CBCS SCHEME

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15MAT31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 expansion of the function $f(x) = x$ over the interval $(-\pi, \pi)$. Deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots$ **(08 Marks)**

b. The following table gives the variations of a periodic current A over a certain period T:

t (sec)	0	T/6	T/3	T/2	2T/3	5T/6	T
A (amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75amp in the variable current and obtain the amplitude of the first harmonic. **(08 Marks)**

OR

2 a. Obtain the Fourier series for the function $f(x) = 2x - x^2$ in $0 \le x \le 2$. **(06 Marks)**

b. Represent the function

$$f(x) = \begin{cases} x, & \text{for } 0 < x < \pi/2 \\ \pi/2 & \text{for } \pi/2 < x < \pi \end{cases}$$

in a half range Fourier sine series. **(05 Marks)**

c. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data:

x°	0	45	90	135	180	225	270	315
y	2	3/2	1	1/2	0	1/2	1	3/2

(05 Marks)

Module-2

3 a. Find the complex Fourier transform of the function

$$f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$$ Hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(06 Marks)**

b. If $\bar{u}(z) = \frac{2z^2 + 3z + 12}{(z-1)^4}$ show that $u_0 = 0 \quad u_1 = 0 \quad u_2 = 2 \quad u_3 = 11$. **(05 Marks)**

c. Obtain the Fourier cosine transform of the function

$$f(x) = \begin{cases} 4x, & 0 < x < 1 \\ 4 - x, & 1 < x < 4 \\ 0 & x > 4 \end{cases}$$ **(05 Marks)**

OR

4 a. Obtain the Z-transform of $\cos n\theta$ and $\sin n\theta$. **(06 Marks)**

b. Find the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx \quad m > 0$. **(05 Marks)**

c. Solve by using Z-transforms $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = 0 = y_1$. **(05 Marks)**

Module-3

5 a. Fit a second degree parabola $y = ax^2 + bx + c$ in the least square sense for the following data and hence estimate y at x = 6. **(06 Marks)**

x	1	2	3	4	5
y	10	12	13	16	19

b. Obtain the lines of regression and hence find the coefficient of correlation for the data:

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

(05 Marks)

c. Use Newton-Raphson method to find a real root of $x\sin x + \cos x = 0$ near $x = \pi$. Carryout the iterations upto four decimal places of accuracy. **(05 Marks)**

OR

6 a. Show that a real root of the equation $\tan x + \tanh x = 0$ lies between 2 and 3. Then apply the Regula Falsi method to find third approximation. **(06 Marks)**

b. Compute the coefficient of correlation and the equation of the lines of regression for the data:

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

(05 Marks)

c. Fit a curve of the form $y = ae^{bx}$ for the data:

x	0	2	4
y	8.12	10	31.82

(05 Marks)

Module-4

7 a. From the following table find the number of students who have obtained:

i) Less than 45 marks

ii) Between 40 and 45 marks.

Marks	30-40	40-50	50-60	60-70	70-80
Number of students	31	42	51	35	31

(06 Marks)

b. Construct the interpolating polgnomial for the data given below using Newton's general interpolation formula for divided differences and hence find y at x = 3.

x	2	4	5	6	8	10
y	10	96	196	350	868	1746

(05 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by Weddle's rule. Taking seven ordinates. Hence find $\log_e 2$. **(05 Marks)**

OR

8 a. Use Lagrange's interpolation formula to find f(4) given below. **(06 Marks)**

x	0	2	3	6
f(x)	-4	2	14	158

b. Use Simpson's $3/8^{th}$ rule to evaluate $\int_1^4 e^{1/x}dx$. **(05 Marks)**

c. The area of a circle (A) corresponding to diameter (D) is given by

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

Find the area corresponding to diameter 105 using an appropriate interpolation formula. **(05 Marks)**

Module-5

9 a. Evaluate Green's theorem for $\oint_c (xy + y^2)\,dx + x^2dy$ where c is the closed curve of the region bounded by $y = x$ and $y = x^2$. **(06 Marks)**

b. Find the extremal of the functional $\int_a^b \left(x^2 + y^2 + 2y^2 + 2xy\right)dx$. **(05 Marks)**

c. Varity Stoke's theorem for $\vec{F} = (2x - y)\,\hat{i} - yz^2\hat{j} - y^2z\,\hat{k}$ where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ C is its boundary. **(05 Marks)**

OR

10 a. Derive Euler's equation in the standard form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y1}\right) = 0$. **(06 Marks)**

b. If $\vec{F} = 2xy\hat{i} + y^2z\hat{j} + xz\hat{k}$ and S is the rectangular parallelepiped bounded by $x = 0$, $y = 0$, $z = 0$, $x = 2$, $y = 1$, $z = 3$. Evaluate $\iint_S \vec{F}.\hat{n}\,ds$. **(05 Marks)**

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

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15EE32

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. For the network K shown in Fig Q1(a) find potential between M and N using source transformation. **(04 Marks)**

b. Using Mesh current Analysis determine V_x and power supplied by 10 volt source of the network shown in Fig Q1(b). **(06 Marks)**

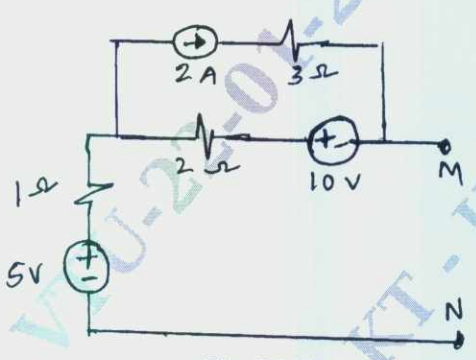

Fig Q1(a)

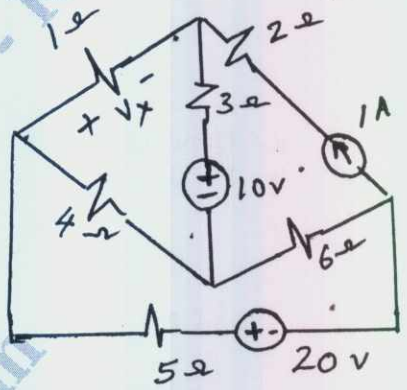

Fig Q1(b)

c. What is Resonance? Show that the resonant frequency in geometric mean of cut off frequencies. **(06 Marks)**

OR

2 a. For the circuit shown in Fig Q2(a), final the resistance between M and N using Star/Delta transformation. **(05 Marks)**

b. Using Node voltage analysis, find V_x and I_x. of the circuit shown in Fig Q2(b) **(06 Marks)**

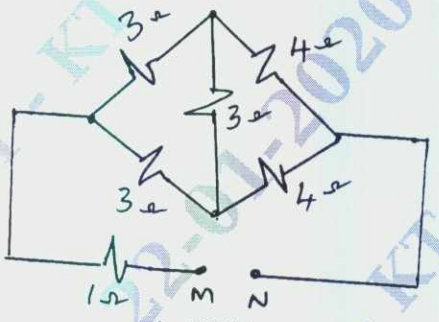

Fig Q2(a)

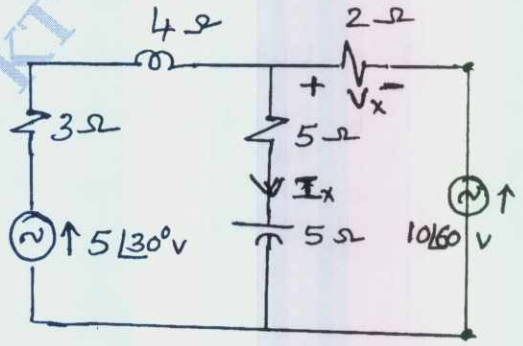

Fig Q2(b)

c. A coil of 20Ω resistance was in inductance of 0.2 henery and is connected in parallel with capacitance of 100μF. Find the resonant frequency at which circuit will act as non inductive resistance, Also find the dynamic resistance. **(05 Marks)**

Module-2

3 a. State and prove Reciprocity theorem. **(05 Marks)**

b. For the network shown in Fig Q3(b), find current I using Milliman's theorem. **(05 Marks)**

c. For the network shown in Fig Q3(c), find current I using Norton's theorem. **(06 Marks)**

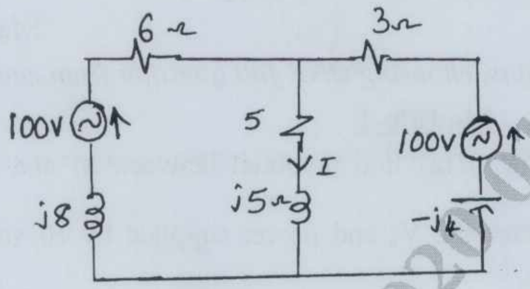

Fig Q3(b)

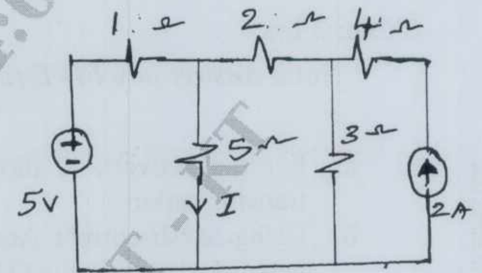

Fig Q3(c)

OR

4 a. Draw the Thevenin's equivalent circuit of Fig shown in Fig Q4(a). **(05 Marks)**

b. For the network shown in Fig Q4(b), find the current 'I_x' using superposition theorem. **(05 Marks)**

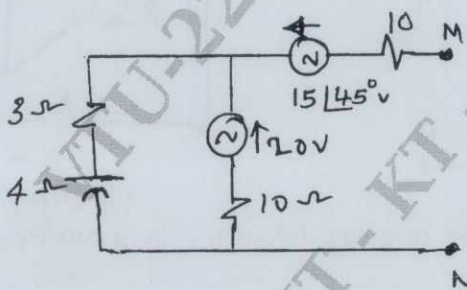

Fig Q4(a)

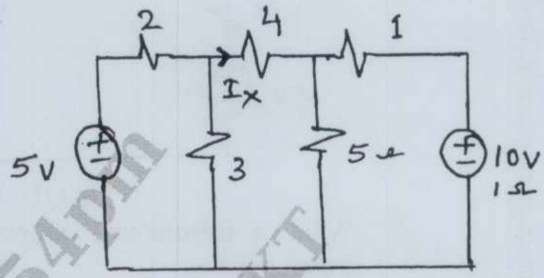

Fig Q4(b)

c. State and obtain the condition for maximum power transfer when load consisting of variable resistance and variable reactance. **(06 Marks)**

Module-3

5 a. Explain the behavior of Resistance, inductance and capacitance for initial condition. **(05 Marks)**

b. For the network shown in Fig Q5(b), switch is closed at t = 0. Write expression for current i(t) for t > 0. **(06 Marks)**

c. For the circuit shown in Fig Q5(c), switch is closed at t = 0. Obtain expression for current i(t) for t > 0. **(05 Marks)**

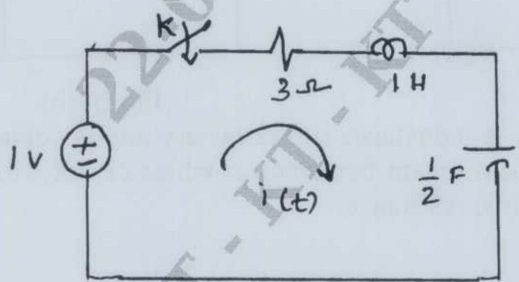

Fig Q5(b)

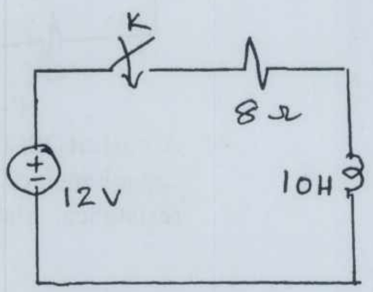

Fig Q5(c)

OR

6 a. Define initial condition and final condition and list merits of initial conditions. **(04 Marks)**

b. For the network shown in Fig Q6(b) switch is changed from M to N at $t = 0$ after reaching steady state condition. Find current i(t) and its derivatives at $t = 0^+$. **(06 Marks)**

c. For the network shown in Fig Q6(c) switch is opened at $t = 0$. Find voltage v(t) and its first and second derivatives at $t = 0^+$. **(06 Marks)**

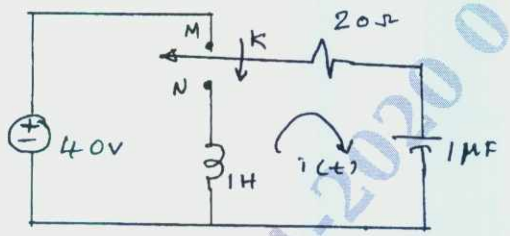

Fig Q6(b)

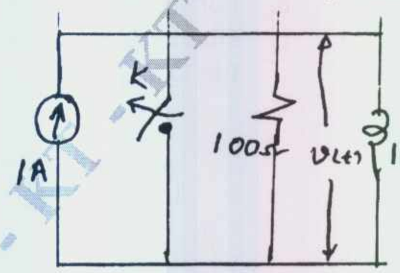

Fig Q6(c)

Module-4

7 a. State and explain Final value theorem. **(05 Marks)**

b. If the capacitors are uncharged and the inductor current is zero at $t = 0^-$, in the given network shown in Fig Q7(b). Show that the transform of the generator current is

$$\frac{10(s^2+s+1)}{(s^2+1)(s^2+2s+2)}$$ **(05 Marks)**

c. Synthesis the waveform shown in Fig Q7(c) and find the Laplace transform. **(06 Marks)**

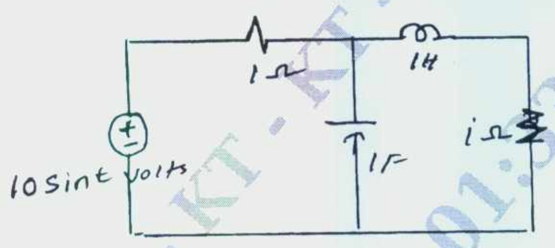

Fig Q7(b)

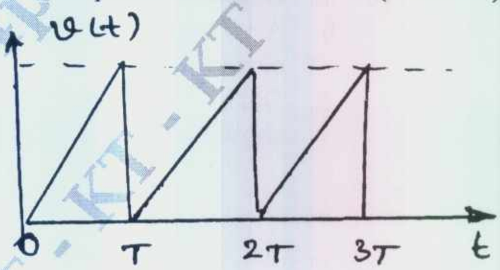

Fig Q7(c)

OR

8 a. Find the Laplace transform of following standard signal. i) Unit step ii) Ramp iii) Impulse **(05 Marks)**

b. Let $I(s) = \dfrac{2s+5}{(s+1)(s+2)}$. Find its initial value using initial value theorem. Verify the result. **(04 Marks)**

c. For the network shown in Fig Q8(c) at $t = 0$ switch is opened. Find node voltage $v_1(t)$ and $v_2(t)$. The network is under steady state condition when the switch is closed. **(07 Marks)**

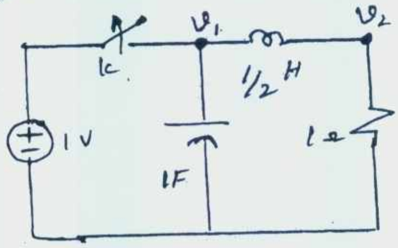

Fig Q8(c)

Module-5

9 a. Determine the line currents and total power supplied to a Delta connected load of $Z_{AB} = 10\angle 60$, $Z_{BC} = 20\angle 90$ and $Z_{CA} = 25\angle 30°\Omega$. Assume a 3 phase 400V and ABC sequence. **(06 Marks)**

b. For the network shown in Fig Q9(b), obtain the z - parameters. **(06 Marks)**

c. Obtain driving point impedance and driving point admittance of one port network shown in Fig Q9(c). **(04 Marks)**

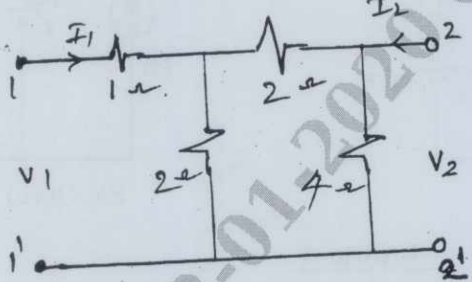

Fig Q9(b)

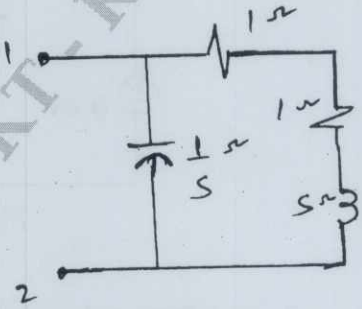

Fig Q9(c)

OR

10 a. Obtain y-parameters interms of z-parameters. **(06 Marks)**

b. A voltage pulse of 10V magnitude is applied to the network shown in Fig Q10(b). Find the current i(t). **(06 Marks)**

c. Determine the system function if the d.c gain of the system is 10 and pole zero plot is as shown in the Fig Q10(c). **(04 Marks)**

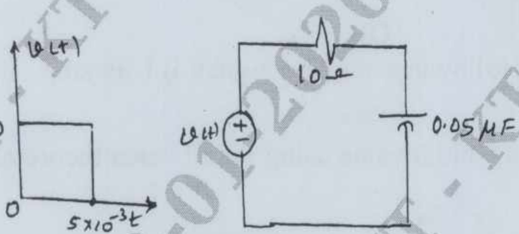

Fig Q10(b)

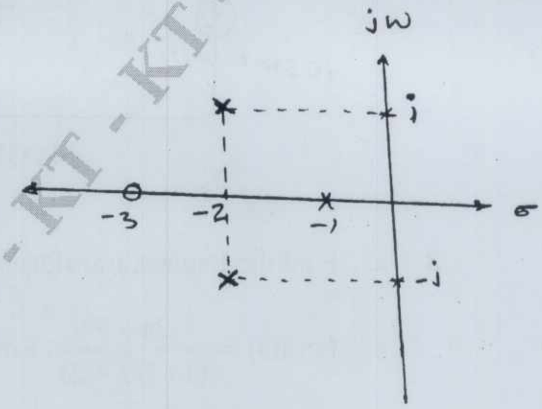

Fig Q10(c)

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15EE33

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Derive an equivalent circuit of a single phase transformer and show that the parameters of the primary and secondary winding may be combined to give a simplified equivalent circuit referred to primary side. **(08 Marks)**

b. A 3ϕ transformer of ratio 33/6.6KV delta/star 2MVA has a primary resistance of 8Ω per phase and a secondary resistance of 0.08 per phase. The percentage of impedance is 7% calculate the secondary load voltage with rated primary voltage and hence the regulation for full load 0.75p.f. lagging condition. **(08 Marks)**

OR

2 a. The following readings are obtained from O.C. and S.C tests on 8KVA 400/120V, 50Hz transformer.
O.C test (L.V side) : 120V ; 4A ; 75W
S.C test (H.V side) : 9.5V ; 20A ; 110W
Calculate:
i) The equivalent circuit constants.
ii) Voltage regulation and efficiency for 0.8 lagging power factor full load.
iii) The efficiency at half load and 0.8 p.f. load. **(08 Marks)**

b. Explain with the help of connection and phasor diagrams how Scott connections are used to obtain two phase supply from three phase supply mains. **(08 Marks)**

Module-2

3 a. What are the conditions necessary for satisfactory parallel operation? **(04 Marks)**

b. What are the advantages of the Sumpner's test? **(04 Marks)**

c. Two 250KVA transformers supplying a network are connected in parallel on both primary and secondary sides. Their voltage ratios are the same. The resistance drops are 1.5% and 0.9% and the reactance drops are 3.33% and 4% respectively. Calculate the KVA loading on each transformer and its power factor when the total load on the transformers is 500KVA and at 0.707 lagging power factor. **(08 Marks)**

OR

4 a. Derive an expression for the currents shared by between two transformers connected in parallel supplying a common load when no load voltages of these transformers are unequal. **(08 Marks)**

b. Write a brief note on:
i) Polarity test
ii) On load tap changing of transformer. **(08 Marks)**

Module-3

5 a. What is armature reaction? With neat figures explain armature reaction in D.C. machine under normal working condition. **(08 Marks)**

b. A 3ϕ star connected alternator on open circuit is required to generate a line voltage of 3.4KV, 50Hz. When driven at 500rpm. The stator has 3 slots/pole/phase and 10 conductors/slot. The coils are short chorded by 1 slot. Calculate the number of poles and useful flux/pole. **(08 Marks)**

OR

6 a. Derive the Emf equation of a synchronous generator. Define distribution factor and pitch factor. **(08 Marks)**

b. An 8 pole wave wound d.c. generator has 480 armature conductors. The armature current is 200A. Find the armature reaction demagnetizing and cross magnetizing ampere turns per pole, if
   i) Brushes are on G.N.A.
   ii) Brushes are shifted 6° electrical from G.N.A. **(08 Marks)**

Module-4

7 a. With a neat phasor diagram derive an expression for the power output of a salient pole alternator. Draw the variation of power, V_s, load angle δ. **(08 Marks)**

b. Explain the behavior of synchronous generator on no load under variable excitation connected to infinite bus bar. **(08 Marks)**

OR

8 a. Two 6600 volt, star connected alternators operating in parallel supply with the following loads:
   i) 400kW at UPF
   ii) 1000kW at 0.71 p.f. lag
   iii) 400kW at 0.8 p.f lag
   iv) 300kW at 0.9 p.f lag.

   The armature current of one machine is 110A, at a p.f. of 0.9 lag. Find the output armature current and p.f. of the other machine. **(08 Marks)**

b. What is synchronizing of alternators? What are the conditions for proper synchronization of alternators? How three phase alternators are synchronized? **(08 Marks)**

Module-5

9 a. Describe the synchronous impedance method to determine regulation of an alternator for lagging and leading power factor. **(10 Marks)**

b. Define short circuit ratio and explain its significance. **(06 Marks)**

OR

10 a. Define regulation of an alternator. Explain the potier reactance method of finding regulation of an alternator. **(10 Marks)**

b. A 2300V, 50Hz, 3ϕ star connected alternator has an effective armature resistance of 0.2Ω. A field current of 35A produces a current of 150A on short circuit and an open circuit emf 780V (line). Calculate the voltage regulation at 0.8pf. lagging and 0.8 p.f. leading for the full load current of 25A. **(06 Marks)**

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CBCS SCHEME

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15EE34

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Explain the dc analysis of emitter stabilized bias circuit. State its advantages and disadvantages. **(06 Marks)**

b. Obtain an expression for S_{VBE} OR S′ for voltage divider bias circuit. Also express relation between S_{ICO} (S) and S_{VBE} (S′). **(10 Marks)**

OR

2 a. For voltage divider bias circuit $R_1 = 68K\Omega$, $R_2 = 6.8K\Omega$, $R_C = 3.3K\Omega$, $R_E = 1K\Omega$, $V_{CC} = 12V$ and $\beta = 100$. Determine the location of Q-point. Draw the circuit diagram. **(10 Marks)**

b. For the circuit shown in Fig.Q.2(b), determine V_{CE}, VE and IE. Given that $R_B = 220K\Omega$, $R_E = 2.2K\Omega$, $V_{BB} = 5V$, $V_{EE} = -5V$, $\beta = 100$. **(06 Marks)**

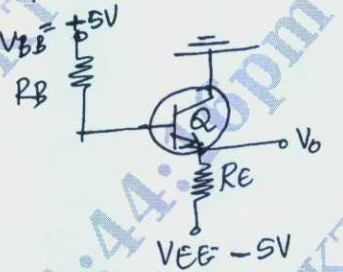

Fig.Q.2(b)

Module-2

3 a. State the conditions to operate transistor in saturation region, just out of saturation region and for active region. **(03 Marks)**

b. For the common collector circuit shown in Fig.Q.3(b), $R_1 = 47K\Omega$, $R_2 = 4.7K\Omega$, $R_E = 3.3K\Omega$, $R_L = 10K\Omega$, $R_S = 1K\Omega$, $h_{ic} = 1.2K\Omega$, $h_{fc} = -101$, $h_{rc} = 1$ and $h_{oc} = 25\mu A/V$. Determine A_I, Z_i, Av and Avs. How do you justify your results? Use exact h-parameter model. **(10 Marks)**

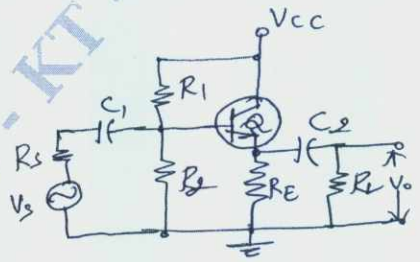

Fig.Q.3(b)

c. State and explain the conditions to apply approximate h-parameter model for small signal equivalent circuit. **(03 Marks)**

OR

4 a. Consider a hybrid II model for CE stage. Explain the variation of current gain vs frequency. Obtain an expression for cut off frequency f_β. **(10 Marks)**

b. The short circuit CE current gain of transistor is 50 at a frequency of 5MHZ, if f_β = 300kHz, determine f_T, hfe and /Ai/ when f = 10MHZ. **(06 Marks)**

Module-3

5 a. For the 2-stage cascade amplifier shown in Fig.Q.5(a), calculate A_I, A_V, Z_i, Z_o. Given h_{ie} = 1.1KΩ, h_{fe} = 50, h_{re} = h_{oe} = 0. **(10 Marks)**

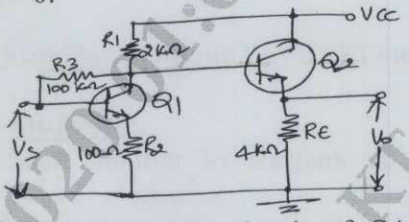

Fig.Q.5(a)

b. What is a CASCODE amplifier? Draw the circuit of CASCODE amplifier. State its advantage. **(06 Marks)**

OR

6 a. Obtain an expression for transfer gain and stability of gain in negative feedback amplifier. **(08 Marks)**

b. For the voltage series feedback amplifier shown in Fig.Q.6(b), calculate D, A_{vf}, Z_{if} and Z'_{of}. **(08 Marks)**

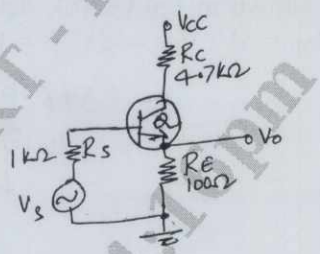

Fig.Q.6(b)

Module-4

7 a. Derive an expression for second harmonic distortion and power output due to distortion in a power amplifier. Use 3-point method. **(10 Marks)**

b. A complementary push pull amplifier has capacitive couple load, R_L = 8Ω, V_{CC} = ±12V, find $P_{ac\,max}$, P_D of each transistor and conversion efficiency. **(06 Marks)**

OR

8 a. Obtain an expression for frequency of oscillations in Hartley oscillator. **(10 Marks)**

b. A crystal has α = 0.1H, C = 0.01pF, R = 10KΩ, C_M = 1pF. Find fs and Q-factor. Also state Barkhausen criteria for sustained oscillations. **(06 Marks)**

Module-5

9 a. List the important features of FET and state its drawback also. **(06 Marks)**

b. For the voltage divider bias circuit of FET, R_D = 1.2KΩ, R_S = 2KΩ, R_1 = 20KΩ, R_2 = 10KΩ, V_{DD} = 12V, I_{DSS} = 12mA, V_P = -4V, determine I_D, V_{GS}, V_G, V_{DS} and V_S. Draw the circuit diagram. **(10 Marks)**

OR

10 a. Consider JFET with self bias having unbypassed R_S. Obtain expression for Z_i Z_o and A_v. Draw the circuit diagram and small signal circuit also. **(10 Marks)**

b. Explain the differences between depletion type and enhancement type MOSFETS. **(06 Marks)**

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15EE35

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Digital System Design

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Simplify the following expression using K-map. Implement the simplified expression using only NOR Gates. **(06 Marks)**

$f(a,b,c,d) = \pi M(0,3,4,7,8,10,12,14) + \sum dc(2,6)$

b. Write a short note on combinational logic circuit. **(04 Marks)**

c. Using Quine-McClusky method and prime implicant reduction, obtain minimal POS for $f(x,y,z) = \sum m(0,1,2,5,6,7) + dc(3)$ **(06 Marks)**

OR

2 a. Write a short note on MEV technique. **(04 Marks)**

b. Generate switching function for odd parity generator where input variables are a, b, c and d. Also define parity. **(06 Marks)**

c. Minimize the function using c and d as MEV on K-map.

$f(a,b,c,d) = \sum m(2,3,4,5,13,15) + d(8,9,10,11)$ **(06 Marks)**

Module-2

3 a. With a neat block diagram, explain the 4-bit carry look ahead adder. **(08 Marks)**

b. Implement the following function pairs using a 3 : 8 line decoder. $f_1(a,b,c) = \sum m(0,2,4,6)$

$f_2(a,b,c) = \sum m(1,2,4,5,7)$. **(04 Marks)**

c. Write a short note on priority encoder. **(04 Marks)**

OR

4 a. Write a short note on 2-bit binary comparator. **(04 Marks)**

b. What is a Mux Tree? Implement a 16 : 1 MUX using only 4 : 1 MUXs. **(06 Marks)**

c. Implement $f(a,b,c,d) = \sum m(0,1,5,6,7,9,10,15)$ using a 4 : 1 MUX with a and b as select lines. **(06 Marks)**

Module-3

5 a. Compare synchronous and asynchronous sequential circuits. **(04 Marks)**

b. Briefly explain the working of a Master Slave JK Flip-Flop. **(06 Marks)**

c. With neat timing diagram, explain the working of an asyncrhronous 4 bit down counter using JK Flip-Flop. **(06 Marks)**

OR

6 a. Design a mod-6 UP counter using synchronously clocked SR Flip Flops. **(08 Marks)**

b. Discuss about counters based on shift registers. **(04 Marks)**

c. With neat timing diagram, explain briefly negative edge triggered T-Flip-Flop. **(04 Marks)**

Module-4

7 a. With block diagrams, explain Melay and Moore models. **(06 Marks)**

b. A sequential circuit with two DFFS : A and B and input X and output Y is specified by the following next state and output equations:

$A(t+1) = AX + BX$

$B(t+1) = \overline{A}X$

$Y = (A+B)\overline{X}$

(i) Draw the logic diagram of the circuit.
(ii) Derive state table.
(iii) Derive the state diagram. **(10 Marks)**

OR

8 a. Explain the following state machine notations:
(i) State and state variable.
(ii) Present state and Next state.
(iii) State diagram.
(iv) State table. **(04 Marks)**

b. Design a sequence detector to detect the following sequence using DFF by using Melay machine.
Sequence : 1101 **(12 Marks)**

Module-5

9 a. Compare VHDL and Verilog. **(04 Marks)**

b. List all relational operators in VHDL and Verilog. **(04 Marks)**

c. Explain a 2×2 unsigned combinational array multiplier and write verilog description for the same. **(08 Marks)**

OR

10 a. List all the mathematical operators in verilog. **(04 Marks)**

b. Discuss about various modeling style or types of descriptions. With full adder as an example, write VHDL behavioral description. **(06 Marks)**

c. Explain data type vectors. For a D latch. Write verilog description. **(06 Marks)**

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15EE36

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Electrical and Electronic Measurements

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive the dimensions of MMF, EMF and FLUX density in LMIT system. **(05 Marks)**

b. Explain with neat sketch how megger is used for the measurement of very high resistance. **(05 Marks)**

c. Derive the bridge balance equation for Kelvin's double bridge. **(06 Marks)**

OR

2 a. Explain the measurement of inductance using Anderson's bridge. Draw the phasor diagram. **(06 Marks)**

b. Explain sources and detectors used in A.C. bridges. **(04 Marks)**

c. The four arms of AC bridges are as,
Arm ab : an insulating material representing an imperfect capacitor.
Arm bc : a non inductive resistance of 1200 Ω
Arm da : a loss free capacitor of 100 μF.
Arm cd : a resistance 300 Ω in parallel with capacitor of 0.6 μF.
An A.C supply of 50 Hz is connected across A.C and detector is connected across bd. Determine capacitance equivalent series resistance and loss angle of insulating material. **(06 Marks)**

Module-2

3 a. Derive the torque equation for dynamometer type wattmeter. **(06 Marks)**

b. Explain the errors and adjustments done in energy meter to read accuractely. **(06 Marks)**

c. The constant of energy meter is 750 revolutions/kwh. Calculate the number of revolutions made by it, when connected to a load carrying 100 A at 230 V and 0.8 p.f. in 30 seconds. If it makes 110 revolutions in 30 seconds. Find the percentage error. **(04 Marks)**

OR

4 a. With a neat diagram, explain the construction of single phase dynamometer type power factor meter. **(08 Marks)**

b. Explain the construction and operation of Weston frequency meter. **(08 Marks)**

Module-3

5 a. Explain the theory and operation of a comparative deflection method of testing a C.T by Silsber's test method. **(06 Marks)**

b. Explain the P.T with the help of an equivalent circuit diagram. **(04 Marks)**

c. A current with 5 primary turns has a secondary burden consisting of a resistance of 0.16 Ω and an inductive reactance of 0.12 Ω, when the primary current is 200 A, the magnetizing current is 1.5 A and the iron loss current is 0.4 A. Find the number of secondary turns needs to make the current ratio 100.1 and the phase angle. **(06 Marks)**

OR

6 a. Explain the wattmeter method of measuring the iron loss. **(06 Marks)**
b. Describe the method of measurement of flux density. **(06 Marks)**
c. Explain Hopkinson's permeameter. **(04 Marks)**

Module-4

7 a. With a neat diagram, explain the working of a true R.M.S responding voltmeter. **(06 Marks)**
b. Explain with a block diagram the working of a Ramp type digital voltmeter. **(05 Marks)**
c. Explain the operation of a electronic multimeter to measure current, voltage and resistance. **(05 Marks)**

OR

8 a. Explain in brief the operation of successive approximate type of digital voltmeter, with a neat sketch. **(06 Marks)**
b. With a neat block diagram, explain the principle of working of electronic energy meter. **(05 Marks)**
c. Explain principle of Q-meter. **(05 Marks)**

Module-5

9 a. Write short note on LCD display. **(05 Marks)**
b. Explain the theory and working of an LED. **(05 Marks)**
c. Draw and explain the structure and main components of conventional cathode ray tube. **(06 Marks)**

OR

10 a. Explain the construction and working of LVDT. **(05 Marks)**
b. With a neat sketch, explain the working of a X-Y recorder. **(06 Marks)**
c. With the help of neat block diagram, briefly explain ECG machine. **(05 Marks)**

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15MATDIP31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Find modulus and amplitude of $1-\cos\theta+i\sin\theta$. **(05 Marks)**

b. Express $\frac{3+4i}{3-4i}$ in $a+ib$ form. **(05 Marks)**

c. Find the value of 'λ' so that the points A(–1, 4, –3), B(3, 2, –5), C(–3, 8, –5) and D(–3, λ, 1), may lie on one plane. **(06 Marks)**

OR

2 a. Find the angle between the vectors $\vec{a}=5\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}-3\hat{j}+6\hat{k}$. **(05 Marks)**

b. Prove that $\left[\vec{a}\times\vec{b},\ \vec{b}\times\vec{c},\ \vec{c}\times\vec{a}\right]=\left[\vec{a}\,\vec{b}\,\vec{c}\right]^2$. **(05 Marks)**

c. Find the real part of $\frac{1}{1+\cos\theta+i\sin\theta}$. **(06 Marks)**

Module-2

3 a. Obtain the n^{th} derivative of $\sin(ax+b)$. **(05 Marks)**

b. Find the pedal equation of $r^n=a^n\cos n\theta$. **(05 Marks)**

c. If $u=\frac{yz}{x}$, $v=\frac{zx}{y}$, $w=\frac{xy}{z}$, show that $\frac{\partial(u,v,w)}{\partial(x,y,z)}=4$. **(06 Marks)**

OR

4 a. If $u=\log\left(\frac{x^4+y^4}{x+y}\right)$ show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=3$. **(05 Marks)**

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

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

Module-3

5 a. Evaluate $\int_0^{\pi} x\sin^8 x\,dx$. **(05 Marks)**

b. Evaluate $\int_0^1 x^2(1-x^2)^{3/2}\,dx$. **(05 Marks)**

c. Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dz\,dy\,dx$. **(06 Marks)**

OR

6 a. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy\,dy\,dx$. **(05 Marks)**

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

c. Evaluate $\int_0^\infty \frac{x^4}{(1+x^2)^4}\,dx$. **(06 Marks)**

Module-4

7 a. If $\vec{r} = (t^2+1)\hat{i} + (4t-3)\hat{j} + (2t^2-6t)\hat{k}$, find the angle between the tangents at t = 1 and t = 2. **(05 Marks)**

b. If $\vec{r} = e^{-t}\hat{i} + 2\cos 3t\,\hat{j} + 2\sin 3t\,\hat{k}$, find the velocity and acceleration at any time t, and also their magnitudes at t = 0. **(05 Marks)**

c. Show that $\vec{F} = (y+z)\hat{i} + (z+x)\hat{j} + (x+y)\hat{k}$ is irrotational. Also find a scalar function 'φ' such that $\vec{F} = \nabla\phi$. **(06 Marks)**

OR

8 a. Find the unit normal vector to the surface $x^2y + 2xz = 4$ at (2, –2, 3). **(05 Marks)**

b. If $\vec{F} = xz^3\hat{i} - 2x^2yz\,\hat{j} + 2yz^4\hat{k}$ find $\nabla\cdot\vec{F}$ and $\nabla\times\vec{F}$ at (1, –1, 1). **(05 Marks)**

c. If $\frac{d\vec{a}}{dt} = \vec{w}\times\vec{a}$ and $\frac{d\vec{b}}{dt} = \vec{w}\times\vec{b}$, then show that $\frac{d}{dt}(\vec{a}\times\vec{b}) = \vec{w}\times(\vec{a}\times\vec{b})$ **(06 Marks)**

Module-5

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

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

c. Solve $\frac{dy}{dx} + \frac{y}{x} = xy^2$. **(06 Marks)**

OR

10 a. Solve $\frac{dy}{dx} + y\cot x = \cos x$. **(05 Marks)**

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

c. Solve $y(x+y)dx + (x+2y-1)dy = 0$ **(06 Marks)**

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