5, 9, 12, 13)$. **(08 Marks)**

b. Simplify the following function using MEV technique and realize the simplified function using basic gates.
$f(a,b,c,d) = \sum m(2,4,5,10,11,14) + \sum d(7,8,9,12,13,15)$
Consider 'd' as a map entered variable. **(08 Marks)**

Module-2

3 a. With the aid of block diagram, clearly distinguish between a decoder and encoder. **(04 Marks)**

b. Implement full adder using 3 : 8 decoder with active low outputs. **(06 Marks)**

c. Design 5 : 32 line decoder using one 2 : 4 and four 3 : 8 decoders which has the active low enable inputs and active low outputs. Explain the operation. **(06 Marks)**

OR

4 a. Implement $f(a,b,c,d) = \sum m(0,1,5,6,7,9,10,15)$ using
(i) 16 : 1 MUX with a, b, c and d as select lines.
(ii) 8 : 1 MUX with b, c and d as select lines.
(iii) 4 : 1 MUX with c and d as select lines **(08 Marks)**

b. Design two bit binary comparator and implement with suitable logic gates. **(08 Marks)**

Module-3

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

b. Explain the working of a master-slave JK flip-flop with the help of logic diagram function table, logic symbol and timing diagram. **(08 Marks)**

OR

6 a. Differentiate between synchronous counter and asynchronous counter. **(04 Marks)**

b. Derive the characteristic equation of D and T flip flop. **(04 Marks)**

c. Explain 4-bit universal shift register with the help of logic diagram, mode control table. **(08 Marks)**

Module-4

7 a. Explain the Mealy model of a sequential circuit. **(06 Marks)**

b. A sequential circuit has one input and one output. The state diagram as shown in Fig. Q7 (b). Design the sequential circuit with J-K flip-flop. **(10 Marks)**

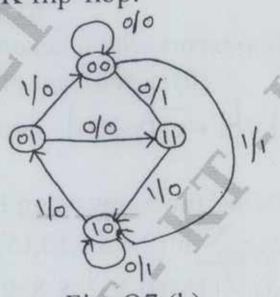

Fig. Q7 (b)

OR

8 a. Explain the Moore model of sequential circuit. **(06 Marks)**

b. Design a synchronous counter using J-K flip-flops to count the sequence, 0, 1, 2, 4, 5, 6, 0, 1, 2,….. Use state diagram and state table. **(10 Marks)**

Module-5

9 a. Mention the types of HDL descriptions. Explain data flow and behavioural descriptions with an example. **(10 Marks)**

b. Differentiate the VHDL and verilog. **(06 Marks)**

OR

10 a. Explain the following :

(i) Signal declaration and assignment statements.

(ii) Concurrent signal assignment statements.

(iii) Constant declaration and assignment statements. **(12 Marks)**

b. Explain the vector data type with an example. **(04 Marks)**

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15EE36

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Electrical and Electronic Measurements

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive the dimensions of EMF, magnetic flux density and resistivity in LMTI system. **(06 Marks)**

b. Derive the expression for the measurement of unknown resistance using Kelvin double bridge. **(06 Marks)**

c. What are the advantages and disadvantages of Maxwell's inductance–capacitance bridge? **(04 Marks)**

OR

2 a. With a neat sketch, explain the construction and working of a Megger. **(06 Marks)**

b. An Anderson's bride is arranged as flows : branch AB is an inductive resistor, branches BC and ED are variable non-reactive resistors ; branches CD and DA are non-reactive resistors of 200Ω each ; branch CE has 1μF capacitor. The supply is connected between A and C while the detector is connected between B and E. Balance is obtained when the resistance of BC is 400Ω and that of DE is 500Ω. Determine the unknown inductance and its resistance in the bridge. **(05 Marks)**

c. The resonant frequency of an AC circuit is given by $fr = \frac{1}{2\pi} L^a C^b$. Find the values of a and b. **(05 Marks)**

Module-2

3 a. Explain with a neat sketch the principle of operation of a single phase low power factor wattmeter. **(06 Marks)**

b. With necessary figures, explain the calibration of single phase energy meter. **(06 Marks)**

c. The power input measurement to a synchronous motor is done using two-wattmeter method. Each of the wattmeter reads 40KW at a certain operating condition. If now, the PF is changed to 0.8 lagging, what would be the new wattmeter readings? **(04 Marks)**

OR

4 a. Explain with a neat sketch the principle of operation of electrodynamometer type single phase power factor meter. **(06 Marks)**

b. A wattmeter is connected to measure the power consumed by a load, which drawn a current of 20A at 250V. The PF of the load is 0.8 lagging. The current coil has an impedance of (0.08 + j0.04)Ω. The resistance of the pressure coil circuit is 6000Ω. Find the error in the reading of the wattmeter for its two possible connections to measure the power. **(06 Marks)**

c. An energy meter is designed to have 80 revolutions of the disc per unit of energy consumed. Calculate the number of revolutions made by the disc, when measuring the energy consumed by a load carrying 30A at 230V and 0.6 power factor. **(04 Marks)**

Module-3

5 a. Explain different types of errors n current transformers. **(04 Marks)**

b. Explain the constructional features of fluxmeter. **(06 Marks)**

c. A moving coil meter taken 25mA to produce full-scale deflection and the resistance of the meter is 10Ω. Design a suitable scheme so as to use the instrument as an ammeter reading 0 – 20A and as a voltmeter reading 0 – 120V. **(06 Marks)**

OR

6 a. With a neat sketch explain the construction and working of Hopkinson permeameter. **(06 Marks)**

b. Defied the following :
i) Transformation ratio
ii) Nominal ratio
iii) Turns ratio
iv) Ratio correction factor of instrument transformer. **(04 Marks)**

c. A ballistic galvanometer has a constant of 0.2 μc per scale division and the resistance in the circuit of the galvanometer is 6000Ω. The galvanometer is connected to :
i) A coil of 8 turns wound around the field coil of a DC machine ii) a coil of 12 turns placed on the armature surface embracing the total flux per pole entering the armature. When the normal field current is broken, the galvanometer readings are 232 and 284 divisions respectively. Calculate the : i) flux per pole and ii) leakage factor. **(06 Marks)**

Module-4

7 a. Briefly explain the explain essential components of an electronic instrument. Also, list the advantages of electronic instruments over conventional meters. **(06 Marks)**

b. Explain with is block diagram the true RMS voltmeter. **(06 Marks)**

c. What are the sources of error in a Q-meter and give the applications of Q-meter. **(04 Marks)**

OR

8 a. With a block diagram, explain the working of a RAMP type DVM. **(08 Marks)**

b. With a neat sketch, explain the working principle of Q-meter. **(08 Marks)**

Module-5

9 a. With a neat sketch explain the working principle of LVDT type recorders. **(06 Marks)**

b. Write a short note on (EEG). **(06 Marks)**

c. Give the advantages and disadvantages of LCDs. **(04 Marks)**

OR

10 a. Explain with a suitable circuit diagram working of seven segment displays. **(06 Marks)**

b. With a block diagram explain the working principle of Electromyograph (EMG). **(05 Marks)**

c. Write a short note on display multiplexing. **(05 Marks)**

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CBCS SCHEME

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15MATDIP31

Third Semester B.E. Degree Examination, Jan./Feb. 2021
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 real and imaginary parts of $\frac{2+i}{3-i}$ and express in the form of x + iy. **(05 Marks)**

b. Reduce $1 - \cos\alpha + j \sin\alpha$ to the modulus amplitude form $[r(\cos\theta + i \sin\theta)]$ by finding r and θ. **(06 Marks)**

c. If $\vec{a} = 4i + 3j + k$ and $\vec{b} = 2i - j + 2k$ find the unit vector perpendicular to both the vectors $\vec{a}$ and $\vec{b}$. Hence show that $\sin\theta = \frac{\sqrt{185}}{3\sqrt{26}}$ where 'θ' is angle between $\vec{a}$ and $\vec{b}$. **(05 Marks)**

OR

2 a. Find the modulus and amplitude of $\frac{3+i}{1+i}$. **(05 Marks)**

b. Find 'a' such that the vectors $2i - j + k$, $i + 2j - 3k$ and $3i + aj + 5k$ are coplanar. **(06 Marks)**

c. Show that for any three vectors $\bar{a}, \bar{b}, \bar{c}$ $[\bar{b}\times\bar{c}, \bar{c}\times\bar{a}, \bar{a}\times\bar{b}] = [\bar{a}, \bar{b}, \bar{c}]^2$. **(05 Marks)**

Module-2

3 a. Find the n^{th} derivative of sin (5x) cos (2x). **(05 Marks)**

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

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

OR

4 a. Expand $e^{\sin x}$ by Maclaurin's series upto the term containing x^4. **(05 Marks)**

b. Give $u - \sin\left(\frac{x}{y}\right)$ $x = e^t$ $y = t^2$ find $\frac{du}{dt}$ as a function of t. **(06 Marks)**

c. If $x = r\cos\theta$, $y = r\sin\theta$ find $\frac{\partial(x,y)}{\partial(r,\theta)}$ and $\frac{\partial(r,\theta)}{\partial(x,y)}$. **(05 Marks)**

Module-3

5 a. State reduction formula for $\int_0^{\pi/2} \sin^n x\,dx$ and evaluate $\int_0^{\pi/2} \sin^9 x\,dx$. **(05 Marks)**

b. Evaluate $\int_0^{\infty} \frac{dx}{(1+x^2)^{7/2}}$. **(06 Marks)**

c. Evaluate : $\int_0^1\int_0^2\int_0^2 x^2yz\,dx\,dy\,dz$. **(05 Marks)**

OR

6 a. Evaluate : $\int_0^{\pi} \sin^4 x \cos^6 x \, dx$. **(05 Marks)**

b. Evaluate : $\int_0^5 \int_0^{x^2} y(x^2 + y^2) dx\, dy$. **(06 Marks)**

c. Evaluate : $\int_0^1 \int_0^2 \int_1^2 x^3 y^2 z^3 \, dx\, dy\, dz$. **(05 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 velocity and acceleration at time $t = 1$. **(05 Marks)**

b. Find the unit normal vector to the surface $xy^3z^2 = 4$ at the point $(-1, -1, 2)$. **(06 Marks)**

c. What is solenoid vector field? Demonstrate that vector $\overline{F}$ given by $\overline{F} = 3y^2z^3 i + 8x^2 \sin(z) j + (x + y)k$ is solenoidal. **(05 Marks)**

OR

8 a. Find div F and Curl F if $\overline{F} = (3x^2 - 3yz)i + (3y^2 - 3xz)j + (3z^2 - 3xy)k$. **(05 Marks)**

b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$. **(06 Marks)**

c. Show that the fluid motion $\vec{V} = (y + z)i + (z + x)j + (x + y)k$ is irrotational. **(05 Marks)**

Module-5

9 Find the solution of :

a. $(x^2 + 2e^x)dx + (\cos y - y^2)dy = 0$. **(05 Marks)**

b. $\frac{dy}{dx} = \frac{y/x}{1 + y/x}$. **(06 Marks)**

c. $(x^2 - ay)dx + (y^2 - ax)dy = 0$. **(05 Marks)**

OR

10 a. Find the solution of :

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

b. $(x^2y^3 + \sin x)dx + (x^3y^2 + \cos y)dy = 0$. **(06 Marks)**

c. $\cos y \frac{dy}{dx} + \sin y = 1$. **(06Marks)**

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