CBCS SCHEME

USN | | | | | | | | | | 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)

USN | | | | | | | | | | | **15EE32**

Third Semester B.E. Degree Examination, June/July 2019
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. Write a system of modal equations for the circuit of Fig.Q1(a) using the nadal voltages v_1 and v_2 as the variables. What power is furnished by the 5Vy dependent source? **(10 Marks)**

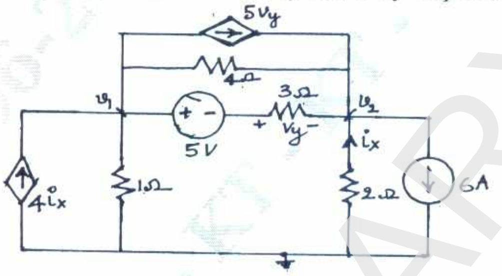

Fig.Q1(a)

b. Find Req for the network shown in Fig.Q1(b) below at points BC. **(06 Marks)**

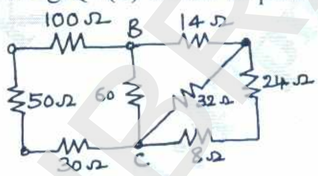

Fig.Q1(b)

OR

2 a. In the network of Fig.Q2(a) determine v_2 such that the current in the impedance (2 + j3) is zero. Use Mesh analysis. **(06 Marks)**

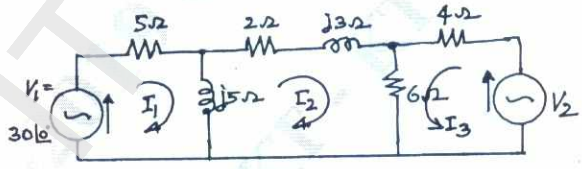

Fig.Q2(a)

b. A tank circuit is supplied by a current source whose source resistance is 56 kΩ. The tank circuit is composed of a 56 nF capacitor in parallel with a coil whose inductance and resistance are 35 mH and 80 Ω respectively. Find (i) Input impedance at resonance (ii) Quality factor of the circuit and (iii) Half power frequencies (f_1 & f_2). **(10 Marks)**

Module-2

3 a. Determine the current in R = 1 Ω resistor of the network shown in Fig.Q3(a) using Thevenin's and Superposition theorem simultaneously. **(10 Marks)**

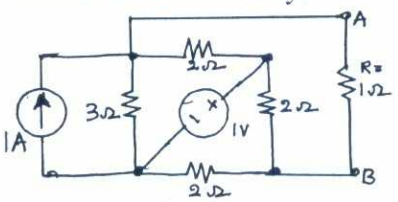

Fig.Q3(a)

b. In the network shown in Fig.Q3(b) determine the voltage 'V_x'. Then apply the reciprocity theorem. And compare two voltages. **(06 Marks)**

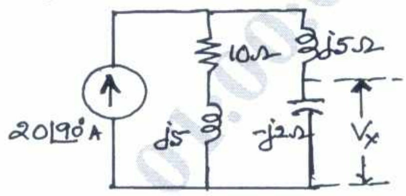

Fig.Q3(b)

OR

4 a. Obtain the Thevenin's equivalent network across the output terminals 'A' and 'B' of the network shown in Fig.Q4(a). **(10 Marks)**

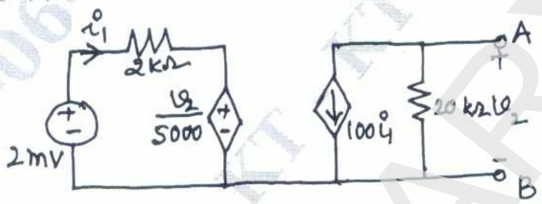

Fig.Q4(a)

b. Use Millman's theorem to find the current I through $R_4 = 5\ \Omega$ in the network shown in Fig.Q4(b). **(06 Marks)**

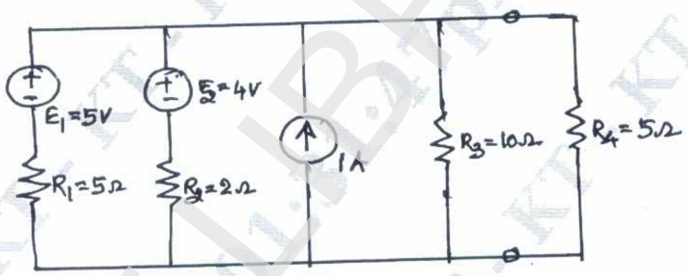

Fig.Q4(b)

Module-3

5 a. Fig.Q5(a) shows a network with zero capacitor voltage and zero inductor current when the switch K is open. At t = 0 the switch K is closed.

Solve for (i) V_1 and V_2 at $t = 0^+$ (ii) $\frac{dv_1}{dt}$ and $\frac{dv_2}{dt}$ at $t = 0^+$. **(10 Marks)**

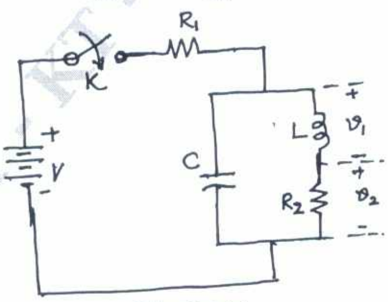

Fig.Q5(a)

b. Fig.Q5(b) shows a RLC series circuit excited by a dc voltage source. At t = 0 the switch K is closed. Find i(t). **(06 Marks)**

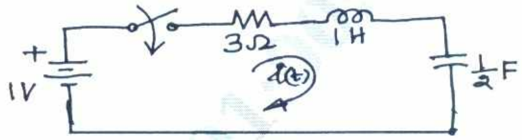

Fig.Q5(b)

OR

6 a. Fig.Q6(a) shows a RLC parallel circuit excited by a dc current source. At t = 0, the switch 'K' is opened. Find V(t). **(08 Marks)**

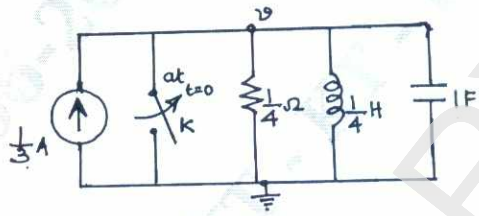

Fig.Q6(a)

b. The network shown in Fig.Q6(b) is in the steady state with the switch 'K' is closed. At t = 0, the switch is opened. Determine the voltage across the switch V_k and $\frac{dV_k}{dt}$ at $t = 0^+$.

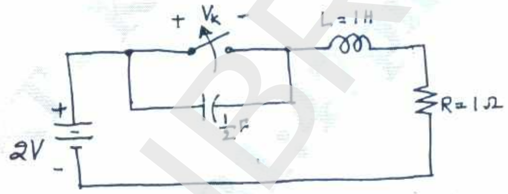

Fig.Q6(b) **(08 Marks)**

Module-4

7 a. In the RL series circuit shown in Fig.Q7(a), the switch K is closed at t = 0. Solve for the current i(t), using the Laplace transform method. **(08 Marks)**

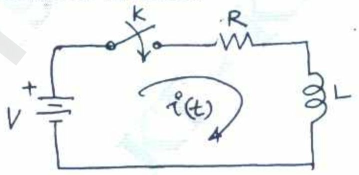

Fig.Q7(a)

b. State and prove (i) initial value theorem and (ii) final value theorem as applied to Laplace Transform. What are the limitations of each theorem? **(08 Marks)**

OR

8 a. Find the Laplace transform of the periodic sawtooth wave shown in Fig.Q8(a). **(08 Marks)**

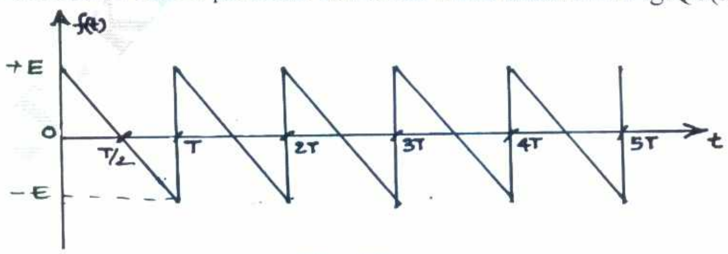

Fig.Q8(a)

b. The waveform shown in the Fig.Q8(b) is non-recurring. Write an equation for this waveform v(t). **(08 Marks)**

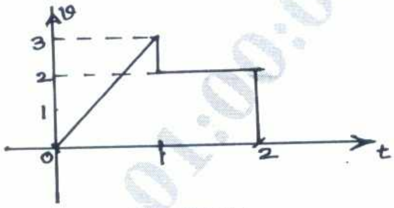

Fig.Q8(b)

Module-5

9 a. Find the Z-parameters for the circuit shown in Fig.Q9(a). Draw the Z-parameters equivalent circuit and find whether the network is (i) reciprocal and (ii) symmetrical. **(08 Marks)**

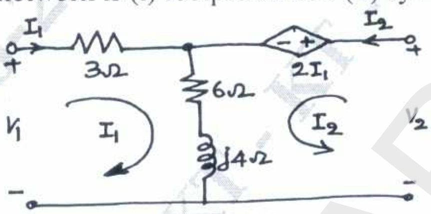

Fig.Q9(a)

b. For the RC network shown in Fig.Q9(b), find the driving point input impedance Z_{11}. Plot the pole-zero plot of this network function. **(08 Marks)**

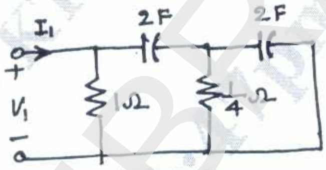

Fig.Q9(b)

OR

10 a. Find the (i) Phase currents (ii) Line currents (iii) Total active and reactive power for the three phase load shown in Fig.Q10(a). Draw the phasor diagram showing all the voltages and currents. Take V_{ac} as reference phasor. acb is the phase sequence and line voltage is 100 V. **(08 Marks)**

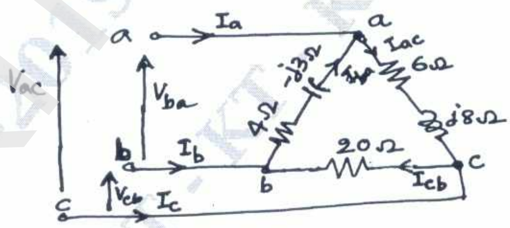

Fig.Q10(a)

b. A voltage wave $v = 141.4 \sin w_1 t + 35.35 \sin(3w_1 t + 30°) - 14.14 \sin(5w_1 t - 30°)$ is applied to the circuit shown in Fig.Q10(b). Find (i) Expression for current wave (ii) rms value of current and (iii) total power dissipated in the circuit. The reactances shown in Fig.Q10(b) are for fundamental frequency. **(08 Marks)**

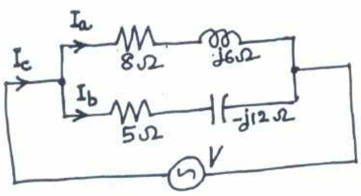

Fig.Q10(b)

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CBCS SCHEME

USN | | | | | | | | | | | **15EE33**

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

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume missing data if any.

Module-1

1 a. Explain the operation of practical transformer on load with the help of phasor diagram. **(06 Marks)**

b. Mention the advantages of bank of three single phase transformers used as three phase transformers. **(04 Marks)**

c. A 5kVA, 500/250V, 50Hz, SPH transformer gave following readings:
O.C. test : 500V, 1A, 50W [LV side open]
SC test : 25V, 10A, 60W [LV side shorted]
Determine: i) Efficiency on full load, 0.8 lagging pf ; ii) Voltage regulation on full load, 0.8 leading pf. **(06 Marks)**

OR

2 a. With a neat circuit diagram of phasor diagra, explain the operation of 3ph transformer connected in star-star. **(04 Marks)**

b. Explain with a neat circuit diagram, how to convert a 3 phase supply to 2 phase supply. **(06 Marks)**

c. Find the all day efficiency of 15kVA, single phase transformed having maximum efficiency of 98% at 15kVA, UPF and loaded as follows:
12 hours – 2kW @ 0.5 pf
6 hours – 12kW @ 0.8 pf
6 hours – No load. **(06 Marks)**

Module-2

3 a. What is an auto transformer? Derive an expression for the saving of copper in an autotransformer compared to two winding transformer. **(08 Marks)**

b. What is the necessity of parallel operation of 8 two single phase transformers? Derive an expression for the current shared by two transformers connected is parallel sharing a common load when no load voltage of both transformer are equal. **(08 Marks)**

OR

4 a. Write short note on 3 phase auto transformer. **(06 Marks)**

b. List out the necessary condition to be satisfied for the parallel operation of two single phase transformers. **(04 Marks)**

c. Explain with a neat diagram, operation of OFF CIRCUIT Tap-changing Transform. **(06 Marks)**

Module-3

5 a. With a neat circuit diagram, explain in detail Sumpner's test for determining the efficiency of a transformer. Mention its advantages and disadvantages. **(08 Marks)**

b. Define armature reaction. With neat figure, explain armature reaction in DC machines. **(08 Marks)**

OR

6 a. Briefly explain the current inrush in transformers. **(05 Marks)**

b. What is commutation? With a neat diagram, explain the process of practical commutation in DC machines. **(06 Marks)**

c. A 3ϕ, 16 pole, star connected alternator has 144 slots having 10 conductor/slot. The flux/pole is 30mWb and distributed sinusoidal and the speed is 375 rpm. Find the Emf [line] for i) Full pitched winding ii) Short pitched by 1 slot. **(05 Marks)**

Module-4

7 a. With a neat circuit diagram, explain the slip test on salient pole synchronous machine and indicate how X_d, X_q and Voltage regulation is calculated. **(08 Marks)**

b. Write short notes on power angle characteristics of a synchronous machines. **(04 Marks)**

c. Explain the behaviour of synchronous generator on constant load and variable excitation with a neat phasor diagram. **(04 Marks)**

OR

8 a. With a phasor diagram, explain the concept of two reaction theory in a salient pole synchronous machine. **(08 Marks)**

b. Define voltage regulation of an alternator and explain the load characteristics of an alternator. **(05 Marks)**

c. Briefly explain the necessary conditions to be satisfied to synchronize the given alternator to infinite bus. **(03 Marks)**

Module-5

9 a. Write short note on hunting and dampers. **(06 Marks)**

b. Name various methods of determining the voltage regulation of an alternator. Explain ZPF method to determine the regulation of an alternator. **(10 Marks)**

OR

10 a. Write short note on short circuit ratio and its significance. **(06 Marks)**

b. The OC and SC test readings for a 3ϕ, star connected 1000 kVA, 2000V, 50Hz alternator are:

I_f	10	20	25	30	40	50
OC terminal voltage	800	1500	1760	2000	2350	2600
1SC armature current	-	200	250	300	-	-

The armature effective resistance is 0.2Ω/ph. Draw the characteristic curves and estimate the full load regulation for i) 0.8pf lag ii) 0.8pf lead. **(10 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | | **15EE34**

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

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. For the circuit shown in Fig.Q1(a), sketch the output waveforms and transfer characteristics for cut in voltage = 0.7V. **(08 Marks)**

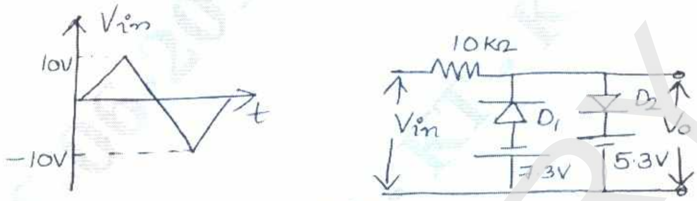

Fig.Q1(a)

b. Derive an expression for I_B, I_C, V_{CE} for voltage divider bias using exact analysis. **(08 Marks)**

OR

2 a. In a voltage divider bias circuit of BJT. $R_C = 4K\Omega$, $R_E = 1.5K\Omega$, $R_1 = 39K\Omega$, $R_2 = 3.9K\Omega$, $V_{CC} = 18V$ and $\beta = 70$. Find I_{CQ} and V_{CEQ}. **(08 Marks)**

b. Explain the operation of transistor as switch along with suitable circuit and necessary waveforms. Highlight the design procedure. **(08 Marks)**

Module-2

3 a. Define h-parameters and hence derive h-parameter model of a CE – BJT. **(06 Marks)**

b. State and prove Miller's theorem. **(04 Marks)**

c. For the network shown in Fig.Q3(c), determine r_e, Z_i, Z_0, A_V and A_I. **(06 Marks)**

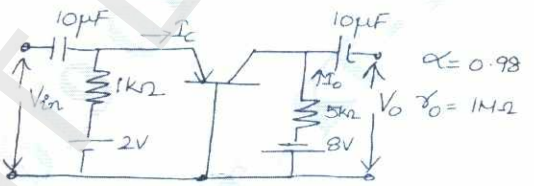

Fig.Q3(c)

OR

4 a. Determine the high frequency response of the amplifier circuit shown in Fig.Q4(a). Draw the frequency response curve.

$\beta = 100$, $C_{be} = 20pF$, $C_{bc} = 4pF$, $h_{ie} = 1100$, $C_{wi} = 6pF$, $C_{WO} = 8pF$, $C_{CC} = 1pF$. **(08 Marks)**

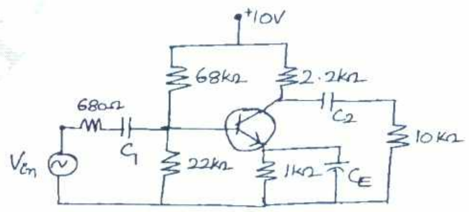

Fig.Q4(a)

b. Describe Miller effect and derive an equation for miller input and output capacitances. **(08 Marks)**

Module-3

5 a. Derive an expression for Z_i, A_V and A_I for Darlington emitter follower circuit. **(08 Marks)**

b. Explain the block diagram of a feedback amplifier. **(08 Marks)**

OR

6 a. List the general characteristics of negative feedback amplifier and derive the expression for gain with negative feedback. **(08 Marks)**

b. Derive the expression of R_{if} and R_{of} for voltage series feedback amplifier. **(08 Marks)**

Module-4

7 a. Explain the operation of a Class B push pull amplifier and show that its conversion efficiency is 78.5%. **(08 Marks)**

b. What is Brakhansen criteria for sustained oscillation? Explain basic principle of operation of oscillators. **(08 Marks)**

OR

8 a. Prove that the maximum conversion efficiency of class A transformer coupled amplifier is 50%. **(08 Marks)**

b. The harmonic distortion component in a power amplifier is $D_2 = 0.1$, $D_3 = 0.02$, $D_4 = 0.01$. The fundamental current amplitude is 4A and it supplies a load of 8Ω. Find total harmonic distortion, fundamental power and total power. **(08 Marks)**

Module-5

9 a. Draw the circuit of common source amplifier using JFET with the help of small signal model and derive an expression for input impedance, voltage gain and output impedance. **(08 Marks)**

b. For the JFET amplifier shown in Fig.Q9(b). Calculate i) g_m ii) r_d iii) Z_i iv) Z_0 v) A_V. **(08 Marks)**

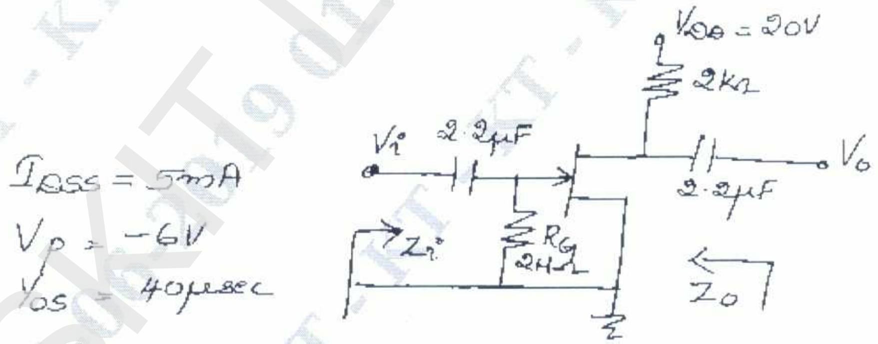

Fig.Q9(b)

OR

10 a. With the help of neat diagram, explain the construction, working and characteristics of n-channel JFET. **(08 Marks)**

b. Define transconductance and r_d of FET. Explain the procedure to determine the above values graphically. **(08 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | | **15EE35**

Third Semester B.E. Degree Examination, June/July 2019
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. Prove the following using Boolean theorems : **(04 Marks)**
i) $(x+\bar{x}\,\bar{y})(\bar{x}+\bar{y})+yz=\bar{y}+z$ ii) $\bar{w}\,\bar{y}\,\bar{z}+wz+\bar{y}z+xyz=\bar{w}\,\bar{y}+wz+xz$.

b. Using K – maps determine all the minimal sums and products of the following Boolean function.
i) $f(w, x, y, z) = \pi\, m\,(1, 3, 4, 5, 10, 11, 12, 14)$
ii) $g(a, b, c, d) = \Sigma\, m\,(0, 1, 4, 8, 9, 10) + dc\,(2, 11)$. **(07 Marks)**

c. Using MEV method determine minimal sum for the following function where x, y, z are map variables. Realize the expression using double rail logic. **(05 Marks)**
$f(A, B, x, y, z) = A\,\bar{x}\,\bar{y}\,\bar{z} + A\,\bar{x}\,\bar{y}z + A\,x\,\bar{y}\,z + B\,\bar{x}\,\bar{y}z + B\bar{x}\,y\,\bar{z} + \bar{x}\,y\,z + x\,\bar{y}\,\bar{z}$.

OR

2 a. For the following Boolean function use Quine Mc Cluskey algorithm method and Petrick's method to obtain all the irredudant disjunctive normal expressions. Which of these from minimal sums? $f(a, b, c, d) = \Sigma\, m(0, 4, 7, 8, 11, 12, 14, 15)$. **(08 Marks)**

b. For the following function use decimal Quine Mc Cluskey method and prime implicant table reduction technique to obtain minimal sum.
$f(a, b, c, d) = \Sigma\, m\,(0, 1, 2, 4, 6, 7, 9, 11, 12, 13, 15)$. **(08 Marks)**

Module-2

3 a. Implement the following functions using IC 74139 , a – 2 to 4 decoder.
i) $f_1(abc) = \Sigma\,(3, 5, 6, 7)$ ii) $f_2(a, b, c) = \Sigma\,(1, 2, 4)$ **(04 Marks)**

b. Design a 4 to 2 line priority encoder with 'valid' output where highest priority is given to input with highest index and obtain the minimal sum expressions for outputs. Realize the expressions with basic gates. **(06 Marks)**

c. Design and implement half adder and half subtractor circuits, with a and b as inputs. **(06 Marks)**

OR

4 a. Implement $f(a, b, c) = \Sigma\, m\,(1, 4, 5, 6, 7)$ using
i) 4 – 1 MUX with 'b' and 'c' to select line   ii) ii) 2 – 1 MUX with 'a' to select line
Show with K – maps and logic circuits. **(08 Marks)**

b. The 1-bit comparator had 3 outputs corresponding to a > b, a = b and a < b. It is possible to code these three outputs using two bits pq such that pq = 10 for a > b, pq = 00 for a = b and pq = 01 for a < b. This reduces the number of output lines of each 1-bit comparator to 2. The 1-bit comparator at the most significant position, however, should have a converter to convert back to three outputs. Design such a 1-bit comparator as well as the output converter network. **(08 Marks)**

Module-3

5 a. Design a switch debouncer using SR latch. Show relevant logic diagram and timing diagrams. **(06 Marks)**

b. What are characteristic equations? Derive them for SR, JK and T flip-flops. **(06 Marks)**

c. Clearly distinguish between:
   i) Synchronous and asynchronous circuits
   ii) Combinational and sequential circuits. **(04 Marks)**

OR

6 a. Explain with suitable logic and timing diagram:
   i) Serial-in-serial out shift register
   ii) Parallel-in-parallel out unidirectional shift register. **(08 Marks)**

b. Consider the synchronous counter shown in Fig.Q.6(b). Assuming it is initialized to "000" prior to the first count pulse, determine the counting sequence. Is this counter self correcting. **(08 Marks)**

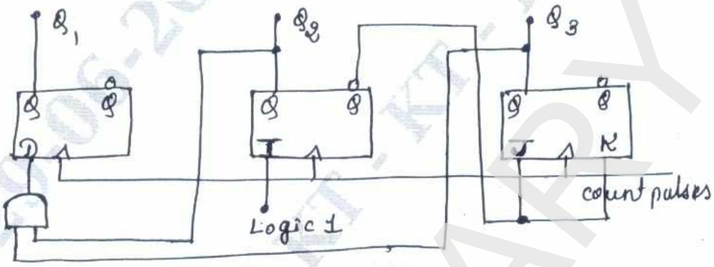

Fig.Q6(b)

Module-4

7 a. Briefly explain structure of clocked synchronous sequential network. **(05 Marks)**

b. Compare Mealy and Moore models. **(05 Marks)**

c. Construct the state table for the following state diagram in Fig.Q7(c). **(06 Marks)**

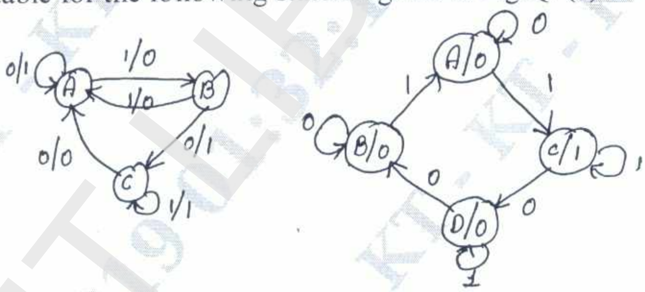

Fig.Q7(c)

OR

8 a. Design a clocked sequential circuit that operates according to state diagram shown in Fig.Q8(a). Implement the circuit using D-flip-flops. **(08 Marks)**

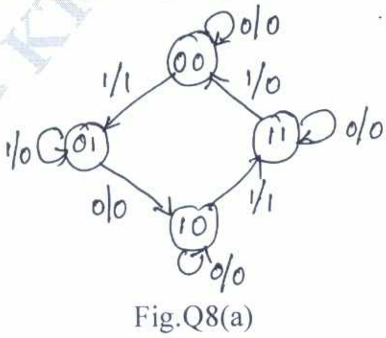

Fig.Q8(a)

b. For the clocked synchronous sequential network shown in Fig.Q8(b). Construct excitation table, transition table, state table and state diagram. **(08 Marks)**

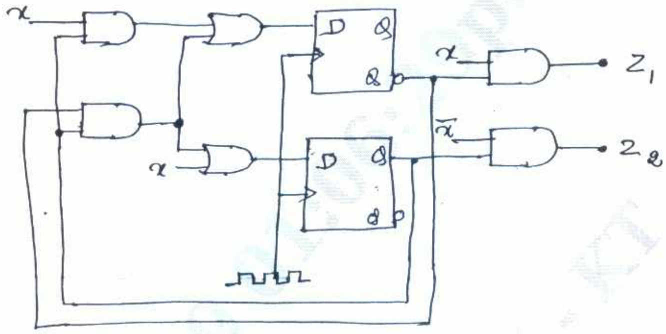

Fig.Q8(b)

Module-5

9 a. With schematic explain VHDL logical and relational operators. **(08 Marks)**

b. Briefly explain all VHDL data types. **(08 Marks)**

OR

10 a. Compare VHDL and verilog in detail. **(08 Marks)**

b. Write data flow description of a half adder (in both VHDL and verilog). Draw the truth table and derive the Boolean expressions, simulate and verify the circuit. **(08 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

15EE36

Third Semester B.E. Degree Examination, June/July 2019
Electrical and Electronic Measurements

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 dimension of MMF, EMF, magnetising force and flux density in LMTI system. **(04 Marks)**

b. In deriving equation for resistance in Hay's bridge the following expression is obtained

$$R = \frac{w^2 R_1 R_2 R_3 C^2}{1 + w^2 R_2^2 C}$$

Find whether the equation is dimensionally correct or not. In case there is an error, find the error and correct the question accordingly. **(08 Marks)**

c. State and explain sensitivity of Wheatstone's bridge. **(04 Marks)**

OR

2 a. Obtain the balance equation for Maxwell's inductance capacitance bridge used for measurement of unknown inductance. Draw the phasor diagram at balance condition. **(08 Marks)**

b. The bridge consists of the following :
Arm AB – a choke coil having a resistance R_1 and inductance L_1.
Arm BC – a non inductive resistance R_3.
Arm CD – a mica – condenser C_4 is series with a non inductive resistance R_4.
Arm DA – non inductive resistance R_2.
When the bridge is fed from a source of 500Hz. balance is obtained under following conditions $R_2 = 2410\Omega$, $R_3 = 750\Omega$, $C_4 = 0.35\ \mu F$, $R_4 = 64.5\Omega$. The series resistance of capacitor is 0.4Ω. Calculate the resistance and inductance of the choke coil. The supply is connected between A and C while the detector is between B and D. **(08 Marks)**

Module-2

3 a. Derive the torque equation of single phase electrodynometer type wattmeter. **(06 Marks)**

b. A 3-ϕ 400V motor takes an input of 40kW at 0.45 p.f lag. Find readings of each of the two single phase wattmeter connected to measures the input. **(05 Marks)**

c. The name plate of a single phase energy meter reads as 250V, 20A, 1800 rev/kwh. The meter is tested at $\frac{3}{4}^{th}$ load and upf. The meter makes 20 revolutions in 10sec. Determine the percentage error in the reading of the energymeter. **(05 Marks)**

OR

4 a. The constant of energy meter is 750rev/kwh calculate the number of revolutions made by it when connected to a load carrying 100A at 230V and 0.8p.f in 30sec. If it makes 110 revolutions in 30sec. find the percentage error. **(06 Marks)**

b. Derive an expression for a single phase induction type energy meter to show that the number of revolutions of disc are proportional to the power consumed by the load. **(06 Marks)**

c. What are the causes of creeping and how it is prevented. **(04 Marks)**

Module-3

5 a. What is shunt? How it is used to extend the range of an ammeter. **(04 Marks)**

b. A current transformer has bar primary and 400 secondary turns. The secondary winding has an impedance $(0.3 + j0.4)\Omega$ and the secondary burden is an ammeter of impedance $(1.5 + j0.6)\Omega$. The core requires 80 A magnetization and 60A for core loss.

Find :

i) The ratio error when ammeter reads 5A and the primary current
ii) The turns compensation required to bring the ratio error to zero
iii) Phase angle of the current transformer **(08 Marks)**

c. Differentiate between current transformer and potential transformer. **(04 Marks)**

OR

6 a. Explain Hopkinson's permeameter. **(06 Marks)**

b. Explain the constructional details of flexmeter. **(06 Marks)**

c. Explain the measurement of leakage factor using search coil. **(04 Marks)**

Module-4

7 a. What are the advantages of electronic voltmeter? **(04 Marks)**

b. With a block diagram, explain the working of a true RMS responding voltmeter. **(06 Marks)**

c. Mention the salient features of digital voltmeter. **(06 Marks)**

OR

8 a. Explain the operation of successive approximation type of digital voltmeter. **(06 Marks)**

b. With a neat block diagram, explain the principle of working of electronic energy meter. **(06 Marks)**

c. What is the working principle of Q meter? **(04 Marks)**

Module-5

9 a. With the help of neat diagram. Explain EMG. Recording. **(06 Marks)**

b. Explain the methods of magnetic tape recording in brief. **(10 Marks)**

OR

10 a. With a neat figure, explain the liquid crystal display. **(06 Marks)**

b. Draw and explain the structure and main components of conventional Cathode Ray Tube. **(10 Marks)**

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

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