CBCS SCHEME

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17EC33

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Analog Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive an expression for input impedance, output impedance, voltage gain and current gain of un bypassed RE common emitter amplifier using r_e model. **(10 Marks)**

b. For the network of Fig.Q1(b), determine : i) r_e ii) Z_i iii) Z_0, ($r_0 = \infty\Omega$) iv) A_V($r_0 = \infty\Omega$) v) the parameters of parts ii through iv if $r_0 = 50K\Omega$ for $R_1 = 56K\Omega$, $R_2 = 8.2K\Omega$, $C_1 = 10\mu f$, $C_2 = 10\mu f$, $R_E = 1.5K\Omega$, $C_E = 20\mu f$, $R_C = 6.8K\Omega$, $\beta = 90$ and $V_{CC} = 22V$. **(10 Marks)**

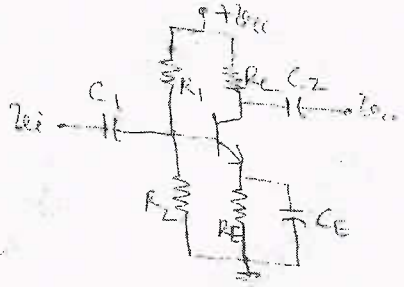

Fig.Q1(b)

OR

2 a. Derive an expression of input impedance, output impedance, voltage gain and current gain of fixed bias CE amplifier using h-parameter. **(10 Marks)**

b. Determine r_e, h_{fe}, h_{ie}, Z_i, Z_0, A_V and A_i for the circuit shown in Fig.Q2(b) using hybrid equivalent model. **(10 Marks)**

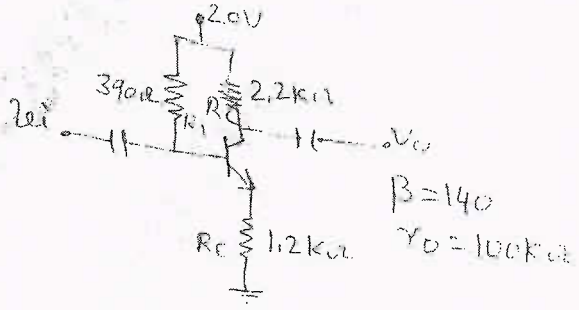

Fig.Q2(b)

Module-2

3 a. Explain the working principle of JFET, and explain the transfer characteristics of JFET. **(08 Marks)**

b. Derive an expression for input impedance, output impedance, voltage gain and current gain of fixed bias FET amplifier. **(08 Marks)**

c. Distinguish between JFET and MOSFET. **(04 Marks)**

OR

4 a. With neat diagram explain construction and working principle of n-channel depletion type MOSFET. **(10 Marks)**

b. Derive an expression for input impedance, output impedance and voltage gain of common – Gate FET amplifier. **(10 Marks)**

Module-3

5 a. Derive an expression for low frequency response of BJT amplifier due to capacitors C_S, C_E and C_C. **(10 Marks)**

b. Determine the lower cutoff frequency for the network of Fig.Q5(b) using the following parameters $C_i = 10\mu f$, $C_E = 20\mu f$, $C_C = 1\mu f$, $R_S = 1k\Omega$, $R_1 = 40\ K\Omega$, $R_2 = 10K\Omega$, $R_E = 2K\Omega$, $R_C = 4K\Omega$, $R_L = 2.2K\Omega$, $\beta = 100$, $r_0 = \infty\Omega$ and $V_{CC} = 20V$, plot the response. **(10 Marks)**

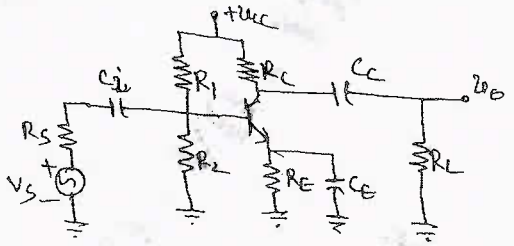

Fig.Q5(b)

OR

6 a. Define Miller's theorem, determine equivalent input and output capacitances of the circuit. **(10 Marks)**

b. Determine the lower cutoff frequency for the network of Fig.Q6(b) using the following parameters. $C_{Gi} = 0.01\mu f$, $C_C = 0.5\mu f$, $C_S = 2\mu f$, $R_{Sig} = 10K\Omega$, $R_G = 1M\Omega$, $R_0 = 4.7K\Omega$, $R_S = 1K\Omega$, $R_L = 2.2K\Omega$, $I_{DSS} = 8mA$, $V_P = -4V$, $r_d = \infty\Omega$, $V_{DD} = 20V$, $V_{GSQ} = -2V$ and $I_{DQ} = 2mA$. Plot the frequency response. **(10 Marks)**

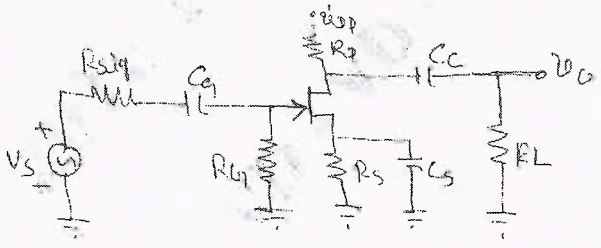

Fig.Q6(b)

Module-4

7 a. Determine input resistance and output resistance of voltage shunt feedback amplifier. **(06 Marks)**

b. Determine the voltage, input and output impedance with feedback for voltage series feedback having $A = 100$, $R_i = 10K\Omega$ and $R_0 = 20K\Omega$ for feedback of i) $\beta = 0.1$ ii) $\beta = 0.5$. **(07 Marks)**

c. Explain the characteristics of negative feedback amplifier. **(07 Marks)**

OR

8 a. What is Barkhasen criteria for sustained oscillation? Explain basic principle of operation of oscillators. **(08 Marks)**

b. Explain the working of Wein bridge oscillator. Write the equation for frequency of oscillations. **(08 Marks)**

c. For the colpitts oscillators, $C_1 = 0.005\mu f$, $C_2 = 0.01\ \mu f$, $L = 100\mu H$, $L_{PFC} = 0.5mH$, $C_C = 10\mu f$ and $h_{fe} = 110$.

i) Calculate frequency of oscillation

ii) Check the condition for oscillation is satisfied. **(04 Marks)**

Module-5

9 a. Explain the operation of transformer coupled class – A power amplifier and show that the maximum percentage efficiency is 50%. **(07 Marks)**

b. Explain with neat circuit diagram, the working of a complementary symmetry class – B amplifier. **(07 Marks)**

c. Derive an expression for second harmonic distortion using 3 – point method. **(06 Marks)**

OR

10 a. Define voltage regulator. Explain the operation of series regulator circuit. **(07 Marks)**

b. Explain the operation of shunt regulator using OP-Amp with neat circuit diagram. **(07 Marks)**

c. Calculate the output voltage and Zener current in the regulator circuit of Fig.Q10(c) for $R_L = 1K\Omega$, $V_z = 12V$, $R = 220\Omega$, $v_i = 20V$ and $\beta = 50$. **(06 Marks)**

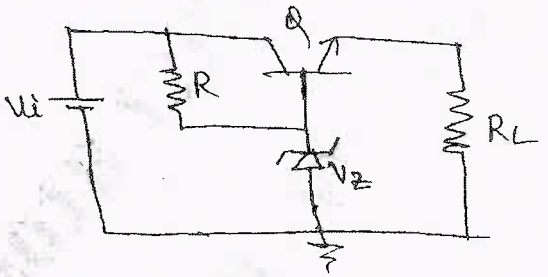

Fig.Q10(c)

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17EC34

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

Digital Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Convert $x = \bar{a}b + bc$ to canonical SOP form. **(02 Marks)**

b. Simplify $G = f(w,x,y,z) = \pi M(1,3,8,10,12,13,14,15)$ in POS form and implement using NOR gates. **(08 Marks)**

c. Simplify the following using Quine-McClusky's minimization technique.
$V = f(a, b, c, d) = \sum m(1, 3, 4, 5, 6, 9, 11, 12, 13, 14)$ **(10 Marks)**

OR

2 a. Convert $P = (\overline{w} + x)(y + \overline{z})$ to canonical POS form. **(03 Marks)**

b. Simplify $P = f(a, b, c, d) = \sum m(2, 3, 4, 5, 13, 15) + \sum d(8, 9, 10, 11)$ in SOP form and implement using NAND gates. **(07 Marks)**

c. Simplify using Quine-McClusky's minimization technique:
$V = f(a, b, c, d) = \sum m(1, 5, 7, 9, 13, 15) + \sum d(8, 10, 11, 14)$ **(10 Marks)**

Module-2

3 a. Implement $f_1(a, b, c) = \sum m(1, 3, 5)$; $f_2(a, b, c) = \sum m(0, 1, 6)$ using 74138, 3:8 decoder. **(06 Marks)**

b. With a neat circuit diagram explain the carry look ahead adder with relevant expressions. **(10 Marks)**

c. Design a one-bit comparator, implement using suitable gates. **(04 Marks)**

OR

4 a. Using 74151, 8:1 Mux, realize the Boolean function $F(a, b, c, d) = \sum m(0, 1, 5, 6, 7, 10, 15)$ with b, c, d as select lines. **(04 Marks)**

b. With neat circuit diagram, explain the keypad interface using 74147, 10 line to BCD encoder. **(10 Marks)**

c. Design a full subtractor and implement using logic gates. **(06 Marks)**

Module-3

5 a. Discuss the working principle of Gated SR latch with its truth Table. **(06 Marks)**

b. Explain the operation of Switch debouncer built using SR latch with the help of circuit and waveforms. **(08 Marks)**

c. Obtain the characteristic equations of JK flip flop and SR flip flop. **(06 Marks)**

OR

6 a. What is race around condition? How it can be overcome? **(02 Marks)**

b. Explain the working of MS-JK flip flop with logic symbol and timing diagram. **(10 Marks)**

c. Explain the working of +ve edge triggered D flip flop with the functional table. **(08 Marks)**

Module-4

7 a. Explain the working of four bit ripple counter using +ve edge triggered T flip-flops with the counting sequence table and timing diagram. **(10 Marks)**

b. Explain the SIPO and SISO operation of shift register with relevant logic diagram and the truth table. **(06 Marks)**

c. Explain the operation of ring counter using logic diagram and truth table. **(04 Marks)**

OR

8 a. Explain Universal Shift Register with the help of logic diagram and mode control table. **(10 Marks)**

b. Realize a three-bit binary synchronous up counter using JK flip flops. **(10 Marks)**

Module-5

9 a. Construct a Mealy state diagram that will detect input sequence 10110, when input pattern is detected Z is asserted high. Write the state diagram. **(10 Marks)**

b. Design a synchronous counter using T flip flops to count the sequence 0, 2, 3, 6, 5, 1, 0, 2, ... Write the excitation table and state diagram and logic diagram. **(10 Marks)**

OR

10 a. Explain Mealy and Moore model of clocked synchronous sequential circuit with the block diagram. **(08 Marks)**

b. For the logic diagram given in Fig.Q10(b):

i) Derive the excitation and output equations

ii) Write the state equations

iii) Construct transition table and state table

iv) Draw the state diagram

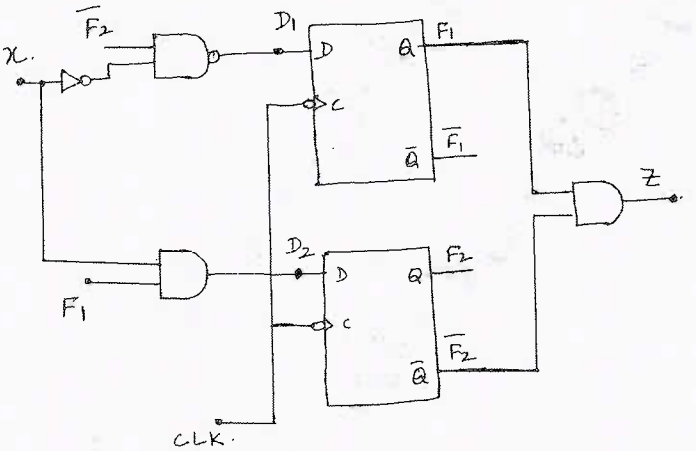

Fig.Q10(b) **(12 Marks)**

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CBCS SCHEME

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17EC35

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Network Analysis

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Reduce the Network shown in Fig Q1(a) to a single voltage source in series with a resistance using source shift and source transformation. **(07 Marks)**

b. Use mesh analysis to determine the three mesh currents I_1, I_2 and I_3 in the circuit show in Fig Q1(b). **(05 Marks)**

c. Find current in 30Ω resistor using nodal analysis for the circuit shown in Fig Q1(c). **(08 Marks)**

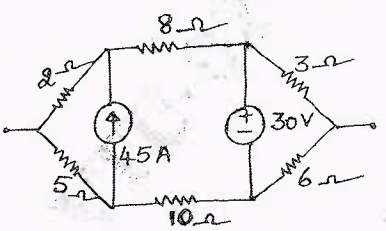

Fig Q1(a)

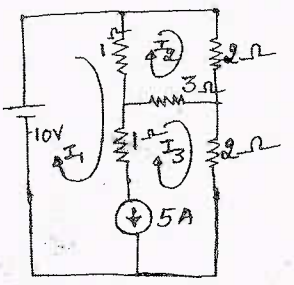

Fig Q1(b)

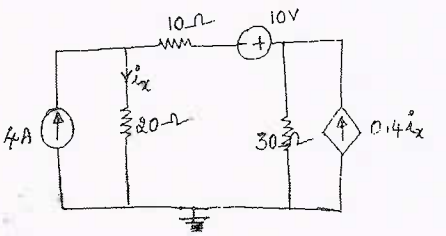

Fig Q1(c)

OR

2 a. Find the equivalent resistance between a and b using star delta transformation for the network shown in Fig Q2(a). **(05 Marks)**

b. For the circuit shown in Fig Q2(b), determine I_x and other loop currents. **(07 Marks)**

c. For the circuit shown in Fig Q2(c), determine all node voltages. **(08 Marks)**

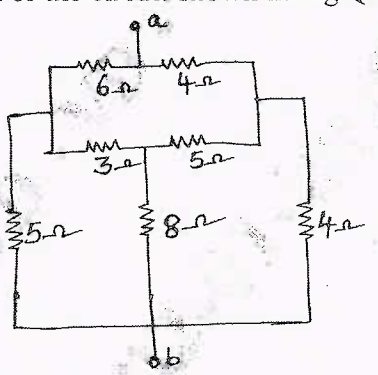

Fig 2(a)

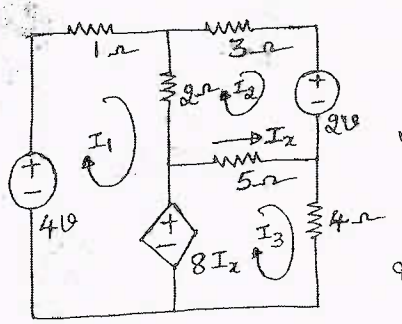

Fig 2(b)

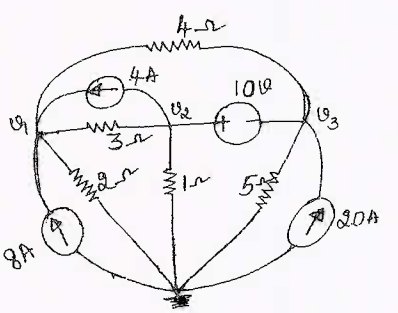

Fig 2(c)

Module-2

3 a. For the circuit shown in Fig Q3(a), find the current I_x using super position theorem. **(07 Marks)**

b. Verify Reciprocity theorem by calculating 'I' for the network shown in Fig Q3(b). **(05 Marks)**

c. Obtain the Thevenin's equivalent of the circuit shown in Fig Q 3(c) **(08 Marks)**

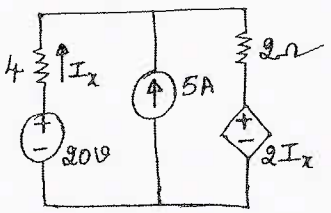

Fig Q3 (a)

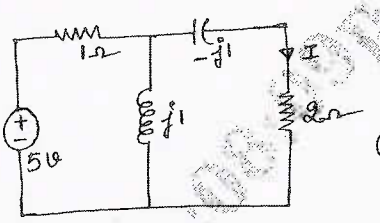

Fig Q3 (b)

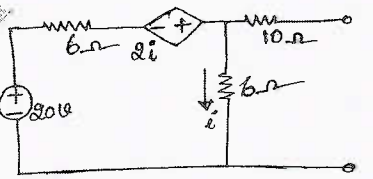

Fig Q3 Q(c)

OR

4 a. For the circuit shown in Fig Q4(a), find the current in (6 + j8)Ω impedance using Millman's theorem. **(05 Marks)**

b. For the Network shown in Fig Q4(b), determine Norton's equivalent across A and B. Find the current thorough the impedance (6 – j8) Ω connected to the terminals A and B. **(05 Marks)**

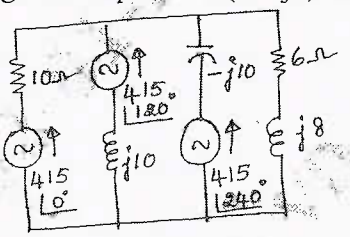

Fig Q4(a)

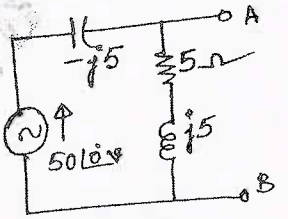

Fig Q4(b)

c. State and prove maximum power transfer theorem for AC circuit, where both R_L and X_L are varying. **(10 Marks)**

Module-3

5 a. In the Network shown in Fig Q5(a), a steady state is reached with the switch K open. At t = 0, the switch K is closed. Obtain the initial values of (i) i_1 (ii) i_2 (iii) v_c iv) $\frac{di_1}{dt}$ v) $\frac{di_2}{dt}$ and $\frac{di_1}{dt}$ at $t = \infty$. **(10 Marks)**

b. For the given circuit in Fig Q5(b), find the value of the loop currents, their first derivatives and their 2nd derivatives, all evaluated at $t = 0^+$, given that $V_c(0^-) = 1$ volt, $i_2(0^-) = 0$ amp. At t = 0, sw_1 and sw_2 are closed. **(10 Marks)**

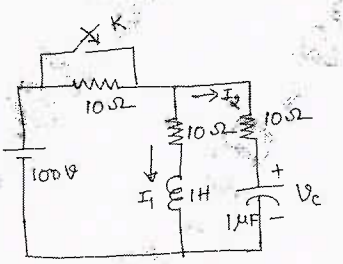

Fig Q5(a)

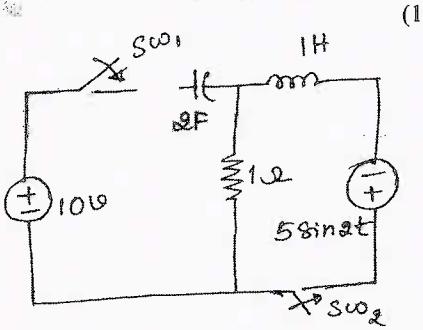

Fig Q5(b)

OR

6 a. In the circuit of Fig Q6(a), the source voltage is v(t) = 50sin 250t. Using Laplace transforms, determine the current when switch K is closed at t = 0. **(08 Marks)**

b. Synthesize the periodic waveform shown in Fig Q6(b) and find its Laplace transform and prove any formula used. **(12 Marks)**

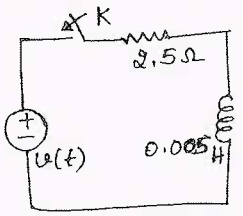

Fig Q6(a)

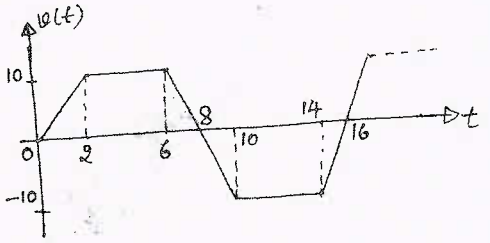

Fig Q6(b)

Module-4

7 a. Show that resonant frequency of series resonant circuit is equal to the geometric mean of two half power frequencies. **(05 Marks)**

b. A coil is connected in series with a variable capacitor across $v(t) = 10 \cos 1000t$. The current is maximum when $c = 10\mu F$. When $C = 12.5\mu F$, the current is 0.707 times the maximum value. Find L, R, and Q of the coil. **(08 Marks)**

c. A coil has resistance of 400Ω and inductance of 318μH. Find the capacitance of capacitor which when connected in parallel with the coil will produce resonance with a supply frequency of 1MHz. If a second capacitor of capacitance 23.42pF is connected in parallel with the first capacitor, find the frequency at which resonance will occur. **(07 Marks)**

OR

8 a. Derive the expression for the resonant frequency of the circuit shown in Fig Q8(a). Also show that the circuit will resonate at all frequencies if $R_L = R_c = \sqrt{\frac{L}{C}}$. **(12 Marks)**

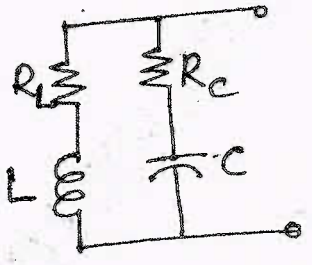

Fig Q8(a)

b. A coil of 10Ω resistance 0.2H inductance is connected in parallel with a variable condenser across 220V, 50Hz supply. Determine: (i) Capacitance of condenser so that current drawn may be in phase with the supply voltage (ii) Effective impedance of the circuit (iii) Power absorbed at resonance (iv) Current magnification factor. **(08 Marks)**

Module-5

9 a. Z-parameters of a Network are obtained from an experiment. Explain how y-parameters and transmission parameter can be computed from the experimental data. **(10 Marks)**

b. Find Z and Y parameters of the network shown in Fig Q9(b).

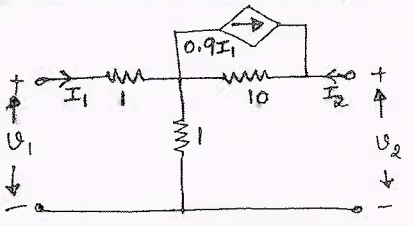

Fig Q9(b) **(10 Marks)**

OR

10 a. Find Z and h-parameters for the network shown in Fig Q10(a). **(12 Marks)**

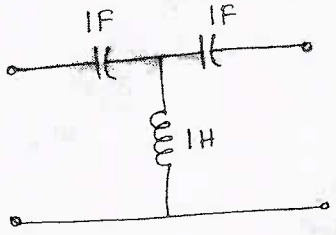

Fig Q10(a)

b. Write a note on hybrid p's with its equivalent circuit. **(04 Marks)**

c. Explain symmetry and reciprocal property of 2-port Networks. **(04 Marks)**

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17EC36

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State and explain Coulomb's law in complete form. **(06 Marks)**

b. Two particles having charges 2nc and 5nc are spaced 80cm apart. Determine the $\overline{E}$ at a point is situated at a distance of 0.5m from each of the two particles. Use $\varepsilon r = 5$. (Use Bakelite medium). **(06 Marks)**

c. Identical point charges of 3μc are located at the four corners of the square of 5cm side, find the magnitude of the force on any one charge? **(08 Marks)**

OR

2 a. Derive expression for E due to infinite line charge from first principle. **(08 Marks)**

b. Two uniform line charges of density 4n c/m and 6n c/m lie in x = 0 plane at y = +5m and −6m respectively. Find E at $(4, 0, 5)^m$. **(06 Marks)**

c. Define E and D, Hence establish the relation between D and E. **(06 Marks)**

Module-2

3 a. State and prove Gauss divergence theorem. **(06 Marks)**

b. If $D = \frac{5r^2}{4}\hat{a}_r\ c/m^2$. (in spherical system) then evaluates both sides of the divergence theorem for the volume enclosed by r = 4m, and θ = π/4 radians. **(08 Marks)**

c. Prove that $\rho_v = \nabla \cdot D$. **(06 Marks)**

OR

4 a. Establish relation $E = -\nabla v$ **(06 Marks)**

b. Electrical potential at an arbitrary point in free space is given as $V = (x+1)^2 + (y+2)^2 + (z+3)^2$ Volts at p(2, 1, 0). Find :

i) V ii) $\overline{E}$ iii) $|\overline{E}|$ iv) $|\overline{D}|$ v) ρ_v **(08 Marks)**

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

Module-3

5 a. Derive Laplace and Poisson's equations and write Laplace Equation in all 3 co-ordinate systems. **(08 Marks)**

b. State and prove uniqueness theorem. **(07 Marks)**

c. Calculate the numerical values for V and ρ_v at P in free space if $V = \frac{4yz}{x^2+1}$ at P(1. 2.3). **(05 Marks)**

OR

6 a. An assembly of two concentric spherical shells is considered. The inner spherical shell is at a distance of 0.1m and is at a potential of 0 volts. The outer spherical shell is at a distance of 0.2m and at a potential of 100V. The medium between them is a free space. Find $\overline{E}$ and $\overline{D}$ using spherical co-ordinate system. **(06 Marks)**

b. State and prove Ampers circuital law. **(08 Marks)**

c. At a point P(x, y, z) the components of vector magnetic potential $\overline{A}$ are given as

$Ax = 4x + 3y + 2z$

$Ay = 5x + 6y + 3z$ and

$Az = 2x + 3y + 5z$

Determine $\overline{B}$ at point P and state its nature. **(06 Marks)**

Module-4

7 a. Derive an expression for the force on a differential current element placed in a magnetic field and deduce the result for straight conductor in a uniform magnetic field. **(08 Marks)**

b. A point charge Q = 18nc has a velocity of 5×10^6 m/s in the direction $\overline{a}_v = 0.6\hat{a}_x + 0.75\hat{a}_y + 0.3\hat{a}_z$.

Calculate the magnitude of the force exerted on the charge by the field

i) $\overline{E} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ K v/m

ii) $\overline{B} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ MT

iii) $\overline{B}$ & $\overline{E}$ acting together. **(06 Marks)**

c. State and explain Lorentz force equation. **(06 Marks)**

OR

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

b. If $\overline{B} = 0.05$ x $\hat{a}_y$ T in a material for which magnetic susceptibility $X_m = 2.5$. Find

i) μ_r ii) μ iii) $\overline{H}$ iv) $\overline{M}$ v) $\overline{J}$ vi) $\overline{J}_b$ **(08 Marks)**

c. Discuss the boundary conditions at the interface between two media of different permiabities? **(08 Marks)**

Module-5

9 a. Derive Maxwell's Equations in point form and Integral form for Time varying fields. **(08 Marks)**

b. For a lossy dielectric $\sigma = 5$ s/m, $\varepsilon_r = 1$ the electric filed intensity is E = 100 sin 10^{10} t. Find J_c and J_d and frequency at which both have Equal Magnitudes. **(04 Marks)**

c. Starting from Maxwell's Equation Derive the wave equation for a uniform plane wave travelling in free space. **(08 Marks)**

OR

10 a. State and prove Poynthing theorem. **(08 Marks)**

b. Deduce the expressions for α and β for a uniform plane wave propagation in good conducting medium. **(06 Marks)**

c. Wet Marshy soil is characterized by $\sigma = 10^{-2}$ s/m, $\varepsilon_r = 15$ and $\mu_r = 1$. At the frequencies 60Hz, 1 MHz, 100 MHz and 10 GHz indicate whether the soil may be considered a conducting dielectric or neither. **(06 Marks)**

CBCS SCHEME

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15EC32

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Analog Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define h parameters using two port systems. **(05 Marks)**

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

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

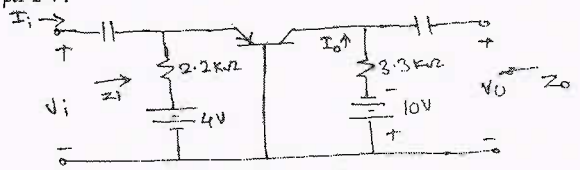

Fig.Q.1(c)

OR

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

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

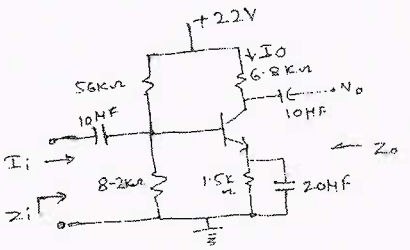

Fig.Q.2(b)

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

Module-2

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

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

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

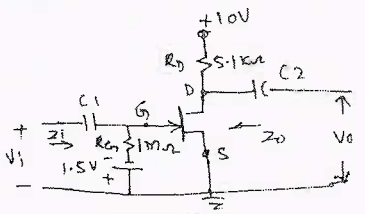

Fig.Q.3(c)

OR

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

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

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

Module-3

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

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

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

OR

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

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

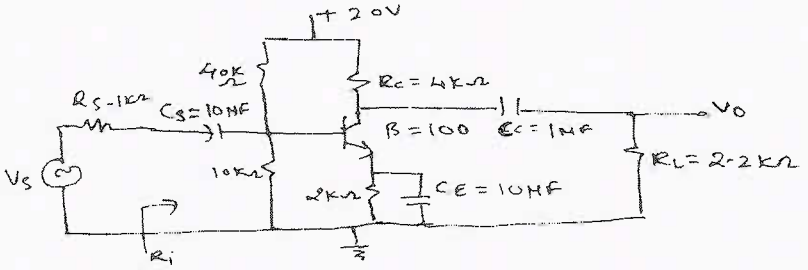

Fig.Q.6(b)

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

Module-4

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

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

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

OR

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

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

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

Module-5

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

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

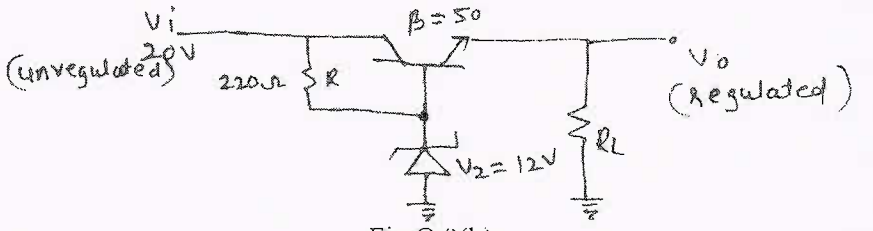

Fig.Q.9(b)

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

OR

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

b. Define the following:

i) Cross over distortion
ii) Harmonic distortion
iii) Percentage load regulation
iv) Amplifiers efficiency **(04 Marks)**

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

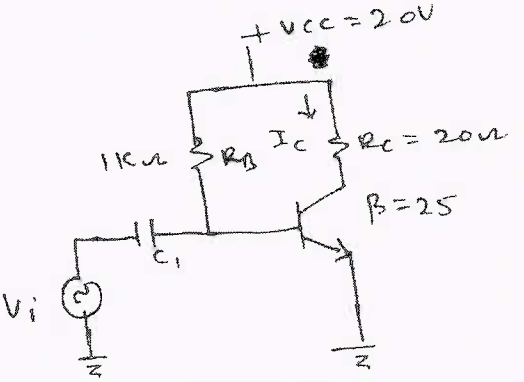

Fig.Q.10(c)

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15EC33

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Digital Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define combinational logic. Design a combinational circuit which takes two, 2 bit binary numbers as its input and generates an output equal to 1, when the sum of the two numbers is even. **(10 Marks)**

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

OR

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

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

Module-2

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

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

OR

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

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

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

Module-3

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

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

OR

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

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

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

Module-4

7 a. With the help of neat diagram, explain PISO and PIPO operation of unidirectional shift registers. **(08 Marks)**

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

OR

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

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

Module-5

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

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

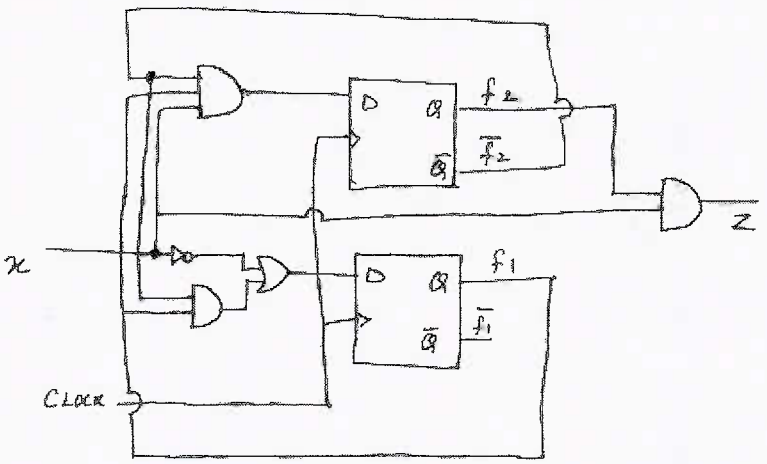

Fig.Q9(b)

OR

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

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

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

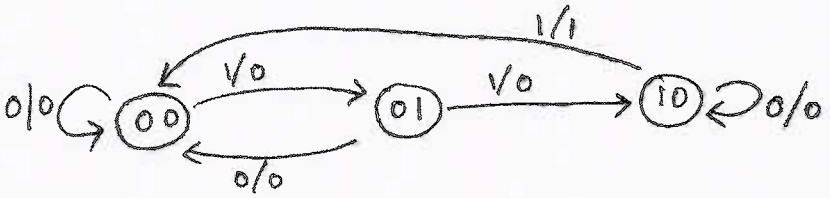

Fig.Q10(c)

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15EC34

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Network Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Reduce the network shown in Fig.Q1(a) to a single voltage source in series with a resistance using source shift and source transformations. **(08 Marks)**

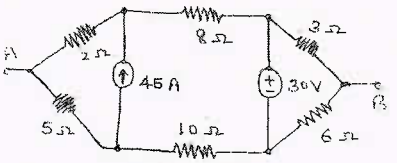

Fig.Q1(a)

b. Using star/delta transformation, determine the resistance between M and N for the network shown in Fig.Q1(b). **(08 Marks)**

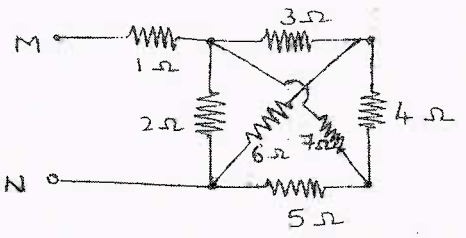

Fig.Q1(b)

OR

2 a. Find the power delivered by the dependent voltage source in the circuit shown in Fig.Q2(a) by Mesh current method. **(06 Marks)**

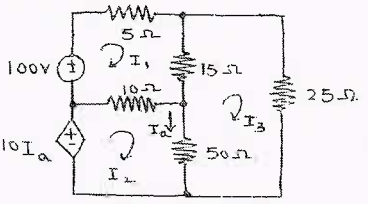

Fig.Q2(a)

b. Define super Mesh and super node. **(02 Marks)**

c. Use the node-voltage method to find the power developed by the 20V source in the circuit shown in Fig.Q2(c). **(08 Marks)**

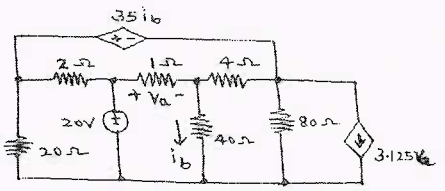

Fig.Q2(c)

Module-2

3 a. Use superposition theorem to find v_x in the circuit shown in Fig.Q3(a). **(08 Marks)**

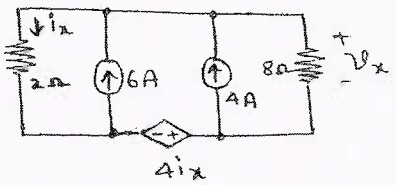

Fig.Q3(a)

b. State and prove reciprocity theorem. **(08 Marks)**

OR

4 a. State and prove Thevenin's theorem. **(06 Marks)**

b. Find the Norton's equivalent circuit across AB terminals for the network shown in Fig.Q4(b) and hence determine current through 5Ω resistor. **(06 Marks)**

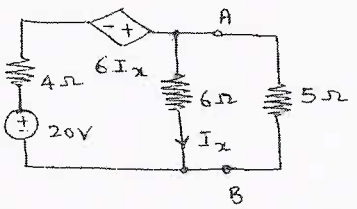

Fig.Q4(b)

c. Find the value of Z_L for which Maximum Power transfer occurs in the circuit shown in Fig.Q4(c). **(04 Marks)**

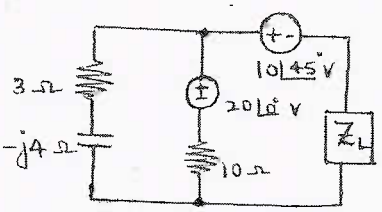

Fig.Q4(c)

Module-3

5 a. In the network shown in Fig.Q5(a), the switch k is closed at t = 0. Find the values of i_1, i_2 $\frac{di}{dt}$ and $\frac{d^2i_2}{dt^2}$ at t = 0. **(08 Marks)**

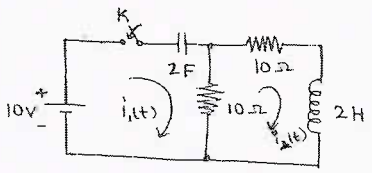

Fig.Q5(a)

b. In the circuit shown n Fig.Q5(b), the capacitor C_1 is charged to a voltage V_0 at t = 0, the switch is closed. Solve for the charge as a function of time. **(08 Marks)**

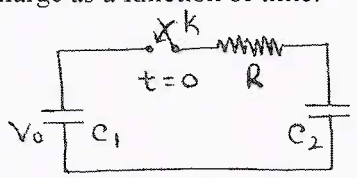

Fig.Q5(b)

OR

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

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

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

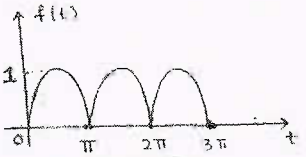

Fig.Q6(b)

Module-4

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

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

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

OR

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

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

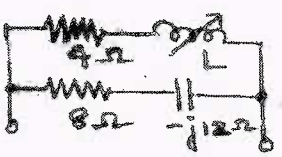

Fig.Q8(b)

Module-5

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

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

OR

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

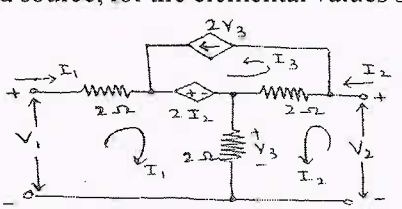

Fig.Q10(a)

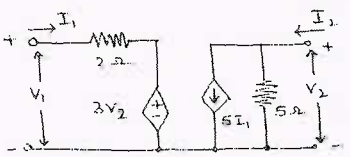

Fig.Q10(b)

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

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15EC35

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Electronic Instrumentation

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define the following :
i) Accuracy ii) precision iii) sensitivity iv) resolution. **(08 Marks)**

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

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

OR

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

x_1	x_2	x_3	x_4	x_5
19.7	20.1	20.2	19.6	19.7

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

Module-2

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

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

OR

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

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

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

Module-3

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

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

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

OR

6 a. Explain the operation of digital storage oscilloscope with a neat block diagram. **(08 Marks)**

b. With a neat block diagram, explain the operation of function generator. **(08 Marks)**

Module-4

7 a. Explain in details the working of Megger. State it applications. **(08 Marks)**

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

OR

8 a. Describe the working principle of an output power meter with a neat sketch. **(08 Marks)**

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

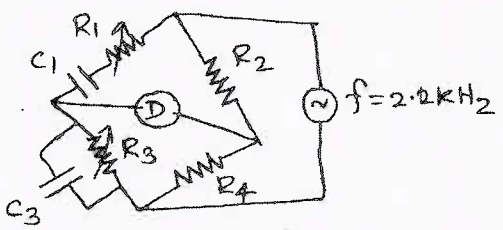

Fig. Q8(b)

Module-5

9 a. Define Gauge factor and prove that $K = 1 + 2\mu$. **(10 Marks)**

b. Explain the operation of semiconductor photo diode and photo transistor. **(06 Marks)**

OR

10 a. List the factors to be considered while selecting a transducer for given application. **(04 Marks)**

b. A displacement transducer with a shaft stroke of 3.0 inch is applied to the circuit. The total resistance of the pot is $5K\Omega$. The applied voltage V_t is 5V. When the Wipor is 0.9 inch from B, what is the value of the output voltage? **(04 Marks)**

c. Explain the construction and operation of a LVDT with a neat sketch. **(08 Marks)**

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CBCS SCHEME

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15EC36

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

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

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

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

OR

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

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

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

Module-2

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

b. Given a $60\ \mu c$ point charge located at the origin. Find the total electric flux passing through the closed surface defined by $\rho = 26$ cm and $z = \pm 26$ cm. **(04 Marks)**

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

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

OR

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

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

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

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

Module-3

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

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

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

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

OR

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

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

c. Evaluate both sides of Stokes theorem for the field, $H = \left(6ay\hat{a}_x - 3y^2 a_y\right)$ A/m and the rectangular path around the region $2 \le x \le 5$, $-1 \le y \le 1$, $z = 0$. Let the positive direction of ds be a_z. **(06 Marks)**

Module-4

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

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

c. Find the magnetization in a magnetic material where

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

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

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

OR

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

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

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

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

Module-5

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

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

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

OR

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

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

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

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CBCS SCHEME

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17EC32

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms as applied to an electronic instruments:
i) Accuracy
ii) Precision
iii) Error
iv) Resolution
v) Sensitivity **(10 Marks)**

b. A basic D'Arsonval movement with an internal resistance of 50Ω and a fall scale deflection current of 2 mA is to be used as a multirange voltmeter. Determine the series resistances to obtain the voltage ranges of 0-10V, 0-50V, 0-100V and 0-500V. **(10 Marks)**

OR

2 a. Explain the working of a true RMS voltmeter with a suitable diagram. **(10 Marks)**

b. Explain the various types of thermocouple used in RF ammeter in detail. **(10 Marks)**

Module-2

3 a. Explain the working of dual slope type DVM with a block diagram. **(10 Marks)**

b. With a neat block diagram, explain the working of frequency meter. **(10 Marks)**

OR

4 a. Draw the block diagram and explain the working principle of successive approximation type DVM. **(10 Marks)**

b. Explain the working of digital pH meter with the help of block diagram. **(10 Marks)**

Module-3

5 a. Draw the block diagram of CRO and explain the functions of each block. **(10 Marks)**

b. Explain with a block diagram AF sine-square wane generator. **(10 Marks)**

OR

6 a. Explain with a block diagram of function generator in detail. **(10 Marks)**

b. Explain the operation of digital storage oscilloscope with a help of block diagram. **(10 Marks)**

Module-4

7 a. Explain with a help of a neat diagram, construction and principle of operation of Megger. **(10 Marks)**

b. Draw the Maxwell's bridge to determine inductance in terms of known capacitance and derive Q-factor and expression for inductance. **(10 Marks)**

OR

8 a. Find parallel R and C, that causes a Wien's bridge to null with the following components values. R_1 = 2.7 KΩ, R_2 = 22 KΩ, C_1 = 5 μF, R_4 = 100 KΩ and operating frequency is 2.2 kHz. **(10 Marks)**

b. Explain susceptance method of Q-measurement. **(06 Marks)**

c. The self capacitance of a coil is to be measured by Q-meter. The first measurement result is f_1 = 1.5 MHz and C_1 = 550 PF. The second measurement result is f_2 = 3 MHz and a new value of tuning capacitor is 110 pF. Find the distributed capacitance and inductance. **(04 Marks)**

Module-5

9 a. What is transducer? Explain working of resistive position transducer with a neat sketch. **(10 Marks)**

b. What are the different types of photoelectric transducer? Explain photo voltaic transducer. **(10 Marks)**

OR

10 a. With a neat sketch, explain construction and working of LVDT. **(10 Marks)**

b. What is gauge factor? Derive an expression for gauge factor and prove that K = 1 + 2μ. **(10 Marks)**

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17EC33

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Draw the graphical symbol and r_e-equivalent circuit for the common Emitter and common base configuration including the effect of r_o. **(06 Marks)**

b. Write the expression for Z_i, Z_o and A_v of a voltage divider configuration using AC equivalent circuit with r_e model, [with bypassed R_E], for a BJT amplifier. **(08 Marks)**

c. For the circuit shown in Fig.Q.1(c), determine Z_i, Z_o and A_v. **(06 Marks)**

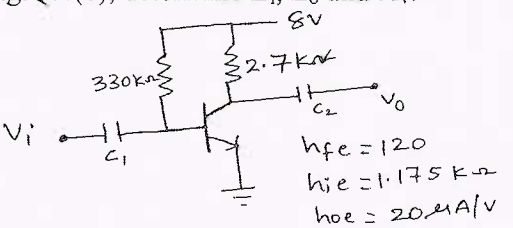

Fig.Q.1(c)

OR

2 a. Draw the circuit diagram of Darlington amplifier and find DC parameters I_{C_2} and V_{CE_2}. **(06 Marks)**

b. Derive the expression for Z_i, Z_o and A_v for common emitter fixed bias configuration using approximate hybrid equivalent circuit. **(08 Marks)**

c. Determine input impedance, output impedance and voltage gain of emitter follower, where V_{CC} = 12V, R_B = 220 KΩ, R_E = 3.3 KΩ, β = 100 and $r_o = \infty\Omega$. Use r_e model. **(06 Marks)**

Module-2

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

b. Derive the expression for Z_i, Z_o and A_v using AC equivalent circuit for JFET common-gate configuration. **(08 Marks)**

c. For the FET amplifier show in Fig.Q.3(c). Calculate Z_i, Z_o and A_v with the effect of r_d.

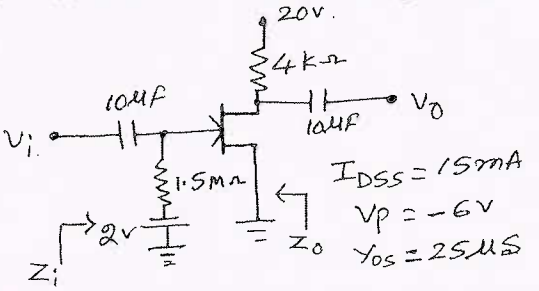

Fig.Q.3(c) **(06 Marks)**

OR

4 a. Draw and explain the drain and transfer characteristic of n-channel depletion MOSFET. **(06 Marks)**

b. Write the ac equivalent circuit for FET self biased configuration and determine Z_i, Z_o and A_v [with Rs bypassed). **(08 Marks)**

c. Give the comparison between JFET and MOSFET. **(06 Marks)**

Module-3

5 a. Draw the single RC coupled BJT amplifier and derive the expression for lower cut-off frequencies due to coupling capacitors C_S and C_C. **(10 Marks)**

b. What is miller effect? Prove that Miller effect input capacitance is $C_{mi} = (1 - A_v)C_f$ and out miller effect capacitance is $C_{mo} = \left(1 - \frac{1}{A_v}\right)C_f$. **(10 Marks)**

OR

6 a. Draw the high frequency ac equivalent circuit for FET amplifier and derive f_{Hi} and f_{Ho}. **(10 Marks)**

b. Derive the expression for overall higher cut-off frequency for a multistage amplifier. **(05 Marks)**

c. An amplifier consists of 3 identical stages in cascade, the bandwidth of overall-amplifier extends from 20Hz to 20kHz. Find the bandwidth of individual stages. **(05 Marks)**

Module-4

7 a. Draw the block diagrams of the following feedback connections types:
i) Voltage-series feedback
ii) Voltage-shunt feedback
iii) Current-series feedback
iv) Current-shunt feedback **(08 Marks)**

b. Draw the circuit diagram of FET phase shift oscillator and explain the operation. Write the expression for the frequency of oscillations. **(08 Marks)**

c. In a Colpitts oscillator, $C_1 = C_2 = C$ and $L = 100\mu H$. The frequency of oscillations is 500kHz. Determine the value of C. **(04 Marks)**

OR

8 a. With block diagram of voltage shunt feedback connection type, obtain the expression for input impedance. **(08 Marks)**

b. With the help of neat circuit diagram, explain the operation of transistor Hartley oscillator write the expression for the frequency of oscillations. **(08 Marks)**

c. A crystal has the following parameter L = 0.334H, C_m = 1pF, C = 0.065pF and R = 5.5KΩ. Find the series and parallel resonant frequency. **(04 Marks)**

Module-5

9 a. Explain the operation of series-fed class-A power amplifier and show that maximum conversion efficiency is 25%. **(08 Marks)**

b. A single transistor amplifier with transformer coupled load produces harmonic amplitudes in the output as B_0 = 1.5mA, B_1 = 120mA, B_2 = 10mA, B_3 = 4mA, B_4 = 2mA and B_5 = 1mA
i) Determine the percentage total harmonic distortion.
ii) Assume a second identical transistor is used along with a suitable transformer to provide pushpull operation. Use the above harmonic amplitudes to find the new total harmonic distortion. **(06 Marks)**

c. Draw the block diagram of shunt voltage regulator and explain the individual blocks. **(06 Marks)**

OR

10 a. What is harmonic distortion? Explain the three point method of calculating the second harmonic distortion. **(06 Marks)**

b. A class-B push-pull amplifier operating with V_{CC} = 25V provides a 22V peak signal to an 8Ω load. Find: i) Peak load current ii) dc current drawn from the supply 11P iii) DC power iv) ac power v) Efficiency. **(06 Marks)**

c. Draw the block diagram of series voltage regulator and explain the operation. Also find the o/p voltage and the zener current for the series regulator shown in Fig.Q.10(c). **(08 Marks)**

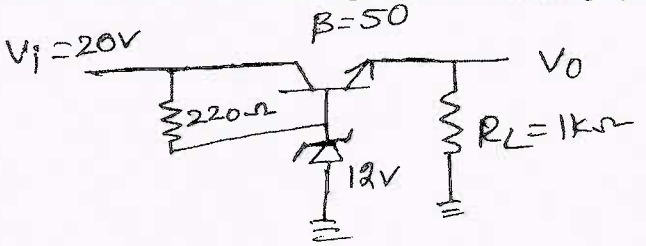

Fig.Q.10(c)

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17EC34

Third Semester B.E. Degree Examination, June/July 2019
Digital Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Construct a truth table and write a Boolean expression for the problem statement. An output variable Y is to be true when the value of inputs exceeds 4. The weights for each input variable is a = 4, b = 3, c = –1, and d = 1. Design the logic circuit for the obtained expression. **(10 Marks)**

b. Place the equation $P = f(a,b,c) = ab + \bar{a}c + b\bar{c}$ into proper canonical form and write the minterms. **(05 Marks)**

c. What do you mean by canonical SOP and canonical POS? Explain with example? **(05 Marks)**

OR

2 a. Simplify K = f(w, x, y, z) = Σm(0, 1, 5, 13, 15) + Σd(2, 7, 10, 14) using K-map method. Draw the logic diagram for obtained expression. **(10 Marks)**

b. Simplify D = f(a, b, c, d) = Σm(0, 1, 2, 3, 6, 7, 8, 9, 12, 15) using QM – method. verify the same using K–map. Draw the logic diagram for simplified expression. **(10 Marks)**

Module-2

3 a. What is an encoder? Design 4 to 2 priority encoder? **(08 Marks)**

b. Realize the function X = f(a, b, c, d) = Σm(0, 3, 7, 10, 13) using 74LS138 ICs. **(08 Marks)**

c. Design 4 : 1 Mux and draw the logic diagram using basic gates. **(04 Marks)**

OR

4 a. Implement f(a, b, c, d) = Σm(0, 1, 5, 6, 7, 10, 15) using 8 : 1 Mux with a, b, c as select lines. **(08 Marks)**

b. Design a binary full subtractor using NAND gates only. **(06 Marks)**

c. Explain about carry look ahead adder. **(06 Marks)**

Module-3

5 a. Obtain the characteristic equations for D and T flip-flops. **(08 Marks)**

b. Explain the operation of SR–Flip-Flop with the help of logic diagram. Draw functional table. **(08 Marks)**

c. What is race around condition? Explain with diagram. **(04 Marks)**

OR

6 a. Explain the working of master slave J-K flip flop with the help of logic diagram. Draw the timing diagrams of the same. **(10 Marks)**

b. Explain D-flip-flop operation using positive edge triggered clock. **(06 Marks)**

c. Write two-two difference between :
i) Combinational and sequential logic
ii) Latch and flip-flop. **(04 Marks)**

Module-4

7 a. What is register? Explain with diagram of 4-bit serial-in parallel-out shift register. **(10 Marks)**

b. Explain 3-bit asynchronous up and down binary counters. **(10 Marks)**

OR

8 a. Design mod-5 ripple counter using T-flip-flops. **(08 Marks)**

b. Design 3-bit synchronous up counter. **(08 Marks)**

c. Compare asynchronous and synchronous counters. **(04 Marks)**

Module-5

9 a. Design a Mealy type sequence detector to detect a serial input sequence of 101. **(10 Marks)**

b. Design 2-bit synchronous up counter. **(10 Marks)**

OR

10 a. Analyze the following sequential circuit, by writing input and output equations, state table and state diagram. **(12 Marks)**

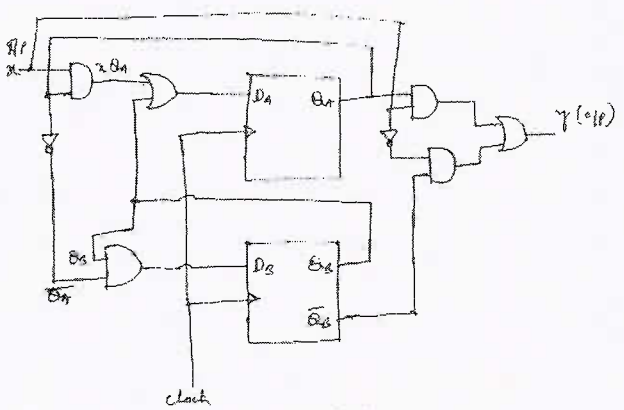

Fig.Q10(a)

b. What are Mealy and Moore models? Explain briefly with diagram. **(04 Marks)**

c. Draw a sate table and state diagram with an example. **(04 Marks)**

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17EC35

Third Semester B.E. Degree Examination, June/July 2019
Network Analysis

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms with examples:
i) Active elements
ii) Passive elements
iii) Linear and non linear elements
iv) Lumped node
v) Unilateral and bilateral elements. **(10 Marks)**

b. Use the node analysis and find the value of V_x in the circuit shown in below Fig.Q.1(b). Such that the current through the impedance $(2 + J3)\Omega$ is zero.

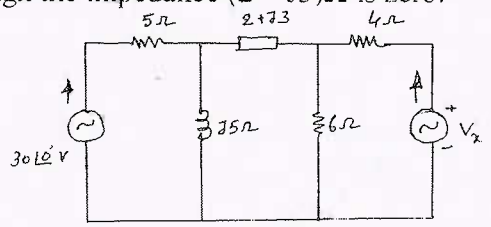

Fig.Q.1(b) **(10 Marks)**

OR

2 a. Derive an expression for i) Δ to Y transformation ii) Y to Δ transformation. **(10 Marks)**

b. Find the voltage across 20Ω resistor in the network shown in Fig.Q.2(b) below by using Mesh analysis method. **(10 Marks)**

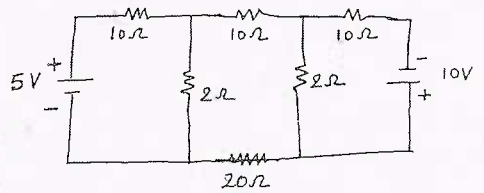

Fig.Q.2(b)

Module-2

3 a. State and prove Millman's theorem with an example. **(10 Marks)**

b. Find the Thevenin's equivalent circuit of Fig.Q.3(b) shown below: **(10 Marks)**

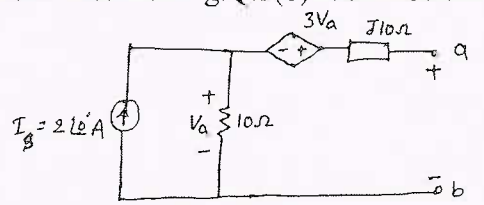

Fig.Q.3(b)

OR

4 a. Prove that the maximum power transferred from source to load when,

i) $R_L = R_o$ ii) $R_L = |Z_o|$ iii) $Z_L = \overline{Z}_o$ **(10 Marks)**

b. Find the value of i_b using Norton's equivalent circuit when R = 667Ω, refer Fig.Q.4(b). **(10 Marks)**

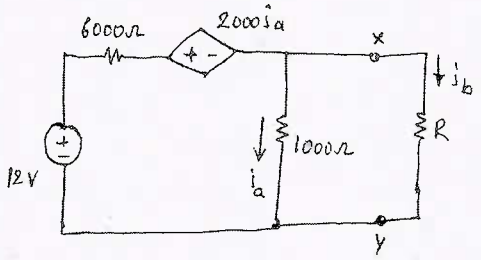

Fig.Q.4(b)

Module-3

5 a. Determine i, $\frac{di}{dt}$, $\frac{d^2i}{dt^2}$ at $t = 0^+$, when the switch is closed at t = 0, from the Fig.Q.5(a) shown below. **(10 Marks)**

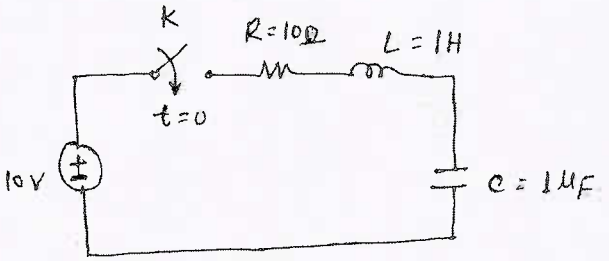

Fig.Q.5(a)

b. Find :

i) $i(0^+)$ and $v(0^-)$

ii) $\frac{di(0^+)}{dt}$ and $\frac{dv(0^+)}{dt}$

iii) $i(\infty)$ and $v(\infty)$

from the circuit shown in Fig.Q.5(b) below. **(10 Marks)**

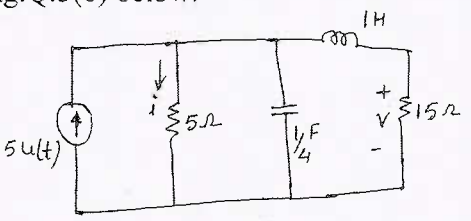

Fig.Q.5(b)

OR

6 a. Deduce the Laplace transform of the following:

i) Sin^2t ii) Cos^2t iii) Sinwt iv) $\int_0^t i(t).dt$ **(10 Marks)**

b. State and prove Initial and Final value theorems. **(10 Marks)**

Module-4

7 a. Demonstrate the terms: i) Resonance ii) Q-factor iii) Band width iv) Selectivity v) Half power frequency pertaining to a R-L-C series circuit. **(10 Marks)**

b. Prove that the Resonating frequency in a R-L-C series circuit is geometrical mean of half power frequencies i.e. $f_0 = \sqrt{f_1 f_2}$. **(10 Marks)**

OR

8 a. Evaluate w_0, Q, BW and half power frequencies and the output voltage V at W_0, refer Fig.Q.8(a). **(10 Marks)**

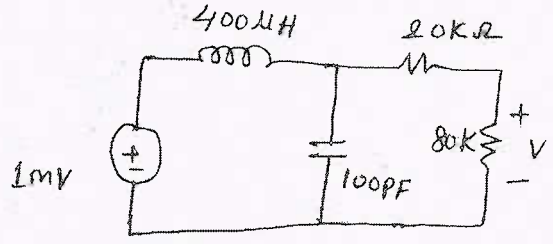

Fig.Q.8(a)

b. Derive an expression for resonance by varying R_L in parallel RLC circuit. **(10 Marks)**

Module-5

9 a. Express Z parameters in terms h parameters and what are hybrid parameters. **(10 Marks)**

b. Determine the transmission parameters for the network shown Fig.Q.9(b) below. **(10 Marks)**

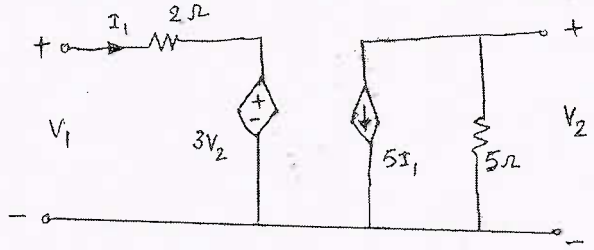

Fig.Q.9(b)

OR

10 a. Obtain the condition of transmission parameters for two networks connected in cascade. **(10 Marks)**

b. Determine the Z-parameters for the circuit shown in Fig.Q.10(b) below. **(10 Marks)**

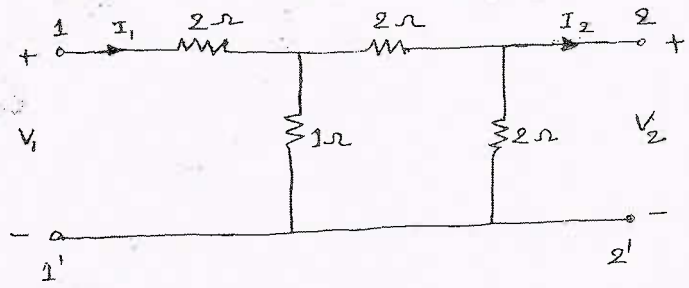

Fig.Q.10(b)

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17EC36

Third Semester B.E. Degree Examination, June/July 2019
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State and explain Coulomb's law of force between two point charges in vector form. **(06 Marks)**

b. Identical point charges of 3μC are located at four corners of the square of 5 cm side. Find the magnitude of the force on any charge. **(08 Marks)**

c. Define Electric Field Intensity. Derive the electric field intensity due to 'n' number of point charges. **(06 Marks)**

OR

2 a. Derive the expression for the electric field intensity due to infinite line charge. **(06 Marks)**

b. Obtain the expression for an electric field intensity due to charged circular ring of radius 'r' placed in x-y plane, at a point (0, 0, z), having uniform line charge density of ρ_L (c/m). **(06 Marks)**

c. A uniform line charge ρ_L = 25 nc/m lies on the line x = –3m and y = 4m in free space. Find the electric field intensity at a point (2, 3, 15) **(06 Marks)**

Module-2

3 a. State and explain Gauss's law and prove Gauss's law as applied to point charge. **(06 Marks)**

b. Given that the field $\vec{D} = \frac{5\sin\theta\cos\phi}{r}\ \vec{ar}$ (c/m^2). Find volume charge density. **(06 Marks)**

c. Given $\vec{D} = 5r\,\vec{ar}$ (c/m^2), prove divergence theorem for a shell region enclosed by spherical surfaces at r = a and r = b (b > a) and centered at the origin. **(08 Marks)**

OR

4 a. Explain the concept of work and potential and obtain the expression for potential difference between two points due to an electric field produced by a point charge. **(06 Marks)**

b. Obtain the point form of continuity equation. **(06 Marks)**

c. Given the current density $\vec{J} = \frac{2}{r^2}\cos\theta\,\vec{ar} + 20e^{-2r}\sin\theta\,\vec{a\theta} - r\sin\theta\cos\phi\,\vec{a\phi}$ (A/m^2)

i) Find $\vec{J}$ at r = 3m, θ = 0°, φ = π.

ii) Find the total current passing through spherical surface r = 3m, 0 < θ < 20°, 0 < φ < 2π. **(08 Marks)**

Module-3

5 a. From point form of Gauss's law, derive Poisson's and Laplace's equation. **(05 Marks)**

b. State and prove uniqueness theorem. **(08 Marks)**

c. Applying Laplace's equation, obtain the expression for capacitance of a parallel plate capacitor. The distance between two plates are 'd' and the area of plate is 'A'. **(07 Marks)**

OR

6 a. Using Biot - Savart law obtain the expression for magnetic field intensity at a point due to infinitely long straight conductor. **(08 Marks)**

b. Given the magnetic field $\vec{H} = 2r^2(z+1)\sin\phi\,\vec{a_\phi}$. Verify stokes theorem for the portion of a cylindrical surface defined by r = 2, $\frac{\pi}{4} \le \phi \le \frac{\pi}{2}$, $1 \le z \le 1.5$ and for its perimeter. Given vector magnetic potential. **(08 Marks)**

c. $\vec{A} = x^2\vec{a_x} + 2yz\vec{a_y} - x^2\vec{a_z}$. Find the magnetic flux density. **(04 Marks)**

Module-4

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

b. A point charge Q = –1.2 (C) has velocity $\vec{V} = 5\vec{a_x} + 2\vec{a_y} - 3\vec{a_z}$ m/s. Find the magnitude of the force exerted on the charge if

i) $\vec{E} = -18\vec{a_x} + 5\vec{a_y} - 10\vec{a_z}$ (V/m)

ii) $\vec{B} = -4\vec{a_x} + 4\vec{a_y} + 3\vec{a_z}$ (T) **(06 Marks)**

c. A current element $I_1dL_1 = 10^{-4}\,\vec{a_z}$ (A.m) is located at $P_1(2, 0, 0)$ and another current element $I_2\,dL_2 = 10^{-6}(\vec{a_x} - 2\vec{a_y} + 3\vec{a_z})$ (A.m) is located at $P_2(-2, 0, 0)$. Find the force exerted on I_1dL_1 by I_2dL_2. **(08 Marks)**

OR

8 a. Discuss the magnetic boundary conditions as applicable to $\vec{B}$ and $\vec{H}$ at the interface between two different magnetic materials. **(10 Marks)**

b. Write short notes on :

i) Energy Density in magnetic field ii) Forces on magnetic materials. **(10 Marks)**

Module-5

9 a. List Maxwell's equations in integral form and derive the point form of Maxwell's equation for time varying fields. **(12 Marks)**

b. Show that in a capacitor the conduction current density is equal to displacement current density for applied voltage $V(t) = V_o \cos \omega t$. **(08 Marks)**

OR

10 a. What is Uniform plane wave? Derive the expression of uniform plane wave travelling in free space. **(10 Marks)**

b. State and prove Poynting theorem. Also show that average power

$P_{avg} = \frac{1}{2}\,\frac{E_m^2}{\eta}\,(W/m^2)$. **(10 Marks)**

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CBCS SCHEME

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15EC32

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive the expression for Z_{in}, Z_0, A_v and A_I for voltage divider bias CE amplifier with R_E unbypassed using re-model. **(10 Marks)**

b. Write a note on hybrid π model. **(06 Marks)**

OR

2 a. For a emitter bias circuit with $R_B = 470k\Omega$, $R_C = 3.3\Omega$, $R_E = 1.2k\Omega$, $C_{C_1} = C_{C_2} = 0.1\mu F$. $h_{fe} = 120$, $h_{ie} = 1k\Omega$, $h_{oe} = 50\mu\mho$. Find A_I, A_V, Z_{in} and Z_0 if R_E is unbypassed. Also write the hybrid model. **(08 Marks)**

b. Derive the expression for Z_{in}, Z_0, A_V and A_I for common collector configuration amplifier using approximate hybrid model. **(08 Marks)**

Module-2

3 a. Derive the expression for transconductance also relate I_D and g_m. **(06 Marks)**

b. Obtain the expression for Z_{in} and A_V for a JFET common gate amplifier. Write the small signal model. **(10 Marks)**

OR

4 a. For a common drain configuration amplifier if $R_G = 2\mu\Omega$, $R_S = 2.2k\Omega$, $V_{DD} = 20V$, $C_{C_1} = C_{C_2} = 0.1\mu F$. Find Z_{in}, Z_0 and A_V given. $I_{DSS} = 10mA$, $V_p = -5V$. $r_d = 40k\Omega$, $V_{GSQ} = -2.85V$. **(06 Marks)**

b. With a neat diagram, explain the construction and operation of D–MOSFET and E–MOSFET. Also write the drain and transfer characteristics. **(10 Marks)**

Module-3

5 a. State Miller's theorem and also obtain the expression for input and output capacitances. **(08 Marks)**

b. Derive the expressions for low frequency response of BJT amplifier due to input and output coupling capacitors and also due to bypass capacitor. **(08 Marks)**

OR

6 a. Determine the higher frequency response of the amplifier circuit shown in Fig.Q6(a) below, also plot the graph.

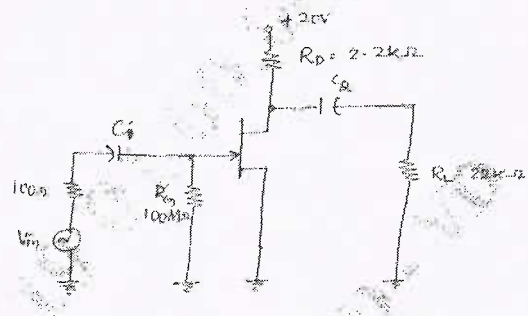

Fig.Q6(a)

b. Given $V_{GS} = -8V$, $I_{GSS} = 80mA$, $g_m = 6ms$, $C_{gs} = 4pF$, $C_{gd} = 2pF$. **(08 Marks)**
Obtain the expression for overall tower and upper cutoff frequency of multistage amplifier. **(08 Marks)**

Module-4

7 a. Prove that input and output impedances in voltage shunt feedback amplifier decreases. **(06 marks)**

b. With the help of neat block diagram, deduce the conditions for sustained oscillations. **(04 marks)**

c. Explain the important advantages of negative feedback. **(06 marks)**

OR

8 a. For a Wein bridge oscillator, if $R_i = 1k\Omega$ and $R_F = 2.5k\Omega$. Find frequency of oscillation for $R = 2k\Omega$ and $C = 10mF$. Is oscillations sustained? **(04 Marks)**

b. Derive the expression for frequency of oscillation in Hartley oscillator with the help of neat circuit diagram. **(06 Marks)**

c. Explain the construction and operation of UJT. **(06 Marks)**

Module-5

9 a. Explain push pull amplifier with a neat circuit diagram. Show that its maximum conversion efficiency is 78.5%. **(12 Marks)**

b. Write a note on class C amplifiers. **(04 Marks)**

OR

10 a. Explain services and shunt voltage regulator. **(10 marks)**

b. For the circuit shown in Fig.Q10(b) below, if peak base circuit is 1mA. Calculate :
i) $P_{0(ac)}$ ii) $P_{in(dc)}$ iii)$\eta(\%)$. **(06 Marks)**

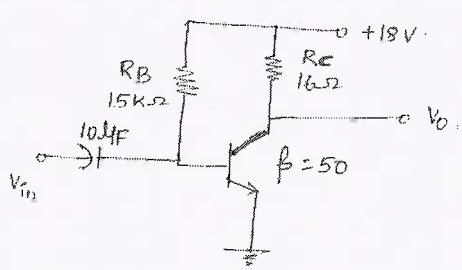

Fig.Q10(b)

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15EC33

Third Semester B.E. Degree Examination, June/July 2019
Digital Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Write the switching equation for a digital circuit with four inputs and whose output is '1' if majority of its inputs are '1'. **(04 Marks)**

b. Place the following equations into proper canonical forms and write its decimal notations also :

i) $P = f(a,b,c) = a\bar{b} + a\bar{c} + bc$

ii) $Q = f(x,y,z) = (x + \bar{y})(\bar{y} + z)$. **(06 Marks)**

c. Solve using k – map and implement using only NAND gates

$B = f(w,x,y,z) = \Sigma(1,2,3,4,9) + \Sigma d(10, 11, 12, 13, 14, 15)$. **(06 Marks)**

OR

2 a. Solve using K Map

$A = f(w, x, y, z) = \pi (1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 14, 15)$

and implement using NOR gates only. **(06 Marks)**

b. Simplify using Quine Mc Clusky method :

$D = f(a, b, c, d) = \Sigma(0, 1, 2, 3, 6, 7, 8, 9 14, 15)$

Show the prime implicant table to determine the EPIs. **(10 Marks)**

Module-2

3 a. Design a combinational circuit that multiplies two 2bit binary values, and produces 4-bit product. Get the minterms for P_0, P_1, P_2 and P_3. Simplify only for P_2. **(08 Marks)**

b. Design a 4 to 16 decoder using 3 to 8 decoders (74LS138) only and realize the function :

$P = f(w, x, y, z) = \Sigma(1, 4, 8, 13)$

$Q = f(w, x, y, z) = \Sigma(2, 7, 13, 14)$. **(08 Marks)**

OR

4 a. Design a 2 bit magnitude comparator and get an expression for A < B only, which is the minimal expression. **(08 Marks)**

b. Explain a carry look ahead adder with a neat diagram and relevant expressions. **(08 Marks)**

Module-3

5 a. Explain an SR latch using NOR gates with circuit diagram function table and timing diagram. **(06 Marks)**

b. Explain a positive edge triggered D flip flop with circuit diagram, function table and timing diagram. **(10 Marks)**

OR

6 a. What is race around? How is it overcome in master slave JK F/F. Explain MS JK with relevant circuit diagram, function table. **(10 Marks)**

b. Derive the characteristics equation for :
i) SR F/F ii) JK F/F iii) D F/F iv) T F/F. **(06 Marks)**

Module-4

7 a. Given an universal shift register, sketch its diagram only for left shift operates and explain its working. **(08 Marks)**

b. What is a twisted ring counter? Sketch its diagram and explain its counting sequence and also give the bits that determine a state uniquely. **(08 Marks)**

OR

8 a. Design a model synchronous counter for the sequence, using a D flip-flop [Refer Fig.Q8(a)].

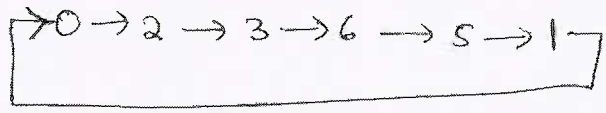

Fig.Q8(a) **(08 Marks)**

b. Explain with net diagram, the counting sequence and timing diagram, the working of a 4 bit binary ripple counter, using positive edge triggered T flip flop. **(08 Marks)**

Module-5

9 a. Draw and explain the Mealy and Moore sequential circuit models. **(06 Marks)**

b. Analyze the following sequential circuit and draw its state diagram.[Refer Fig.Q9(b)]. **(10 Marks)**

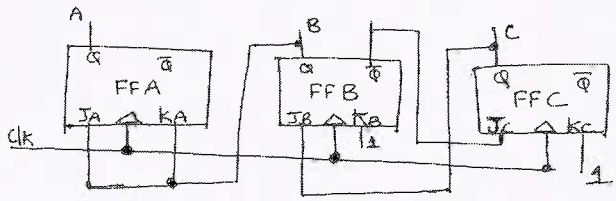

Fig.Q9(b)

OR

10 a. Represent a Moore circuit notation of a JK flip-flop through state diagram and explain. **(06 Marks)**

b. Design a modulo 8 synchronous counter with :
i) state diagram ii) state table iii) transition table iv) excitation table, kmap and logic diagram **(10 Marks)**

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15EC34

Third Semester B.E. Degree Examination, June/July 2019
Network Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain E-shift and I-shift with an example. **(08 Marks)**

b. Find the voltage across the capacitor of 10 Ω reactance of the network shown in Fig.Q1(b) by loop current method.

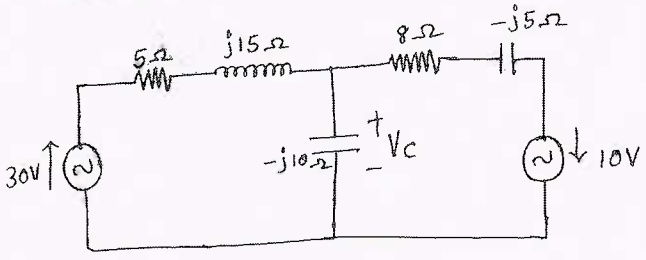

Fig.Q1(b) **(08 Marks)**

OR

2 a. Determine the equivalent resistance between the terminals A and B in the network of Fig.Q2(a) using star-delta transformation.

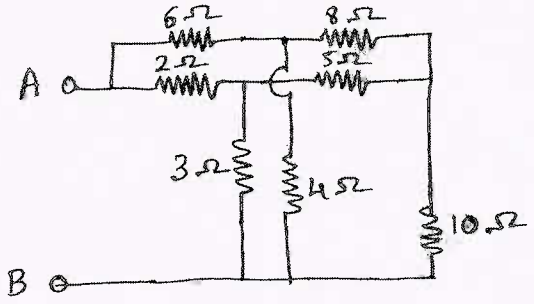

Fig.Q2(a) **(08 Marks)**

b. Find the voltages at nodes 1, 2, 3 and 4 for the network shown in Fig.Q2(b) using nodal analysis.

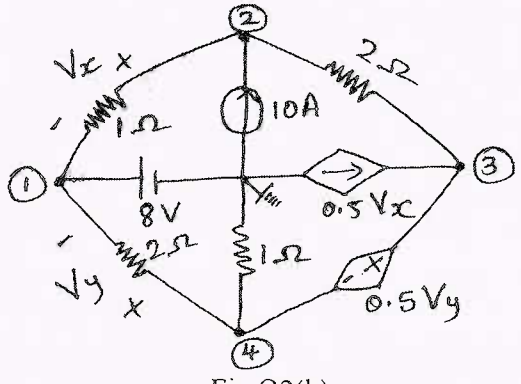

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. State and explain superposition theorem. **(08 Marks)**

b. Obtain Thevenin's equivalent circuit across A and B for the network shown in Fig.Q3(b).

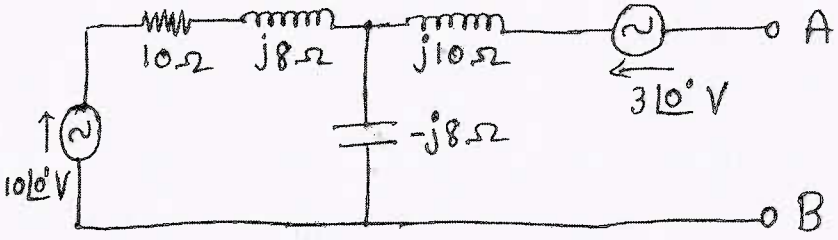

Fig.Q3(b) **(08 Marks)**

OR

4 a. State and explain Millman's theorem. **(08 Marks)**

b. Find the value of Z_L in the circuit shown in Fig.Q4(b) using maximum power transfer theorem and hence the maximum power.

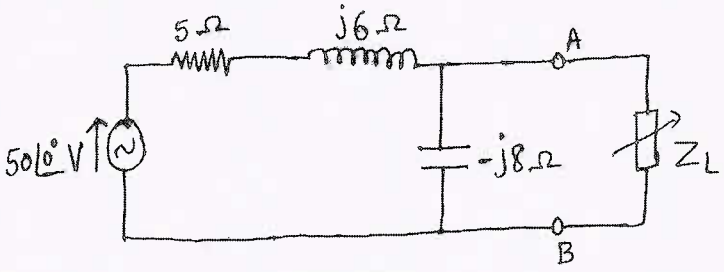

Fig.Q4(b) **(08 Marks)**

Module-3

5 a. State and prove initial value theorem and final value theorem. **(08 Marks)**

b. In the network shown in Fig.Q5(b), K is changed from position a to b at t = 0. Solve for i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$, if R = 100 Ω, L = 0.1 H and C = 0.25 μF and V = 100 V. Assume that the capacitor is initially uncharged.

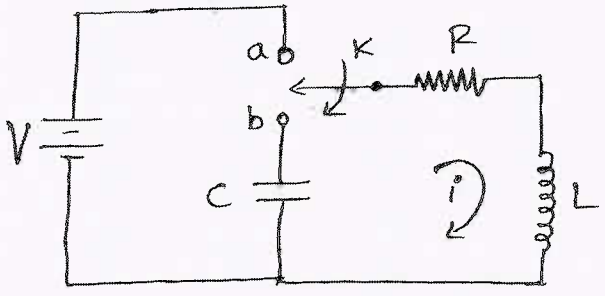

Fig.Q5(b) **(08 Marks)**

OR

6 a. What is the significance of initial conditions? Write a note on initials and final conditions in basic circuit elements. **(08 Marks)**

b. Find the Laplace transform of (i) f(t) = u(t) (ii) f(t) = t. **(08 Marks)**

Module-4

7 a. Derive an expression for half power frequencies for a series resonant circuit, **(08 Marks)**

b. For the network shown in Fig.Q7(b), find the value of L at which circuit resonates at a frequency of 600 rad/sec.

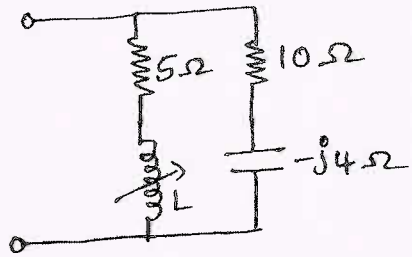

Fig.Q7(b) **(08 Marks)**

OR

8 a. Obtain the expression for the resonant frequency and the dynamic impedance of a parallel resonant circuit. **(08 Marks)**

b. An RLC series resonant circuit draws a maximum current of 10 Amps, when connected to 230 V, 50 Hz supply. If the Q-factor is 5, find the parameters of the circuit. **(08 Marks)**

Module-5

9 a. Derive the Y-parameters in terms of ABCD parameters. **(08 Marks)**

b. Obtain the h-parameters for the circuit shown in Fig.Q9(b).

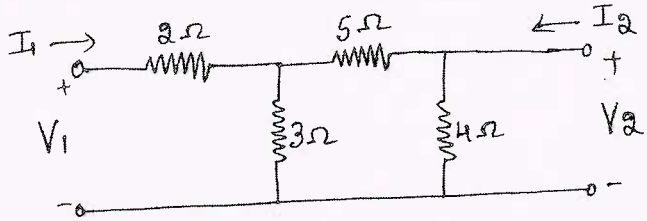

Fig.Q9(b) **(08 Marks)**

OR

10 a. Express h-parameters interms of z-parameters. **(08 Marks)**

b. Find the y-parameters for the circuit shown in Fig.Q10(b). The use parameter relationships to find h-parameter.

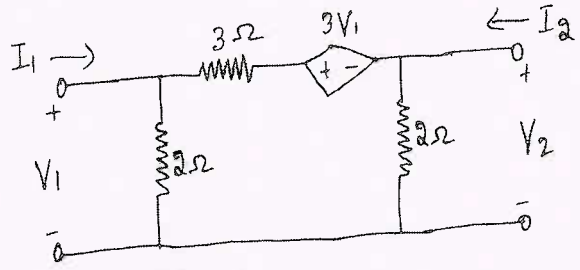

Fig.Q10(b) **(08 Marks)**

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CBCS SCHEME

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15EC35

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

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain different types of static errors of a measuring instrument. **(08 Marks)**

b. What is a thermocouple? Explain different type of thermocouple. **(08 Marks)**

OR

2 a. Explain the operation of true RMS voltmeter with diagram. **(08 Marks)**

b. Two different voltmeters are used to measure the voltage across R_b in the circuit of Fig.Q2(b)

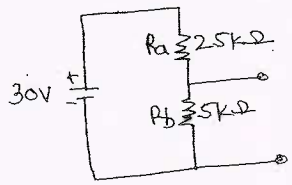

Fig.Q2(b)

The meters are as follows:
meter1: S = 1 kΩ/V Range = 10V
meter2
: S = 20 kΩ/V Range = 10V
Calculate :
(i) The voltage across R_b without any meter across it.
(ii) The voltage across R_b when meter1 is used.
(iii) The voltage across R_b when meter2 is used.
(iv) Error in the voltmeters. **(08 Marks)**

Module-2

3 a. Describe the principle operation of successive approximation DVM. **(08 Marks)**

b. Explain the operation of a microprocessor based instrument with a block diagram. **(08 Marks)**

OR

4 a. Explain the working of Dual-Slope integrating type DVM with the block diagram. **(08 Marks)**

b. With the help of diagram, explain the operation of a Digital Tachometer. **(08 Marks)**

Module-3

5 a. Draw the block diagram of CRT and explain the function of each block. **(08 Marks)**

b. Explain the principle of operation of square and pulse generator with its block diagram. **(08 Marks)**

OR

6 a. Explain the operation of a digital read out oscilloscope with block diagram. **(08 Marks)**

b. Describe the operation of a AF sine and square wave generator with diagram. **(08 Marks)**

Module-4

7 a. Explain the operation of an Analog pH meter using hydrogen electrode. **(08 Marks)**

b. Derive the balance equation for Wheatstone's bridge and mention its advantages and limitations. **(08 Marks)**

OR

8 a. Explain Wagner's earth connection. **(08 Marks)**

b. Explain the principle operation of a field strength meter with its block diagram. **(08 Marks)**

Module-5

9 a. Explain the operation of a Resistive Position Transducer with block diagram. **(08 Marks)**

b. Explain construction and principle operation of LVDT. **(08 Marks)**

OR

10 a. Explain the operation of a resistance thermometer and mention its advantages and limitations. **(08 Marks)**

b. Write note on:
(i) PieZoelectric Transducers (ii) Strain Gauges. **(08 Marks)**

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15EC36

Third Semester B.E. Degree Examination, June/July 2019
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Four point charges each 20μc are on x-y axes at ± 4m. find the force on a 100μc point charge at (0, 0, 3)m. **(06 Marks)**

b. Define electric field intensity $(\vec{E})$ and using Coulomb's law derives the expression for $\vec{E}$ due to a point charge. **(04 Marks)**

c. A line charge of density ρ_ℓ = 24 n c/m is located in free space on the line y = 1, z = 2. Find electric filed intensity $\vec{E}$ at P(6, −1, 3). **(06 Marks)**

OR

2 a. Derive an expression for Electric field Intensity $\vec{E}$ due to an infinite line charge of density ρ_ℓ c/m. **(08 Marks)**

b. A point charge of 6μc is located at origin and a uniform line charge of density 180nc/m lies along x – axis,
   i) Find electric flux density D at (1, 2, 4)
   ii) Calculate the total electric flux leaving the surface of a sphere of 4m radius centered at origin. **(08 Marks)**

Module-2

3 a. A charge of Q coulombs is uniformly distributed throughout the volume of a sphere of radius 'R' meters. Using Gauss law Find electric field intensity 'E' everywhere. Plot the variation of E with radial distance. **(08 Marks)**

b. Given that $D = \frac{5r^2}{4} a_r$ in spherical co-ordinates evaluate both sides of Divergence Theorem for the volume enclosed between r = 1m and r = 2m. **(08 Marks)**

OR

4 a. Find the work done in moving a 5μc point charge from origin to p(2, −1, 4) through $E = 2xyz\, ax + x^2z\, a_y + x^2y\, a_z$ v/m via the path
   i) Straight line segment (0, 0, 0) to (2, 0, 0) to (2, −1, 0) to (2, −1, 4)
   ii) Straight line x = −2y, z = 2x. **(10 Marks)**

b. Given potential function $V = 50x^2yz + 20y^2$ V in free space find
   i) Voltage at p(1, 2, -3)
   ii) E at P
   iii) a_N at P **(06 Marks)**

Module-3

5 a. Using Laplace Equation derive the expression for capacitance of co-axial cylindrical capacitor. Assume the potential is a function of 'ρ' only. The boundary condition are V = 0 at ρ = b and V = V_0 at ρ = a (b > a) **(08 Marks)**

b. Conducting planes at ϕ = 10° and ϕ = 0° in cylindrical co-ordinates have voltages of 75V and 0 V respectively. Obtain the expression for Electric flux density 'D' in the region between the planes which contains a material for which E_r = 1.65. **(08 Marks)**

OR

6 a. Using Biot - Savart's law derive an expression for magnetic field intensity 'H' due to an infinite current carrying conductor at any point P. **(08 Marks)**

b. In cylindrical co-ordinates magnetic field H = $(2\rho - \rho^2)$ aϕ A/m. for $0 \le \rho \le 1$.

i) Determine current density 'J'

ii) What total current passes through a surface z = 0, $0 \le \rho \le 1$. **(08 Marks)**

Module-4

7 a. Derive Lorentz force equation for a moving charge in both electric and magnetic fields. **(04 Marks)**

b. The point charge Q = 18nc has a velocity of 5 × 10^6 m/s in the direction $q_v = 0.60\ a_x + 0.75\ a_y + 0.30a_z$. Calculate magnetic force exerted on the charge by

i) B = −3ax + 4ay + 6az MT

ii) E = −3ax + 4ay + 6az KV/m **(06 Marks)**

c. The magnetization in a magnetic material for which $\chi_m = 8$ is given in a certain region as $150z^2\ a_x$ A/m. At z = 4cm, find the magnitude of J and J_b. **(06 Marks)**

OR

8 a. Derive the expression for boundary conditions for magnetic flux density B, magnetic field intensity H and magnetization M for both normal and tangential field. **(08 Marks)**

b. Let μ_1 = 5 μH/m in region A where x < 0 and μ_2 = 20μH/m in region B where x > 0. If there is a surface current density K = 150 a_y − 200 a_z A/m at x = 0 and if $H_A = 300\ a_x - 400a_y + 500a_z$ A/m find (i) $|H_{tA}|$ (ii) $|H_{NA}|$ (iii) $|H_{tB}|$ (iv) $|H_{NB}|$ **(08 Marks)**

Module-5

9 a. What was the inconsistency of Ampere's law with continuity equation? How was it modified by Maxwell? **(06 Marks)**

b. Show that the displacement current in the dielectric of parallel plate capacitor is equal to conduction current between the two plates. **(04 Marks)**

c. Given $E = E_m \sin(\omega t - \beta z)\ a_y$ V/m in free space find, D, B and H. **(06 Marks)**

OR

10 a. Show that the intrinsic impedance defined as $\eta = \frac{|E|}{|H|}$ is equal to $\sqrt{\frac{\mu}{\epsilon}}$ for a perfect dielectric and hence prove that for free space η = 377Ω. **(08 Marks)**

b. A wave propagation in a lossless dielectric has the components

$E = 500 \cos(10^7 t - \beta z)\ a_x$ V/m

$H = 1.1 \cos(10^7 t - \beta z)\ a_y$ A/m

If the wave is travelling at v = 0.5C , where 'C' is velocity of light in free space find μ_r, ϵ_r, β, λ. **(08 Marks)**

CBCS SCHEME

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17EC43

Fourth Semester B.E. Degree Examination, June/July 2019
Control Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define control system. Compare open loop and closed loop control system. **(06 Marks)**

b. Find the transfer function $\frac{I(s)}{Ui(s)}$ for the circuit shown in Fig.Q.1(b) and K is the gain of an ideal amplifier. **(06 Marks)**

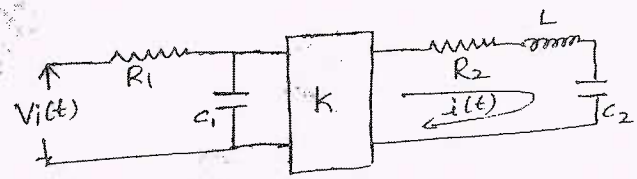

Fig.Q.1(b)

c. The system block diagram is shown in Fig.Q.1(c). Find $\frac{C(s)}{N(s)}$ if R(s) = 0 using block diagram reduction technique. **(08 Marks)**

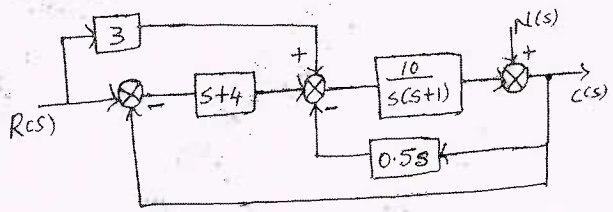

Fig.Q.1(c)

OR

2 a. Define signal flow graph and list the properties of signal flow graph. **(06 Marks)**

b. Find $\frac{C(s)}{R(s)}$ for the signal flow graph shown in Fig.Q.2(b) using Mason's gain formula. **(06 Marks)**

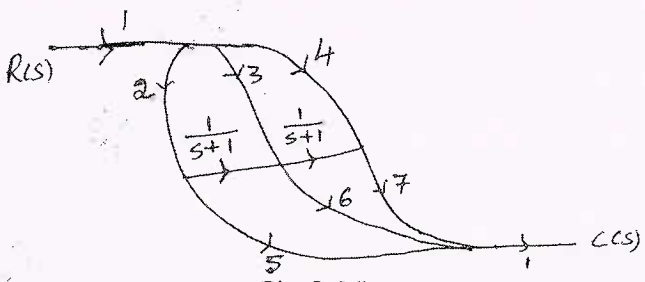

Fig.Q.2(b)

c. For the mechanical system shown in Fig.Q.2(c) i) Draw mechanical network ii) Write differential equations iii) Write the force-to-voltage analogous electric network. **(08 Marks)**

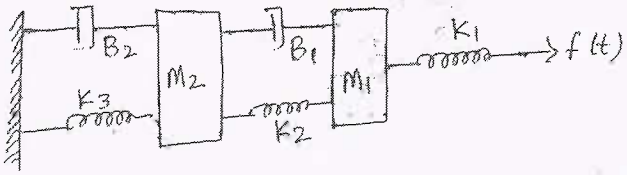

Fig.Q.2(c)

Module-2

3 a. List the standard test input signals used for analysis and evolution of control system. Also write the Laplace transform of corresponding inputs. **(04 Marks)**

b. Find the positional error (k_p), velocity error (k_v) and acceleration error (k_a) coefficients for a unity feed back system with open loop transfer function $G(s)H(s) = \frac{K}{s^2(s+20)(s+30)}$. Also find 'K' to limit the steady state error to 5 units due to input $r(t) = 1 + 10t + 20t^2$. **(08 Marks)**

c. A system is given by differential equation $\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 8y(t) = 8x(t)$, where y(t) = output and x(t) = input, obtain the output response to step input. For the same calculate: Peak time, Rise time and Peak overshoot. **(08 Marks)**

OR

4 a. Draw the block diagram of PID controller and explain briefly. **(04 Marks)**

b. A unity feedback system has $G(s) = \frac{40(s+2)}{s(s+1)(s+4)}$.

Find: i) Type of the system ii) All error coefficients iii) Error for Ramp input with magnitude 4. **(08 Marks)**

c. A system has 30% overshoot and settling time of 5 seconds for an unit step input. Determine: i) The transfer function ii) Peak time (T_P) iii) Output response (Assume C_{ss} as 2%). **(08 Marks)**

Module-3

5 a. A system with characteristics equation $s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$. Examine stability using Routh's Hurwitz criterion. **(08 Marks)**

b. Sketch the complete root locus for the system having $G(s)H(s) = \frac{K}{s(s^2+8s+17)}$, from the root locus diagram, evaluate the value of K for a system damping factor of 0.5. **(12 Marks)**

OR

6 a. The open loop transfer function of a unity feedback system is $G(s) = \frac{K(s+2)}{s(s+3)(s^2+5s+10)}$

i) Find the value of 'K' so that the steady state error for the input r(t) = t u(t) is less than or equal to 0.01.

ii) For the value of K found in part (i) Verify whether the closed loop system is stable or not using R.H criterion. **(08 Marks)**

b. A feedback control system has open loop transfer function $G(s)H(s) = \frac{K}{s(s+3)(s^2+3s+2)}$.

Sketch the complete root locus and comment on stability. **(12 Marks)**

Module-4

7 a. For a closed loop control system $G(s)=\frac{100}{s(s+8)}$ $H(s)=1$. Determine the resonant peak and resonant frequency. **(04 Marks)**

b. Draw the polar plot whose open loop transfer function is $G(s)H(s)=\frac{1}{1+0.1s}$. **(06 Marks)**

c. Using Nyquist stability criterion, investigate the closed loop stability whose open loop transfer function is given by $G(s)H(s)=\frac{100}{(s+1)(s+2)(s+3)}$. **(10 Marks)**

OR

8 a. Explain lead-lag compensator. **(04 Marks)**

b. Explain Nyquist stability criterion. **(06 Marks)**

c. Sketch the Bode plot for a unity feed back system $G(s)=\frac{K}{s(s+2)(s+10)}$. Determine marginal value of 'K' for which system will be marginally stable. Using bode plot. **(10 Marks)**

Module-5

9 a. Explain spectrum analysis of sampling process. **(06 Marks)**

b. State the properties of state transition matrix. **(06 Marks)**

c. Consider the system having state model

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-3 & 1\\ -2 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}0\\ 1\end{bmatrix}u \quad \text{and} \quad y=\begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$ with D = 0. Determine the transfer function of the system. **(08 Marks)**

OR

10 a. Obtain the state model of the electrical system shown in Fig.Q.10(a). **(06 Marks)**

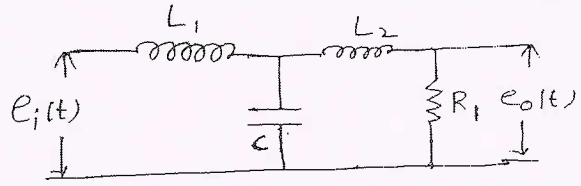

Fig.Q.10(a)

b. Obtain the state model for the system represented by the differential equation

$$\frac{d^3y(t)}{dt^3}+\frac{6d^2y(t)}{dt^2}+11\frac{dy(t)}{dt}+10y(t)=3u(t)$$ **(06 Marks)**

c. Find the state transition matrix for $A=\begin{bmatrix}0 & -1\\ 2 & -3\end{bmatrix}$. **(08 Marks)**

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17EC44

Fourth Semester B.E. Degree Examination, June/July 2019
Principles of Communication

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Illustrate the time domain and frequency domain characteristics of standard Amplitude modulation produced by a single tone. **(08 Marks)**

b. A carried wave 4 sin ($2\pi \times 500 \times 10^3$ t) volts is amplitude modulated by an audio wave 0.2 sin 3 [($2\pi \times 500t$) + 0.1 sin 5 ($2\pi \times 500t$)] volts. Determine the upper and lower side band and sketch the complete spectrum of the modulated wave. Estimate the total power in the sideband. **(08 Marks)**

c. Discuss coherent detection of DSBSC modulated waves. **(04 Marks)**

OR

2 a. Discuss the concept of Frequency Translation process with the help of block diagram and spectrum. **(07 Marks)**

b. Explain the system of Quadrature carried multiplexing. **(07 Marks)**

c. Compare the parameters of DSBSC and VSB modulation system. **(06 Marks)**

Module-2

3 a. Explain the generation of FM waves by using VCO method. **(08 Marks)**

b. An angle modulated signal is defined by S(t) = 10 cos [$2\pi \times 106$ t + 0.2sin ($2000\pi t$)]. Find the following : i) Power in the modulated signal ii) Frequency deviation iii) Phase deviation iv) Approximate transmission bandwidth. **(06 Marks)**

c. Mention the merits and demerits of F.M. **(06 Marks)**

OR

4 a. Illustrate the detection of FM using non – linear model of PLL. **(10 Marks)**

b. With a block diagram approach, explain the operation of FM stereo system. **(10 Marks)**

Module-3

5 a. Explain conditional probability of 2 events. **(05 Marks)**

b. The pdf of a random variable is given as $f_x(x) = \begin{cases} K & \text{for } a \le x \le b \\ 0 & \text{otherwise} \end{cases}$. **(05 Marks)**

where K = constant i) Sketch the pdf and determine the value of 'K'.

c. Determine the Noise equivalent Bandwidth of low pass filter. **(10 Marks)**

OR

6 a. A mixed stage has a noise figure of 20dB. It is preceded by an amplifier which has a noise figure of 9dB and an available power gain of 35 dB. Calculate the overall noise figure referred to the input. **(06 Marks)**

b. Let 'X' be a continuum random variable having a uniform probability distribution defined in the range $2 \le x \le 4$. Let Y = (3x + 2). Find the mean m_x and m_y. **(06 Marks)**

c. Discuss the properties of auto – correlation function. **(08 Marks)**

Module-4

7 a. Derive the figure of merit of AM Receivers. **(10 Marks)**

b. Explain about pre – emphasis and de – emphasis in FM system. **(10 Marks)**

OR

8 a. Show that the figure of merit of FM is $\frac{3}{2}\beta^2$. **(14 Marks)**

b. An AM receiver operating with a sinusoidal modulating signal has the following specifications. M = 0.8 $\varepsilon[SNR]_0$ = 30dB. What is the corresponding signal to noise ratio. **(06 Marks)**

Module-5

9 a. Explain the concept with block diagram of TDM system. **(06 Marks)**

b. A TV signal with a bandwidth of 4.2 MHz is transmitted using binary PCM. The number of quantization levels is 512. Calculate i) Code word length ii) Transmission B.W iii) Final bit rate. **(06 Marks)**

c. With neat diagram, explain the generation and detection of PCM signals. **(08 Marks)**

OR

10 a. A PCM system uses a uniform quantizer followed by a 'V' bit encoder. Show that rms signal to quantization noise is approximately given by (1.8 + 6V) dB. **(06 Marks)**

b. Mention the merits , demerits and applications of PAM. **(06 Marks)**

c. A signal m(t) = 10cos (20πt) cos (200πt) is sampled at the rate of 250 samplers/sec.

i) Sketch the spectrum of the sampled signal.

ii) Specify the cutoff for the ideal reconstruction filter.

iii) Specify the Nyquist rate for the signal m(t). **(08 Marks)**

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17EC46

Fourth Semester B.E. Degree Examination, June/July 2019
Microprocessors

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Why multiplexing technique is used in 8086? Mention its advantages. **(05 Marks)**

b. Explain the internal architecture of Intel 8086 with neat block diagram and explain in brief. **(10 Marks)**

c. Analyze the effective and physical address if :
i. Disp = 1B57H, DS = 2100H
ii. DI = 1045H, DS = 2100H
iii. BP = 8000H, DS = 5000H, SS = 1000H, Disp = 2345H
iv. BX = 0158H, SI = 1045H, DS = 2100H, SS = 1400H
v. BP = 0720H, Disp = 1000H, DS = 2000H, SS = 4000H. **(05 Marks)**

OR

2 a. List the need of control word register of Intel 8086. Explain with an example. **(08 Marks)**

b. What is addressing modes? Explain any four addressing modes with an example to each. **(08 Marks)**

c. Interpret the following instructions : i) SUB and CMP ii) AND and TEST. **(04 Marks)**

Module-2

3 a. Identify the operation of the following instructions :
i) NEG ii) CBW iii) DAA iv) AAD v) SAHF. **(05 Marks)**

b. Write ALP to move 16 bytes of string of data from the offset 0200H to 0300H. **(10 Marks)**

c. What are assembler directions? Explain the following assembler directions.
i) Model ii) Assume iii) DB iv) DUP v) END. **(05 Marks)**

OR

4 a. Tell the functions of the following instructions with an example :
i) ROL ii) RCR iii) SHL iv) SAR v) ROR. **(10 Marks)**

b. Write ALP o convert 8 digits packed BCD number to 16 digits unpacked BCD number. **(10 Marks)**

Module-3

5 a. Explain the operation of the stack using PUSH and POP instructions. **(05 Marks)**

b. Write ALP to find the factorial of an 8-bit number. **(10 Marks)**

c. Interpret the maskable and non–maskable interrupts of 8086. **(05 Marks)**

OR

6 a. Write ALP to generate a delay of 100ms using an 8086 system that runs on 10MHz frequency. **(10 Marks)**

b. Analyze the interrupt cycle of 8086. **(10 Marks)**

Module-4

7 a. Draw the pin configuration of Intel 8086 and explain the operation of pins in maximum mode of operation. **(10 Marks)**

b. Interface two 4K × 8 EPROM and two 4K × 8 RAM chips with 8086. Show the memory mapping. **(10 Marks)**

OR

8 a. Show the block diagram of Intel 8255 and explain the operation of each unit in detail. **(10 Marks)**

b. Interface 8 seven segment display using 8255 with 8086. Write ALP to display 1, 2, 3, 4, 5, 6, 7, 8 over the 8 seven segment display continuously. **(10 Marks)**

Module-5

9 a. Interface 8 bit ADC 0808 through 8255 to 8086. Write ALP to accept the channel number through key board ($O_0 - 0_7$), convert analog i/p of selected channel to digital o/p and store the result as a digital data. **(10 Marks)**

b. Design a stepper motor controller and write ALP to rotate shaft of 4-phase stepper motor. i) In clockwise 5 rotations ii) In anticlockwise 5 rotations. **(10 Marks)**

OR

10 a. Interpret the following INT 214 dos function. I) function 09H ii) function 4CH. **(08 Marks)**

b. Write ALP to generate a square waveform using DAC 0800 through 8255 to 8086. **(12 Marks)**

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15EC42

Fourth Semester B.E. Degree Examination, June/July 2019
Microprocessor

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 internal architecture of 8086 with its neat block diagram. **(08 Marks)**

b. Explain any four addressing modes of 8086 microprocessor with an example each. **(08 Marks)**

OR

2 a. Write a program to exchange of two block of data from 5000H to 6000H memory locations. **(08 Marks)**

b. Explain any three conditional branch instructions with example. **(03 Marks)**

c. Explain the flag register of 8086. **(05 Marks)**

Module-2

3 a. Explain any four Assembler directives with one example each. **(08 Marks)**

b. Write an ALP to reverse the string "MY INDIA" and store in memory location STR2. **(08 Marks)**

OR

4 a. Explain the following instructions with example each.
(i) RCL (ii) SAR (iii) TEST (iv) LOOPZ. **(08 Marks)**

b. What are the machine control instructions? Explain any 3 instructions. **(06 Marks)**

c. What is the difference between IRET and RET? **(02 Marks)**

Module-3

5 a. What is stack? Explain the stack operation for PUSH and POP instruction of 8086 with neat diagram. **(08 Marks)**

b. Define a macro. Write a program using macro to display a message. **(04 Marks)**

c. Write a delay program to generate a delay of 0.1 sec, using an 8086 system operating at 10 MHz. **(04 Marks)**

OR

6 a. Define Interrupts. Explain TYPE0 and TYPE2 Interrupts. **(06 Marks)**

b. Explain hardware interrupts of 8086 microprocessor. Explain maskable and NMInterrupts. **(06 Marks)**

c. Bring out the differences between MACRO and procedure. **(04 Marks)**

Module-4

7 a. Sketch the maximum mode configuration of 8086 and explain the operation briefly. **(08 Marks)**

b. Interface a 4×4 keyboard to 8086 and write the program logic flow. **(08 Marks)**

OR

8 a. Interface a multiplexed 7-segment display to 8086 and explain. **(08 Marks)**

b. With a neat diagram, explain 8255 PPI device and also explain control register of 8255. **(08 Marks)**

Module-5

9 a. With a neat diagram explain the interfacing of 1.8° step stepper motor and also write clockwise rotation program for 100 steps assuming 'DELAY' procedure is available. **(08 Marks)**

b. Write interfacing diagram of DAC AD7523 with an 8086 CPU. Write an ALP to generate Sawtooth waveform. **(08 Marks)**

OR

10 a. With a neat diagram explain the 8087 coprocessor. **(08 Marks)**

b. Explain with a neat diagram of 8254 internal architecture. **(08 Marks)**

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15EC44

Fourth Semester B.E. Degree Examination, June/July 2019
Signals and Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Find the odd part and even part of the signal given in Fig.Q1(a). **(08 Marks)**

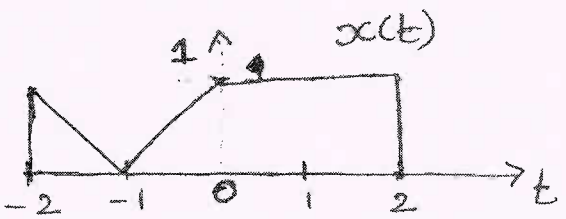

Fig.Q1(a)

b. Find $4x(-3n+4)$, if x(n) is as shown in Fig.Q1(b). **(04 Marks)**

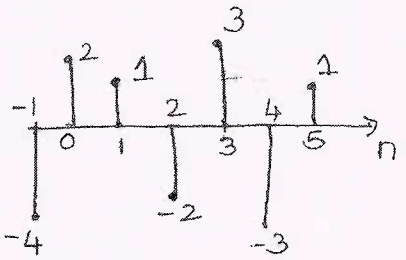

Fig.Q1(b)

c. Find whether the signal is causal, linear, time variant and static for all values of 'n'. $y(n) = x(-3n)$. **(04 Marks)**

OR

2 a. Find whether the given signal is periodic and if periodic, determine the period :

$$x(t) = a\cos(\sqrt{2}t) + b\sin\left(\frac{t}{4}\right).$$ **(04 Marks)**

b. Sketch the following signal $x(t) = r(t+1) - r(t-1) + 2r(-3)$. **(05 Marks)**

c. Find $y(-t-2)\cdot x\left(\frac{t}{2}+1\right)$ if y(t) and x(t) are as shown in FigQ2(c). **(07 Marks)**

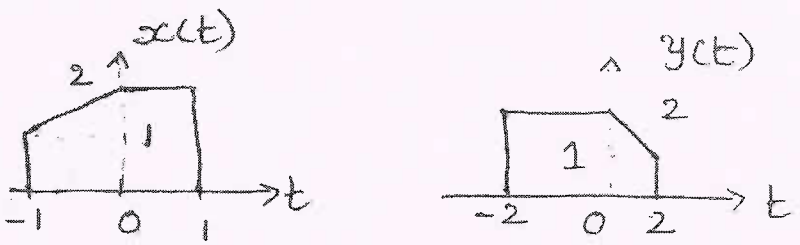

Fig.Q2(c)

Module-2

3 a. Make use of graphical method to perform the convolution of two signals $x_1(n)$ and $x_2(n)$ given : $x_1(n) = \{1, \underset{\uparrow}{2}, 3, 4\}$ $x_2(n) = \{-2, \underset{\uparrow}{0}, 2\}$ **(08 Marks)**

b. Find $x_1(t) * x_2(t)$ if

$$x_1(t)\begin{cases} e^{-t}; & 0 \le t \le 1 \\ 0; & \text{otherwise} \end{cases}$$

$$x_2(t)\begin{cases} 2; & 0 \le t \le 2 \\ 0; & \text{otherwise} \end{cases}$$ **(08 Marks)**

OR

4 a. Find $x_1(t) * x_2(t)$ if

$$x_1(t)\begin{cases} 1; & 0 \le t \le 2 \\ 0; & \text{otherwise} \end{cases}$$

$$x_2(t)\begin{cases} t; & 0 \le t \le 1 \\ 0; & \text{otherwise} \end{cases}$$ **(08 Marks)**

b. Find the convolution of $x_1(n)$ and $x_2(n)$ if $x_1(n) = a^n u(n)$ $x_2(n) = b^n u(-n)$. **(08 Marks)**

Module-3

5 a. Define the following properties of DTFS :
i) Convolution ii) Periodicity iii) Linearity **(06 Marks)**

b. Find the complex exponential Fourier series for the periodic rectangular pulse train shown in Fig.Q5(b). **(10 Marks)**

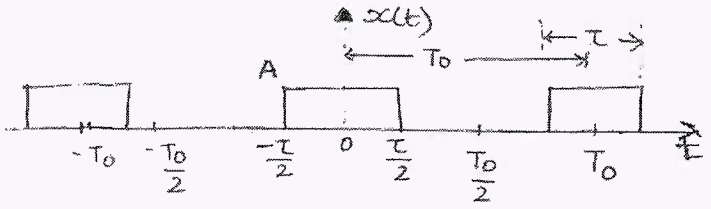

Fig.Q5(b)

OR

6 a. Find the DTFS coefficients of the signal shown in Fig.Q6(a). **(10 Marks)**

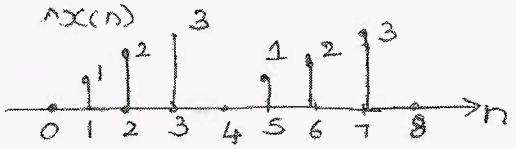

Fig.Q6(a)

b. Find an expression for impulse response of interconnection of LTI systems shown in Fig. Q6(b). **(06 Marks)**

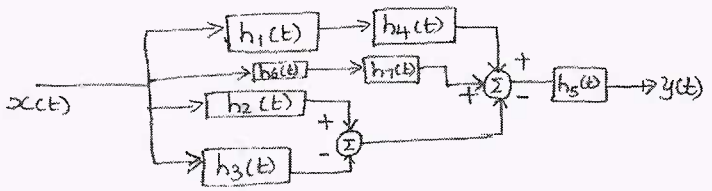

Fig.Q6(b)

Module-4

7 a. Construct the Fourier transform of rectangular pulse shown in Fig.7(a). Also obtain and plot magnitude and phase responses. **(08 Marks)**

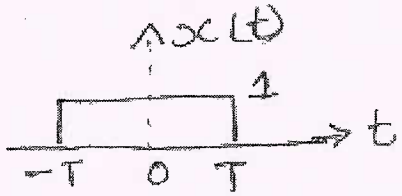

Fig.Q7(a)

b. Define and prove the following properties of DTFT i) frequency shift ii) time reversal. **(08 Marks)**

OR

8 a. Explain sampling theorem and the concept of aliasing. **(04 Marks)**

b. Find DTFT of the signal, $x(n) = -a^n u(-n-1)$. **(04 Marks)**

c. Find Fourier transform of the following signals.

i) $x(t) = e^{-a|t|}$ ii) $x(t) = e^{at}u(-t)$. **(08 Marks)**

Module-5

9 a. Explain the properties of RoC. **(06 Marks)**

b. The system function of the LTI is given as $H(z) = \frac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}}$. Specify the RoC of H(z) and determine the unit sample response h(n) for the following conditions :

i) Stable system
ii) Causal system
iii) Anticausal system. Also determine poles and zeroes of H(z). **(10 Marks)**

OR

10 a. Find Z-transform of x(n) = nu(n-1). **(06 Marks)**

b. Find inverse z-transform if $X(z) = \frac{z}{(z^2+z+0.5)(z-1)}$. **(10 Marks)**

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15EC43

Fourth Semester B.E. Degree Examination, June/July 2019
Control Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define a control system. Explain the difference between open loop and closed loop control system with example for each. **(06 Marks)**

b. Determine the transfer function $X_2(s)/F(s)$ for the mechanical system shown in Fig.Q.1(b) **(08 Marks)**

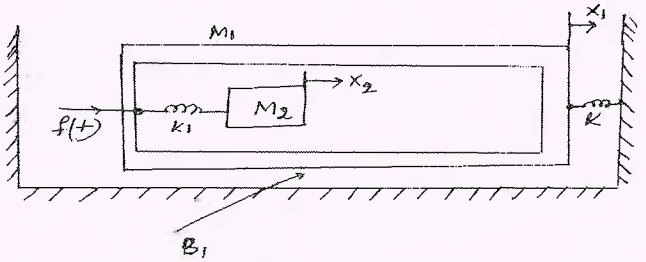

Fig.Q.1(b)

c. State advantages of the block diagram reduction technique. **(02 Marks)**

OR

2 a. Explain the block diagram reduction rules. **(04 Marks)**

b. Obtain C(s)/R(s) using block diagram reduction rules for the Fig.Q.2(b). **(06 Marks)**

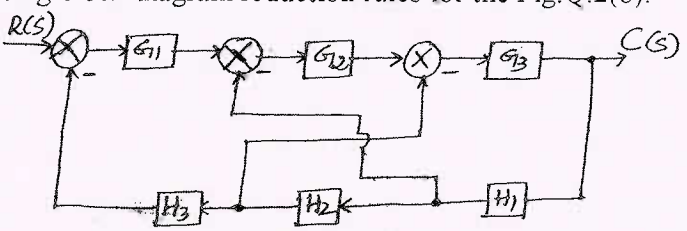

Fig.Q.2(b)

c. Using Mason's gain formula, find the gain of the system in Fig.Q.2(c). **(06 Marks)**

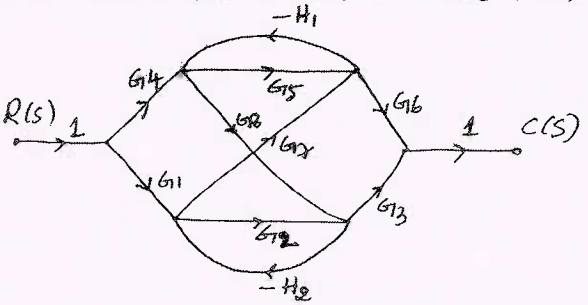

Fig.Q.2(c)

Module-2

3 a. What are disadvantages of static error coefficient method? **(03 Marks)**

b. Find k_p, k_v, k_a and static error for a system with open loop transfer function as:

$$G(s)H(s) = \frac{10(s+2)(s+3)}{s(s+1)(s+5)(s+4)}$$ where the input is $r(t) = 3 + t + t^2$. **(05 Marks)**

c. Derive the expression of unit step response of a second order system (under damped case). **(08 Marks)**

OR

4 a. Derive the expressions for Peak Time (T_P), Peak over short (M_P), Rise Time (T_R) and Settling Time (T_S). **(08 Marks)**

b. For a spring mass damper shown in Fig.Q.4(b) (i), an experiment was conducted by applying a force of 2 Newton's to the mass. The response X(t) was recorded using an xy plotter and the experimental result are shown in Fig.Q.4(b) (ii). Find the value of M, K and B. **(08 Marks)**

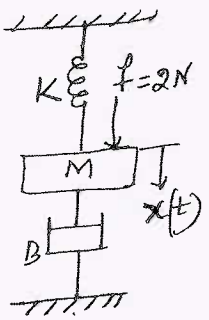

Fig.Q.4(b) (i)

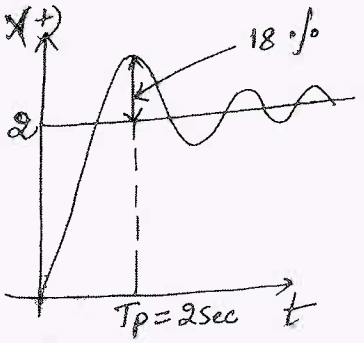

Fig.Q.4(b) (ii)

Module-3

5 a. State and explain Routh-Hurmitz criterion of stability. What are limitations? **(05 Marks)**

b. A unity feedback control system has $G(s) = \frac{K(s+13)}{s(s+3)(s+7)}$, using Routh's criterion calculate the range of K for which the system is i) stable ii) has its closed loop, poles more negative than -1. **(08 Marks)**

c. Define absolute stability and marginal stability. **(03 Marks)**

OR

6 a. State the rules for the construction of root loci of the characteristic equation of a feedback control system. **(04 Marks)**

b. Draw the root locus diagram for the loop transfer function:

$$G(s)H(s) = \frac{K}{s(s^2+8s+17)}$$

From the diagram, evaluate the value of K for a system damping ratio of 0.5. **(12 Marks)**

Module-4

7 a. Explain the correlation between time and frequency time for second order system. **(06 Marks)**

b. A unity feedback control system has $G(s) = \frac{80}{s(s+2)(s+20)}$. Draw the bode plot. **(10 Marks)**

OR

8 a. Distinguish between gain margin and phase margin. **(04 Marks)**

b. Draw the complete Nyquist plot of the system whose loop transfer function is given by $G(s) = \frac{10}{s^2(s+0.25s)(1+0.5s)}$. And hence determine system is stable or not. **(12 Marks)**

Module-5

9 a. Define state variables and state transition matrix. List the properties of the state transition matrix. **(06 Marks)**

b. For a certain system, when $X(0) = \begin{bmatrix} 1 \\ -3 \end{bmatrix}$ then $X(t) = \begin{bmatrix} e^{-3t} \\ -3e^{-3t} \end{bmatrix}$ while $X(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ then $X(t) = \begin{bmatrix} e^{t} \\ e^{t} \end{bmatrix}$. Determine the system matrix A. Also find state transition matrix. **(10 Marks)**

OR

10 a. Obtain the state model for the electrical system as shown in the Fig.Q.10(a), choosing the state variables as $i_1(t)$, $i_2(t)$ and $v_c(t)$. **(06 Marks)**

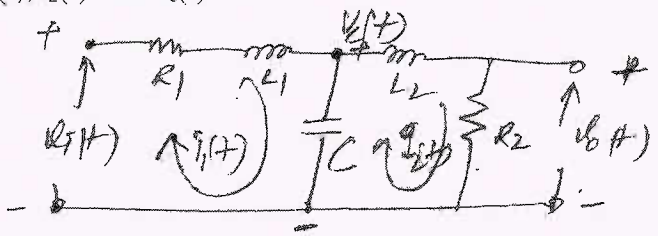

Fig.Q.10(a)

b. State and prove sampling theorem for low pass signals. **(10 Marks)**

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15EC45

Fourth Semester B.E. Degree Examination, June/July 2019
Principles of Communication Systems

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 generation of DSB-SC wave using ring modulator. **(06 Marks)**

b. Explain briefly on the following :
i) Frequency discrimination method
ii) Phase discrimination method for SSB generation. **(06 Marks)**

c. A broadcast transmitter radiates 20 kilowatts when the modulation percentage is 75. How much of this is carrier power? Also calculate the power of each sidebands. **(04 Marks)**

OR

2 a. Explain the working of envelope detector. **(06 Marks)**

b. With a neat block diagram. What a note on quadrature carrier multiplexing. **(06 Marks)**

c. Explain how costas receivers can be used for demodulating the DSB – SC signal. **(04 Marks)**

Module-2

3 a. Define angle modulation and explain important advantages of modulated waves. **(06 Marks)**

b. With a block diagram. Explain the working of a FM stereo multiplexing. **(06 Marks)**

c. A sinusoidal modulating wave of amplitude 5V and frequency 1KHz is applied to a frequency modulator. The frequency sensitivity of the modulator is 50 and calculate :
i) The frequency deviation ii) Modulation index. **(04 Marks)**

OR

4 a. Explain narrowband frequency modulation. **(05 Marks)**

b. Explain nonlinearity and its effect in frequency modulation system. **(05 Marks)**

c. Explain the linear model of phase locked loop with relevant expression. **(06 Marks)**

Module-3

5 a. Explain the following terms :
i) Moments ii) central moments iii) mean iv) covarience. **(08 Marks)**

b. Explain the properties of joint distribution function. **(04 Marks)**

c. The random variable 'y' is the function of another random variable 'X' such that $y = \cos(X)$ and 'X' is uniformly distributed in the interval $(-\pi, \pi)$ i.e.,

$$f_x(x) = 1/2\pi \quad -\pi < x < \pi$$
$$= 0 \quad \text{othwerise}$$

Find out the mean value of 'y'. **(04 Marks)**

OR

6 a. Explain the following of their properties :
i) Autocorrelation function
ii) Cross circulation function. **(05 Marks)**

b. Explain briefly about sources of noise. Explain thermal noise. **(06 Marks)**

c. Define and derive noise equivalent bandwidth, and also calculate the mean square noise across capacitor. **(05 Marks)**

Module-4

7 a. With neat diagram, explain about AM noise receiver and obtain the figure of merit. **(08 Marks)**

b. With neat diagram, explain a DSB–SC receiver using coherent detection. Show that figure of merits for such receiver is unity. **(08 Marks)**

OR

8 a. Find the figure of merit when the depth of modulation of AM system when :
i) 100% ii) 50% iii) 30%. **(06 Marks)**

b. Explain the pre-emphasis and de-emphasis in frequency modulation with circuit and graph. **(06 Marks)**

c. Write short notes on capture effect. **(04 Marks)**

Module-5

9 a. Give the comparison of analog signals and digital signals use in communication system. **(04 Marks)**

b. With neat block diagram, explain the generation of PAM waves. **(06 Marks)**

c. With neat diagram, explain concept of time division multiplexing. **(06 Marks)**

OR

10 a. With diagram, explain the generation of PPM waves. **(08 Marks)**

b. Explain channel vocoder with its neat diagram. **(08 Marks)**

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15EC46

Fourth Semester B.E. Degree Examination, June/July 2019
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. With a neat circuit diagram. Explain the basic op-amp circuit. **(06 Marks)**

b. Define the following parameters and mention their typical values for op-amp 741.
i) Common Mode Rejection Ratio(CMRR) ii) Slew Rate iii) input offset voltage. **(06 Marks)**

c. A 741 op-amp is used in a non inverting amplifier with a voltage gain of 50. Calculate the typical output voltage that would result from a common mode input with a peak level of 100mV. **(04 Marks)**

OR

2 a. Sketch the circuit of a three input non inverting summing amplifier. Explain the operation of the circuit and derive an equation for the output voltage. **(07 Marks)**

b. With a neat circuit diagram, explain direct coupled non –inverting amplifier with necessary design steps. **(05 Marks)**

c. Design an inverting amplifier using LF353 BIFET op-amp. The voltage gain is to be 50 and. The output voltage amplitude is to be 2.5V. **(04 Marks)**

Module-2

3 a. With a neat circuit diagram, explain the design steps for :
i) capacitor coupled voltage follower ii) capacitor coupled inverting amplifier. **(10 Marks)**

b. Explain how the upper cutoff frequency can be set for inverting and non inverting amplifiers. **(06 Marks)**

OR

4 a. Draw the circuit of a precision voltage source using an op-amp and a zener diode. Explain the circuit operation. **(06 Marks)**

b. Draw the complete circuit of an instrumentation amplifier and explain its operation. **(06 Marks)**

c. What are the advantages of precision rectifier over simple diode rectifier? **(04 Marks)**

Module-3

5 a. Draw the circuit of an op-amp precision clamping circuit and explain its operation with necessary design steps. **(08 Marks)**

b. With a neat circuit diagram and waveforms, explain the operations of op-amp sample and hold circuit. **(08 Marks)**

OR

6 a. Using a 741 op-amp with a supply of ± 12V, design a phase shift oscillator to have an output frequency of 3.5 KHz. **(06 Marks)**

b. With a neat circuit diagram and waveforms, explain the operation of differentiating circuit using op-amp. **(04 Marks)**

c. With a neat circuit, explain the operation of a fundamental log amplifier using op-amp. Derive the output voltage equation. **(06 Marks)**

Module-4

7 a. What do you mean by active filter? Explain how active filters are classified. **(04 Marks)**

b. Design a first order active low pass filter to have a cutoff frequency of 1KHz. Use 741 op-amp. **(05 Marks)**

c. Draw the circuit of a second order active high pass filter and explain its working. **(07 Marks)**

OR

8 a. What is voltage regulator? With a neat circuit explain the working of series op-amp regulator. **(05 Marks)**

b. Define the following performance parameters of a voltage regulators i) line regulation ii) load regulation. **(04 Marks)**

c. With a neat functional diagram, explain the operation of low voltage regulator using IC 723. **(07 Marks)**

Module-5

9 a. Draw the block diagram representation of Phase Locked Loop (PLL) and explain its operation. **(06 Marks)**

b. Define lock in range and capture range with reference to Phase Locked Loop (PLL). **(04 Marks)**

c. With a neat sketch, explain the working of R–2R ladder digital to analog convertor (DAC). **(06 Marks)**

OR

10 a. Draw and explain the functional diagram of 555 timer. **(06 Marks)**

b. With a neat sketch and waveforms explain the working of astable multivibrator using 555 timer. **(06 Marks)**

c. Design a monostable multi vibrator using 555 timer to obtain a pulse width of 5 msec. **(04 Marks)**

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15EC42

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Microprocessors

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 flag register of 8086 in detail with neat diagram. **(08 Marks)**

b. Explain in detail with examples any 4 addressing modes of 8086. **(06 Marks)**

c. Opcode for MOV instruction is "100010", explain the formation of opcode for MOV AX, BX. **(02 Marks)**

OR

2 a. With a neat block diagram explain the internal architecture of 8086. **(08 Marks)**

b. Write an 8086 assembly language program to sort a block of 20 eight bit numbers at LOC1 into even and odd numbers, save them at EVN and ODD. **(06 Marks)**

c. Explain the working of following 8086 instructions:
(i) MOV AX, [SI] (ii) ADD BYTE PTR [DI], 3 **(02 Marks)**

Module-2

3 a. Write an ALP to add two ASCII numbers N1 and N2 and save the result at RES as a hexadecimal number. **(08 Marks)**

b. Write an ALP to replace the "##" in a given string of 50 characters with "**". **(08 Marks)**

OR

4 a. What are assembler directives? Explain the following assembler directives :
(i) DQ (ii) ASSUME (iii) DUP. **(04 Marks)**

b. Write an ALP to copy a 100 Byte block of data from LOC1 to LOC2 using the MOVS instruction. **(06 Marks)**

c. A two digit BCD number is typed using a keyboard. Write an ALP to read the value. save it as BCD number at LOC as packed BCD. **(06 Marks)**

Module-3

5 a. Describe the purpose of the interrupt vector table of 8086 processor and conditions which cause the following interrupts Type 0; Type 2; Type 4. **(08 Marks)**

b. What are the differences between MACRO and PROCEDURE? **(04 Marks)**

c. Write a procedure DELAY which performs 10 msec delay with 8086 processor @ 10MHz. Show the calculations of the delay. **(04 Marks)**

OR

6 a. Explain the type of interrupts and the action taken by the 8086 when an interrupt occurs in detail. **(06 Marks)**

b. Explain the interrupt acknowledgement cycle of 8086 with the neat timing diagram. **(06 Marks)**

c. Write a MACRO to create a DELAY where the delay parameter is passed on to the macro. **(04 Marks)**

Module-4

7 a. With a neat diagram explain the control register of 8255 in detail. **(06 Marks)**

b. Write ALP to setup 8255 so that port A is input port B is output and PC0-3 are input, PC4-7 are output ports. Assume 8255 is mapped as IO at 40H. Show with neat diagram the hardware connection of 8086 to 8255 using 74LS138 decoder to generate $\overline{CS}$ logic. **(10 Marks)**

OR

8 a. With neat diagram explain maximum mode of operation of 8086. **(06 Marks)**

b. 8086 is interfaced through a 8255 to a 4 by 4 keypad where Port C4-7 is connected to column and PC0-3 to row. 8255 is in isolated IO mode at location 40H. Write ALP to setup 8255 and read the key pressed to display on screen as "ROW#: __" and "COLUMN#:__". Assume a 50 msec delay routine DELAY50 is available to you. **(10 Marks)**

Module-5

9 a. Explain the internal architecture of 8087. **(06 Marks)**

b. Write a program to read analog input connected to the last channel of ADC0808 interfaced to 8086 using 8255 and digital value to be stored at location 3000h. **(06 Marks)**

c. Explain the working of DOS21H interrupt when AH = 09h and AH = 02h. **(04 Marks)**

OR

10 a. Write an ALP to rotate 100 steps in clockwise direction for a 1.8 degree stepper motor connected to 8255 port. Show details of calculations. Motor to rotate at 12 rpm. Processor speed is 10 MHz. **(08 Marks)**

b. Explain the control register of 8253/54 in detail. **(06 Marks)**

c. Explain the difference between CISC and RISC Architecture. **(02 Marks)**

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15EC43

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Control Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define control system. Write the differences between open loop control system and closed loop control system. **(08 Marks)**

b. For the mechanical system shown in Fig.Q1(b) the analogous electrical network based on F-V analogy. **(08 Marks)**

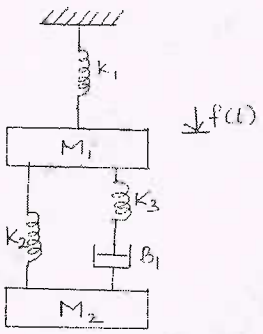

Fig.Q1(b)

OR

2 a. Define transfer function, derive an expression for the transfer function of a closed loop, negative feedback system. **(04 Marks)**

b. Reduce the block diagram shown in Fig.Q2(b) using block diagram reduction rules and obtain C(S)/R(S). **(06 Marks)**

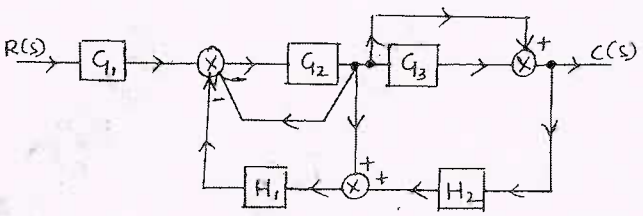

Fig.Q2(b)

c. Find $\frac{C(S)}{R(S)}$ using Mason's gain formula. **(06 Marks)**

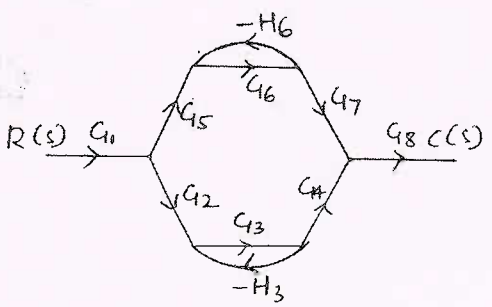

Fig.Q2(c)

Module-2

3 a. With the help of graphical representation and mathematical expression, explain the following test signals.
i) Step signal ii) Ramp signal iii) Impulse signal iv) Parabolic signal. **(08 Marks)**

b. Derive an expression for the underdamped response of a second order feedback control system for step input. **(08 Marks)**

OR

4 a. Define the following terms with respect to an underdamped second order system :
i) Peak time (T_p) ii) settling time (T_S) iii) Delay Time (T_d). **(06 Marks)**

b. A unity feedback system has $G(S) = \frac{40(s+2)}{s(s+1)(s+4)}$.
Determine : All error co-efficient ii) Error for ramp input with magnitude of 4. **(06 Marks)**

c. Derive the expression for rise time(T_r). **(04 Marks)**

Module-3

5 a. A feedback control system has a characteristic equation :
$s^6 + 2s^5 + 9s^4 + 16s^3 + 24s^2 + 32s + 16 = 0$.
How many poles are : i) in the left half of s-plane ii) on the imaginary axis iii) on the right half of the s-plane. **(06 Marks)**

b. For a unity feedback system, $G(s) = \frac{k}{s(1+0.4s)(1+0.25s)}$. Find the range of values of 'k', marginal value of 'K' and frequency of sustained oscillations. **(06 Marks)**

c. Explain the Routh's stability criterion for assessing the stability of a system. **(04 Marks**

OR

6 a. Explain the angle condition and magnitude condition. **(04 Marks)**

b. Sketch the complete root locus for the system having $G(s)H(s) = \frac{k}{s(s+1)(s+2)(s+3)}$. **(12 Marks)**

Module-4

7 a. Sketch the bode plot for the transfer function :

$$G(s) = \frac{ks^2}{(1+0.2s)(1+0.02s)}$$

Determine the value of k for the gain cross-over frequency to be 5 rad/sec. **(10 Marks)**

b. Define : i) Gain margin ii) Phase margin iii) Gain cross-over frequency. **(06 Marks)**

OR

8 a. For a certain control system :

$$G(s)H(s) = \frac{k}{s(s+2)(s+10)}$$

Sketch the Nyquist plot and hence calculate the range of values of k for system stability. **(10 Marks)**

b. State and explain the Nyquist stability criterion. **(06 Marks)**

Module-5

9 a. Explain a typical system with digital controller. **(06 Marks)**

b. Explain the spectrum analysis of sampling process. **(10 Marks)**

OR

10 a. Obtain the state transition matrix for

$$A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}.$$ **(08 Marks)**

b. List the properties of state transition matrix. **(04 Marks)**

c. Define : i) state ii) state variables. **(04 Marks)**

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15EC44

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Signals and Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define a signal and a system. Explain any two properties of a system. **(06 Marks)**

b. A continuous signal x(t) is shown in Fig Q1(b). sketch and label each of the following :

i) $x(t)\cdot u(1-t)$

ii) $x(t)\cdot[u(t)-u(t-1)]$

iii) $x(t)\cdot\sigma(t-3/2)$

iv) $x(t)\cdot[u(t+1)-u(t)]$

v) $x(t)\cdot u(t-1)$

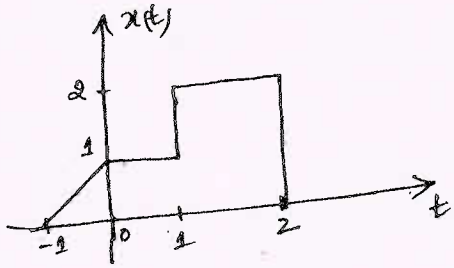

Fig Q1(b) **(10 Marks)**

OR

2 a. Distinguish between :

i) Energy and power signal

ii) Even and odd signal **(04 Marks)**

b. Determine whether the continuous – time signal $x(t) = x_1(t) + x_2(t) + x_3(t)$ is periodic or not. If periodic find the fundamental period. Where $x_1(t)$, $x_2(t)$ and $x_3(t)$ have periods of 8/3, 1.26 and $\sqrt{2}$ respectively. **(06 Marks)**

c. For the following system, determine whether the system is

(i) Linear (ii) Time – invariant (iii) Memory less and (iv) Causal.

$y(t) = e^{x(t)}$ **(06 Marks)**

Module-2

3 a. Determine the convolution sum of the given sequence

$x(n) = \left\{ \underset{\uparrow}{1},2,3,1 \right\}$ and $h(n) = \left\{ 1,\underset{\uparrow}{2},1,-1 \right\}$ **(04 Marks)**

b. Evaluate the discrete time convolution sum given and also plot the output y(n)

$y(n) = \left(\frac{1}{2}\right)^n \cdot u(n-2) * u(n)$ **(06 Marks)**

c. For the system with impulse response shown, determine whether the system in stable, memory less and causal $h(t) = e^{-2|t|}$. **(06 Marks)**

OR

4 a. Compute the o/p y(t) for an continuous time LTI system whose impulse response h(t) and its input x(t) are given by

$h(t) = e^{-t} \cdot u(t)$

$x(t) = u(t) - u(t-2)$ **(10 Marks)**

b. Prove the following convolution properties of impulse function

i) $x(t) * \sigma(t) = x(t)$

ii) $x(t) * \sigma(t - t_0) = x(t - t_0)$

iii) $x(t) * \sigma(t + t_0) = x(t + t_0)$ **(06 Marks)**

Module-3

5 a. Find the overall impulse response of a cascade of two systems having identical impulse responses $h(t) = 2[u(t) - u(t-1)]$ **(06 Marks)**

b. Find the unit step response of the following system given by their impulse response

$h(n) = \left(\frac{1}{2}\right)^n \cdot u(n)$ **(04 Marks)**

c. State the condition for the Fourier series to exist. Also prove the convergence condition (Absolute Integrability) **(06 Marks)**

OR

6 a. Prove the following properties of Fourier series:

i) Convolution property

ii) Parasevals relationship **(04 Marks)**

b. Determine the Fourier – series of the signal $x(t) = 3\cos\left(\frac{\pi}{2}t + \frac{\pi}{3}\right)$. Plot the magnitude and phase spectra. **(06 Marks)**

c. Show that if x(n) is real and even, its Fourier coefficient are real. Hence find the DTFS coefficients for the signal

$x[n] = \sum_{p=-\infty}^{\infty} \sigma[n - 2p]$ **(06 Marks)**

Module-4

7 a. State and prove the following properties of Fourier transform :

i) Frequency shift property

ii) Differentiation in time property **(04 Marks)**

b. Find the Fourier transform of

$x(t) = e^{-at} \cdot u(t)$. Also plot magnitude and phase spectra. **(06 Marks)**

c. For the rectangular pulse shown in Fig Q7(c), Evaluate the Fourier Transform and draw its spectrum. **(06 Marks)**

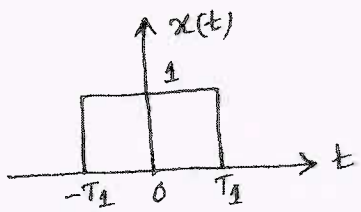

Fig Q7(c)

OR

8 a. Determine the DTFT of the following signal and draw its spectrum.

$$x(n) = \left(\frac{1}{2}\right)^n \cdot u(n-4)$$ **(06 Marks)**

b. Define the DTFT of a signal. Establish the relation between DTFT and z-transform. **(05 Marks)**

c. Find the NyQuist rate and Nyquist interval for the following signal.
$x(t) = 5\,Cos1000\,\pi t + 2Sin\,500\pi t$. **(05 Marks)**

Module-5

9 a. Describe the properties of Region of convergence and sketch the ROC of two sided, right sided and left sided sequence. **(08 Marks)**

b. Determine the z-transfer of

(i) $x[n] = -u[-n-1] + \left(\frac{1}{2}\right)^n \cdot u(n)$

(ii) $x[n] = \left(\frac{1}{2}\right)^{|n|}$

Find the ROC and pole zero locations of x(z). **(08 Marks)**

OR

10 a. Find the inverse z – transform of

$$x(z) = \frac{z(z^2 - 4z + 5)}{(z-3)(z-1)(z-2)}$$ with : i) $|z| > 3$ ii) $|z| < 1$. **(08 Marks)**

b. A discrete LTI system is characterized by the difference equation
$y(n) = y(n-1) + y(n-2) + x(n-1)$

i) Find the system function H(z)
ii) Plot poles and zeros of H(z)
iii) Indicate the ROC of system is stable and causal
iv) Determine the impulse response of the stable system. **(08 Marks)**

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15EC45

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define amplitude modulation. Derive the expression on AM by both time domain and frequency domain representation with necessary waveforms. **(08 Marks)**

b. Explain how RING modulator can be used to generate DSB-SC modulation. **(08 Marks)**

OR

2 a. An audio frequency signal 5 sin $2\pi(1000t)$ is used to amplitude modulate a carrier of 100 sin $2\pi(10^6t)$. Assume modulation index of 0.4.
Find :
i) Sideband frequencies
ii) Bandwidth required. **(02 Marks)**

b. Explain the scheme for generation and demodulation of VSB modulated wave, with relevant spectrum of signals in the demodulation scheme. Give relevant mathematical expressions. **(08 Marks)**

c. With a neat block diagram, explain the operation of FDM technique. **(06 Marks)**

Module-2

3 a. Describe with necessary equations and phasor diagram, the generation of Narrow Band FM(NBFM). **(08 Marks)**

b. Explain the direct method of generating FM waves. **(06 Marks)**

c. A FM signal has sinusoidal modulation with W = 15KHz and modulation index $\beta = 2$. Using Carson's rule, find the transmission bandwidth and deviation ratio. Assume $\Delta f = 75$ KHz. **(02 Marks)**

OR

4 a. Explain with relevant block diagram and mathematical expression, the demodulation of a FM signal using non-linear and linear model of the PLL. **(10 Marks)**

b. Draw the block diagram of a super heterodyne receiver and explain the function of each section. **(06 Marks)**

Module-3

5 a. Define probability theory. Explain conditional probability. **(06 Marks)**

b. Describe mean, auto correlation and co-variance functions with respect to random process. **(04 Marks)**

c. Explain the properties of auto correlation function. **(06 Marks)**

OR

6 a. A random variable has probability function :

$$f(x) = \begin{cases} \frac{5(1-x^4)}{4} & ; \quad 0 \le x \le 1 \\ 0 & ; \quad \text{elsewhere} \end{cases}$$

Find : i)E(x) ii) E(4x + 2) iii) $E(x^2)$. **(06 Marks)**

b. Explain the following :
i) Short Noise ii) Thermal Noise iii) White Nose iv) Noise Figure v) Noise Equivalent Bandwidth. **(10 Marks)**

Module-4

7 a. Derive the expression for the FOM of DSB – SC receiver. **(08 Marks)**

b. Derive the expression for the FOM of an AM receiver. **(08 Marks)**

OR

8 a. In AM receiver, find the Figure of Merit (FOM) when the depth of modulation is :
i) 50% ii) 100%. **(02 Marks)**

b. Explain the working of pre-emphasis and de-emphasis in FM. **(06 Marks)**

c. Derive the expression for the FOM of an FM receiver. **(08 Marks)**

Module-5

9 a. Mention the advantages of digital communication system. **(04 Marks)**

b. State and prove sampling theorem and reconstruction of lowpass signal using Nyquist Criterion. **(12 Marks)**

OR

10 a. With a neat block diagram, explain the operation of TDM. **(06 Marks)**

b. With a neat block diagram, explain the concept of PCM. **(10 Marks)**

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15EC46

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data may be assumed with necessary justification.

Module-1

1 a. List the ideal electrical characteristics of operational amplifier and mention the practical values for each. **(05 Marks)**

b. Explain the operation of direct coupled non-investing summing amplifier and show that output voltage $V_0 = V_1 + V_2$ with necessary proof. **(05 Marks)**

c. Design an direct coupled inverting amplifier using op-amp 741 with voltage gain 100 and output voltage required is 5V. **(06 Marks)**

OR

2 a. Explain the following terms : i) input offset voltage ii) slew rate iii) output voltage swing iv) CMRR v) PSRR.
Mention the typical values of each terms for 741 op-amp. **(05 Marks)**

b. Discuss the ideal voltage transfer curve of op-amp and also draw the equivalent circuit of op-amp and discuss it significance. **(05 Marks)**

c. Sketch the direct coupled difference amplifier circuit. Derive an equation for output voltage (ie $V_0 = \frac{R_2}{R_1}(V_2 - V_1)$) and explain the operation. **(06 Marks)**

Module-2

3 a. Sketch the circuit of a high Z_{in} capacitor coupled voltage follower. Briefly explain its operation and show that the input impedance is very high compared to the capacitor coupled voltage follower. **(05 Marks)**

b. Design capacitor coupled non-inverting amplifier to have voltage gain of 66. The signal amplitude is of 25mV. The load resistor is 2.2kΩ and lower cut-off frequency is to be 120Hz. Sketch the circuit. **(05 Marks)**

c. Design a capacitor coupled inverting amplifier to operate with a +20V supply. The minimum input signal level is 50mV, the voltage is to be 68, the load resistance is 500 ohms, the lowest cutoff frequency is to be 200Hz. Use 741 op-amp with maximum input bias current $I_{B(max)} = 500nA$. **(06 Marks)**

OR

4 a. Sketch the circuit of 3-op-amp instrumentation amplifier and explain its operation and with necessary proof show that $V_0 = \frac{R_2}{R_1}\left[1 + \frac{2R_f}{R_G}\right](V_2 - V_1)$. And also list the requirements of instrumentation amplifier. **(10 Marks)**

b. Sketch the precision full wave rectifier and explain the operation with necessary mathematical equations and waveforms. **(06 Marks)**

Module-3

5 a. Draw the circuit diagram of inverting Schmitt trigger with different UTP and LTP adjustments. Sketch I/O transfer curve and waveform and the operation. **(10 Marks)**

b. Using 741 op-amp with supply of ±12V, design a RC phase shift oscillator to have an output frequency of oscillation 5KHz. Choose $I_1 = 50\ \mu A$. **(06 Marks)**

OR

6 a. Draw the detailed circuit diagram of sample and hold circuit and explain the operation with necessary waveforms. **(05 Marks)**

b. Sketch the circuit and explain the operation of voltage to current converter with grounded load and show that load current is independent of R_L. **(05 Marks)**

c. Design the capacitor coupled zero- crossing detector using op-amp 741 having $I_{B(max)} = 500nA$ and minimum signal frequency is 500Hz. The supply voltages are ±12V. **(06 Marks)**

Module-4

7 a. Design a first order high pass filter with $f_L = 10KHz$ with passband gain of 1.5 and also plot the frequency response of designed filter. **(06 Marks)**

b. Show how ban stop filter circuit can be constructed by using LPF and HPF. Sketch the block diagram and explain with necessary waveform. **(06 Marks)**

c. Draw the ideal response curves for all types of filters and briefly explain. **(04 Marks)**

OR

8 a. List the performance parameters of power supply and explain. **(05 Marks)**

b. With necessary functional block diagram of 3-terminal IC voltage regulator explain its operation. **(05 Marks)**

c. Draw the circuit of wide band pass filter and explain its operation. Sketch the necessary wave forms also. **(06 Marks)**

Module-5

9 a. Draw the block diagram of PLL and explain its operation, list the application of PLL. **(05 Marks)**

b. Explain the operation of analog to digital conversion using successive approximation technique. **(05 Marks)**

c. Design astable multivibration using 555 timer for the frequency of oscillation 2KHz with 25% duty cycle. Sketch the circuit after design. **(06 Marks)**

OR

10 a. With necessary circuit, explain how PLL can be used as frequency multiplier and divider. **(05 Marks)**

b. Explain how 4-bit digital information converted to analoge using R-2R ladder N/w DAC. **(05 Marks)**

c. List the specification parameters of ADC and briefly discuss on same (min 4 parameters). **(06 Marks)**

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