CBCS SCHEME

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18EC32

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Network Theory

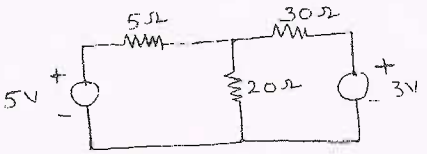
Time: 3 hrs. Max. Marks: 100

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

Module-1

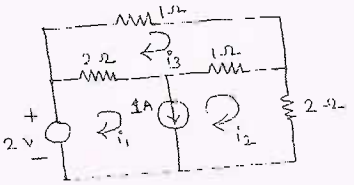
1 a. Using source transformation technique find the current through 5Ω resistor for the circuit shown in Fig.Q.1(a). **(06 Marks)**

Fig.Q.1(a)



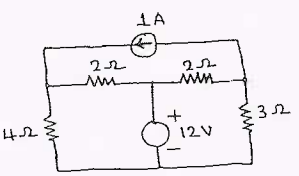
b. Use Mesh Analysis to determine the Mesh currents i_1, i_2 and i_3 for the network shown in Fig.Q.1(b). **(06 Marks)**

Fig.Q.1(b)



c. Find the power delivered by 1A current source using nodal analysis for the circuit shown in Fig.Q.1(c). **(08 Marks)**

Fig.Q.1(c)

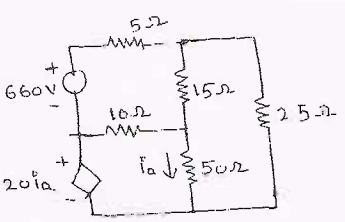


OR

2 a. Three Impedances are connected in delta, obtain the star equivalent of the network. **(06 Marks)**

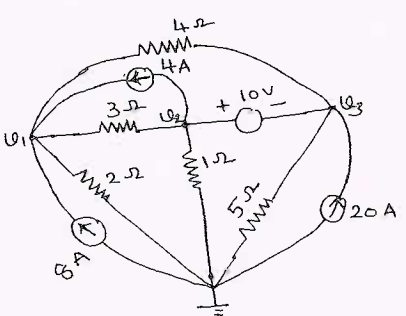
b. Use Mesh Analysis to find the power delivered by the dependent voltage source in the circuit shown in Fig.Q.2(b). **(06 Marks)**

Fig.Q.2(b)



c. Determine all the node voltages for the circuit shown in Fig.Q.2(c) using nodal analysis. **(08 Marks)**

Fig.Q.2(c)



Module-2

3 a. State and explain superposition theorem **(06 Marks)**

b. Use Millman's Theorem to find the current flowing through $(2 + j3)\Omega$ impedance for the circuit shown in Fig.Q.3(b). **(08 Marks)**

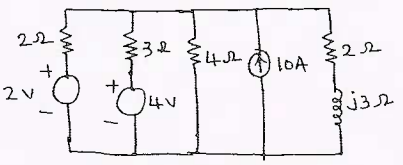


Fig.Q.3(b)

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

OR

4 a. Find the Thevenin's equivalent for the circuit shown in Fig.Q.4(a) with respect to terminals X-Y. **(08 Marks)**

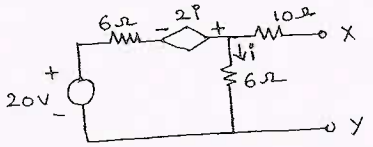


Fig.Q.4(a)

b. Find the condition for maximum power transfer in the AC circuit, where both R_L and X_L are varying. **(06 Marks)**

c. Determine the current through the load resistance using Norton's Theorem for the circuit shown in Fig.Q.4(c). **(06 Marks)**

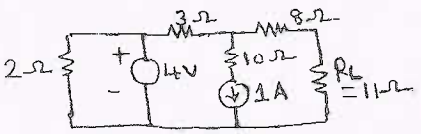


Fig.Q.4(c)

Module-3

5 a. Explain the behavior of R, L, C elements at the time of switching at t = 0, at t = 0$^-$ and t = ∞. **(07 Marks)**

b. In the network shown in Fig.Q.5(b). Find i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at t = 0$^+$. Assume that the capacitor is initially uncharged. **(07 Marks)**

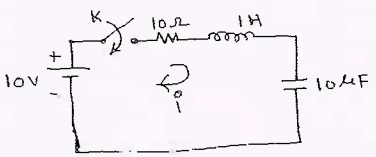


Fig.Q.5(b)

c. In the network shown in Fig.Q.5(c) find, i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at t = 0$^+$. The swich k is closed at t = 0 with zero current in the inductor. **(06 Marks)**

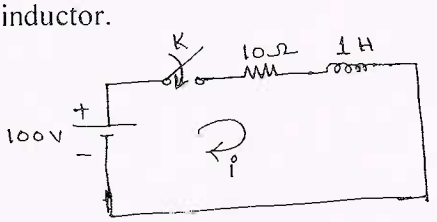


Fig.Q.5(c)

OR

6 a. In the network shown in Fig.Q.6(a). The switch k is changed from position a to b at t = 0. the steady state is reached at position a. Find i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. Assume that the capacitor is initially uncharged. **(10 Marks)**

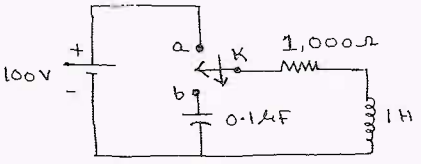


Fig.Q.6(a)

b. For the network shown in Fig.Q.6(b). The network is in steady state with switch k is closed. At t = 0, the switch is opened. Determine the voltage across the switch V_k and $\frac{d}{dt}V_k$ at $t = 0^+$. **(10 Marks)**

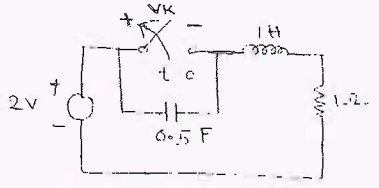


Fig.Q.6(b)

Module-4

7 a. Obtain Laplace transform of
   i) Step function
   ii) Ramp function
   iii) Impulse function. **(09 Marks)**

b. Find the Laplace transform of the periodic signal x(t) as shown in Fig.Q.7(b). **(11 Marks)**

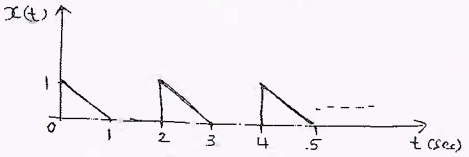


Fig.Q.7(b)

OR

8 a. In the series RL circuit shown in Fig.Q.8(a), the source voltage is v(t) = 50 sin 250t V. Using Laplace transform determine, the current when switch K is closed at t = 0. **(10 Marks)**

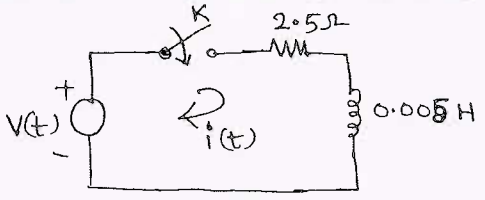


Fig.Q.8(a)

b. Find the Laplace transform of the non-sinusoidal periodic waveform shown in Fig.Q.8(b)

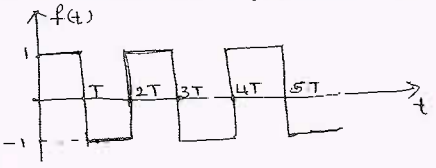


Fig.Q.8(b) **(10 Marks)**

Module-5

9 a. Define Z parameters. Determine Z parameters interms of Y parameters. **(06 Marks)**

b. Determine h parameters of the circuit shown in Fig.Q.9(b) **(07 Marks)**

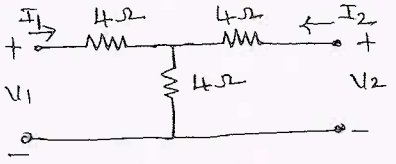


Fig.Q.9(b)

c. For the network shown in Fig.Q.9(c). Find the transmission parameters. **(07 Marks)**

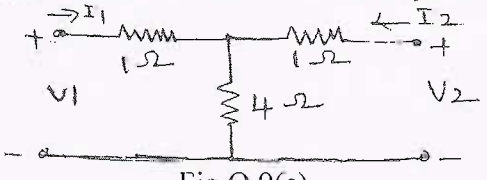


Fig.Q.9(c)

OR

10 a. Define Q-factor, selectivity and Band width. **(03 Marks)**

b. A series RLC circuit has a resistance of 10Ω, an inductance of 0.3H and a capacitance of 100μF. The applied voltage is 230V. Find: i) The resonant frequency ii) lower and upper cut off frequencies iii) current at resonance iv) currents at f_1 and f_2 v) Voltage across. the inductance at resonance. **(07 Marks)**

c. Derive the expression for the resonant frequency of the circuit shown in Fig.Q.10(c). Also show that the circuit will resonate at all frequency if $R_L = R_C = \sqrt{\frac{L}{C}}$. **(10 Marks)**

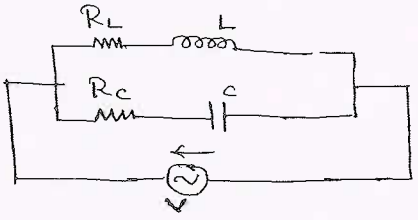


Fig.Q.10(c)

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18EC33

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Electronic Devices

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What are the types of Bonding forceses in solids? Explain. **(06 Marks)**

b. Explain the classification of material based on conductivity and energy band diagram. **(08 Marks)**

c. Find the conductivity of the intrinsic germanium at 300 K. If a donar type impurity is added to the extent of 1 atom/10^7 germanium atom assume $\mu_n = 3800$, $\mu_P = 1800$, $n_i = 2.5\times10^3$, $Q = 1.602\times10^{-19}$. **(06 Marks)**

OR

2 a. What are Direct and Indirect band gap semiconductor? Explain with examples. **(08 Marks)**

b. Explain the concentration of electron-hole pair in Intrinsic semiconductor with energy band diagram. **(06 Marks)**

c. Calculate the Intrinsic carrier concentration in Silicon at room temperature T = 300 K , where B is the material dependent parameter 5.4×10^{31} and E_G as the bandgap energy 1.12 eV, where K is the Boltzman constant = 8.62×10^{-5} eV/K. **(06 Marks)**

Module-2

3 a. With energy band diagram, explain the doping level in extrinsic semiconductor at 0 K and at 50 K. **(09 Marks)**

b. What is the magnitude of HALL voltage in a N-Type germanium bar having an majority carrier concentration $N_D = 10^{17}$ cm^3. Assume B = 0.2 Wb/m^2, d = 2 mm, E = 10 V/cm. **(05 Marks)**

c. Explain the effect of temperature on semiconductor. **(06 Marks)**

OR

4 a. Explain the qualitative description of current flow at P-N junction under equilibrium and biased condition. **(08 Marks)**

b. Explain zener breakdown and avalanche breakdown under reverse biased P-N junction. **(06 Marks)**

c. Discuss the piece-wise linear approximations of junction diode under ideal condition. **(06 Marks)**

Module-3

5 a. Explain the optical generation of carrier in a P-N junction. **(08 Marks)**

b. Discuss the configuration of a solar cell in enlarged view of the planar junction. **(06 Marks)**

c. What is injection-electroluminiscence and what are its applications? **(06 Marks)**

OR

6 a. Explain I-V characteristics of n-p junction as a function of emitter current. **(08 Marks)**

b. Discuss switching operation in common-emitter transistor. **(06 Marks)**

c. Figure Q6 (c) shows the common emitter amplifier circuit. Calculate I_B and I_C assume $\tau_p = 10\,\mu s$, $\tau_t = 0.1\ \mu s$ **(06 Marks)**

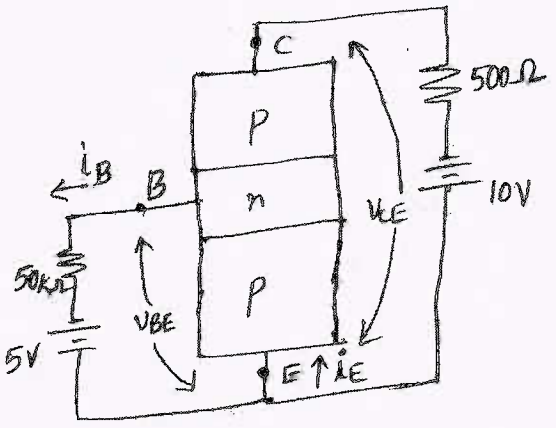

Fig. Q6 (c)

Module-4

7 a. Draw and explain the I-V characteristics of n-channel PNJFET for different biasing voltages. **(07 Marks)**

b. Draw and explain the small signal equivalent circuit of n-channel PNJFET. **(07 Marks)**

c. Explain the MOS structure with the aid of parallel-plate capacitor. **(06 Marks)**

OR

8 a. Explain the effect of frequency on gate voltage of a MOS capacitor with a P-type substrate. **(10 Marks)**

b. Explain P-channel enhancement and depletion type MOSFET with their circuit symbols. **(10 Marks)**

Module-5

9 a. With schematic diagram, explain ION-implantation system. **(07 Marks)**

b. Explain low pressure chemical vapour deposition reactor. **(07 Marks)**

c. Discuss photolithography. **(06 Marks)**

OR

10 a. What are the different types of integrated circuits and its advantages? **(10 Marks)**

b. Explain the process of Integration. **(10 Marks)**

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18EC34

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Design a combinational circuit to output the 2's complement of a 4-bit binary number. **(07 Marks)**

b. Identify all prime implicants and essential prime implicants of following function using K-map:
$f(a, b, c, d) = \sum m + (6, 7, 9, 10, 13) + dc(1, 4, 5, 11, 15)$. Draw the diagram using NAND gates. **(07 Marks)**

c. Expand the following in to canonical form and represent in decimal form:
i) $f_1 = a + bc + ac'd$ in to min-terms
ii) $f_2 = a(b + c)(a + c + d)$ into max terms. **(06 Marks)**

OR

2 a. Find the minimal sum of the following Boolean function using Quine-McClusky method:
$f(a, b, c, d) = \sum m(7, 9, 12, 13, 14, 15) + dc(4, 11)$. **(07 Marks)**

b. Using K-map determine minimal product of sum expressions an implement the simplified equation using only NOR gates:
$f(w, x, y, z) = \pi(1, 2, 3, 4, 9, 10) + d(0, 14, 15)$. **(07 Marks)**

c. Explain briefly K-map, Incompletely specified functions, essential prime implicants and Gray code. **(06 Marks)**

Module-2

3 a. Implement the following using 3 to 8 decoder with active low enable and active HIGH outputs:
i) $f_1(a, b, c, d) = \sum m(0, 1, 5, 6, 7, 9, 10, 15)$
ii) $f_2(a, b, c) = \pi(1, 3, 6, 7)$ **(06 Marks)**

b. Explain 4-bit carry look-ahead adder with necessary diagram and relevant expressions. **(08 Marks)**

c. Design 4 line to 2 line priority encoder which gives MSB the highest priority and LSB least priority. **(06 Marks)**

OR

4 a. Implement $f(a, b, c, d) = \sum(0, 4, 8, 10, 14, 15)$ using
i) 8:1 MUX with a, b, c as select lines
ii) 4:1 MUX with a, b as select lines. **(06 Marks)**

b. Design a two bit magnitude comparator and draw the neat diagram. **(08 Marks)**

c. Explain the structure of programmable logic arrays (PLA) with an example. **(06 Marks)**

Module-3

5 a. Explain clocked SR flip flop using NAND gates with necessary truth table and waveform. **(06 Marks)**

b. Explain with a neat diagram and truth table, a 4-bit SIPO shift register to store binary number 1011. **(07 Marks)**

c. What is race around condition? Explain JK master slave flip flop with a diagram, function table and timing diagram. **(07 Marks)**

OR

6 a. Explain with an excitation table, the conversion of SR flip flop in to JK and D flip flop. **(06 Marks)**

b. Explain the working of 4-bit Twisted Ring counter using necessary diagram and waveform. **(07 Marks)**

c. Explain the working of 3-bit Asynchronous up-down counter with necessary waveform and truth table. **(07 Marks)**

Module-4

7 a. Design a self correcting synchronous counter using positive edge triggered JK flip flop to count 0, 1, 2, 4, 5, 6, 0, 1, 2.... Use the state table and state diagram. **(10 Marks)**

b. Design a clocked sequential circuit which operates according to the state diagram shown in Fig.Q.7(b). Implement the circuit using negative edge triggered JK flip-flop. **(10 Marks)**

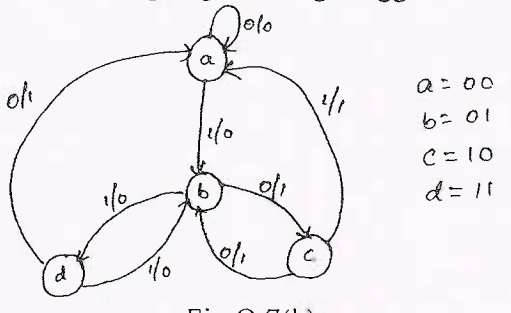

Fig.Q.7(b)

OR

8 a. Construct the excitation table, transition table, state table and state diagram for the sequential circuit shown in Fig.Q.8(a). **(10 Marks)**

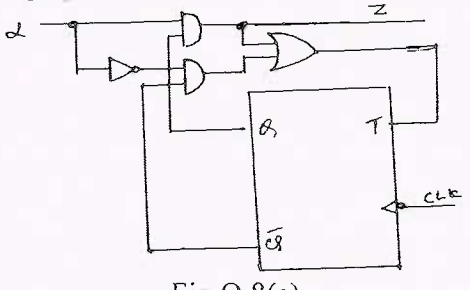

Fig.Q.8(a)

b. Realize synchronous decade counter using T-flip-flop and draw the neat diagram. **(10 Marks)**

Module-5

9 a. Design a Melay type sequence detector to detect the sequence of 101 in the given sequence of 001101100101011. **(10 Marks)**

b. With necessary diagram, explain the concept of serial adder with accumulators. **(10 Marks)**

OR

10 a. Design a sequential circuit to convert BCD to Excess-3 code with state table, state graph and transition table. **(10 Marks)**

b. Explain the design of sequential circuit using CPLDs and give CPLD implementation of a shift register and parallel adder with accumulator. **(10 Marks)**

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18EC35

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Computer Organization and Architecture

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With a neat diagram, explain basic operational concept of computer. **(10 Marks)**

b. Explain in brief different types of key parameters that affect the processor performance. **(05 Marks)**

c. Explain the Bus Structures. **(05 Marks)**

OR

2 a. Illustrate Instruction and Instruction sequencing with an example. **(10 Marks)**

b. Define Byte Addressability, Big-endian and Little-endian assignment. **(06 Marks)**

c. Represent 85.125 in IEEE floating point using single precision. **(04 Marks)**

Module-2

3 a. What is an addressing mode? Explain any five types of addressing modes with example. **(10 Marks)**

b. Write a program to add 'n' number using indirect addressing mode. **(06 Marks)**

c. Explain various assembler directives used in assembly language program. **(04 Marks)**

OR

4 a. Explain stack operation with an example **(10 Marks)**

b. Explain subroutine linkage with an example using linkage register. **(06 Marks)**

c. Explain the shift and rotate operations with example. **(04 Marks)**

Module-3

5 a. Showing the possible register configuration in I/O interface, explain program controlled input/output. **(10 Marks)**

b. What is an interrupt? With an example illustrate the concept of interrupt. **(10 Marks)**

OR

6 a. Explain in detail, the situations where a number of devices capable of initiating interrupts are connected to processor. How to resolve the problems? **(10 Marks)**

b. Explain the registers involved in a DMA interface, to illustrate DMA. **(06 Marks)**

c. Explain the concept of Vectored Interrupt. **(04 Marks)**

Module-4

7 a. With figure, explain Internal Organization of 2M×8 dynamic memory chip. **(10 Marks)**

b. Illustrate Internal structure of static memories. **(10 Marks)**

OR

8 a. With a neat diagram, explain virtual memory organization. **(10 Marks)**

b. Briefly explain any four non-volatile memory concepts. **(05 Marks)**

c. Briefly explain secondary storage devices. **(05 Marks)**

Module-5

9 a. Explain the three-bus organization of the processor and its advantages. **(10 Marks)**

b. Discuss the organization of hardwired control unit. **(05 Marks)**

c. Discuss the control sequence for execution of instruction ADD(R_3), R_1 **(05 Marks)**

OR

10 a. With a block diagram, describe the organization of a micro programmed control unit. **(10 Marks)**

b. Describe the sequence of control signals to be generated to fetch an instruction from memory in a single bus organization. **(10 Marks)**

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CBCS SCHEME

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18EC36

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Power Electronics and Instrumentation

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Name the power semiconductor devices along their circuit symbols and maximum Ratings. **(04 Marks)**

b. Explain the operation of SCR, interms of two transistor model and derive anode current and gate currents relation. Discuss how a small gate current can trigger the device into condition. **(08 Marks)**

c. The latching current of a thyristor circuit is 60m Amp. The duration of the firing pulse is 50μsec. Given V_s = 100V, R = 20Ω and L = 0.5H are connected in series.
i) Derive the expression for circuit current i(t)
ii) Draw variation of current i(t) with reference to time
iii) Will the thyristor device gets turned ON? **(08 Marks)**

OR

2 a. Enumerate the applications of power electronics. **(04 Marks)**

b. Explain the operation of self commutation by resonating load [class A] with relevant circuit and waveforms. **(08 Marks)**

c. What are the gate triggering schemes? Explain with circuit diagram and wave forms, now RC triggering circuit turns ON (triggers) SCRs. **(08 Marks)**

Module-2

3 a. Explain the control strategies used to operate choppers. **(06 Marks)**

b. Explain with the help of neat circuit diagram and waveforms, the operation of a single phase half wave controlled rectifiers with resistive load. Derive an expression for the :
i) Average load voltage ii) RMS load voltage. **(08 Marks)**

c. For the ideal type A [step down] chopper circuit, following conditions are given : V = 220V, Duty cycle = 0.3, Chopping frequency f = 500Hz, R = 1Ω, L = 3mH and E_b = 23 volts. Determine the following :
i) Minimum value of output current (load)
ii) Maximum value of output current (load)
iii) Average output (load) current. **(06 Marks)**

OR

4 a. Explain the effect of free wheeling diode used in controlled rectifiers. **(04 Marks)**

b. With the circuit diagram and circuit waveforms, explain the principle of operation of step-up chopper. **(08 Marks)**

c. A single phase fully controlled bridge rectifier is feeding to a RL load, to obtain a regulated DC output voltage. The RMS value of the AC voltage is 230V, at 50Hz and the firing angle is maintained at π/3, so that the load current is 4Amp.
i) Calculate the DC average output voltage
ii) Active power and reactive power input
iii) Assuming the load resistance remains the same, determine DC average output voltage. If a freewheeling diode is used at output with all the conditions remains same. **(08 Marks)**

Module-3

5 a. Define the terms : i) instrument ii) Accuracy iii) Absolute error iv) Relative errors? **(04 Marks)**

b. Explain the operation of single – phase half bridge inverter connected to RL load, with the help of circuit and waveforms. **(08 Marks)**

c. A basic D' arsonval movement with a null scale deflection of 2mAmp and having an internal resistance of 50Ω is available. It is to be converted into a 0–10V, 0–1000V, 0–100V and 0–250V multi range voltmeter. Determine the value of resistance to extend? **(08 Marks)**

OR

6 a. What are inverters? Classify the inverters according to commutation and connections? **(04 Marks)**

b. What are the static errors? Explain them in detail with examples. **(08 Marks)**

c. A single phase half bridge inverter, has resistive load of R = 3Ω and DC input voltage V_{dc} = 50 volts. Calculate :

i) RMS output voltage at fundamental frequency
ii) The output power (P_0)
iii) The average and peak current of each thyristor
iv) The peak – reverse blocking voltage of each thyristor. **(08 Marks)**

Module-4

7 a. Explain how a simple AC bridge circuit operates and derive an expression for the unknown parameters. **(04 Marks)**

b. With the aid of diagram, explain the working of unbalanced wheat stone bridge and derive for a galvanometer current expression. **(08 Marks)**

c. Explain the principle of operation of digital time measurement with basic block diagram. **(08 Marks)**

OR

8 a. What are the advantages of digital instruments over analog instruments? **(04 Marks)**

b. Determine the equivalent parallel resistance and capacitance that causes a Wein's bridge to null condition with the following values : R_1 = 3.1KΩ, C_1 = 5.2μF, R_2= 55KΩ, R_4 = 100KΩ, ff = 2.5KHz. Derive the balanced expressions. **(08 Marks)**

c. With neat block diagram, explain the operating principle of a Ramp type DVM. **(08 Marks)**

Module-5

9 a. Define transducers. What are advantages of electrical transducers? **(04 Marks)**

b. Explain instrumentation Amplifier using transducer bridge with the help of circuit diagram. **(08 Marks)**

c. Explain with neat diagram the PLC structure. **(08 Marks)**

OR

10 a. What are features of instrumentation Amplifiers? How it differs from the ordinary opAmp. **(04 Marks)**

b. Describe the operation of resistive position transducer with constructional diagram and typical circuit used. **(08 Marks)**

c. With the aid of Bridge circuit, explain the working of resistance thermometer. Mention limitations of it. **(08 Marks)**

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CBCS SCHEME

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17EC33

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 the expression for input impedance, output impedance, voltage gain and current gain for common emitter voltage divider bias configuration using re model. **(10 Marks)**

b. For the emitter-follower circuit shown in Fig.Q.1(b). Determine:
i) Input impedance
ii) Output resistance
iii) Voltage gain
iv) Current gain.

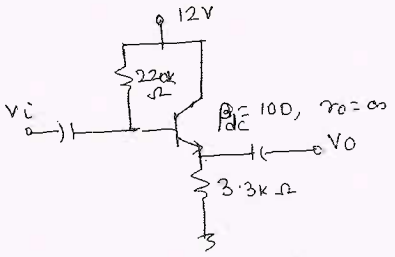

Fig.Q.1(b)

(10 Marks)

OR

2 a. Derive the expression for voltage gain, current gain, input resistance, output resistance CE transistor amplifier using hybrid parameters. **(10 Marks)**

b. Describe the hybrid π-model. **(04 Marks)**

c. Determine Z_i, Z_o, A_v, A_i for the circuit shown in Fig.Q.2(c) using approximate hybrid model. Given data $h_{ie} = 1.1K\Omega$, $h_{fe} = 100$, $h_{oe} = 20\mu A/V$ **(06 Marks)**

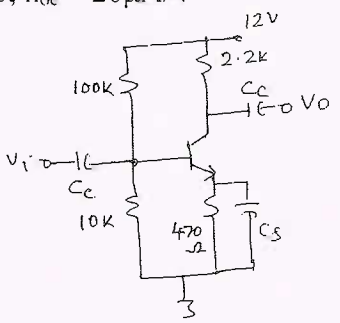

Fig.Q.2(c)

Module-2

3 a. Indicate various operating regions of JFET. Also determine parameters from the characteristics. **(06 Marks)**

b. Analyze self bias configuration of JFET and derive the expression for voltage gain, output impedance and input impedance. **(07 Marks)**

c. Compute g_m, z_i, z_o and A_v for the circuit shown in Fig.Q.3(c). Given V_{GSQ} = -2.2V, I_{DQ} = 2.03mA, I_{DSS} = 10mA, V_p = -4V and r_d = 40KΩ. **(07 Marks)**

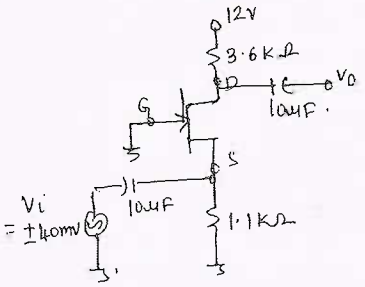

Fig.Q.3(c)

OR

4 a. Explain the characteristics of enhancement type MOSFET. Also indicate various operating regions. **(06 Marks)**

b. Derive the expression voltage gain, input resistance and output resistance of the source follower. **(07 Marks)**

c. Evaluate z_i, z_o and A_v for the JFET circuit shown in Fig.Q.4(c). Given: I_{DSS} = 12mA, V_p = -3V, g_m = 2m℧, r_d = 40KΩ **(07 Marks)**

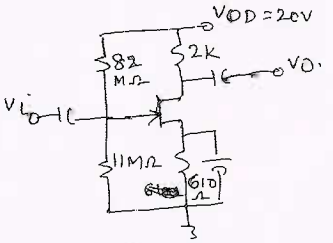

Fig.Q.4(c)

Module-3

5 a. Derive the expression for cut-off frequency due to source capacitor and coupling capacitor of a BJT amplifier. **(06 Marks)**

b. If the applied ac power to a system is 5μw at 100mV and the output power is 48W, Determine: i) Power gain in dB ii) The voltage gain in dB if the output impedance is 40KΩ iii) The input impedance. **(06 Marks)**

c. Derive an expression for Miller input and output capacitance. Also draw the equivalent circuit. **(08 Marks)**

OR

6 a. Derive the expression f_L' and f_H' for the multistage amplifier. **(06 Marks)**

b. For the circuit shown in Fig.Q.6(b) determine f_{Hi} and f_{Ho}, given C_{wi} = 3pF, C_{wo} = 5pF, C_{gd} = 4pF, C_{gs} = 6pF, C_{ds} = 1pF, I_{DSS} = 6mA, V_p = -6V r_d = ∞ and g_m = 2m℧. **(08 Marks)**

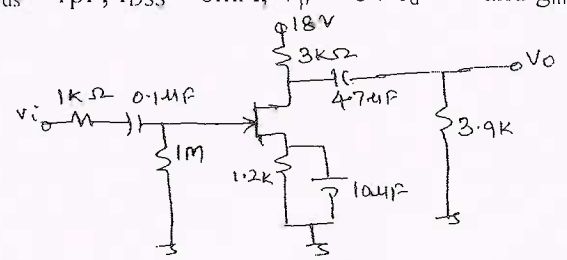

Fig.Q.6(b)

c. Determine overall lower 3dB and upper 3dB frequency for a four stage amplifier having an individual value of $f_1 = 40Hz$ and $f_2 = 2.5MHz$. Also calculate overall bandwidth. **(06 Marks)**

Module-4

7 a. Explain the concept of feed back using block diagram. **(06 Marks)**

b. Derive the expression for input resistance and output resistance of a voltage series feedback amplifier. **(08 Marks)**

c. If the gain of an amplifier changes from a value of -1000 by 10%, calculate the gain change, if the amplifier used in a feedback circuit having $\beta = \frac{-1}{20}$. **(06 Marks)**

OR

8 a. Explain the operation of FET phase shift oscillator. **(08 Marks)**

b. Describe the Wein bridge oscillator for the oscillating frequency $f_0 = 2.2kHz$. Also draw the circuit diagram. **(06 Marks)**

c. Determine the oscillating frequency of the Colpitts oscillator for the given specifications $C_1 = 750pF$, $C_2 = 2500pF$ and $L = 40\mu H$. Also calculate the feedback factor of the Colpitts oscillator. **(06 Marks)**

Module-5

9 a. Derive an expression for conversion efficiency of transformer coupled class-A amplifier. **(08 Marks)**

b. Calculate the second harmonic distortion for an output waveform having measured values of $V_{CEmin} = 2.4V$ $V_{CEQ} = 10V$ and $V_{CEmax} = 20V$. **(04 Marks)**

c. Explain with the help of neat circuit diagram, voltage series regulator operation. **(08 Marks)**

OR

10 a. Derive an expression for conversion efficiency of class B push pull amplifier. **(08 Marks)**

b. A transformer coupled class-A amplifier drives a 16Ω speaker through 4:1 transformer using a power supply of $V_{cc} = 36V$, the circuit delivers 2W to the load. Calculate : i) P(ac) across transformer primary ii) V_L(ac). **(06 Marks)**

c. Calculate the harmonic distortion components for an output signal having fundamental amplitude of 2.1V, second harmonic component amplitude of 0.3V, third harmonic component of 0.1V and fourth harmonic component of 0.05V. Also calculate total harmonic distortion. **(06 Marks)**

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CBCS SCHEME

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17EC35

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Derive the expression for: (i) Δ to Y transformation (ii) Y to Δ transformation **(10 Marks)**

b. Calculate the voltage across the 6Ω resistor in the network of Fig.Q1(b) using source shifting technique.

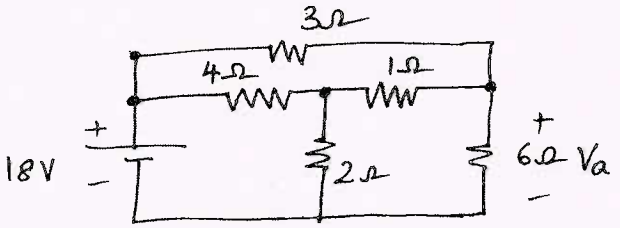

Fig.Q1(b) **(10 Marks)**

OR

2 a. Determine the resistance between the terminals A and B of the network shown in Fig.Q2(a).

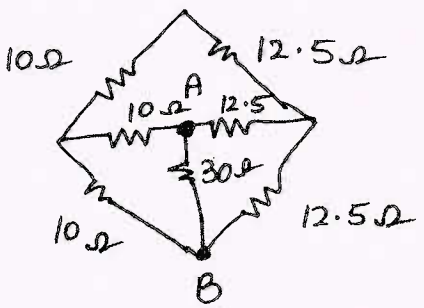

Fig.Q2(a) **(10 Marks)**

b. Find currents in all the branches of the network shown in Fig.Q2(b) using mesh analysis.

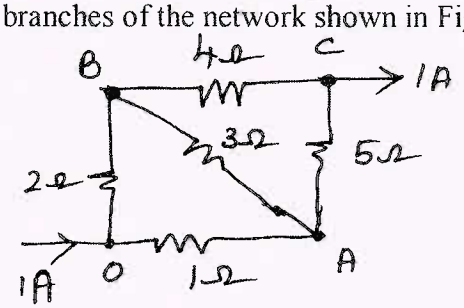

Fig.Q2(b) **(05 Marks)**

c. Find voltages V_1 and V_2 in the network shown in Fig.Q2(c) using node analysis method.

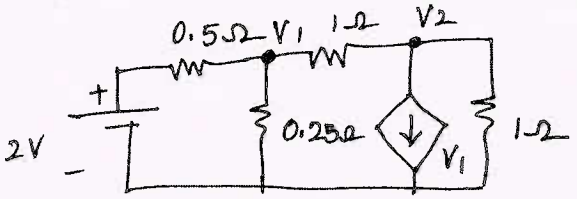

Fig.Q2(c) **(05 Marks)**

Module-2

3 a. Obtain Thevenin's equivalent network for Fig.Q3(a).

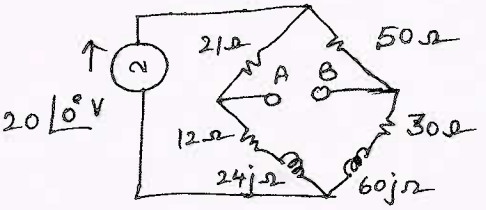

Fig.Q3(a) **(08 Marks)**

b. State and prove Millman's theorem. **(06 Marks)**

c. For the circuit shown in Fig.Q3(c), find the voltage V_x and verify reciprocity theorem.

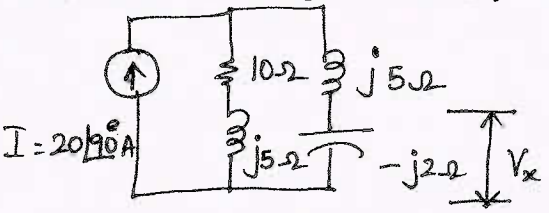

Fig.Q3(c) **(06 Marks)**

OR

4 a. State and prove maximum power transfer theorem for AC circuits (when R_L and X_L are varying) **(10 Marks)**

b. Find 'V' in the circuit shown in Fig.Q4(b) using super position theorem.

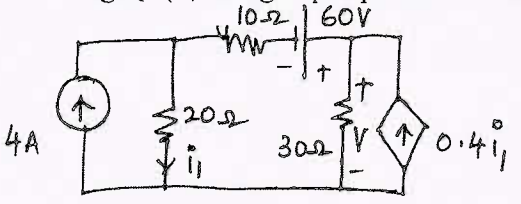

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. What is the significance of initial conditions? Write a note on initial and final conditions for basic circuit elements. **(05 Marks)**

b. In the network shown in Fig.Q5(b) switch 'S' is changed from A to B at t = 0 having already established a steady state in position A shown that at $t = 0^+$, $i_1 = i_2 = \frac{-V}{R_1 + R_2 + R_3}$ and $i_3 = 0$.

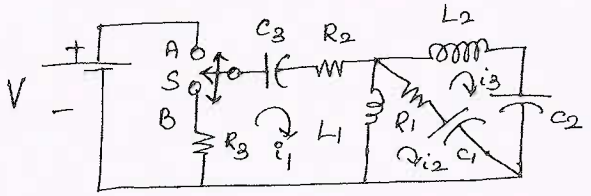

Fig.Q5(b) **(10 Marks)**

c. In the network of Fig.Q5(c) switch 'S' is closed at t = 0 with zero initial current in the inductor. Find i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$ if R = 10 Ω, L = 1 H and V = 10 Volts.

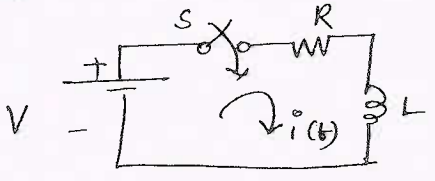

Fig.Q5(c) **(05 Marks)**

OR

6 a. Obtain Laplace transform of:
(i) Step function
(ii) Ramp function
(iii) Impulse function **(10 Marks)**

b. Find the Laplace transform of the waveform shown in Fig.Q6(b).

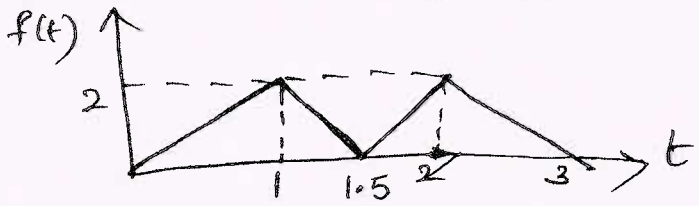

Fig.Q6(b) **(10 Marks)**

Module-4

7 a. Derive the relation between bandwidth and quality factor $B.W = f_0/Q$. **(10 Marks)**

b. Show that the value of capacitance for max voltage across the capacitor in case of capacitor tuning series resonance is given by $C = \frac{L}{R^2 + X_L^2}$.

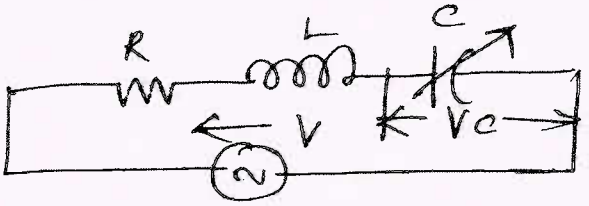

Fig.Q7(b) **(10 Marks)**

OR

8 a. Derive for f_0 for parallel resonance circuit when the resistance of the capacitance is considered.

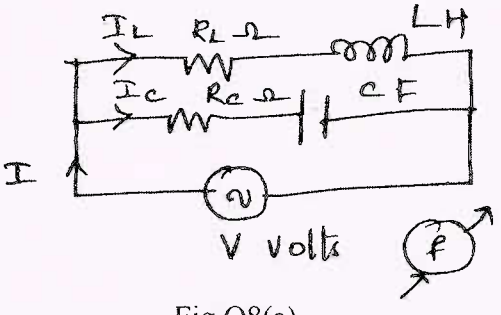

Fig.Q8(a) **(10 Marks)**

b. Find the value of L for which the circuit in Fig.Q8(b) resonates at $\omega = 5000$ rad/sec.

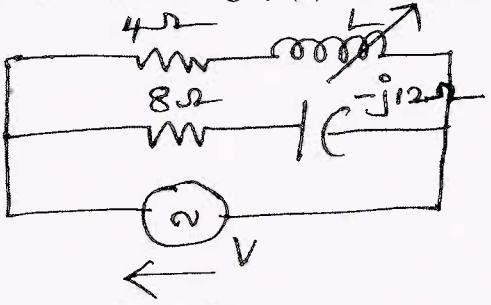

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Derive the expression of Z parameters in terms of Y parameters. **(10 Marks)**

b. Determine Y and Z parameters for the network shown in Fig.Q9(b).

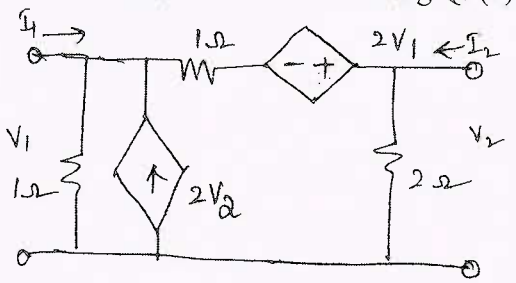

Fig.Q9(b) **(10 Marks)**

OR

10 a. Derive the expression of h parameters in terms of ABCD parameters. **(10 Marks)**

b. Find ABCD constants and show that AD – BC = 1 for the network shown in Fig.Q10(b).

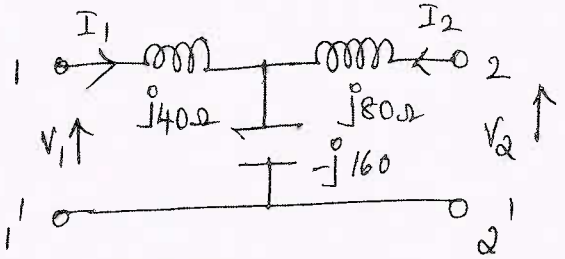

Fig.Q10(b) **(10 Marks)**

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CBCS SCHEME

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17EC36

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Obtain an expression for electric field intensity at any given point due to 'n' number of point charges. **(04 Marks)**

b. Four 10 nC positive charges are located in the z = 0 plane at the corners of a square 8 cm on a side. A fifth 10 nC positive charge is located at a point 8 cm distant from the other charges. Calculate the magnitude of the total force on this fifth charge for $\epsilon = \epsilon_0$. **(08 Marks)**

c. Find the total charge contained in a 2 cm length of the electron beam for 2 cm < z < 4 cm, ρ = 1 cm and $\rho_v = -5\, e^{-100\rho z}\ \mu c/m^3$. **(08 Marks)**

OR

2 a. Define electric flux and electric flux density, and also, obtain the relationship between electric flux density and electric field intensity. **(06 Marks)**

b. Infinite uniform line charges of 5 nC/m lie along the (positive and negative) x and y axes in free space, Find $\vec{E}$ at P(1, 2, 3). **(10 Marks)**

c. Given a 60 μC point charge located at the origin, find the total electric flux passing through:

(i) That portion of the sphere r = 26 cm bounded by $0 < \theta < \frac{\pi}{2}$ and $0 < \phi < \frac{\pi}{2}$.

(ii) The closed surface defined by ρ = 26 cm and z = ±26 cm. **(04 Marks)**

Module-2

3 a. State and obtain mathematical formulation of Gauss law. **(07 Marks)**

b. Given $\vec{D} = 6\rho\sin\left(\frac{\phi}{2}\right)\hat{a}_\rho + 1.5\rho\cos\left(\frac{\phi}{2}\right)\hat{a}_\phi\ C/m^2$. Evaluate both sides of divergence theorem for the region bounded by ρ = 2m, ϕ = 0, $\phi = \pi$ rad, z = 0 and z = 5m. **(08 Marks)**

c. Derive the point form of current continuity equation. **(05 Marks)**

OR

4 a. Given the non-uniform field $\vec{E} = y\hat{a}_x + x\hat{a}_y + 2\hat{a}_z$ V/m, determine the work expended in carrying 2C from B(1, 0, 1) to A(0.8, 0.6, 1), along the shorter arc of the circle; $x^2 + y^2 = 1$, z = 1. **(07 Marks)**

b. Derive the expression for potential field resulting from point charge in free-space. **(07 Marks)**

c. Find the value of volume charge density at p(r = 1.5 m, θ = 30°, ϕ = 50°), when $\vec{D} = 2r\sin\theta\cos\phi\,\hat{a}_r + r\cos\theta\cos\phi\,\hat{a}_\theta - r\sin\phi\,\hat{a}_\phi\ C/m^2$. **(06 Marks)**

Module-3

5 a. Using Gauss law derive Poisson and Laplace equations. **(05 Marks)**

b. State and prove uniqueness theorem. **(10 Marks)**

c. Calculate $\Delta\vec{H}_2$ at P_2(4, 2, 0) resulting from $I_1\Delta\vec{L}_1 = 2\pi\hat{a}_z\ \mu Am$ at P_1(0, 0, 2). **(05 Marks)**

OR

6 a. Show that $\nabla^2 V = 0$, for $V = (5\rho^4 - 6\rho^{-4})\sin 4\phi$. **(05 Marks)**

b. Evaluate both sides of Stoke's theorem for the field $\vec{H} = 6xy\,\hat{a}_x - 3y^2\,\hat{a}_y$ A/m and the rectangular path around the region, $2 \le x \le 5$, $-1 \le y \le 1$, $z = 0$. Let positive direction of $d\vec{s}$ be $\hat{a}_z$. **(08 Marks)**

c. State and explain Ampere's circuital law. Using the same, obtain the expression for $\vec{H}$ at any given point due to the infinite length filamentary conductor, carrying current I. **(07 Marks)**

Module-4

7 a. Obtain an expression for Lorentz force equation. **(05 Marks)**

b. Obtain the relationship between magnetic fields at the boundary of two different magnetic media. **(09 Marks)**

c. Derive the expression for force between two infinitely long. Straight, parallel filamentary conductors, separated by distance d, carrying equal and opposite currents, I. **(06 Marks)**

OR

8 a. Given a ferrite material which operates in a linear mode with B = 0.05 T, calculate values for magnetic susceptibility, magnetization and magnetic field intensity. Given $\mu_r = 50$. **(05 Marks)**

b. Obtain expressions for magneto motive force (mmf) and reluctance in magnetic circuits by making use of analogy between electric and magnetic circuits. **(08 Marks)**

c. Two differential current elements, $I_1\Delta\vec{L}_1 = 3(10^{-6})\hat{a}_y$ Am at $P_1(1, 0, 0)$ and $I_2\Delta\vec{L}_2 = 3(10^{-6})(-0.5\hat{a}_x + 0.4\hat{a}_y + 0.3\hat{a}_z)$ Am at $P_2(2, 2, 2)$ are located in free space. Find vector force exerted on $I_2\Delta\vec{L}_2$ by $I_1\Delta\vec{L}_1$. **(07 Marks)**

Module-5

9 a. Explain the inadequacy of Ampere's circuital law for time-varying fields. Obtain a suitable correction for the same, which will remain consistent for both time and non-time-varying fields. **(05 Marks)**

b. Let $\mu = 10^{-5}$ H/m, $\epsilon = 4 \times 10^{-9}$ F/m, $\sigma = 0$ and $\rho_v = 0$. Find K (including units) so that the following pair of fields satisfy Maxwell's equations: $\vec{E} = (20y - Kt)\hat{a}_x$ V/m, $\vec{H} = (y + 2\times 10^6 t)\hat{a}_z$ A/m. **(05 Marks)**

c. Starting from Maxwell's curl equation, obtain the equation of Poynting's theorem and interpret the same. **(10 Marks)**

OR

10 a. Express Maxwell's equations in phasor form as applicable to free-space. Using the same, obtain vector Helmholtz equation in free space. **(09 Marks)**

b. Obtain an expression for skin depth when an electromagnetic wave enters a conducting medium. Also, calculate the skin depth when a 160 MHz plane wave propagates through aluminum of conductivity 10^5 ℧/m, $\epsilon_r = \mu_r = 1$ **(05 Marks)**

c. Starting from equation of Faraday's law, obtain the point form of Maxwell's equation concerning spatial derivative of $\vec{E}$ and time derivative of $\vec{H}$. **(06 Marks)**

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CBCS SCHEME

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15EC34

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Network Analysis

Time: 3 hrs. Max. Marks: 80

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Missing data, if any, may be suitably assumed.

Module-1

1 a. Derive expression for converting star to delta. **(08 Marks)**

b. Using Mesh current find V_2 which result a zero current in 4 ohm resistor in the network shown in Fig.Q1(b). **(08 Marks)**

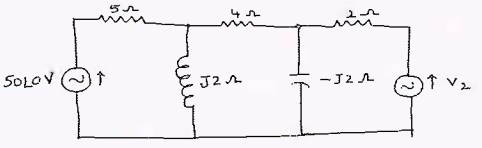

Fig.Q1(b)

OR

2 a. For the network of Fig.Q2(a), determine the v_1 and v_2 by nodal analysis. **(08 Marks)**

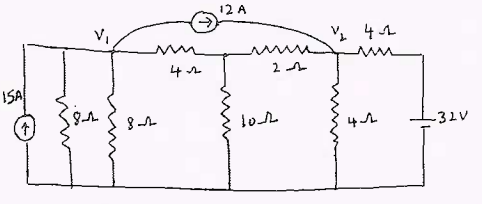

Fig.Q2(a)

b. Find the current I in 28Ω resistor by Mesh analysis in Fig.Q2(b). **(08 Marks)**

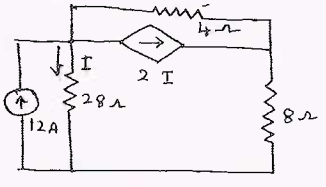

Fig.Q2(a)

Module-2

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

b. Using Milliman's theorem, find I_L through R_L for the network shown in Fig.Q3(b). **(04 Marks)**

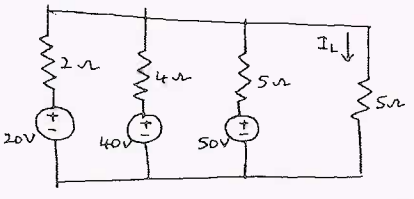

Fig.Q3(b)

c. Obtain Norton equivalent of the network of Fig.Q3(c) between terminals A and B. **(06 Marks)**

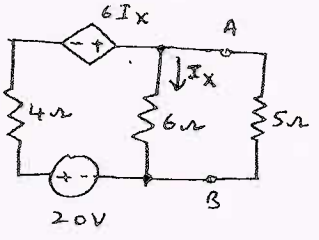

Fig.Q3(c)

OR

4 a. State maximum power transfer theorem. Prove that $Z_L = Z_0^*$ for AC circuits. **(08 Marks)**

b. Verity reciprocity theorem to find value of V_X in the circuit shown Fig.Q4(b). **(08 Marks)**

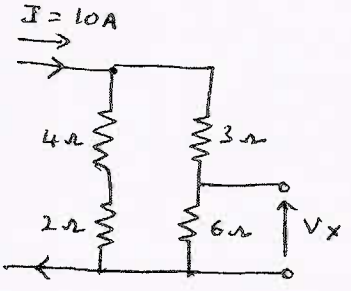

Fig.Q4(b)

Module-3

5 a. In the network shown in Fig.Q5(a), 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 = 1000Ω, L = 1H, C = 0.1μF and V = 100V. Assume that the capacitor is initially uncharged. **(08 Marks)**

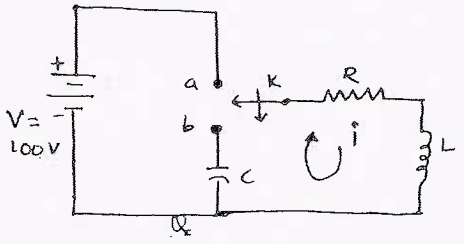

Fig.Q5(a)

b. Determine the response current i(t) in the circuit shown in Fig.Q5(b) using Laplace transform. **(08 Marks)**

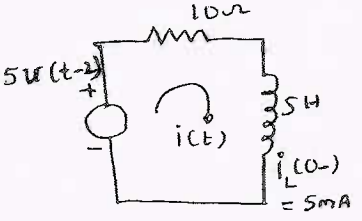

Fig.Q5(b)

OR

6 a. Synthesis the waveform shown in Fig.Q6(a) and find the Laplace transform of the periodic waveform. **(08 Marks)**

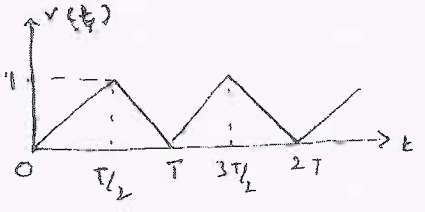

Fig.Q6(a)

b. Determine v, $\frac{dv}{dt}$ and $\frac{d^2v}{dt^2}$ at $t = 0^+$ when the switch k is opened at t=0 in Fig.Q6(b). **(08 Marks)**

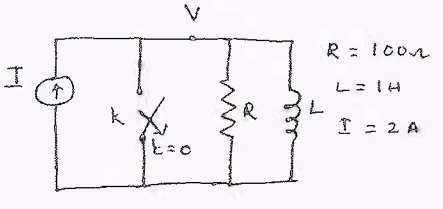

Fig.Q6(b)

Module-4

7 a. What is resonance? Show that $f_0 = \sqrt{f_1 f_2}$ for series resonance circuit. **(08 Marks)**

b. Find the values of c for which the circuit given in Fig.Q7(b) resonates at 750Hz. **(08 Marks)**

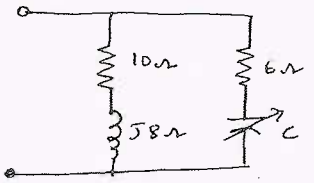

Fig.Q7(b)

OR

8 a. A series RLC circuit has R = 4Ω, L = 1mH, and C = 10μF, calculate Q – factor, bandwidth, resonant frequency and the half power frequencies f_1 and f_2. **(08 Marks)**

b. Derive expression for fr, Q and bandwidth of a parallel resonant circuit with lossless capacitor in parallel with a coil of resistance R and inductance L. **(08 Marks)**

Module-5

9 a. Derive Y parameters and transmission parameters of a circuit interms of its z-parameters. **(08 Marks)**

b. Find the z-parameters for the network shown in Fig.Q9(b). **(08 Marks)**

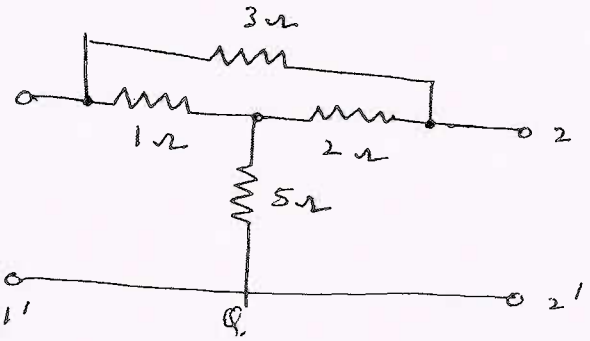

Fig.Q9(b)

OR

10 a. The z parameters of a two port network are $z_{11} = 20\Omega$, $z_{22} = 30\Omega$, $z_{12} = z_{21} = 10\Omega$. Find Y and ABCD parameters. **(08 Marks)**

b. Determine Y parameters of the two port network shown in Fig.Q10(b). **(08 Marks)**

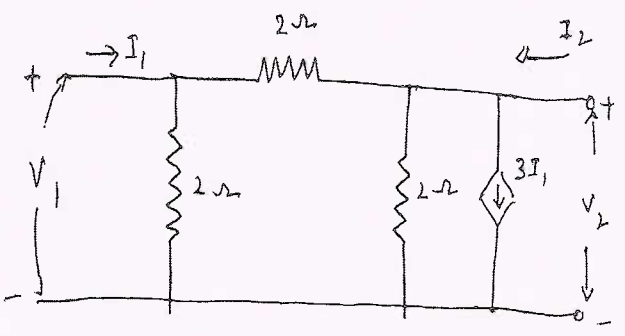

Fig.Q10(b)

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CBCS SCHEME

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

17EC42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Signals and Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain with an example :
i) Even and odd signal
ii) Energy and power signal
iii) Time shifting
iv) Time scaling
v) Prescenduce rule. **(10Marks)**

b. Sketch the following :
$y(t) = r(t + 2) - r(t + 1) - r(t - 1) + r(t - 2)$ **(02Marks)**

c. Given the signal x(t) as shown in the Fig.1(c) sketch the following :
i) x(2t + 2) and ii) x(t/2 – 1). **(08Marks)**

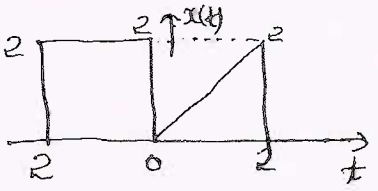

Fig.1(c)

OR

2 a. Find the even the odd components of the following signals :
i) $x(t) = \cos t + \sin t + \sin t \cdot \cos t$
ii) $x(n) = \{-3, 1, \underset{\uparrow}{2}, -4, 2\}$. **(06 Marks)**

b. For the signal shown in Fig.Q2(b), find the total energy. **(08 Marks)**

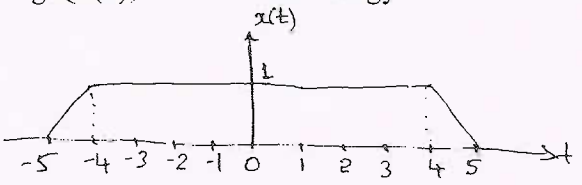

Fig.Q2(b)

c. Verify the following system for linearity and time invariance :
i) $y(t) = t \cdot x(t)$ ii) $y(n) = x[n] + n$. **(06 Marks)**

Module-2

3 a. What do you mean by impulse response of an LTI system? Starting from fundamentals, deduce the equation for the response of an LTI system if the input sequences x(n) and the impulse response h(n) are given. **(08 Marks)**

b. Determine the output of an LTI system for an input $x(t) = u(t) - u(t - 2)$ and impulse response $h(t) = u(t) - u(t - 2)$. **(06 Marks)**

c. An LTI system is characterized by an impulse response $h(n) = (3/4)^n u(n)$. Find the response of the system when the input $x(n) = u(n)$. Also evaluate the output of the system at $n = +5$ and $n = -5$. **(06 Marks)**

OR

4 a. LTI system has an impulse response :

$$h(n)=\begin{cases}1 & ; \ n=+/-1\\ 2 & ; \ n=0\\ 0 & ; \ \text{otherwise}\end{cases}$$

Determine the output of this system in response to the input :

$$x(n)=\begin{cases}2 & ; \ n=0\\ 3 & ; \ n=1\\ -2 & ; \ n=2\\ 0 & ; \ \text{otherwise}\end{cases}$$ **(06 Marks)**

b. Determine the discrete time convolution of input $x(n) = \beta^n u(n)$ and impulse response $h(n) = u(n-3)$. Assume magnitude of β to be less than 1. **(08 Marks)**

c. Prove $[x(n) * h_1(n)] * h_2(n) = x(n) * [h_1(n) * h_2(n)]$. **(06 Marks)**

Module-3

5 a. Evaluate the step response for the following impulse responses

i) $h(n) = (\frac{1}{2})^n u(n)$

ii) $h(t) = u(t+1) - u(t-1)$. **(08 Marks)**

b. Check for the following impulse responses memoryless, causal and stable.

i) $h(t) = e^{2t} u(t-1)$

ii) $h(n) = (\frac{1}{2})^n u(n)$. **(06 Marks)**

c. Evaluate the DTFS representation for the signal :

$$x[n]=\sin\left[\frac{4\pi}{21}n\right]+\cos\left[\frac{10\pi}{21}n\right]+1$$

Sketch magnitudes and phase spectra. **(06 Marks)**

OR

6 a. An inter connection of LTI system is shown in Fig.Q6(a). The impulse responses are $h_1(n) = (\frac{1}{2})^n u(n+2)$, $h_2(n) = \delta(n)$ and $h_3(n) = u(n-1)$. Find the impulse response h(n) of the overall system. **(06 Marks)**

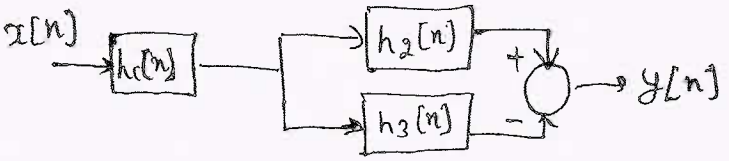

Fig.Q6(a)

b. State the following properties of continuous time Fourier series

i) Convolution ii) Time shift iii) Linearity iv) Differential in time domain. **(04 Marks)**

c. Find the complex Fourier coefficient for the periodic waveform x(t) as shown in the Fig.Q6(c). Also draw the amplitude and phase spectra. **(10 Marks)**

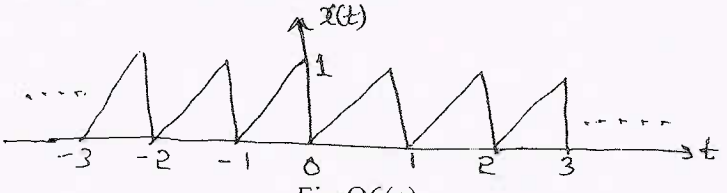

Fig.Q6(c)

Module-4

7 a. Find the Fourier transform of the signal $x(t) = e^{-at}$; $a > 0$. Also sketch magnitude and phase spectra. **(08 Marks)**

b. State and prove the following properties of discrete time Fourier transform.
i) Convolution
ii) Frequency differentiation. **(08 Marks)**

c. Find the DTFT of the signal $x[n] = u[n] - u[n-6]$. **(04 Marks)**

OR

8 a. Obtain the DTFT of the rectangular pulse is defined as :
$x[n] = 1 \; ; |n| \leq M$
$= 0 \; ; |n| > M$ **(08 Marks)**

b. Specify the Nyquist rate for the following signals
i) $x(t) = \cos(5\pi t) + 0.5\cos(10\pi t)$
ii) $x(t) = \text{sin c}(200t)$. **(04 Marks)**

c. Using properties of Fourier transform, find the Fourier transform of the signal :
$x(t) = \frac{d}{dt}\left[te^{-2t}\sin u(t)\right]$. **(08 Marks)**

Module-5

9 a. Determine the Z–transform of the signal $x[n] = a^n u[n]$. Indicate the ROC and locations of poles and zeros of X(z) in the z–plane. **(06 Marks)**

b. Find the Z-transform and the ROC of the discrete sinusoid signal $x(n) = \sin[\Omega n]\, u(n)$. **(08 Marks)**

c. Find the inverse Z–transform of $x(z) = \frac{1/4\, z^{-1}}{(1 - 1/2\, z^{-1})(1 - 1/4\, z^{-1})}$ ROC $|z| > \frac{1}{2}$. **(06 Marks)**

OR

10 a. Find the impulse response for the following difference equation :
$y(n) - 4y(n-1) + 3y(n-2) = x(n) + 2x(n-1)$. **(08 Marks)**

b. Find the Z –transform and ROC of $x(n) = a^{n-1}\, u(n-1)$ using properties of Z–transforms. **(06 Marks)**

c. Using Z-transform find the convolution of the following two sequences :
$$h[n] = \begin{cases} \left[1/2\right]^n ; & 0 \leq n \leq 2 \\ 0 \; ; & \text{otherwise} \end{cases}$$
And $x[n] = \delta[n] + \delta[n-1] + \delta[n-2]$. **(06 Marks)**

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CBCS SCHEME

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17EC43

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 closed loop control systems and list its advantages and disadvantages with examples. **(04 Marks)**

b. For the mechanical system shown in Fig.Q.1(b), write i) The mechanical network ii) the equations of motion and iii) the force-current analogous electrical network. **(08 Marks)**

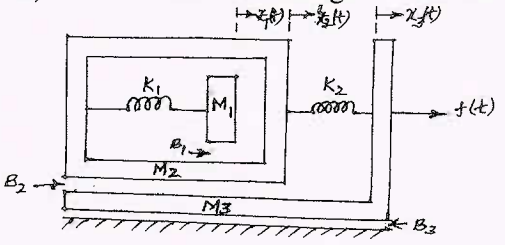

Fig.Q.1(b)

c. For the system represented by the following equations, find the transfer function X(S)/U(S) by signal flow graph technique.

$x(t) = x_1(t) + \beta_3 u(t)$

$x_1^1(t) = -a_1 x_1 + x_2 + \beta_2 u(t)$

$x_2^1(t) = -a_2 x_1 + \beta_1 u(t)$ **(08 Marks)**

OR

2 a. Define analogous systems. Show that two systems shown in Fig.Q.2(a) are analogous systems, by comparing their transfer functions. **(08 Marks)**

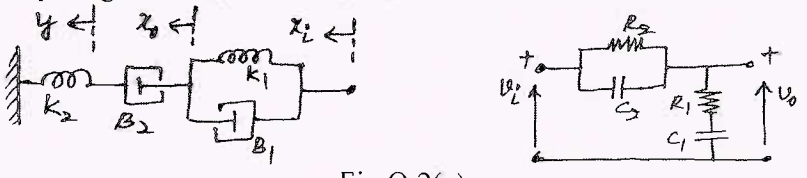

Fig.Q.2(a)

b. For the block diagram shown in Fig.Q.2(b), determine the transfer function C(S)/R(S) using block diagram reduction technique. **(08 Marks)**

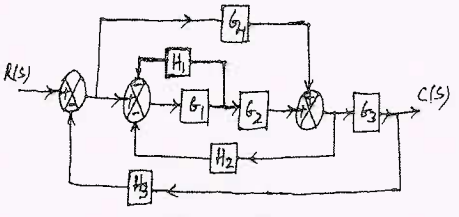

Fig.Q.2(b)

c. Define the following terms in connection with signal flow graph:
   i) Node
   ii) Forward path gain
   iii) Feedback loop
   iv) Non-touching loops. **(04 Marks)**

Module-2

3 a. Define the following time response specifications for an underdamped second order system:
   i) Rise time, t_r
   ii) Peak time, t_p
   iii) Peak-overshoot, M_p
   iv) Settling time, t_s **(04 Marks)**

b. A system is given by the differential equation $y''(t)+y'(t)+y(t)=x(t)$, where $y(t)$ in the output. Determine all time domain specifications for unit step input. **(08 Marks)**

c. The open loop transfer function of a unity feedback system is given by $G(s)=\frac{K}{S(ST+1)}$
   i) By what factor should the amplifier gain K be multiplied in order that the damping ratio is increased from 0.2 to 0.8?
   ii) By what factor should K be multiplied so that the system overshoot for unit step excitation is reduced from 60% to 20%? **(08 Marks)**

OR

4 a. Derive the expressions for i) Rise time, t_r and ii) Peak overshoot, M_p for the underdamped response of a second order system for a unit step input. **(06 Marks)**

b. For the system shown in Fig.Q.4(b), compute the values of K and τ to give an overshoot of 20% and peak time of 2 sec for an unit step excitation. **(08 Marks)**

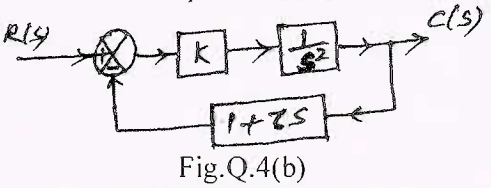

Fig.Q.4(b)

c. Find the position, velocity and acceleration error constant for a control system having open loop transfer function $G(S)H(S)=\frac{10}{S(S+1)}$. Also find the steady state error for the input $r(t) = 1 + t$. **(06 Marks)**

Module-3

5 a. State and explain Routh's stability criterion for determining the stability of the system and mention its limitations. **(06 Marks)**

b. Determine the number of roots that are
   i) in the right half of s-plane
   ii) on the imaginary axis and
   iii) in the left half of s-plane
   for the system with the characteristic equation $s^6 + s^5 - 2s^4 - 3s^3 - 7s^2 - 4s - 4 = 0$. **(06 Marks)**

c. Sketch the root locus plot of a certain control system, whose characteristic equation is given by $s^3 + 10s^2 + ks + k = 0$, comment on the stability. **(08 Marks)**

OR

6 a. For a system with characteristic equation $s^4 + ks^3 + s^2 + s + 1 = 0$, determine the range of K for stability. **(04 Marks)**

b. Determine the values of 'k' and 'a' for the open loop transfer function of a unity feedback system is given by $G(s) = \frac{K(s+1)}{s^3 + as^2 + 3s + 1}$, so that the system oscillates at a frequency of 2rad/sec. **(06 Marks)**

c. Draw the root locus diagram for the system shown in Fig.Q.6(c), show all the steps involved in drawing the root locus. Determine:

i) The least damped complex conjugate closed loop poles and the value of 'K' corresponding to these roots

ii) Minimum damping ratio. **(10 Marks)**

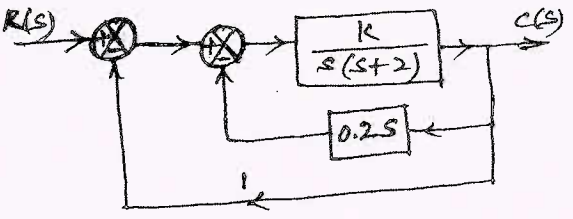

Fig.Q.6(c)

Module-4

7 a. Define the following terms in connection with bode plots:

i) Gain cross over frequency

ii) Phase crossover frequency

iii) Gain margin

iv) Phase margin. **(04 Marks)**

b. A negative feedback control system is characterized by an open loop transfer function $G(S)H(S) = \frac{20}{S(S+1)(S+2)}$. Sketch the polar plot and hence determine w_{gc}, w_{pc}, G_M and P_M. Comment on the stability. **(06 Marks)**

c. A unity feedback control system has $G(s) = \frac{100(1+0.1s)}{s(s+1)^2(0.01s+1)}$. Draw the Bode plots and hence determine W_{gc}, W_{pc}, GM and PM. Comment on the stability. **(10 Marks)**

OR

8 a. A unity feedback control system has $G(s) = \frac{200(s+2)}{s(s^2+10s+100)}$. Draw the bode plots and hence determine stability of the system. **(10 Marks)**

b. Using Nyquist stability criterion, find the range of K for closed loop stability for the negative feedback control system having the open loop transfer function $G(S)H(S) = \frac{K}{S(S^2+2S+2)}$. **(10 Marks)**

Module-5

9 a. State the advantages of state variable analysis. (04 Marks)

b. Obtain the state model for the electrical system shown in Fig.Q.9(b). Take $i_o(t)$ as output. (06 Marks)

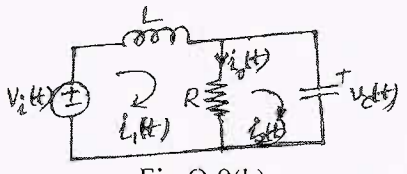

Fig.Q.9(b)

c. For a system represented by the state model

$$\begin{bmatrix} x_1'(t) \\ x_2'(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t) \text{ and } y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$$

Determine:

i) The state transition matrix, $\phi(t)$ and

ii) The transfer function of the system. (10 Marks)

OR

10 a. Define state transition matrix and list its properties. (04 Marks)

b. Consider a state model with matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix}$. Determine the model matrix M. (06 Marks)

c. Obtain the time response of the following non homogeneous state equation:

$$\begin{bmatrix} x_1'(t) \\ x_2'(t) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u(t)$$

where u(t) is a unit step function, when $x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ (10 Marks)

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CBCS SCHEME

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17EC44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Describe time-domain analysis of amplitude modulation with relevant spectrum. **(08 Marks)**

b. Explain with neat circuit working of switching modulator with relevant signals. **(07 Marks)**

c. Explain COSTAS RECEIVER with neat block diagram. **(05 Marks)**

OR

2 a. Describe coherent detection of DSB-SC signal waves with block diagram and spectra. **(08 Marks)**

b. Explain the Frequency Translation with block diagram and relevant spectra. **(07 Marks)**

c. Explain Time-Domain approach in VSB transmission of analog and digital television. **(05 Marks)**

Module-2

3 a. Explain single tone-frequency modulation. Derive necessary FM equation. **(08 Marks)**

b. Calculate the carrier swing, carrier frequency freq deviation and modulation index for an FM wave, which reaches max freq of 99.047 MHz and minimum frequency of 99.023 MHz. The frequency of modulating signal is 7 kHz. **(08 Marks)**

c. Explain Direct Method of generating FM wave. Draw block diagram of Generating WBFM wave with frequency stabilization. **(04 Marks)**

OR

4 a. Explain FM demodulation using PLL. Develop non-linear model of PLL. **(10 Marks)**

b. Explain with block diagram FM Stereo Multiplexing. **(10 Marks)**

Module-3

5 a. Derive expression for overall noise figure when two-port network are in cascade. **(08 Marks)**

b. For the network connection shown in Fig.Q5(b), determine overall noise figure and also find equivalent noise temperature.

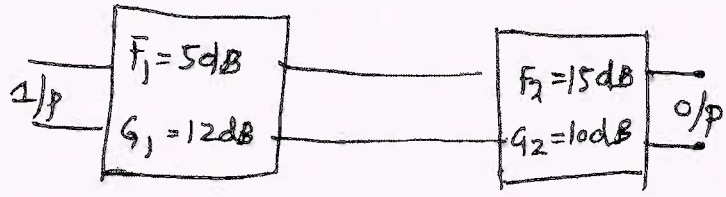

Fig.Q5(b) **(07 Marks)**

c. Explain: (i) Thermal noise (ii) White noise **(05 Marks)**

OR

6 a. Explain noise equivalent bandwidth and show that effective bandwidth $B_\eta = \frac{1}{4RC}$. **(06 Marks)**

b. Define equivalent noise temperature. Define $Te = Te_1 + \frac{Te_2}{G} + \frac{Te_3}{G_1 G_2} + ...$ **(08 Marks)**

c. Mention properties of auto-correlation function. **(06 Marks)**

Module-4

7 a. Discuss noise in AM Receiver. Derive $FOM = \frac{Ka^2 P_m}{1 + Ka^2 P_m}$. **(10 Marks)**

b. Explain the need of pre-emphasis and de-emphasis in FM. Derive $I = \frac{2W^3}{3\int_{-w}^{w} f^2 |H_{dc}(f)^2| df}$ **(10 Marks)**

OR

8 a. Discuss threshold effect in FM. **(08 Marks)**

b. Derive expression for FOM in case of FM, $FOM = \frac{3K_f^2 P_m}{W^2}$. **(12 Marks)**

Module-5

9 a. A continuous time signal X(t) has a bandwidth F_3 = 10 kHz and it is sampled at F_s = 22 kHz using 8bit/sample. The signal is properly scaled. So that |X(n)| < 128 for all n.

(i) Determine your best estimate of the variance of the quantization error σ_e^2.

(ii) We want to increase the sampling rate by 16 times. How many bits per samples you would use in order to maintain the same level of quantization? **(08 Marks)**

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

c. Mention advantages of digital communication. **(04 Marks)**

OR

10 a. Explain TDM with neat block diagram. **(10 Marks)**

b. Find the Nyquist rate and Nyquist interval for:

i) $m_1(t) = \frac{1}{2\pi}\cos(4000\pi t)\cos(1000\pi t)$

ii) $m_2(t) = \frac{\sin 500\pi t}{\pi t}$ **(10 Marks)**

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CBCS SCHEME

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17EC45

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Linear Integrated Circuits

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 parameter of Op-Amp and also mention its typical values of 741:
i) CMRR ii) Slew rate iii) Power supply voltage rejection. **(06 Marks)**

b. Design an inverting amplifier using a 741 Op-Amp. The voltage gain is to be 50 and output voltage amplitude is to be 2.5V. **(07 Marks)**

c. Derive the expression for output voltage of a difference amplifier and also explain the common mode nulling. **(07 Marks)**

OR

2 a. Discuss the methods of offset nulling in Op-Amp circuit. **(06 Marks)**

b. Design a Non-inverting amplifier using 741-Op-Amp, is to amplify the input voltage of 100mV to a level of 3V output. **(07 Marks)**

c. Explain the various methods of Biasing Op-Amp. **(07 Marks)**

Module-2

3 a. Sketch and explain high Z_{in} capacitor coupled voltage follower with necessary design steps and also show that the input impedance is very high as compared to direct coupled voltage follower. **(08 Marks)**

b. Design inverting amplifier circuit is to be capacitor coupled and to have a signal frequency range of 10Hz to 1kHz. If load resistance is 250Ω with Av = 50 and V_0 = 3V. Use 741 Op-Amp. **(08 Marks)**

c. What is Precision Rectifiers? Mention the advantages of it. **(04 Marks)**

OR

4 a. Sketch precision full wave rectifier using HWR and summing circuit and explain it. **(08 Marks)**

b. What is instrumentation amplifier? Compare differential input/output amplifier and a difference amplifier. **(06 Marks)**

c. Design a basic current amplifier circuit has an input current of 1mA and a 100Ω load resistor. The current gain is 5. **(06 Marks)**

Module-3

5 a. Prove that $V_{0(comp)} = \left(1 + \frac{R_2}{R_{TC}}\right)\frac{KT}{q}\ell_n\left(\frac{V_{in}}{V_{ref}}\right)$ of a log amplifier. **(08 Marks)**

b. Sketch and explain the working of phase shift oscillator using Op-Amp and also write the design equations. **(08 Marks)**

c. What are the applications of analog multipliers? **(04 Marks)**

OR

6 a. Draw an Op-Amp sample and hold circuit. Sketch the input signal, control, output waveforms and explain the circuit operation. **(08 Marks)**

b. Explain the operation of a inverting Schmitt triggering with two different level of trigger points using diodes. **(08 Marks)**

c. For the voltage detector shown in Fig.Q.6(c). Design a value of R_1 and R_2. Assume $V_{R_2} = 1.5V$. **(04 Marks)**

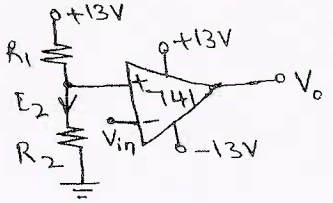

Fig.Q.6(c)

Module-4

7 a. Sketch the circuit and frequency response of a first order low pass filter and explain its operation. **(06 Marks)**

b. Design a second order high pass filter to have a cut off frequency of 12kHz. Use a 715 Op-Amp with $I_{B(max)} = 1.5\mu A$. **(07 Marks)**

c. List and explain the characteristics of three terminal IC regulators. **(07 Marks)**

OR

8 a. Draw the functional block diagram of a 723 regulator and explain it. **(06 Marks)**

b. Explain how fixed regulator can be used as adjustable regulator. Design fixed voltage regulator using 7805 to get an output of 7.5V. Assume $I_{R_1} = 25mA$ and $I_Q = 4.2mA$. **(07 Marks)**

c. Discuss the differences between wide band and narrow band pass filter. Sketch typical frequency response for each. Write the equations relating Q, B, f_1 and f_2. **(07 Marks)**

Module-5

9 a. Draw the block diagram of a PLL and explain the functions of each block. **(06 Marks)**

b. A 555 Astable multivibrator has $R_A = 2.2K\Omega$, $R_B = 6.8K\Omega$ and $C = 0.01\mu F$. Calculate:

i) t_{high}
ii) t_{low}
iii) free running frequency
iv) Duty cycle

and also draw the connection diagram **(07 Marks)**

c. Derive the expression of pulse width of a monostable multivibrator using 555 IC timer and also design a monostable multivibrator with pulse width of 0.25msec. Assume $C = 0.1\mu F$. **(07 Marks)**

OR

10 a. Derive the expression of output voltage of a R – 2R ladder type DAC. **(08 Marks)**

b. Draw the block diagram of a successive approximation type ADC and explain it. **(08 Marks)**

c. Mention the applications of monostable multivibrator using 555 timer. **(04 Marks)**

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CBCS SCHEME

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17EC46

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Microprocessors

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Microprocessor. Describe the architecture of 8086 with neat block diagram. **(10 Marks)**

b. Explain flag register of 8086 with its format. **(08 Marks)**

c. Explain the formation of opcode for MOV AX, BX. Opcode for MOV instruction is "100010". **(02 Marks)**

OR

2 a. Explain the following addressing modes of 8086:
(i) Register Addressing mode (ii) Based Indexed mode.
(iii) Immediate mode (iv) Direct addressing mode **(08 Marks)**

b. Write 8086 program to find the smallest number out of N 16 bit unsigned numbers stored in a memory block starting with the address 2000H. Store the result at word location 3000H. **(08 Marks)**

c. Explain the significance of following pins of 8086:
(i) ALE (ii) RESET (iii) $\overline{TEST}$ (iv) M/$\overline{IO}$ **(04 Marks)**

Module-2

3 a. Explain the following instruction with examples:
(i) LEA (ii) IDIV (iii) XLAT (iv) TEST **(08 Marks)**

b. Write a complete assembly language program in 8086 which determines all the occurrences of a character in a given string. **(08 Marks)**

c. What are assembler directives? Explain any three. **(04 Marks)**

OR

4 a. List and explain the string manipulation instructions. Also give its advantages. **(10 Marks)**

b. Write an ALP to copy a 100 byte block of data from LOC1 to LOC2 using the MOVS instructions. **(06 Marks)**

c. Write an ALP to find whether the given number is 2 out of 5 code. **(04 Marks)**

Module-3

5 a. Explain the stack structure of 8086 and the operations of PUSH and POP instructions with examples. **(08 Marks)**

b. Differentiate between procedure and macro. **(06 Marks)**

c. Write an ALP to change a sequence of sixteen 2 byte numbers from ascending to descending order. Store the new series at different address. Use LIFO property of the stack. **(06 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 program to generate a delay of 100ms using an 8086 system that runs on 10 MHz frequency. Show the calculations. **(08 Marks)**

Module-4

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

b. Interface two 4k×8 EPROM and two 4k×8 static RAM chips of 8086. The addresses of RAM and ROM should start from FC000H and FE000H respectively. **(08 Marks)**

c. Draw the timing diagram for $\overline{RQ}/\overline{GT}$ for maximum mode. **(04 Marks)**

OR

8 a. Write the control word format of 8255 PIA. **(06 Marks)**

b. Show an interface of keyboard of 8086 and explain with a flowchart. **(10 Marks)**

c. How is key Debounce achieved through hardware? **(04 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 following INT 21K DOS function calls:
(i) Function 01H (ii) Function 02H (iii) Function 09H (iv) Function OAH **(08 Marks)**

OR

10 a. Write an ALP to rotate a stepper motor by 100 steps in clockwise direction for a 1.8 degree connected to 8255 port. Show details of calculations. Motor is rotating at 12 rpm and processor speed is 10 MHz. **(08 Marks)**

b. Explain Von-Neumann and Harvard CPU architecture and USC and RISC CPU architecture. **(08 Marks)**

c. Write a program to generate triangular wave using DAC 0800. **(04 Marks)**

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CBCS SCHEME

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15EC42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 architecture of 8086 micro processor with a neat block diagram. **(10 Marks)**

b. Explain any three advantage of segmented memory. **(03 Marks)**

c. Explain the significance of following pins of 8086:
i) READY ii) NMI iii) $\overline{DEN}$ **(03 Marks)**

OR

2 a. Explain the following addressing modes of 8086; with example.
i) Immediate ii) Direct iii) Register iv) Register Indirect v) Register Relative vi) Relative Based Indexed. **(09 Marks)**

b. Explain the physical address formatting in 8086 with an example. Also, if CS = 0000H, DS = 1000H, SS = 2000H, ES = 3000H, AX = 1000H, BX = 2000H, find the physical address of the following instruction MOV AX, [BX]. **(04 Marks)**

c. The opcode for MOV instruction is "100010". Determine machine language code for the following instructions: i) MOV BL, CL ii) MOV [SI], DL. **(03 Marks)**

Module-2

3 a. Explain the following instructions with example: i) LOOP ii) XALT iii) DAA iv) AAM v) IMUL. **(10 Marks)**

b. Write an ALP to find out the largest number from a given twenty unordered array of 8-bit numbers, stored in the locations starting from a known address. **(06 Marks)**

OR

4 a. Explain the following assembles directives with example:
i) EVEN ii) EXTRN and PUBLIC iii) PROC. **(06 Marks)**

b. Explain any three string manipulation instructions in 8086. **(06 Marks)**

c. Write an ALP to move a string of data words from offset 2000H to offset 3000H the length of the string is OFH. **(04 Marks)**

Module-3

5 a. Explain the stack structure of 8086 and the operations of PUSH and POP instructions. **(06 Marks)**

b. Explain interrupt response sequence of 8086. Also draw the structure of interrupt vector table. **(06 Marks)**

c. Write any four differences between non maskable interrupt and maskable interrupt. **(04 Marks)**

OR

6 a. List the techniques used to pass parameters to a procedure. Explain the passing of parameters using CPU resister with an example program. **(06 Marks)**

b. Distinguish between a procedures and a macro (Any four). **(04 Marks)**

c. Write a program to generate a delay of 100ms using an 8086 system that runs on 10MHz frequency. Indicate the calculation for the delay. **(06 Marks)**

Module-4

7 a. Explain memory read cycle of 8086 with a timing diagram. **(08 Marks)**

b. Explain the different modes of operation of 8255, and the control word format. **(08 Marks)**

OR

8 a. Explain the minimum mode configuration of 8086 with a neat diagram. **(08 Marks)**

b. Interface 4 × 4 keyboard with 8086 using 8255 and write the flowchart for the same. **(08 Marks)**

Module-5

9 a. Explain the working of ADC 0808/0809 with a neat block diagram. Also draw the timing diagram. **(08 Marks)**

b. Design a stepper motor controller and write an ALP to rotate shaft of a 4-phase stepper motor. i) In clockwise 5 rotations ii) In anticlockwise 5 rotations. Assume procedure DELAY is available for this 1.8° stepper motor. **(08 Marks)**

OR

10 a. Explain control word register of Timer 8253/8254 with bit definitions. **(05 Marks)**

b. Explain the architecture of NDP 8087. **(08 Marks)**

c. Differentiate between: RISC and CISC architecture. **(03 Marks)**

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CBCS SCHEME

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15EC43

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Compare open loop and closed loop control system. **(05 Marks)**

b. Find the transfer function $\frac{C(S)}{R(S)}$ for the signal flow graph shown in Fig.Q.1(b). **(05 Marks)**

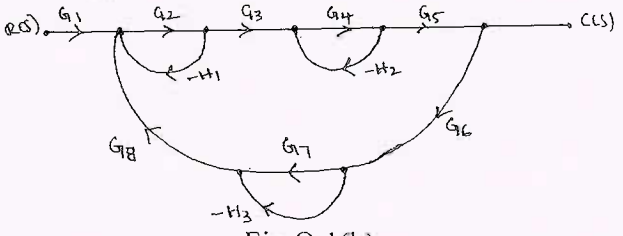

Fig.Q.1(b)

c. For the Mechanical system shown in Fig.Q.1(c):
i) Draw the mechanical network
ii) Write the differential equation
iii) Draw the force-voltage analogous electrical network. **(06 Marks)**

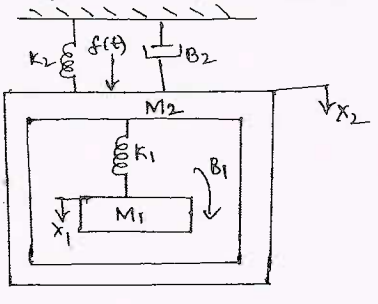

Fig.Q.1(c)

OR

2 a. Obtain the transfer function $\frac{\theta_2(s)}{T(s)}$ for the system shown in Fig.Q.2(a). **(05 Marks)**

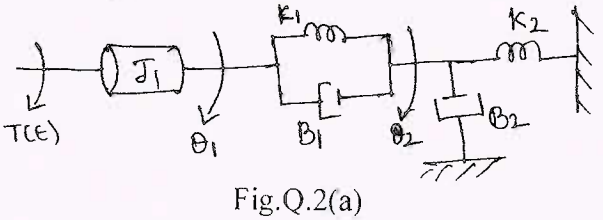

Fig.Q.2(a)

b. Obtain the transfer function $\frac{C(s)}{R(s)}$ of the system shown in Fig.Q.2(b) by using block diagram reduction technique. **(05 Marks)**

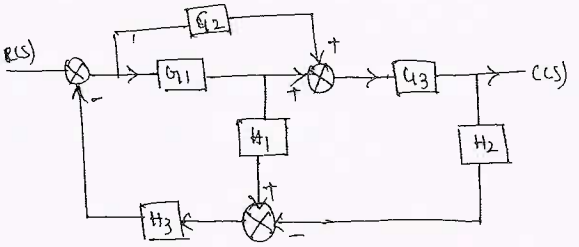

Fig.Q.2(b)

c. For the network shown in Fig.Q.2(c) construct the signal flow graph and obtain the transfer function using Mason gain formula. Given $R_1 = 100K\Omega$, $R_2 = 1M\Omega$, $C_1 = 10\mu f$, $C_2 = 1\mu f$. **(06 Marks)**

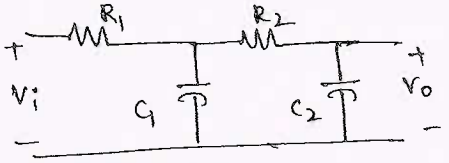

Fig.Q.2(c)

Module-2

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

b. For a unity feedback control system with $G(S) = \frac{10(S+2)}{S^2(S+1)}$. Find the static error coefficients and steady state error when input transform is $R(S) = \frac{3}{S} + \frac{2}{S^2} + \frac{1}{3S^3}$. **(04 Marks)**

c. A units feedback control system has $G(S) = \frac{K}{S(S+10)}$ determine the gain K for $\xi = 0.5$. Also find rise time, peak time, peak overshoot and settling time. Assume system is subjected to a step of 1v. **(04 Marks)**

OR

4 a. Show that the steady state error $e_{ss} = \lim_{s \to o} \frac{S.R(s)}{1+G(s).H(s)}$ using simple closed loop system with negative feedback. **(04 Marks)**

b. For a spring-mass damper system shown in Fig.Q.4(b), an experiment was conducted by applying a force of 2 Newtons to the mass. The response x(t) was recorded using xy plotter and experimental result is as shown in Fig.Q.4(b) below. Find the value of M, K, B. **(07 Marks)**

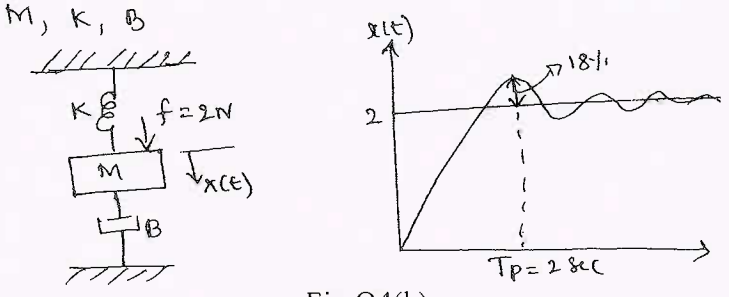

Fig.Q4(b)

c. A signal is represented by the equation $\frac{d^2\theta}{dt^2}+10\frac{d\theta}{dt}=150e$ where e = (r - θ) is the actuating signal, calculate the value of damping ratio, undamped and damped frequency of oscillation. Also draw the block diagram and find its closed loop transfer function. **(05 Marks)**

Module-3

5 a. Explain the concept of Routh Hurwitz creterio. What are the necessary and sufficient conditions for the system to be stable as per Routh-Hurwitz criteria? **(05 Marks)**

b. Comment on the stability of a system using Routh's stability criteria whose characteristic equation is $s^4 + 2s^3 + 4s^2 + 6s + 8 = 0$. How many poles of systems lie in right half of s plane? **(04 Marks)**

c. Construct the root locus and show that part of the root locus is circle. Comment on stability of open loop transfer function given by $G(s)=\frac{K(s+2)}{s(s+1)}$. **(07 Marks)**

OR

6 a. Determine the range of K such that the characteristic equation.
$S^3 + 3(k + 1)S^2 + (7K + 5)S + (4K + 7) = 0$ has roots more negative than S = -1. **(07 Marks)**

b. A feedback control system has open loop Transfer function
$G(S)H(S)=\frac{K}{S(S+4)(S^2+4S+20)}$ plot the root locus for K = 0 to ∞. Indicate all the points on it. **(09 Marks)**

Module-4

7 a. Explain Nyquist stability criterion. **(04 Marks)**

b. Sketch the Nyquist plot for open loop transfer function $G(S)H(S)=\frac{K}{S(S+1)(S+2)}$. Find the range of K for closed loop stability. **(08 Marks)**

c. For the log magnitude diagram shown in Fig.Q.7(c) find the transfer function. **(04 Marks)**

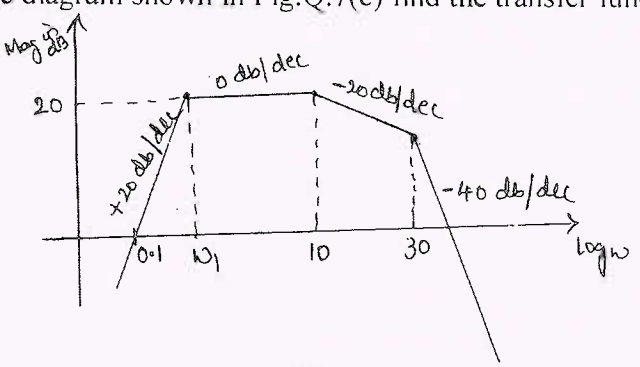

Fig.Q.7(c)

OR

8 a. Define Gain Margin and phase Margin. Explain how these can be determined using Bode plot. **(04 Marks)**

b. Construct the Bode magnitude and phase plot for $G(s)H(s)=\frac{100(0.1s+1)}{s(s+1)^2(0.01s+1}$. Find Gain margin and phase Margin. **(06 Marks)**

c. The polar plot of open loop transfer function of unity feedback system is shown in Fig.Q.8(c). None of the G(s) H(s) functions have poles on RHS.
   i) Complete the Nyquist path
   ii) Is the system stable
   iii) What is the system TYPE number? **(06 Marks)**

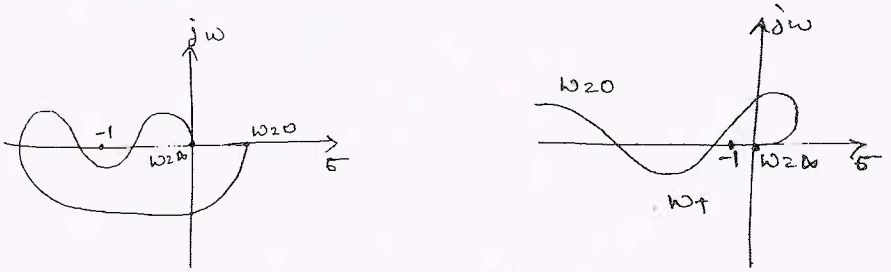

Fig.Q.8(c)

Module-5

9 a. List the properties of state transition matrix. **(04 Marks)**

b. Obtain an appropriate state model for a system represented by an electric circuit as shown in Fig.Q.9(b). **(06 Marks)**

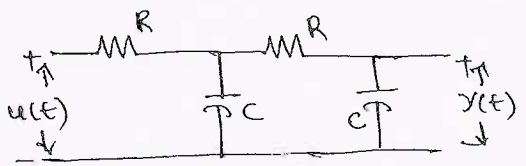

Fig.Q.9(b)

c. Find the state transition matrix for a system whose system matrix is given by

$$A = \begin{bmatrix} 0 & 1 \\ -8 & -6 \end{bmatrix}$$ **(06 Marks)**

OR

10 a. Draw and explain the block diagram of sample data control system. **(04 Marks)**

b. The transfer function of a control system is given by $\frac{y(s)}{u(s)} = \frac{s^2+3s+4}{s^3+2s^2+3s+2}$ obtain a state model using signal flow graph. **(08 Marks)**

c. Obtain the state model of the system shown in Fig.Q.10(c). **(04 Marks)**

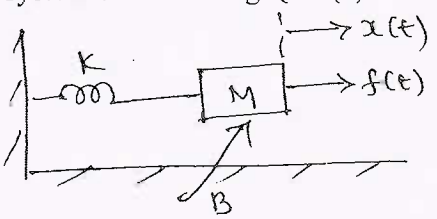

Fig.Q.10(c)

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15EC44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Sketch the even and odd parts of the signals shown in Fig.Q1(i) and (ii) **(08 Marks)**

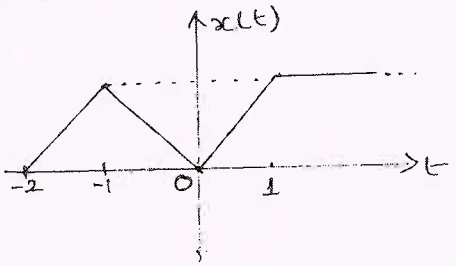

Fig.Q1(i)

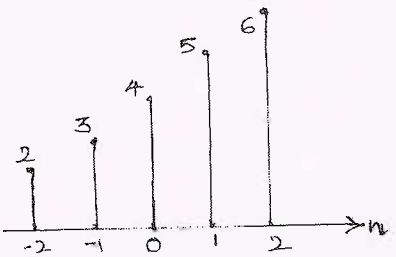

Fig.Q1(ii)

b. Determine whether the following signal is periodic or not if periodic find the fundamental period. $x(t) = \sin^2(4t)$. **(03 Marks)**

c. The trapezoidal pulse x(t) shown in Fig.Q1(c) is applied to a differentiator is $y(t) = \frac{dx(t)}{dt}$.

i) Find the resulting output y(t) of the differentiator ii) Find the energy of y(t). **(05 Marks)**

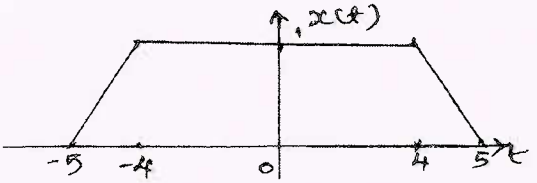

Fig.Q1(c)

OR

2 a. Determine whether the following systems are memoryless, causal, time invariant, linear and stable. i) $y(t) = x(t^2)$ ii) $y(n) = \log_{10}(|x(n)|)$. **(08 Marks)**

b. i) A continuous time signal x(t) is shown in Fig.Q2(b) sketch $y(t) = [x(t) + x(2-t)]\, u(1-t)$.

ii) Sketch the signal : $x(n) = 1; -1 \le n \le 3$

$= \frac{1}{2}; n = 4$

$= 0$; elsewhere

Sketch : i) $2x(2n)$ ii) $\frac{1}{2}x(n) + \frac{1}{2}(-1)^n x(n)$. **(08 Marks)**

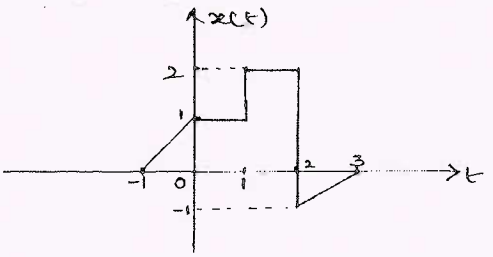

Fig.Q2(b)

Module-2

3 a. Prove the following :

i) $x(t) * u(t) = \int_{-\infty}^{t} x(\tau)\, d\tau$

ii) $x(n) * [h_1(n) * h_2(n)] = \{x(n) * h_1(n)\} * h_2(n)$. **(08 Marks)**

b. Compute the convolution sum of $y(n) = \beta^n u(n) * \alpha^n u(n)$; $|\beta| < 1$ and $|\alpha| < 1$. **(08 Marks)**

OR

4 a. Sate and prove the associative and commutative properties of convolution integral. **(08 Marks)**

b. Compute the convolution integral of $x(t) = e^{-2t}u(t)$ and $h(t) = u(t + 2)$. **(08 Marks)**

Module-3

5 a. A system consists of several subsystems connected as shown in Fig.Q5(a). Find the operator T relating x(t) to y(t) for the subsystem operators given by

$T_1 : y_1(t) = x_1(t)\, x_1(t - 1)$

$T_2 : y_2(t) = | x_2(t) |$

$T_3 : y_3(t) = 1 + 2x_3(t)$

$T_4 : y_4(t) = \cos(x_4(t))$

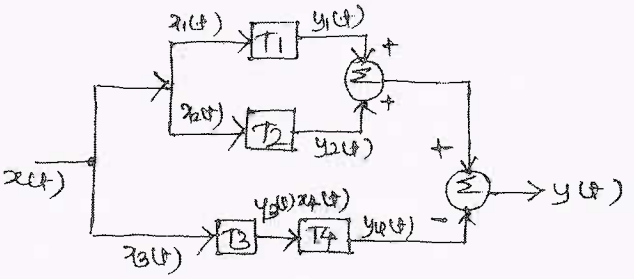

Fig.Q5(a) **(04 Marks)**

b. Determine whether the following systems defined by their impulse response are causal, meoryless and stable.

i) $h(t) = e^{-4|t|}$

ii) $h(n) = (0.99)^n u(n + 3)$. **(06 Marks)**

c. Evaluate the step response for the LTI system represented by the following impulse response

i) $h(n) = e^{-t}u(t) * \delta(t - 2)$

ii) $h(n) = (-1)^n\{u(n + 2) - u(n - 3)\}$. **(06 Marks)**

OR

6 a. State the following properties of CTFS :

i) Time shift

ii) Differentiation in time domain

iii) Linearity

iv) Convolution

v) Frequency shift scaling. **(06 Marks)**

b. Determine the DTFS coefficients of the signal

$$x(n) = \cos\left(\frac{6\pi}{13}n + \frac{\pi}{6}\right)$$

Draw : i) Magnitude spectrum

ii) Phase spectrum. **(10 Marks)**

Module-4

7 a. State and prove the following properties :

i) $y(t) = x(t - t_0) \xleftrightarrow{FT} Y(j\omega) = e^{-j\omega t_0} X(j\omega)$

ii) $-jtx(t) \xleftrightarrow{FT} \frac{d}{d\omega} X(j\omega)$. **(06 Marks)**

b. Find the DTFT of the following signals :

i) $x(n) = (-1)^n u(n)$

ii) $x(n) = (\frac{1}{2})^n \{u(n+3) - u(n-2)\}$. **(10 Marks)**

OR

8 a. Find he FT of the signal : $x(t) = te^{-2t} u(t)$. **(06 Marks)**

b. Find the FT of unit step function. **(04 Marks)**

c. Determine the signal x(n) if its spectrum is shown in Fig.Q8(c). **(06 Marks)**

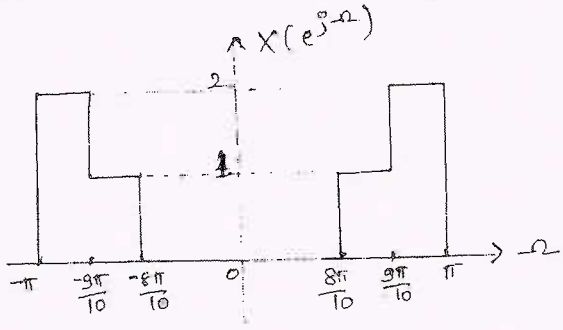

Fig.Q8(c)

Module-5

9 a. Explain properties of ROC with example. **(06 Marks)**

b. Determine the z–transform of the following signals.

i) $x(n) = \left(\frac{1}{3}\right)^n \sin\left(\frac{\pi}{4} n\right) u(n)$

ii) $x(n) = \left(\frac{1}{2}\right)^n \{u(n) - u(n-10)\}$. **(10 Marks)**

OR

10 a. Find the corresponding time domain signals corresponding to the following z-transform.

$x(z) = \frac{z^2 - 3z}{z^2 + \frac{3}{2}z - 1}$; ROC ; $\frac{1}{2} < |z| < 1$. **(06 Marks)**

b. The input and output of on LTI system is given by

$x(n) = u(n)$

$y(n) = (\frac{1}{2})^{n-1} u(n+1)$.

Find :

i) Transfer function

ii) Impulse response

iii) Is the system stable?

iv) Is the system causal? **(10 Marks)**

CBCS SCHEME

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15EC45

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Principles of Communication System

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 AM wave using switching modulator and show the output of the switching modulator is $V_2(t) = \frac{A_c}{2}\left[1 + \frac{4}{\pi A_c} m(t)\right]\cos(2\pi f_c t)$. **(06 Marks)**

b. Calculate the percent power saving for a DSB-SC signal for the percent modulation of (i) 100% (ii) 50%. **(04 Marks)**

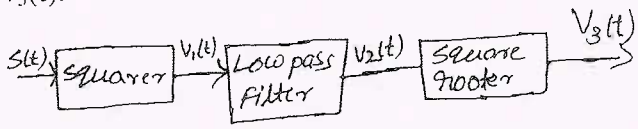
c. With a block diagram explain how downward and upward frequency translation is achieved. **(06 Marks)**

OR

2 a. Explain the operation of the ring modulator circuit which generates the DSB-SC waves. **(06 Marks)**

b. The AM signal $S(t) = A_c[1 + K_a m(t)] \cos 2\pi f_c t$ is applied to the system shown in Fig.Q.2(b). Assuming that $|k_a m(t)| < 1$ for all t and the message signal m(t) is limited to the interval $-w \le f \le w$, and the carrier frequency $f_c > 2w$, show that m(t) can be obtained from the square-rooter output $v_3(t)$. **(04 Marks)**

Fig.Q.2(b)



c. What is vestigial sideband modulation? Explain the generation of VSB modulated signal and list the advantages. **(06 Marks)**

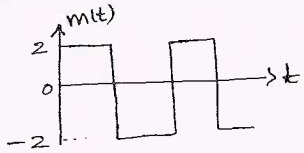
Module-2

3 a. With the help of block diagram. Explain the schemes for generating i) FM wave using PM ii) PM wave using FM. **(06 Marks)**

b. Explain non-linearity and its effect in FM system. **(06 Marks)**

c. Sketch the FM wave for the modulating signal m(t) as shown in Fig.Q.3(c). Assume frequency of 100MHz and constant k_f as $2\pi \times 10^5$. **(04 Marks)**

Fig.Q.3(c)



OR

4 a. Explain the generation of wide band FM wave using a voltage controlled oscillator. **(06 Marks)**

b. A 93.2 MHz carrier is frequency modulated by a 5kHz sine wave. The resultant FM signal has a frequency deviation of 40kHz. I) Find the carrier swing of the FM wave ii) What are the highest and lowest frequencies attained by the frequency modulated signal iii) Find the modulation index. **(04 Marks)**

c. Draw the linear model of phase locked loop and show that the resulting output signal of the PLL is approximately equal to $v(t) = \frac{K_f}{K_v} m(t)$. **(06 Marks)**

Module-3

5 a. Explain mean, correlation and covariance. **(06 Marks)**

b. List the properties of autocorrelation function. **(04 Marks)**

c. A TV receiving system is as shown in the Fig.Q.5(c). A preamplifier is used to overcome the effect of the Lossy cable. Typical values of the parameters are shown.

i) Find the overall noise figure of the system.

ii) Find the overall noise figure if the preamplifier is omitted. **(06 Marks)**

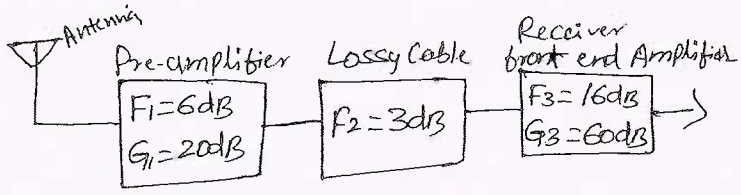


Fig.Q.5(c)

OR

6 a. What is probability density function? Show that the area under the PDF curve is equal to one. **(06 Marks)**

b. Consider the random variable X defined by probability density function

$$f_X(x) = \begin{cases} k & \text{a constant for } 2 \le x \le 4 \\ 0 & \text{elsewhere} \end{cases}$$

Determine : i) The constant K ii) $F_X(x)$. **(04 Marks)**

c. What is noise equivalent bandwidth? Show that noise equivalent band width for RC low pass filter is $\frac{1}{4RC}$. **(06 Marks)**

Module-4

7 a. Show that the figure of merit of a noisy FM receiver for single tone modulation is $\frac{3}{2}\beta^2$. **(08 Marks)**

b. Show that the figure-of-merit for DSB-SC receiver system is unity. **(08 Marks)**

OR

8 a. An AM receiver operating with a sinusoidal modulating signal has the following specifications. $\mu = 0.8$, $[SNR]_0 = 30dB$. What is the corresponding carrier-to-noise ratio? **(06 Marks)**

b. Briefly discuss FM threshold effect. **(04 Marks)**

c. Explain pre-emphasis and de-emphasis in frequency modulation system. **(06 Marks)**

Module-5

9 a. Draw the block diagram of Time Division Multiplexing system and explain the working principle of operation. **(08 Marks)**

b. Explain the generation of Pulse Position Modulation (PPM) system. **(08 Marks)**

OR

10 a. List the two operations involved in the generation of PAM [Pulse Amplitude Modulation] and explain how message signal m(t) is recovered from PAM. **(08 Marks)**

b. Discuss briefly quantization noise and show the output signal-to-noise ratio of a uniform quantizer is $[SNR]_0 = \left[\frac{3P}{m^2 \max}\right] 2^{2R}$. **(08 Marks)**

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CBCS SCHEME

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15EC46

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Define the following terms as applied to Op-Amp and mention their typical values for IC 741. i) CMRR ii) Slew rate iii) PSRR. **(06 Marks)**

b. With a neat circuit diagram explain the basic Op-Amp circuit. **(06 Marks)**

c. An operational amplifier has a specified input voltage range of ± 8V and an output voltage range of ±14V when the supply voltage is ±15V. Calculate the maximum output voltage that can be produced i) When the Op-Amp is used as a voltage follower ii) When it is used as an amplifier with a voltage gain of 2. **(04 Marks)**

OR

2 a. With a neat circuit diagram, explain direct coupled inverting amplifier with design steps, input impedance and output impedance. **(08 Marks)**

b. Derive an output voltage equation of 3 input inverting summing circuit and show how it can be converted into averaging circuit. **(08 Marks)**

Module-2

3 a. Explain capacitor coupled voltage follower with neat circuit diagram. **(08 Marks)**

b. Design a capacitor coupled non-inverting amplifier to have a voltage gain of approximately 66. The signal amplitude is to be 15mV. The load resistor is 2.2 kΩ and the lower cutoff frequency is to be 120Hz. **(08 Marks)**

OR

4 a. Explain the circuit operation of a differential input/output amplifier and derive the equation for differential voltage gain. Also show that the common mode gain is unity. **(10 Marks)**

b. Design a non-saturating precision half wave rectifier to produce a 2V peak output from a sine wave input with a peak value of 0.5V and frequency of 1MHz. Use a bipolar Op-Amp with supply voltage of ±15V. **(06 Marks)**

Module-3

5 a. With neat circuit diagram and waveforms, explain sample and hold circuit. **(08 Marks)**

b. Explain differentiating circuit operation with neat circuit diagram and design steps. **(08 Marks)**

OR

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

b. Explain log amplifier and derive its output voltage equation. **(06 Marks)**

c. Using a 741 Op-Amp with supply voltage of ± 12V, design an inverting Schmitt trigger circuit to have trigger points of ± 2V. **(04 Marks)**

Module-4

7 a. Explain the operation of second order high pass filter with a neat circuit diagram, frequency response and design steps. **(08 Marks)**

b. With a neat diagram and design steps explain the operation of single stage first order bandpass filter. **(08 Marks)**

OR

8 a. With a neat sketch, explain the working of series Op-Amp regulator. **(06 Marks)**

b. List and explain the characteristics of 3 terminal IC regulators. **(04 Marks)**

c. Draw and explain functional diagram of 723 regulators. **(06 Marks)**

Module-5

9 a. Define the following in relation to PLL :
i) Lock in range ii) Capture range iii) Pull in time. **(06 Marks)**

b. With necessary circuit diagram, derive the equations and explain R – 2R DAC. What output voltage could be produced by a DAC whose output range is 0 to 10V and whose input binary number is i) 11(for 2 bit DAC) ii) 1011 (for 4 bit DAC). **(10 Marks)**

OR

10 a. Explain the operation of monostable multivibrator using 555 timer. **(08 Marks)**

b. In the satable multivibrator $R_A = 3.3k\Omega$ $R_B = 6.8k\Omega$ and $C = 0.01\ \mu F$. Calculate :
i) t_{High} ii) t_{low} iii) free running frequency iv) duty cycle D. **(08 Marks)**

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CBCS SCHEME

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15EC32

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Analog Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Draw the circuit diagram of common Emitter fixed bias configuration. Derive the expression for Z_i Z_o, A_v using r_e model. **(08 Marks)**

b. For the network shown in Fig. Q1 (b), determine Z_i Z_o, A_v and A_i. Given h_{ic} = 1.175 KΩ, h_{fe} = 120, h_{oe} = 20 μA/v using approximate hybrid equivalent model. **(08 Marks)**

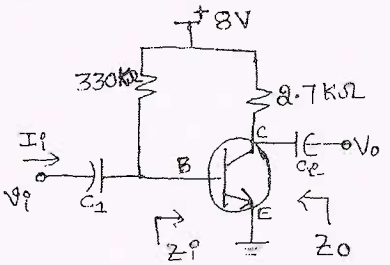

Fig. Q1 (b)

OR

2 a. Draw 'r_e' and 'h'-parameter models for a transistor in common Emitter configuration. Also give relation between 'r_e' and 'h'-parameter. **(05 Marks)**

b. For the circuit shown below, calculate r_e, Z_i Z_o and A_v, while consider $r_0 = \infty$. **(08 Marks)**

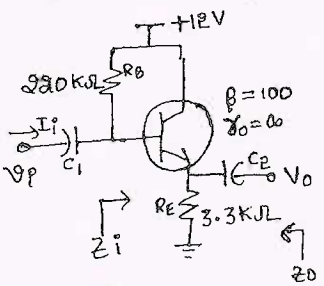

Fig. Q2 (b)

c. What are the advantages of h-parameters? **(03 Marks)**

Module-2

3 a. Explain the small signal model of the FET. **(04 Marks)**

b. Derive the expression for Z_i Z_o and A_v for FET voltage divider bias circuit. **(08 Marks)**

c. Compare JFET and MOSFET. **(04 Marks)**

OR

4 a. Explain the n-channel enhancement type MOSFETs, with their characteristics curves. **(08 Marks)**

b. Derive the expression for Z_i Z_o and A_v for FET self biased configuration (with R_s bypassed). **(08 Marks)**

Module-3

5 a. Prove that
Input capacitance is $C_{Mi} = (1 - A_v)C_f$ and
Output capacitance is $C_{MO} = \left(1 - \frac{1}{A_v}\right)C_f$ using miller effect. **(08 Marks)**

b. Describe the factors that affect the low frequency response of a BJT-CE amplifier. **(08 Marks)**

OR

6 a. Explain high frequency response of FET amplifier and derive expression for cut off frequencies, defined by input and output circuits (f_{Hi} and f_{Ho}). **(08 Marks)**

b. Determine the lower cut off frequency for the network shown in Fig. Q6 (b), using following parameters $g_m = 2$ ms, $r_d = \infty\Omega$, $I_{DSS} = 8$ mA, $V_P = -4V$, $V_{DD} = 20$ V. **(08 Marks)**

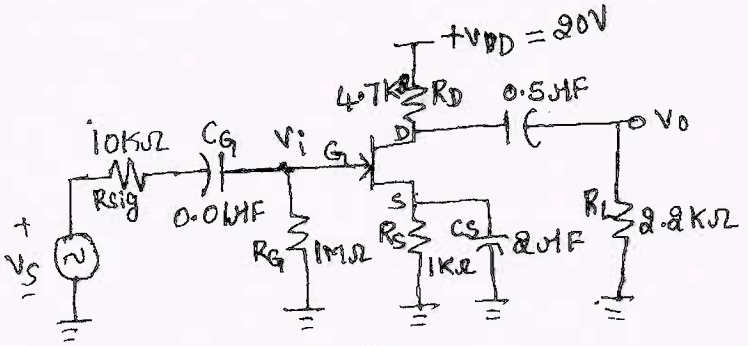

Fig. Q6 (b)

Module-4

7 a. With the help of a neat circuit diagram, explain the working of Hartley oscillator. **(08 Marks)**

b. The following data for Colpitts oscillator are as follows : $C_1 = 1$ nF, $C_2 = 99$ nF, $L = 1.5$ mH and $h_{fe} = 110$. Calculate frequency of oscillation for the same. **(04 Marks)**

c. Explain the important advantages of a negative feedback amplifier. **(04 Marks)**

OR

8 a. Mention the types of feedback connections. Draw their block diagrams indicating input and output signal. **(08 Marks)**

b. Obtain expression for Z_{if}, Z_{of} for a voltage series feedback. **(08 Marks)**

Module-5

9 a. Explain the operation of a class B push-pull amplifier and also show that its efficiency 78.50%. **(08 Marks)**

b. With a neat circuit diagram, explain the operation of a transformer coupled class A power amplifier. **(08 Marks)**

OR

10 a. For a harmonic distortion reading of $D_2 = 0.1$, $D_3 = 0.02$ and $D_4 = 0.01$, with $I_1 = 4$ A and $R_C = 8\ \Omega$, calculate the total harmonic distortion, fundamental power and total power. **(04 Marks)**

b. What are the classification of power amplifiers, based on the location of Q – point? Discuss them briefly. **(08 Marks)**

c. With the help of neat block diagram, explain the working of shunt voltage regulator. **(04 Marks)**

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CBCS SCHEME

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15EC33

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Two motors M_2 and M_1 are controlled by three sensors S_1, S_2 and S_3. One motor M_2 is to run any time when all three sensors are on the other motor (M_1) is to run whenever sensors S_2 or S_1 but not both are on and S_3 is off. For all sensors combinations where M_1 is on, M_2 is to be off, except when all sensors are off and then both motors remains off. Design using combinational logic. **(06 Marks)**

b. Convert the given Boolean function into minterm canonical form.

$f(a,b,c) = \bar{a}(\bar{b}+c)+c$ **(02 Marks)**

c. Reduce the following Boolean function using K-map and realize the simplified expression using NAND gates.

$T = f(a,b,c,d) = \sum m(1,3,4,5,13,15) + \sum d(8,9,10,11)$ **(08 Marks)**

OR

2 a. Determine the prime implicants and essential prime implicants for the given Boolean function using K-map.

$N = f(a, b, c, d) = \pi(0,1,4,5,8,9,11) + d(2,10)$ **(05 Marks)**

b. Define Minterm, Maxterm, Canonical POS. **(03 Marks)**

c. Simplify the given function using Quine McCluskey method.

$f(a, b, c, d) = \Sigma m(7, 9, 12, 13, 14, 15) + d(4, 11)$ **(08 Marks)**

Module-2

3 a. Design a priority encoder for a system with 3 inputs, the middle bit with highest priority encoding to 10, the MSB with next priority encoding to 11, while the LSB with last priority encoding to 01. **(05 Marks)**

b. Realize the following Boolean function using 8 to 1 MUX.

$f(a, b, c, d) = \sum m(0, 1, 5, 6, 7, 10, 15)$ **(03 Marks)**

c. Design a four-bit carry look ahead adder and briefly explain how it is better than parallel adder. **(08 Marks)**

OR

4 a. Realize a 16:1 MUX using 4:1 Multiplexers only. **(03 Marks)**

b. Implement the given function using 74139 dual 2:4 decoder

$f_1(a, b, c) = \pi(1, 3, 5, 7)$ **(03 Marks)**

c. Design two-bit binary comparator and implement with suitable logic gates. **(10 Marks)**

Module-3

5 a. What is the difference between combinational logic and sequential logic? Explain switch debouncer using SR latch with waveforms. **(08 Marks)**

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

OR

6 a. What is race around condition and how this can be eliminated? **(03 Marks)**

b. Obtain the characteristic equation of JK and SR flip-flops. **(05 Marks)**

c. Explain the working of positive edge triggered D flip-flop with neat logic diagram and waveforms. **(08 Marks)**

Module-4

7 a. Explain Universal Shift Register with the help of logic diagram, mode control table and symbol. **(08 Marks)**

b. Explain the working of 4-bit Johnson counter using positive edge triggered D flip-flop, also draw the timing diagram. What is the modulus of this counter? **(08 Marks)**

OR

8 a. Design a synchronous Mod-6 counter using JK flip-flop. **(08 Marks)**

b. Explain the working of 4-bit binary ripple up counter using negative edge triggered flip-flop also draw the timing diagram. **(08 Marks)**

Module-5

9 a. Explain Mealy and Moore models of clocked synchronous sequential circuits. **(06 Marks)**

b. A sequential circuit has one input and one output, the state diagram is as shown in Fig.Q9(b), design the sequential circuit with JK flip-flop.

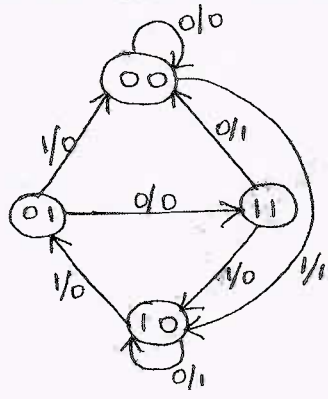

Fig.Q9(b) **(10 Marks)**

OR

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

b. Construct the excitation table, transition table, state table and state diagram for the Moore sequential circuit shown in Fig.Q10(b).

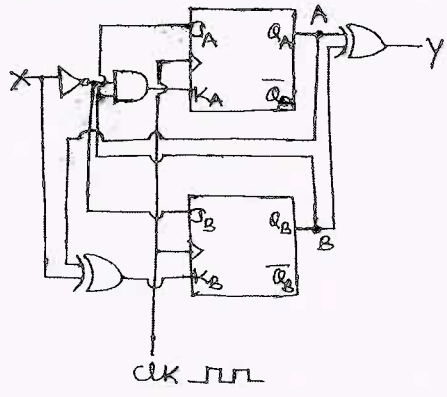

Fig.Q10(b) **(10 Marks)**

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15EC36

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Define electric field intensity and electric flux density and derive the expression for D due to point charge. **(05 Marks)**

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

c. On the line described x = 4m, y = -2m there is uniform charge distribution of density ρ_l = 10nc/m. Find $\bar{E}$ at (4, 2, -1)m. **(03 Marks)**

OR

2 a. State and explain Coulomb's law of force between two point charges in vector form and mention the units of quantities in the force equation. **(08 Marks)**

b. Three point charges Q_1 = -1μc, Q_2 = -2μc and Q_3 = -3μc are placed at the corners of an equilateral triangle of side 1m, find the magnitude of the electric field intensity at the point bisecting the line joining Q_1 and Q_2. **(08 Marks)**

Module-2

3 a. In the region $r \leq 2$, $\bar{D} = \frac{7r^2}{3}\hat{a}r$ and in the region $r > 2$, $\bar{D} = \frac{120}{r^2}\hat{a}r$ in spherical coordinate system calculate the charge density. **(08 Marks)**

b. Derive the expression for continuity of current. **(04 Marks)**

c. Derive Maxwell's first equation in electrostatic. **(04 Marks)**

OR

4 a. Obtain the boundary condition at the interface between a dielectric material and a conductor. **(08 Marks)**

b. State and explain Gauss law in point form. **(04 Marks)**

c. If the potential field $V = 3x^2 + 3y^2 + 2z^3$ volts, find: i) V ii) E iii) $\bar{P}$ at P(-4, 5, 4). **(04 Marks)**

Module-3

5 a. State and explain Biot-Savart's law. **(05 Marks)**

b. Two parallel conducting discs are separated by distance 5mm at z = 0 and z = 5mm. If v = 0 at z = 0 and v = 100v at z = 5mm, find the charge densities on the discs. **(05 Marks)**

c. Using Poisson's equation obtain the expression for the junction potential in a p-n junction. **(06 Marks)**

OR

6 a. Derive Laplace and Poisson's equation starting from the Gauss's law and also write Laplace's equation in Cartesian, cylindrical and spherical coordinate system. **(08 Marks)**

b. Evaluate both sides of the Stoke's theorem for the field $\overline{H} = 6xy\ \hat{a}x - 3y^2\hat{a}y\ A/m$ and the rectangular path around the region $2 \le x \le 5$, $-1 \le y \le 1$, $z = 0$ let the positive direction of $\overline{ds}$ be $\hat{a}_z$. **(08 Marks)**

Module-4

7 a. Obtain the expression for reluctance in a series of magnetic circuits. **(04 Marks)**

b. A point charge of Q = -1.2C has velocity, $\overline{V} = (5\hat{a}x + 2\hat{a}y - 3a\hat{z})m/s$. Find the magnitude of the force exerted on the charge if,

i) $\overline{E} = -18\hat{a}x + 5\hat{a}y - 10\hat{a}z$ v/m

ii) $\overline{B} = -4\hat{a}x + 4\hat{a}y + 3\hat{a}z$ T

iii) Both are present simultaneously. **(08 Marks)**

c. Two infinitely long straight conductors are located at x = 0, y = 0 and x = 0, y = 10m. Both carry current of 10A in positive $\hat{a}_z$ direction. Determine force experienced per meter between them. **(04 Marks)**

OR

8 a. State and explain Lorentz force equation. **(08 Marks)**

b. Find the magnetization in a magnetic material where,

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

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

iii) B = 300μT and $\chi_m = 15$. **(08 Marks)**

Module-5

9 a. Starting from Maxwell's equation derive wave equation in E and H for a uniform plane wave travelling in free space. **(08 Marks)**

b. A homogeneous material has $\epsilon = 2 \times 10^9$ F/m and $\mu = 1.25 \times 10^{-6}$H/m and $\sigma = 0$. Electric field intensity is given as $\overline{E} = 400\cos(10^9 t - kz)\ \hat{a}n$ v/m, if all the fields vary sinusoidally find $\overline{D}$, $\overline{B}$ and $\overline{H}$. Also find k using Maxwell's equations. **(08 Marks)**

OR

10 a. List Maxwell's equation in point form and integral form. **(06 Marks)**

b. A 15GHZ plane wave travelling in a medium has an amplitude E_0 = 20v/m. Find phase velocity, propagation constant and impedance. Assume $\epsilon_r = 2$ and $\mu_r = 5$. **(06 Marks)**

c. 8 watts/m^2 is the pointing vector of a plane wave travelling in free space. What is the average energy density? **(04 Marks)**

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CBCS SCHEME

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18EC32

Third Semester B.E. Degree Examination, Aug./Sept. 2020
Network Theory

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Using source shifting and source transformation techniques, find the value of V_x for the circuit in Fig.Q1(a).

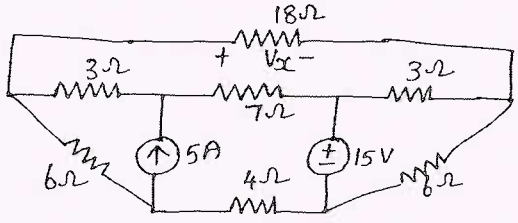

Fig.Q1(a) **(10 Marks)**

b. Use Mesh analysis to the circuit shown in Fig.Q1(b) to find the power supplied by 4V source.

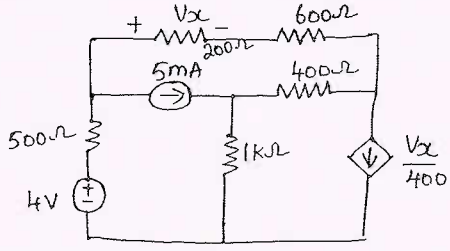

Fig.Q1(b) **(10 Marks)**

OR

2 a. Find the resistance R_{xy} for the circuit shown in Fig.Q2(a) using star–delta transformation.

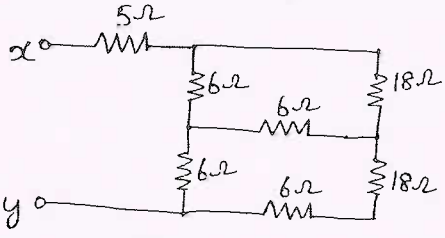

Fig.Q2(a) **(10 Marks)**

b. Find I_1 in the circuit of Fig.Q2(b) using nodal analysis.

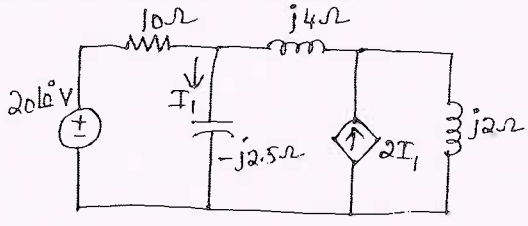

Fig.Q2(b) **(10 Marks)**

Module-2

3 a. Use superposition theorem to find i_0 in the circuit shown in Fig.Q3(a).

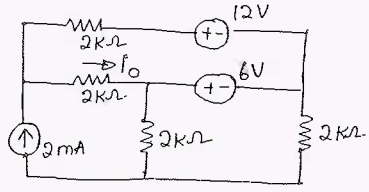

Fig.Q3(a) **(10 Marks)**

b. Find the Thevenin's and Norton's equivalent circuits at the terminals a–b for the circuit in Fig.Q3(b).

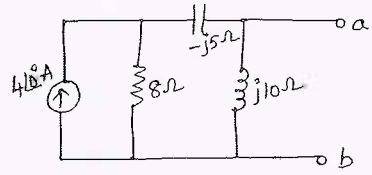

Fig.Q3(b) **(10 Marks)**

OR

4 a. Find the current through $(10 - j3)\Omega$ using Millman's theorem Refer Fig.Q4(a).

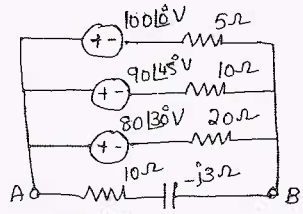

Fig.Q4(a) **(10 Marks)**

b. Find the value of R_L for the network shown in Fig.Q4(b) that results in maximum power transfer. Also find the value of maximum power.

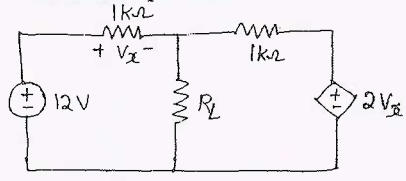

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. For the circuit shown in Fig.Q5(a), the switch K is changed from position 1 to position 2 at t = 0. Steady–state condition having been reached at position 1. Find the values of

$i, \frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$

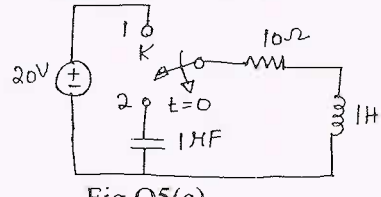

Fig.Q5(a) **(10 Marks)**

b. For the circuit shown in Fig.Q5(b), steady-state is reached with switch K open. At t = 0, the switch is closed. Determine the values $V_a(0^-)$ and $V_a(0^+)$.

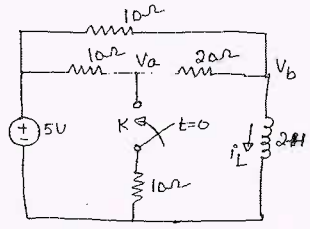

Fig.Q5(b) **(10 Marks)**

OR

6 a. In the network shown in Fig.Q6(a), the switch K is opened at t = 0. Find v, $\frac{dv}{dt}$ and $\frac{d^2v}{dt^2}$ at $t = 0^+$.

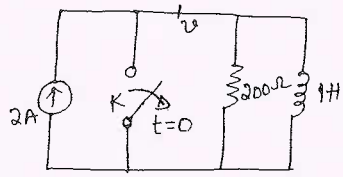

Fig.Q6(a) **(10 Marks)**

b. For the circuit shown in Fig.Q6(b) find :

i) $i(0^+)$ and $v(0^+)$ ii) $\frac{di(0^+)}{dt}$ and $\frac{dv(0^+)}{dt}$ iii) $i(\infty)$ and $v(\infty)$.

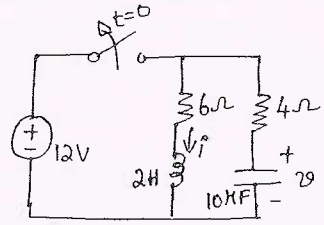

Fig.Q6(b) **(10 Marks)**

Module-4

7 a. State and prove initial–value theorem and final-value theorem. **(10 Marks)**

b. For the circuit of Fig.Q7(b).

i) Write a differential equation for $i_L(t)$ ii) find $I_L(s)$ iii) solve for $i_L(t)$.

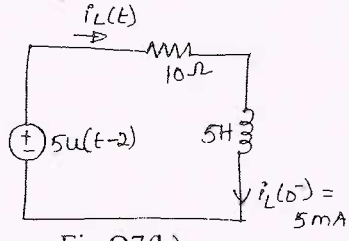

Fig.Q7(b) **(10 Marks)**

OR

8 a. Find the Laplace transform of the periodic signal x(t) shown in Fig.Q8(a).

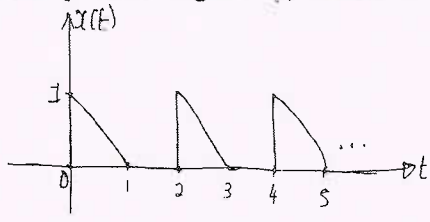

Fig.Q8(a) **(10 Marks)**

b. For the circuit shown in Fig.Q8(b), steady state is reached with the 100V source. At t = 0, switch k is opened. What is the current through the inductor at t = $\frac{1}{2}$ seconds.

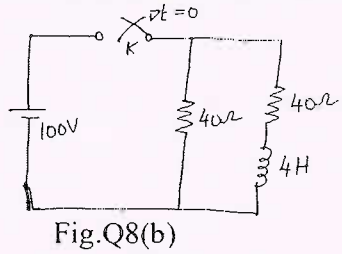

Fig.Q8(b) **(10 Marks)**

Module-5

9 a. Explain h-parameters. Express h-parameters in terms of z-parameters. **(10 Marks)**

b. Find y-parameters for the circuit shown in Fig.9(b).

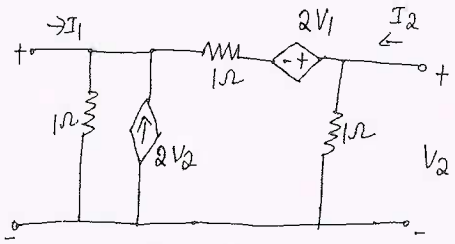

Fig.Q9(b) **(10 Marks)**

OR

10 a. A series RLC circuit has R = 10Ω, L = 0.1H and C = 100μF and is connected across a 200V, variable frequency source, find :

i) Resonant frequency
ii) Impedance at this frequency
iii) Voltage drops across l and c at this frequency
iv) Quality factor
v) Bandwidth. **(07 Marks)**

b. Find the value of R_1 such that the circuit given in Fig.10(b) is resonant.

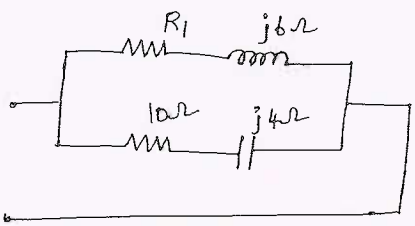

Fig.10(b) **(07 Marks)**

c. A series RLC circuit has R = 10Ω, L = 0.01H and C = 0.01μF and it is connected across 10mV supply. Calculate :

i) f_0 ii) Q_0 iii) Bandwidth iv) f_1 and f_2 v) I_0. **(06 Marks)**

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18EC33

Third Semester B.E. Degree Examination, Aug./Sept.2020
Electronic Devices

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain different types of bonding in solids with the help of neat diagram. **(10 Marks)**

b. With a neat diagram explain direct and indirect semiconductor. **(10 Marks)**

OR

2 a. Explain Electron-Hole pair concept with the help of neat diagram and equations. **(10 Marks)**

b. What is Hall-effect? With suitable diagram and equation explain how does Hall-effect works? **(10 Marks)**

Module-2

3 a. What is tunneling? Explain voltage current characteristic of a tunnel diode with the help of energy band diagram. **(10 Marks)**

b. Mention the differences between Zener effect and Avalanche effect. **(03 Marks)**

c. Explain light emitting diode with a neat sketch. **(07 Marks)**

OR

4 a. Explain qualitative description of current flow at forward and reverse bias junction of a diode. **(10 Marks)**

b. How does photodiode works as a photovoltaic cell explain with the help of diagram? **(10 Marks)**

Module-3

5 a. Explain how BJT acts as a amplifier with the help of equation. **(10 Marks)**

b. Draw the Ebers – Moll model for a PNP transistor and explain its significance. **(10 Marks)**

OR

6 a. Explain how BJT acts as a switch with necessary equations and diagram. **(10 Marks)**

b. Explain specification for switching transistor BJT with suitable diagram. **(04 Marks)**

c. Explain the effect of base narrowing with neat diagram. **(06 Marks)**

Module-4

7 a. Explain the construction and operation of n-JFET with neat diagram and equations. **(06 Marks)**

b. Explain small signal equivalent circuit of JFET with neat diagram. **(06 Marks)**

c. Explain the principle of operation n-channel enhancement mode MOSFET with neat diagram and equations. **(08 Marks)**

OR

8 a. Explain two-terminal MOS structure using energy band diagram. **(10 Marks)**

b. Explain the principle of operation of p-channel enhancement mode MOSFET with neat diagram and equations. **(10 Marks)**

Module-5

9 a. Explain thermal oxidation process with neat diagram. **(10 Marks)**

b. What is metallization process explain with neat diagram by showing all the steps in the fabrication of p-n junctions. **(10 Marks)**

OR

10 a. Explain integration of other circuit elements with suitable diagrams. **(10 Marks)**

b. Explain CMOS process of integration with the help of neat diagram. **(10 Marks)**

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18EC34

Third Semester B.E. Degree Examination, Aug./Sept.2020
Digital System Design

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Place the following equations into proper canonical forms:
i) $f(abc) = a\bar{b} + a\bar{c} + bc$
ii) $f(abcd) = (a + \bar{b})(a + \bar{b} + d)$ **(06 Marks)**

b. Identify all the prime implicants and essential prime implicants of the Boolean function using K-map.
$f(abcd) = \Sigma(0, 1, 2, 5, 6, 7, 8, 9, 10, 13, 14, 15)$ **(06 Marks)**

c. Find the minimal sum and minimal product for the function using K-map.
$f(abcd) = \Sigma(6, 7, 9, 10, 13) + \Sigma d(1, 4, 5, 11, 15)$ **(08 Marks)**

OR

2 a. Represent the number of days in a month for a non-leap year by a truth table, indicating the output of invalid input if any by '0'. **(05 Marks)**

b. Find all the prime implicants of the function using Quine-McClusky method.
$f(abcd) = \Sigma(7, 9, 12, 13, 14, 15) + d(4, 11)$ **(10 Marks)**

c. Simplify the given Boolean equation using K-map:
$f(abcd) = \pi(1, 2, 3, 4, 9, 10) + \pi d(0, 14, 15)$ **(05 Marks)**

Module-2

3 a. Implement full subtractor using 74138 decoder. **(06 Marks)**

b. Design 2-bit magnitude comparator. **(08 Marks)**

c. Implement Boolean function using 8:1 MUX treat a, b, c as select lines:
$f(abcd) = \Sigma(0, 1, 5, 6, 7, 9, 10, 15)$ **(06 Marks)**

OR

4 a. Implement the Boolean function $f(abcd) = \Sigma(0, 2, 4, 5, 7, 9, 10, 14)$ using multiplexers with two 4:1 MUX with variable a, d connected to their select lines in the first level and one 2:1 MUX with variable 'C' connected to its select lines in the second level. **(10 Marks)**

b. Implement Boolean function $f(abcd) = \Sigma(4, 5, 7, 8, 10, 12, 15)$ using 4:1 MUX and external gates:
(i) a, b are connected to select line a_1 a_0 respectively
(ii) c, d are connected to select lines a_1 a_0 respectively. **(10 Marks)**

Module-3

5 a. Explain the operation of switch debouncer using SR latch with the help of circuit and waveforms. **(07 Marks)**

b. Explain Master Slave JK F/F with the help of circuit diagram and waveforms. **(07 Marks)**

c. Design a 4-bit binary ripple-up counter using negative edge triggered JK flip-flop. **(06 Marks)**

OR

6 a. Explain positive edge triggered D-flip-flop with the help of circuit diagram and waveforms. **(08 Marks)**

b. Design a 4-bit universal shift register using positive edge triggered D-flip-flop and multiplexers to operate as indicated below:

Mode select	Operation
00	Hold
01	Right shift
10	Left shift
11	Parallel load

(08 Marks)

c. Write the difference between ripple counter and synchronous counter. **(04 Marks)**

Module-4

7 a. Design 3 bit synchronous up-counter using J-K flip-flop. **(10 Marks)**

b. Design a mod-6 synchronous counter using D-flip flop for the sequence 0-2-3-6-5-1. **(10 Marks)**

OR

8 a. Draw and explain block diagram of Moore model and mealy model. **(06 Marks)**

b. Design a synchronous circuit using positive edge triggered J-K flip-flop with minimal combinational gating to generate the sequence:
0 - 1 - 2 - 0 if input x = 0
0 - 2 - 1 - 0 if input x = 1
Provide an output which goes high to indicate the non-zero state in the sequence 0 – 1 – 2 – 0. **(08 Marks)**

c. Design mod-5 synchronous counter using TF/F. **(06 Marks)**

Module-5

9 a. A sequential circuit has one input (x) and one output (z) the circuit examines groups of four consecutive inputs and produces an output z = 1 if the input sequence 0101 or 1001 occurs. The circuit resets after every four inputs. Find the mealy state graph typical sequence is 0101 0010 1001 0100. **(10 Marks)**

b. Explain with block diagram design and serial Adder with accumulator. **(10 Marks)**

OR

10 a. Write a short note on 4 × 4 bit binary parallel multiplication. **(10 Marks)**

b. List the guide lines for construction of state graphs. **(10 Marks)**

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18EC35

Third Semester B.E. Degree Examination, Aug./Sept.2020
Computer Organization and Architecture

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the operation of computer with neat block diagram. **(10 Marks)**

b. Explain computer basic performance equation. **(04 Marks)**

c. Explain following with an example : i) Three – address instruction ii) Two – address instruction iii) One – address instruction. **(06 Marks)**

OR

2 a. Explain Single –BUS structure in computer. **(06 Marks)**

b. Explain system software functions in computer. **(06 Marks)**

c. What is Operating system? Explain user program and OS routine sharing the processor. **(08 Marks)**

Module-2

3 a. Explain Big–Endian and Little–Endian with neat diagram. **(08 Marks)**

b. Explain memory operations with examples. **(04 Marks)**

c. Explain condition codes with examples. **(08 Marks**

OR

4 a. Discuss following addressing modes with example : i) Immediate ii) Register iii) Direct iv) Indirect v) Index. **(10 Marks)**

b. What are assembler directive? Explain any five assembler directives. **(10 Marks)**

Module-3

5 a. With a neat diagram, explain how to interface printer to the processor. **(10 Marks)**

b. Define Interrupt. Point out and explain the various ways of enabling and disabling interrupts. **(10 Marks)**

OR

6 a. Explain the following method of handling interrupts from multiple devices. i) Daisy chain method ii) Priority structure. **(10 Marks)**

b. Explain operation of DMA with neat diagram. **(10 Marks)**

Module-4

7 a. Explain internal organization of 16 × 8 memory chip. **(10 Marks)**

b. Discuss a single–transistor dynamic memory cell. **(06 Marks)**

c. Write a note on Virtual Memory. **(04 Marks)**

OR

8 a. Draw and explain the internal organization of 2M × 8 asyndronous DRAM Chip. **(08 Marks)**

b. Describe the principles of magnetic disk. **(06 Marks)**

c. What is mapping? Explain set associative cache mapping techniques. **(06 Marks)**

Module-5

9 a. Discuss with neat diagram, the single bus organization of data path inside a processor. **(10 Marks)**

b. What are the action required to execute a complete instruction ADD(R3), R1. **(10 Marks)**

OR

10 a. Draw and explain multiple bus organization of CPU. **(10 Marks)**

b. Draw and explain organization of the control unit to allow conditional branching in the microprogram. **(10 Marks)**

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18EC36

Third Semester B.E. Degree Examination, Aug./Sept.2020
Power Electronics and 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 power electronics. Mention the different power electronic circuits. **(04 Marks)**

b. With the help of the static V-I characteristics, explain the three modes of operation of the SCR. **(10 Marks)**

c. Explain class-B commutation with necessary circuit diagram and waveforms. **(06 Marks)**

OR

2 a. Define commutation. Differentiate between natural and forced commutation. **(06 Marks)**

b. Explain the gate characteristics of the SCR. **(04 Marks)**

c. Explain the working of a UJT fixing circuit for a full wave rectifier using SCR with necessary circuit diagram and waveforms. **(10 Marks)**

Module-2

3 a. Differentiate between uncontrolled and controlled rectifier. **(04 Marks)**

b. Explain the operation of single-phase full converter with resistive load with necessary circuit diagram and waveforms. Derive the expression for the average and rms output voltage. **(10 Marks)**

c. Explain the operation of step-up chopper. **(06 Marks)**

OR

4 a. With necessary circuit diagram and waveforms, explain the working of single phase half wave converter with inductive load. **(10 Marks)**

b. Explain the working of step-down chopper. **(06 Marks)**

c. Explain the effect of freewheeling diode. **(04 Marks)**

Module-3

5 a. Explain the working of single phase full bridge inverter with necessary circuit diagram and waveforms. **(08 Marks)**

b. Define the following terms as applied to an electronic instrument:
i) Accuracy
ii) Precision
iii) Resolution **(06 Marks)**

c. Sketch and explain the operation of a multirange ammeter. **(06 Marks)**

OR

6 a. Explain the working of isolated forward SMPS with necessary circuit diagram. **(08 Marks)**

b. Calculate series connected multiplier resistance with D'Arsonal movement with an internal resistance of 50Ω and full scale deflection current of 2mA when converted into a multirange d.c. voltmeter with ranges from 0-20V, 0-40V, 0-150V and 0-200V. **(08 Marks)**

c. Briefly explain the Gross error and absolute error with an example. **(04 Marks)**

Module-4

7 a. Discuss the operation of dual slope integrating type DVM with the help of block diagram. **(08 Marks)**

b. Explain an unbalanced Wheatstone bridge circuit. Determine the amount of deflection due to unbalance of Wheatstone bridge. **(08 Marks)**

c. An inductance comparison bridge is used to measure inductive impedance at a frequency of 5Hz. The bridge constants at balance are $L_3 = 10mH$, $R_1 = 10K\Omega$, $R_2 = 40K\Omega$, $R_3 = 100K\Omega$. Find the equivalent series circuit of an unknown impedance. **(04 Marks)**

OR

8 a. Explain the working of a digital frequency meter with the help of a block diagram. **(10 Marks)**

b. Explain the operation of the Wein's bridge with a neat circuit diagram. Derive an expression for the frequency. **(07 Marks)**

c. If the three arms of a Wheatstone's bridge have the resistances $R_1 = 2K\Omega$, $R_2 = 10K\Omega$ and $R_3 = 40K\Omega$. Find the unknown resistance. **(03 Marks)**

Module-5

9 a. Explain the construction, working principle and operation of LVDT. Show the characteristics curve. **(10 Marks)**

b. Mention the advantages and limitations of thermistor. **(04 Marks)**

c. Briefly explain the analog weight scale. **(06 Marks)**

OR

10 a. Explain the structure and operation of programmable logic controller. **(07 Marks)**

b. Explain the operation of resistive position transducer. **(05 Marks)**

c. Derive an expression for the gauge factor of bonded resistance wire strain gauge. **(08 Marks)**

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17EC33

Third Semester B.E. Degree Examination, Aug./Sept.2020
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 expressions for Z_i , Z_o, A_v and A_I for common emitter fixed bias configuration using hybrid equivalent model. **(10 Marks)**

b. Draw and explain the hybrid-π model of transistor in CE configuration mentioning significance of each component in model. **(06 Marks)**

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

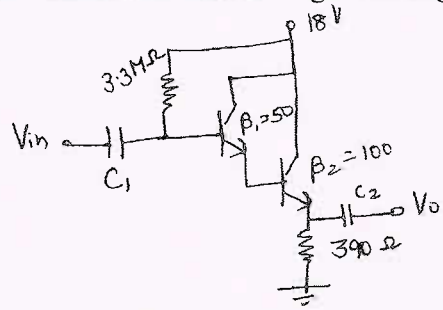

Fig.Q1(c) **(04 Marks)**

OR

2 a. Derive the expression for Z_i, Z_o and A_v for emitter follower configuration using r_e model. **(10 Marks)**

b. Define h parameters and derive h parameters model of CE-BJT. **(10 Marks)**

Module-2

3 a. Explain the construction and working principle of n-channel JFET and draw the characteristics. **(08 Marks)**

b. Derive an expression for Z_i, Z_o and A_v of FET self bias configuration with bypassed R_S. **(08 Marks)**

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

OR

4 a. Draw the JFET common gate configuration circuit. Derive Z_i, Z_o and A_v using small signal model. **(10 Marks)**

b. The fixed bias configuration of Fig.Q4(b) has an operating point defined by $V_{GSQ} = -2V$ and $I_{DQ} = 5.625$ mA with $I_{DSS} = 10$ mA and $V_P = -8V$. Determine : (i) g_m (ii) r_d (iii) Z_i (iv) Z_o (v) A_V

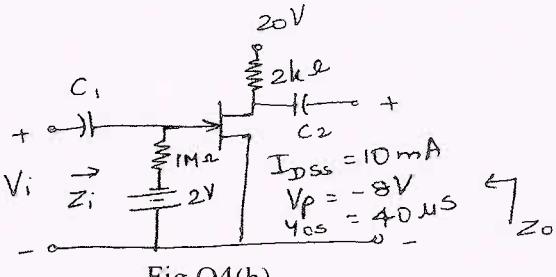

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. Describe Miller effect and derive an equation for miller input and output capacitance. **(10 Marks)**

b. Explain high-frequency response of FET amplifier and derive expression for cut off frequencies defined by input and output circuits (f_{Ii} and f_{Io}). **(10 Marks)**

OR

6 a. Determine the lower cut off frequencies for the voltage divider bias BJT amplifier with C_S = 10 μf, C_C = 1 μf, C_E = 20 μf, R_S = 1 kΩ, R_1 = 40 kΩ, R_2 = 10 kΩ, R_E = 2 kΩ, R_0 = 4 kΩ, R_L = 2.2 kΩ, β = 100, r_0 = αΩ, V_{CC} = 20 V. **(10 Marks)**

b. Obtain the expressions for overall lower and higher cut-off frequencies for a multistage amplifier. **(10 Marks)**

Module-4

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

b. Draw the circuit diagram of uni-junction oscillator and explain the principle of operation and draw the characteristic curve. **(08 Marks)**

c. The following component values are given for the Wein-bridge oscillator of the circuit of $R_1 = R_2 = 33$ kΩ, $C_1 = C_2 = 0.001$μb, $R_3 = 47$ kΩ, $R_4 = 15$ kΩ.

(i) Will this circuit oscillate?

(ii) Calculate the resonant frequency. **(06 Marks)**

OR

8 a. Briefly explain characteristics of negative feedback amplifier. **(08 Marks)**

b. Determine the voltage gain, input and output impedance with feedback for voltage series feedback having A = –100, R_1 = 10 kΩ and R_0 = 20 kΩ for feedback of β = –0.1. **(04 Marks)**

c. Explain characteristics of quartz crystal. With a neat diagram, explain the crystal oscillator in parallel resonant mode. **(08 Marks)**

Module-5

9 a. Explain series fed class A power amplifier. Show that its maximum conversion η is 25%. **(10 Marks)**

b. For a class B amplifier providing a 20 V peak signal to a 16Ω load (speaker) and a power supply of V_{CC} = 30 V. Determine the input power, output power and circuit η. **(10 Marks)**

OR

10 a. Derive an expression for second harmonic distortion. **(05 Marks)**

b. Define voltage regulator. Explain the series voltage regulator using transistor. **(08 Marks)**

c. Derive an expression for conversion gain of class B push pull amplifier with neat circuit diagram and waveform. **(07 Marks)**

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CBCS SCHEME

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17EC34

Third Semester B.E. Degree Examination, Aug./Sept.2020
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 the Boolean output for a single output 2 which is to be true when the input variables a and b are true and when b is false, but a and c are true. Implement the Boolean expression using gates. **(04 Marks)**

b. Convert the given Boolean function :

(i) $f_1 = f(a, b, c, d) = (a + \bar{b} + c)(\bar{a} + d)$ into maxterm canonical form

(ii) $f_2 = f(w, x, y, z) = \bar{w}x + y\bar{z}$ into minterm canonical form. **(08 Marks)**

c. Identify the prime implicants and essential prime implicants for the following expression.

(i) $f(a, b, c, d) = \Sigma(1, 5, 7, 8, 9, 10, 11, 13, 15)$

(ii) $f(a, b, c, d) = \pi(0, 2, 3, 8, 9, 10, 12, 14)$ **(08 Marks)**

OR

2 a. Find the minimal sum and minimal product for the following Boolean function using Kmap.

$Y = f(u, v, w, x) = \Sigma(1, 5, 7, 9, 13, 15) + \Sigma d(8, 10, 11, 14)$ **(08 Marks)**

b. Simplify the following expression using Quine McCluskey method and find the minimal sum using PI reduction table.

$f(a, b, c, d) = \Sigma(2, 3, 4, 5, 13, 15) + \Sigma d(8, 9, 10, 11)$ **(12 Marks)**

Module-2

3 a. Design a circuit that will find the 2's complement of a three bit binary number. Draw the logic diagram for the reduced equations. **(08 Marks)**

b. Draw the logic diagram, function table and IEEE logic symbol of a 2 to 4 line decoder in 74139 IC. Realize the Boolean function $X = f(a, b, c) = (0, 3, 5, 6)$ using 74139. **(12 Marks)**

OR

4 a. Realize the following Boolean function using 4:1 multiplexer with a, b as select lines.

$f(a, b, c, d) = \Sigma(0, 3, 4, 5, 7, 9, 13, 15)$ **(06 Marks)**

b. Design a BCD adder using 7483. **(06 Marks)**

c. Design a two bit magnitude comparator. **(08 Marks)**

Module-3

5 a. Explain the working of a SR latch as a switch debouncer with necessary circuit and timing diagram. **(06 Marks)**

b. Explain the working of master slave JK flip flop with the help of a logic diagram, function table, logic symbol and timing diagram. **(10 Marks)**

c. Explain race around condition and how it is overcome. **(04 Marks)**

OR

6 a. Explain with timing diagram for (i) SR flip flop and (ii) D flip flop. **(06 Marks)**

b. Derive the characteristic equation for JK and T flip flop. **(06 Marks)**

c. With a neat logic diagram, explain the working of positive edge triggered D flip flop. Also draw the timing diagram. **(08 Marks)**

Module-4

7 a. Design a register using four multiplexer and positive edge triggered D flip flop having the behavior specified in the table below.

S_1	S_0	Register operation
0	0	Hole
0	1	Synchronous clear
1	0	Complement contents
1	1	Circular shift right.

(08 Marks)

b. Illustrate the operation of 4-bit binary ripple counter using positive edge triggered D flip flop without a count enable line. **(08 Marks)**

c. Design a MOD 7 twisted ring counter. Write the logic diagram and counting sequence. **(04 Marks)**

OR

8 a. Design a Mod 6 counter whose counting sequence is 000, 001, 100, 110, 111, 101, 000.... by using positive edge triggered JK flip flop. **(10 Marks)**

b. Show how an 8 bit synchronous binary counter can be constructed from two 4 bit synchronous binary counters. **(04 Marks)**

c. Explain PIPO and PISO shift register with relevant logic diagrams. **(06 Marks)**

Module-5

9 a. Explain the Mealy model and Moore model of a clocked synchronous sequential network. **(08 Marks)**

b. Give the logic diagram shown in Fig.Q9(b).
(i) Derive the excitation and output equations.
(ii) Write the next state equations
(iii) Construct a state transition table
(iv) Draw the state diagram.

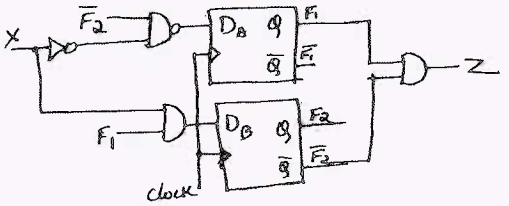

Fig.Q9(b) **(12 Marks)**

OR

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

b. Design a sequential circuit for a state diagram shown in Fig.Q10(b) using JK flip flop.

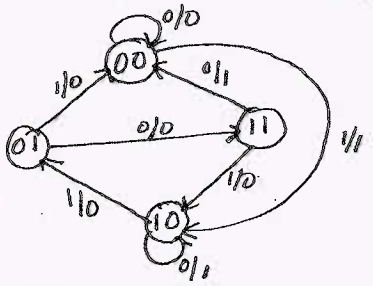

Fig.Q10(b) **(10 Marks)**

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CBCS SCHEME

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17EC35

Third Semester B.E. Degree Examination, Aug./Sept. 2020
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. Briefly explain the classification of electrical networks. **(08 Marks)**

b. Find the current through 2 Ω resistor for the network shown in the Fig. Q1 (b) by making use of source transformation technique. **(06 Marks)**

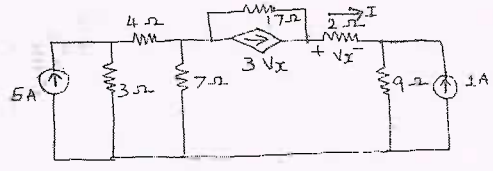

Fig. Q1 (b)

c. Three impedances are connected in delta, obtain the star equivalent of one network. **(06 Marks)**

OR

2 a. Using mesh current method, find the power delivered by the dependent voltage source in the circuit shown in Fig. Q2 (a). **(10 Marks)**

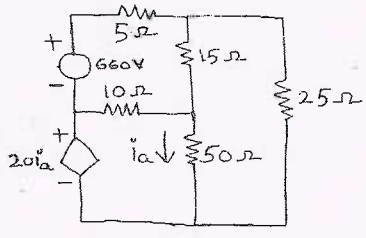

Fig. Q2 (a)

b. Find the current i_1 for the circuit shown in Fig. Q2 (b) using nodal analysis. **(10 Marks)**

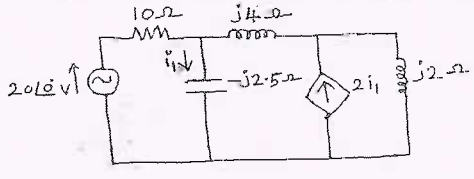

Fig. Q2 (b)

Module-2

3 a. State and explain reciprocity theorem. **(05 Marks)**

b. For the circuit shown in Fig. Q3 (b), find the voltage Vx using super position theorem. **(08 Marks)**

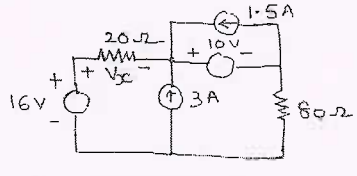

Fig. Q3 (b)

c. Find the voltage across the load of 1 KΩ connected between the terminals a and b, for the circuit shown in Fig. Q3 (c) using Millman's theorem. **(07 Marks)**

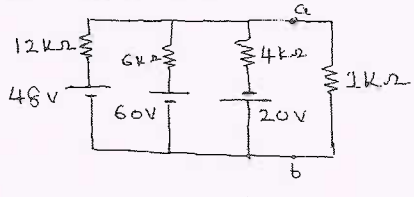

Fig. Q3 (c)

OR

4 a. State and prove Thevinin's theorem. **(05 Marks)**

b. Find the value of R_L for the circuit shown in Fig. Q4 (b) for which the power transferred to the loading maximum and also find the maximum power transferred. **(07 Marks)**

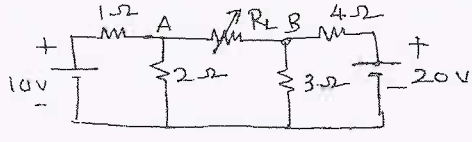

Fig. Q4 (b)

c. For the circuit shown in Fig. Q4 (c), find the Norton's equivalent circuit across the terminal's x and y. **(08 Marks)**

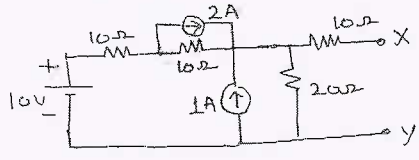

Fig. Q4 (c)

Module-3

5 a. For the network shown in Fig. Q5 (a), the switch is moved from position a to b at t = 0 and steady state is reached at position a. Find i, $\frac{di}{dt}$, $\frac{d^2i}{dt^2}$ at $t = 0^+$. Assume that the capacitor is initially uncharged. **(08 Marks)**

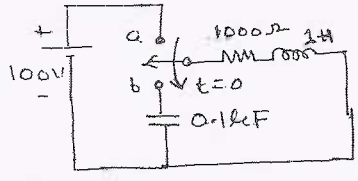

Fig. Q5 (a)

b. In the network shown in Fig. Q5 (b), the switch is closed at t = 0 with the capacitor uncharged. Find the values of i, $\frac{di}{dt}$, $\frac{d^2i}{dt^2}$ at $t = 0^+$. **(06 Marks)**

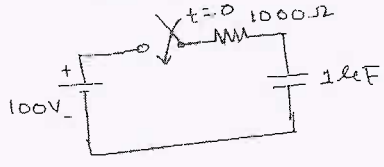

Fig. Q5 (b)

c. In the network shown in Fig. Q5 (c), find $i_1(0^+)$ and $i_L(0^+)$. The circuit is in steady state for t < 0. **(06 Marks)**

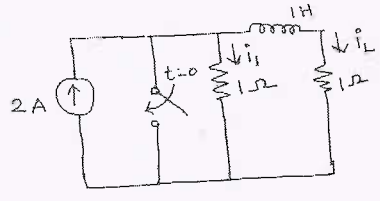

Fig. Q5 (c)

OR

6 a. Obtain the Laplace transform of (i) Unit step function (ii) Unit Ramp function (iii) Unit impulse function. **(09 Marks)**

b. Find the Laplace transform of the periodic function shown in Fig. Q6 (b). **(07 Marks)**

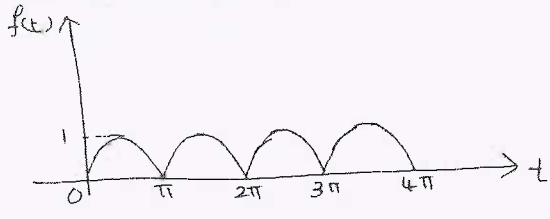

Fig. Q6 (b)

c. Find the Laplace transform of the non-sinusoidal periodic waveform shown in Fig. Q6 (c). **(04 Marks)**

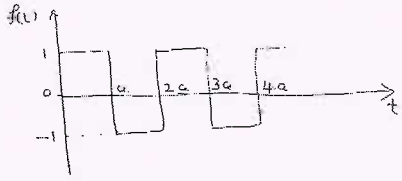

Fig. Q6 (c)

Module-4

7 a. What is resonance? Derive an expression for half power frequencies in series RLC circuit. **(08 Marks)**

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

c. A series RLC circuit has a resistance of 10 Ω, an inductance of 0.3 H and a capacitance of 100 μF. The applied voltage is 230 V. Find

(i) The resonant frequency and quality factor.
(ii) Current at resonance and currents at lower and upper cutoff frequencies.
(iii) Voltage across the inductor and capacitor at resonance.
(iv) Band width. **(09 Marks)**

OR

8 a. For the circuit shown in Fig. Q8 (a), derive an expression for resonant frequency. **(07 Marks)**

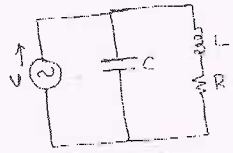

Fig. Q8 (a)

b. Show that a two branch parallel resonant circuit is resonant at all frequencies. If $R_L = R_C = \sqrt{\frac{L}{C}}$, where R_L = resistance in inductor branch, R_C = Resistance in the capacitor branch. **(07 Marks)**

c. An inductance coil of resistance 6 Ω and inductance 1 mH is connected in parallel with another branch consisting of a resistance of 4 Ω with a capacitance of 20 μF. Find (i) The resonant frequency (ii) Current at resonance. The applied voltage is 200 V. **(06 Marks)**

Module-5

9 a. Derive the z parameters in terms of y parameters. **(08 Marks)**

b. Find y and z parameters for the network shown in Fig. Q9 (b). **(12 Marks)**

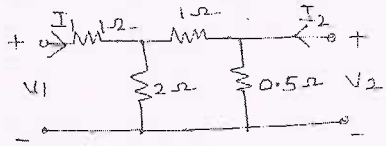

Fig. Q9 (b)

OR

10 a. Derive y parameters in terms of ABCD parameters. **(08 Marks)**

b. Determine the h parameters, for the circuit shown in Fig. Q10 (b). **(06 Marks)**

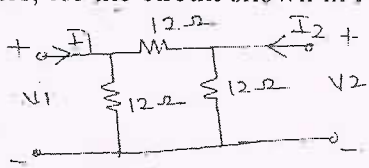

Fig. Q10 (b)

c. Find the ABCD parameters, for the circuit shown in Fig.Q10 (c). **(06 Marks)**

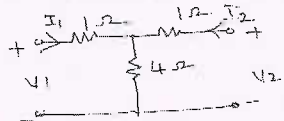

Fig. Q10 (c)

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CBCS SCHEME

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17EC36

Third Semester B.E. Degree Examination, Aug./Sept. 2020
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 vector form. **(05 Marks)**

b. Define electric field intensity and electric flux density. **(05 Marks)**

c. Let a point charge $Q_1 = 25nC$ be located at $P_1(4, -2, 7)$ and a charge $Q_2 = 60nC$ be at $P_2(-3, 4, -2)$.

i) If $\epsilon = \epsilon_0$, find electric field intensity (E) at $P_3(1, 2, 3)$

ii) At what point on the Y axis is $E_X = 0$. **(10 Marks)**

OR

2 a. Given a 60μC point charge located at the origin, find the total electric flux passing through

i) That portion of the sphere r = 26cm bounded by $0 < \theta < \frac{\pi}{2}$ and $0 < \phi < \frac{\pi}{2}$.

ii) The closed surface defined by ρ = 26cm and z = ± 26cm. **(07 Marks)**

b. Derive an expression for electric field intensity at a distant point due to infinite line charge distribution. **(08 Marks)**

c. A uniform volume charge density of $80\mu C/m^3$ is present throughout the region 8mm < r < 10mm. Let $\rho_r = 0$ for 0 < r < 8mm.

i) Find the total charge inside the spherical surface r = 10mm

ii) Find D_r at r = 10mm

iii) If there is no charge for r > 10mm, find D_r at r = 20mm. **(05 Marks)**

Module-2

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

b. Determine the work done in carrying a 2μC charge from (2, 1, –1) to (8, 2, –1) in the field $\vec{E} = ya_x + xa_y$ along

i) the parabola $x = 2y^2$

ii) the hyperbola $x = \frac{8}{(7-3y)}$. **(08 Marks)**

c. Determine an expression for the volume charge density associated with each $\vec{D}$ field following :

i) $\vec{D} = \frac{4xy}{z}a_x + \frac{2x^2}{z}a_y + \frac{2x^2y}{z^2}a_z$

ii) $\vec{D} = z\sin\phi a_\rho + z\cos\phi a_\phi + \rho\sin\phi a_z$

iii) $\vec{D} = \sin\theta\sin\phi a_\gamma + \cos\theta\sin\phi a_\theta + \cos\phi a_\phi$. **(07 Marks)**

OR

4 a. Two uniform line charges, 8nC/m each, are located at x= 1, z = 2 and at x = –1, y = 2 in free space. If the potential at the origin is100V, find V at P(4, 1, 3). **(08 Marks)**

b. Within the cylinder $\rho = 2, 0 < z < 1$, the potential is given by $v = 100 + 50\rho + 150\rho \sin \phi V$.

Find V, $\vec{E}$, $\vec{D}$ and ρ_V at P(1, 60°, 0.5) in free space. **(08 Marks)**

c. Derive equation of continuity. **(04 Marks)**

Module-3

5 a. Derive Poisson's and Laplaces equation. **(05 Marks)**

b. A uniform volume charge has constant density $\rho_V = \rho_0$ C/m^3, and fills the region $r < a$, in which permittivity 'ϵ' is assumed. A conducting spherical shell is located at r = a and is held at ground potential. Find :

i) the potential everywhere

ii) the electric field intensity, $\vec{E}$ everywhere. **(09 Marks)**

c. Explain Biot-Savart's law. **(06 Marks)**

OR

6 a. State and prove Stoke's theorem. **(05 Marks)**

b. A solid conductor of circular cross-section with a radius of 5mm has a conductivity that varies with radius. The conductor is 20m long, and there is a potential difference of 0.1V DC between its two ends. Within conductor, $H = 10^5\rho^2 a_\phi$ A/m.

i) Find 'σ' conductivity as a function ρ charge density

ii) What is the resistance between the two ends? **(08 Marks)**

c. A straight conductor of length '2L' carrying a current 'I' coincides with z direction. Obtain an expression for vector magnetic potential at a point in a bisecting plane of the conductor.

Also find magnetic flux density $\vec{B}$ at that point. **(07 Marks)**

Module-4

7 a. The point charge Q = 18nC has a velocity of 5×10^6m/s in the direction :

$a_V = 0.60a_x + 0.75a_y + 0.30a_z$

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

i) $\vec{B} = -3a_x + 4a_y + 6a_z$mT

ii) $\vec{E} = -3a_x + 4a_y + 6a_z$kV/m

iii) $\vec{B}$ and $\vec{E}$ acting together. **(07 Marks)**

b. Obtain an expression for the force between differential current elements. **(07 Marks)**

c. Write a note on magnetic boundary conditions. **(06 Marks)**

OR

8 a. Find the magnetic field intensity 'H' inside a magnetic material, given the following :

i) $M = 100$ A/m, $\mu = 1.5 \times 10^{-5}$ H/m

ii) $B = 200\mu T$, $\chi_m = 15$. **(06 Marks)**

b. Derive an expression for energy stored in the magnetic field. **(06 Marks)**

c. A current element $I_1dl_1 = 10^{-4}a_z$ A.m is located at $P_1(2, 0, 0)$ another current element $I_2dl_2 = 10^{-6}[a_x - 2a_y + 3a_z]$ A.m is located at P_2 (--2, 0, 0) and both are in free space :

i) Find force exerted on I_2dl_2 by I_1dl_1

ii) Find force exerted on I_1dl_1 by I_2dl_2. **(08 Marks)**

Module-5

9 a. Define Faraday's law. Derive Maxwell's equation from Faraday's law in point form. **(07 Marks)**

b. Let $\mu = 3 \times 10^{-5}$H/m, $\epsilon = 1.2 \times 10^{-10}$F/m, and $\sigma = 0$ everywhere. If $\vec{H} = 2\cos(10^{10}t - \beta x)a_z A/m$, use Maxwell's equations to obtain expressions for $\vec{D}$ and $\vec{E}$ **(06 Marks)**

c. Derive wave equations in free space for a uniform plane wave. **(07 Marks)**

OR

10 a. State and prove Poynting's theorem. **(08 Marks)**

b. Discuss wave propagation in good conductor. **(07 Marks)**

c. A certain lossless material has $\mu_r = 4$ and $\epsilon_r = 9$. A 10MHz uniform plane wave is propagating in the α_y direction with $E_{x_0} = 400V/m$ and $E_{y_0} = E_{z_0} = 0$ at P(0.6,0.6,0.6) at $t = 60$ns. Find 'β', λ, v_p and η. **(05 Marks)**

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CBCS SCHEME

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15EC32

Third Semester B.E. Degree Examination, Aug./Sept. 2020
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 an expression for A_v, Z_i and Z_0 for CE fixed bias using hybrid equivalent model. **(08 Marks)**

b. With a neat circuit explain hybrid – π model for a transistor in CE configuration. **(08 Marks)**

OR

2 a. Derive an expression for Z_i, Z_0 and A_v for emitter – Follower configuration using r_e model. **(08 Marks)**

b. For the network shown in Fig Q2(b). Determine :
i) r_e ii) Z_i iii) Z_0 ($r_0 = \alpha\Omega$) iv) A_V ($r_0 = \alpha\Omega$) v) A_i ($r_0 = \alpha\Omega$).

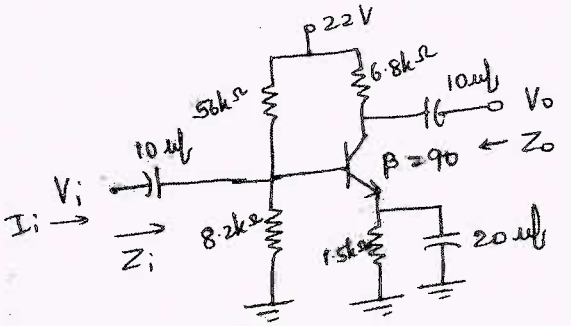

Fig Q2(b) **(08 Marks)**

Module-2

3 a. Derive an expression for Z_i, Z_0 and A_v of FET self bias configuration with bypassed R_s. **(08 Marks)**

b. Explain the construction and working principle of n-channel depletion type MOSFET and draw the characteristic curves. **(08 Marks)**

OR

4 a. The fixed bias configuration of Fig Q4(a) has an operating point defined by $V_{GSQ} = -2V$ and $I_{DQ} = 5.625mA$ with $I_{DSS} = 10mA$ and $V_P = -8V$. Determine :
i) g_m ii) r_d iii) Z_i iv) Z_0 v) A_V.

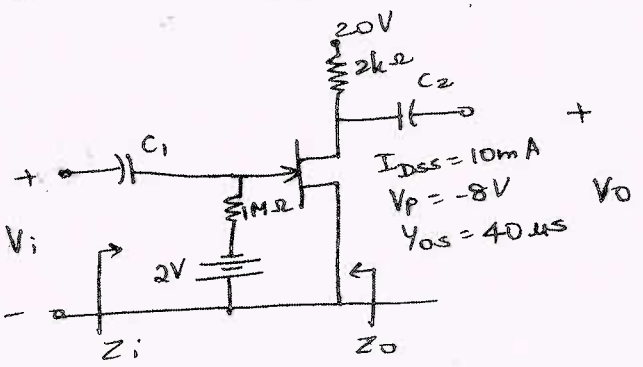

Fig Q4(a) **(08 Marks)**

b. Draw the JFET common drain configuration circuit. Derive Z_i, Z_0 and A_v using small signal model. **(08 Marks)**

Module-3

5 a. The i/p power to a device is 10,000w at a voltage of 1000V. The output power is 500W and the output impedance is 20Ω.
   i) Find power gain in db
   ii) Find voltage gain in db
   iii) Find input impedance. **(06 Marks)**

b. Describe Miller's effect and derive an equation for Miller input and output capacitance. **(10 Marks)**

OR

6 a. Explain high frequency response of FET amplifier. **(06 Marks)**

b. Determine A_v, Z_i, A_{vs}, F_{LS} for the low frequency response of the BJT amplifier circuit shown in Fig Q6(b). Assume $r_0 = \alpha$.

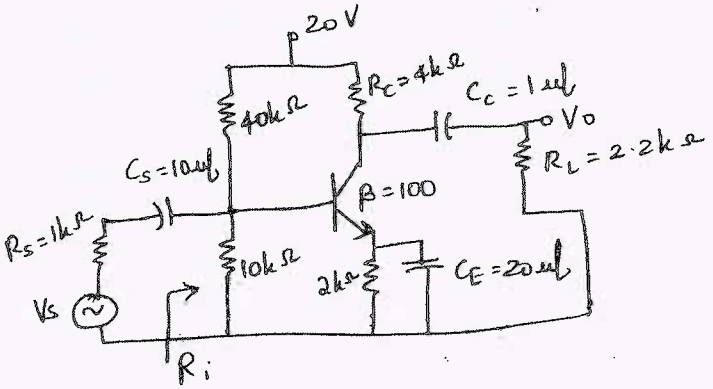

Fig Q6(b) **(10 Marks)**

Module-4

7 a. Explain with neat circuit diagram the operation of transistor Colpitt's oscillator. **(08 Marks)**

b. What are the effects of negative feedback in an amplifier? Show how bandwidth of an amplifier increases with negative Feedback. **(08 Marks)**

OR

8 a. Mention the types of Feedback connections. Draw their block diagrams indicating i/p and o/p signal. **(08 Marks)**

b. With a neat circuit and waveforms, explain the working operation of UJT relaxation oscillator. **(08 Marks)**

Module-5

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

b. The Following distortion readings are available for a power amplifier $D_2 = 0.1$, $D_3 = 0.02$, $D_4 = 0.01$ with $I_1 = 4A$, $R_c = 8\Omega$.
   i) Calculate the THD
   ii) Determine the fundamental power component
   iii) Calculate the total power. **(06 Marks)**

OR

10 a. Explain series voltage regulator using transistor. **(08 Marks)**

b. Explain series Fed class A power amplifier. Show that its maximum conversion η is 25%. **(08 Marks)**

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CBCS SCHEME

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15EC33

Third Semester B.E. Degree Examination, Aug./Sept.2020
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. i) Convert the following expression in standard SOP and also represent in decimal notation form f(A, B, C) = AC + BC + AB

ii) Convert the following expression in standard POS form and also represent in decimal notation f(A, B, C) = (A + B) (B + C) (A + C) **(08 Marks)**

b. Reduce the following using K-map and draw the logic diagram using NAND gates for the reduced expression: f(a, b, c, d) = $\sum$m (6, 7, 9, 10, 13) + dc(1, 4, 5, 11, 15) **(08 Marks)**

OR

2 a. Reduce the following function using K-map technique and Implement using NOR-gates f(a, b, c, d) = πM (0, 3, 4, 7, 8, 10, 12, 14) + dc (2, 6) **(06 Marks)**

b. Simplify the following using Quine-M_C Cluskey method and draw the logic diagram using NAND gates for the reduced expression:
f(w, x, y, z) = $\sum$m (1, 2, 3, 5, 9, 12, 14, 15) + $\sum$dc (4, 8, 11) **(10 Marks)**

Module-2

3 a. Write and explain 2 to 4 decoder. **(06 Marks)**

b. Implement the following functions using ICS 74 × 138
f_1 (a, b, c, d) = $\sum$m (0, 4, 8, 10, 14, 15)
f_2 (a, b, c, d) = $\sum$m (3, 7, 9, 13) **(10 Marks)**

OR

4 a. Implement the following Boolean function with 8:1 MUX
F(A, B, C, D) = $\sum$m (0, 2, 6, 10, 11, 12, 13) + dc (3, 8, 14) **(08 Marks)**

b. Explain the look ahead carry generator. **(08 Marks)**

Module-3

5 a. Write and explain JK Flip-Flop by Truth table and logic diagram. **(06 Marks)**

b. Write the excitation table of JK Flip-Flop. **(04 Marks)**

c. Write the characteristic equation of SR Flip-Flop. **(06 Marks)**

OR

6 a. Explain the Master-slave JKFF with logic diagram and truth table. **(10 Marks)**

b. Explain the Negative Edge triggered JK Flip-Flop. **(06 Marks)**

Module-4

7 a. Write and explain parallel in serial out shift register by writing logic diagram and timing diagram. **(10 Marks)**

b. Write and explain 3-bit asynchrous counter. **(06 Marks)**

OR

8 a. Design a mod-6 synchronous counter using JK Flip-Flop. **(10 Marks)**

b. Write and explain counter applications. **(06 Marks)**

Module-5

9 a. Write the difference between Moore model and Mealy model. **(06 Marks)**

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

OR

10 a. Design a clocked sequence circuit that operates according to the state diagram shown in Fig.Q.10(a). Implement the circuit using D-Flip-Flop.

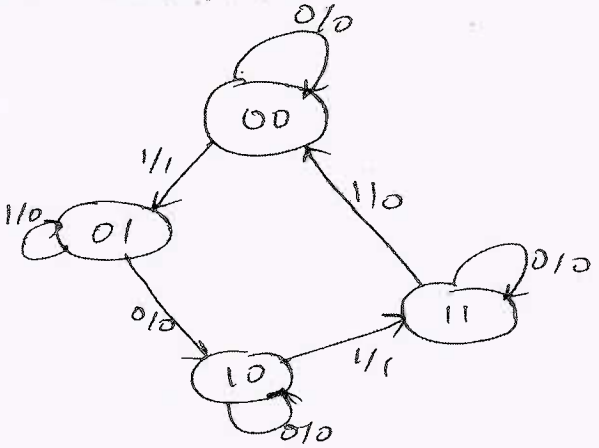

Fig.Q.10(a) State diagram

(08 Marks)

b. Obtain the transition table for the given state diagram shown in Fig.Q.10(b) and design the sequential network using JK Flip-Flop.

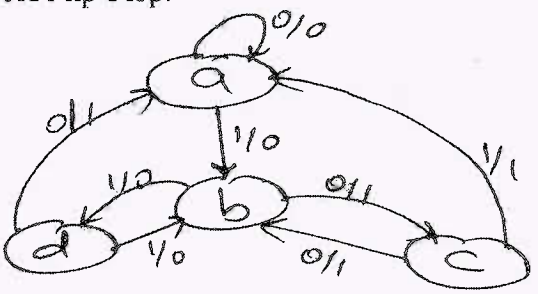

Fig.Q.10(b) State diagram

(08 Marks)

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CBCS SCHEME

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15EC34

Third Semester B.E. Degree Examination, Aug./Sept.2020
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 circuit shown in Fig.Q1(a) into single voltage source with series resistance between terminals A and B.

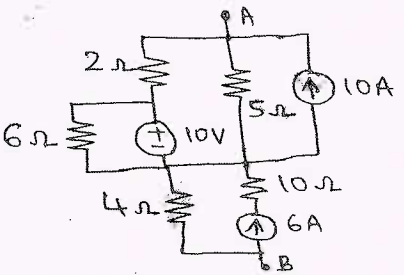

Fig.Q1(a) **(06 Marks)**

b. Using Mesh analysis, find the current I_1 for the circuit shown in Fig.Q1(b).

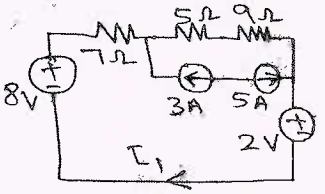

Fig.Q1(b) **(06 Marks)**

c. Explain the concept of Super node. **(04 Marks)**

OR

2 a. Determine the resistance between terminals A and B of the circuit shown in Fig.Q2(a) using Star to Delta conversion.

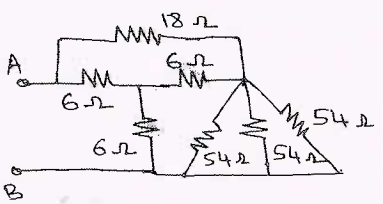

Fig.Q2(a) **(06 Marks)**

b. Using Nodal analysis, find the value of V_x in the circuit shown in Fig.Q2(b), such that the current through $(2 + j3)\Omega$. Impedance is zero.

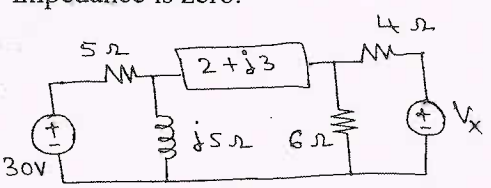

Fig.Q2(b) **(06 Marks)**

c. Explain the Dependent sources. **(04 Marks)**

Module-2

3 a. For the circuit shown in Fig.Q3(a), find the current through 20 Ω resistor using super position theorem.

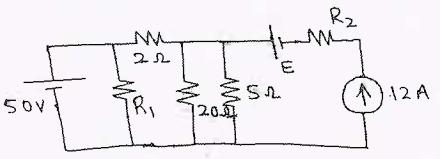

Fig.Q3(a) **(08 Marks)**

b. For ac circuits, prove that the maximum power deliver to load is $\frac{(V_{th})^2}{8R_{th}}$,

where V_{th} – Thevenin's equivalent voltage and R_{th} – Thevenins equivalent resistance. **(08 Marks)**

OR

4 a. State the Millman's theorem. Using Millman's theorem, determine the current through (2+j2)Ω impedance for the network shown in Fig.Q4(a).

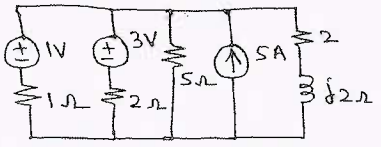

Fig.Q4(a) **(08 Marks)**

b. State the Thevinin's Theorem and obtain the Thevinin's equivalent circuit for the circuit shown in Fig.Q4(b).

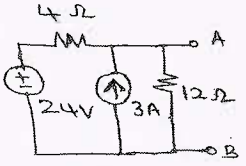

Fig.Q4(b) **(08 Marks)**

Module-3

5 a. Explain the behavior of a inductor and capacitor under switching conditions in detail. **(08 Marks)**

b. The switch is changed from position to position 2 at t = 0. Steady State condition have been reached in position 1. Find the value i , $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$ for the circuit shown in Fig.Q5(b).

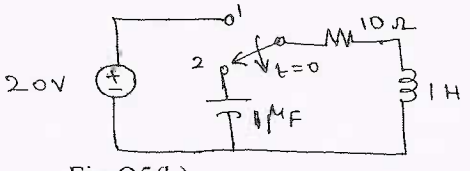

Fig.Q5(b) **(08 Marks)**

OR

6 a. Find the Laplace of f(t) shown in Fig.Q6(a).

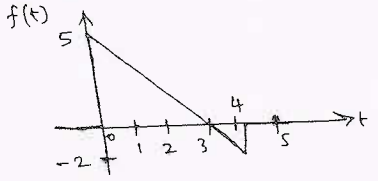

Fig.Q6(a) **(08 Marks)**

b. Find the impulse response of the circuit shown in Fig.Q6(b). Assuming that all initial conditions to be zero.

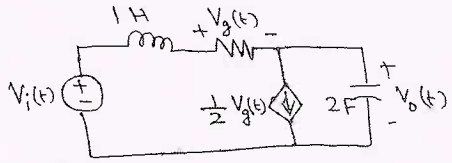

Fig.Q6(b) **(08 Marks)**

Module-4

7 a. Derive the expression for frequency at which voltage across the capacitor is maximum of a series resonance circuit. **(08 Marks)**

b. Show that the circuit shown in Fig.Q7(b) can have more than one resonant condition.

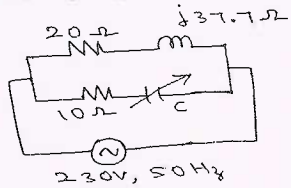

Fig.Q7(b) **(08 Marks)**

OR

8 a. Determine the parallel resonance circuit parameters whose response curve is shown in Fig.Q8(a). What are the new values of W_r and bond width if 'c' is increased 4 times?

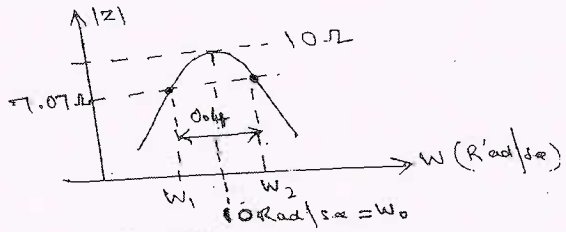

Fig.Q8(a) **(08 Marks)**

b. Prove that the bandwidth of a series resonance circuit $f_2 - f_1 = \frac{R}{2\pi L}$. **(08 Marks)**

Module-5

9 a. Express the z-parameters in terms of Y-parameter. **(08 Marks)**

b. For the network shown in Fig.Q9(b), find the transmission parameters.

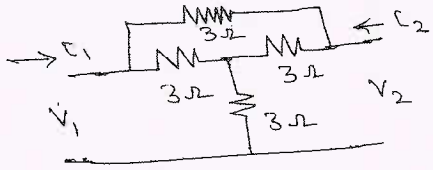

Fig.Q9(b) **(08 Marks)**

OR

10 a. Express the h-parameter in terms of Z-parameters. **(08 Marks)**

b. Find the z-parameter for the two-port network shown in Fig.Q10(b).

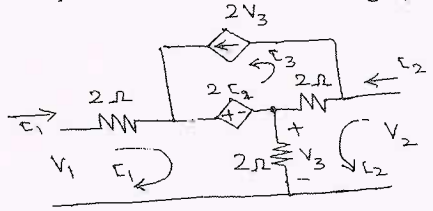

Fig.Q10(b) **(08 Marks)**

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CBCS SCHEME

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15EC35

Third Semester B.E. Degree Examination, Aug./Sept. 2020
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 the following with examples.
   i) Accuracy
   ii) Resolution
   iii) Significant Figures. **(06 Marks)**

b. Explain the working of True RMS voltmeter with the help of a suitable block diagram. **(08 Marks)**

c. What is loading effect in voltmeters? **(02 Marks)**

OR

2 a. Convert a basic D'Arsonval movement with internal resistance of 50Ω and full scale deflection current of 2mA into a multirange dc voltmeter with voltage range of 0-10V, 0-50V, 0-100V and 0-250V. Connect the multiplier resistances in series with D'Arsonval movement. **(10 Marks)**

b. Explain the operation of a Transistor voltmeter with a neat sketch. **(06 Marks)**

Module-2

3 a. With a block schematic, explain the principle and working of Dual slope integrating type DVM. **(08 Marks)**

b. Explain the working of a Digital, Tachometer. **(06 Marks)**

c. Determine the resolution of $3\frac{1}{2}$ digit display on 1V and 10V ranges. **(02 Marks)**

OR

4 a. Explain the working of a successive Approximation DVM with its block diagram. **(08 Marks)**

b. With neat circuit diagrams, explain its operation of Digital Frequency Meter. **(08 Marks)**

Module-3

5 a. Explain the CRT features briefly. **(06 Marks)**

b. List the advantages of using –ve supply in CRO? **(02 Marks)**

c. Explain the operation of an AF sine/square generator with the help of block diagram. **(08 Marks)**

OR

6 a. Explain in detail the working of Digital Storage Oscilloscope. **(08 Marks)**

b. Explain in detail the working of function generator with a neat block diagram. **(08 Marks)**

Module-4

7 a. Explain the working of a Meggar instrument with a neat sketch. **(07 Marks)**

b. Write a note on Stroboscope principle and working. **(05 Marks)**

c. A capacitance comparison bridge is used to measure a capacitive impedance at a frequency of 2KHz. The bridge constants at balance are $C_3 = 100\mu F$, $R_1 = 10\ K\Omega$, $R_2 = 50\ K\Omega$, $R_3 = 100\ K\Omega$. Find the equivalent series circuit of the unknown impedance. **(04 Marks)**

OR

8 a. With a neat circuit diagram, explain the operation of a Q-meter. **(06 Marks)**

b. Derive the balance condition of Whetstone's bridge. **(05 Marks)**

c. Explain in detail the circuit of Wagner's earth connection. **(05 Marks)**

Module-5

9 a. List atleast five designed properties of electrical transducers. **(03 Marks)**

b. What are the factors to be considered for the selection of transducer? **(03 Marks)**

c. Explain the construction, principle and operation of LVDT. **(10 Marks)**

OR

10 a. Explain the principle of working of a resistive position transducer with a block diagram. **(06 Marks)**

b. Write a note on Piezoelectric transducer with a neat sketch. **(04 Marks)**

c. Define the term Thermistor. Explain the various configurations of thermistor. Mention its advantages and limitations. **(06 Marks)**

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CBCS SCHEME

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15EC36

Third Semester B.E. Degree Examination, Aug./Sept.2020
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. Define Electric Field Intensity, $\vec{E}$. Find $\vec{E}$ at $(2, \frac{\pi}{2}, \frac{\pi}{6})$ due to a point charge located at origin. Let Q = 40nC. **(04 Marks)**

b. Point charges of 120nC are located at A (0, 0, 1) and B(0, 0, -1) in free space. Find $\vec{E}$ at P(x, 0, 0). Also find the maximum value of $\vec{E}$. **(06 Marks)**

c. Uniform line charges of 120 nC/m each lie along the entire extent of the three co-ordinate axes. Assuming free space conditions, find $\vec{E}$ at P(-3, 2, -1)m. **(06 Marks)**

OR

2 a. Derive an expression for electric field intensity at a point in cylindrical coordinate system due to an infinite line charge distribution on Z - axis. **(06 Marks)**

b. A point charge Q_1 = 10 μC is located at P_1(1, 2, 3)m in free space while Q_2 = -5μC is at P_2(1, 2, 10)m. i) Find vector force exerted on Q_2 by Q_1 ii) Also, find the co-ordinates of P_3 at which a point charge Q_3 experiences no force. **(07 Marks)**

c. Find the total electric flux crossing an infinite plane at y = 0 due to the following charge distributions :
- a point charge, 30nC located at (1, 2, 3).
- Two line charge distributions of 10nC/m each located in x = 0 plane at y = ± 2m extending over a length of 4m. **(03 Marks)**

Module-2

3 a. Define 'Divergence of a Vector' and 'Gradient of a Scalar'. **(04 Marks)**

b. Derive the point form of Gauss's law. **(06 Marks)**

c. Give the flux density, $\vec{D} = \frac{5\sin\theta\cos\phi}{r}\hat{a}_r$, c/m^2. Find
- Volume charge density
- Total charge contained in the region, r < 2m.
- Total electric flux leaving the surface, r = 2m. **(06 Marks)**

OR

4 a. The value of $\vec{E}$ at P($\rho = 2$, $\phi = 40^0$, Z = 3) is given by $\vec{E} = 100\,\hat{a}_\rho - 200\,\hat{a}_\phi + 300\,\hat{a}_z$, V/m. Determine the incremental work required to move a 20μC charge a distance of 6μm in the direction of : i) $\hat{a}_\rho$ ii) $\vec{E}$ iii) $\vec{G} = \hat{a}_\rho + 3\,\hat{a}_\phi - 2\,\hat{a}_z$. **(06 Marks)**

b. State and explain continuity equation of current. **(05 Marks)**

c. Given the potential field $V = 2x^2y - 80$, and a point, P(2, 3, -4) in free space, find at 'P'.
i) V ii) $\vec{E}$ iii) $\frac{dV}{dN}$ iv) $\hat{a}_N$.
Where $\hat{a}_N$ is the unit vector normal to equipotential surface? **(05 Marks)**

Module-3

5 a. Conducting plates at Z = 2cm and Z = 8cm are held at potentials of -3V and 9V respectively. The region between the plates is filled with a perfect dielectric of $\epsilon = 5\epsilon_0$. Find V, $\vec{E}$ and $\vec{D}$ in the region between the plates. **(06 Marks)**

b. Let $V = \frac{\cos 2\phi}{\rho}$ volts in free space. Find volume charge density at P(5, 60^0, 1) using Poisson's equation. (05 Marks)

c. State the following : i) Uniqueness theorem ii) Ampere's law iii) Stoke's theorem. (05 Marks)

OR

6 a. Explain Scalar and Vector magnetic potentials. (05 Marks)

b. Verify Stoke's theorem for $\vec{H} = 2r \cos\theta\ \hat{a}_r + r\ \hat{a}_\phi$ for the path defined by $0 \le r \le 1$ and $0 \le \theta \le 90^0$. (06 Marks)

c. The magnetic field intensity is given by $\vec{H} = 0.1\ y^3\ \hat{a}_x + 0.4\ x\ \hat{a}_y$, A/m. Determine the current flow through the path $P_1(5, 4, 1)$ to $P_2(5, 6, 1)$ to $P_3(0, 6, 1)$ to (0, 4, 1). Also find current density , $\vec{J}$. (05 Marks)

Module-4

7 a. Obtain an expression for magnetic force between differential current elements. (05 Marks)

b. A point charge , Q = 18nC has a velocity of 5×10^6 m/s in the direction $\hat{a} = 0.6\ \hat{a}_x + 0.75\ \hat{a}_y + 0.3\ \hat{a}_z$. Calculate the magnitude of the force exerted on the charge by the field $\vec{B} = -3\ \hat{a}_x + 4\ \hat{a}_y + 6\ \hat{a}_z$, mT. (05 Marks)

c. Three infinitely long parallel filaments each carry 50A in the $\hat{a}_z$ direction. If the filament lie in the plane, x = 0 with a 2cm spacing between wires, find the vector fore per meter on each filament. (06 Marks)

OR

8 a. Obtain the boundary conditions at the interface between two magnetic materials. (05 Marks)

b. Find Magnetization in magnetic material where
i) $\mu = 1.8 \times 10^{-5}$ H/m and H = 120 A/m ii) B = 300μT and $X_m = 15$. (05 Marks)

c. Explain briefly the following as applicable to magnetic materials :
i) Magnetization ii) Permeability iii) Potential energy. (06 Marks)

Module-5

9 a. Write Maxwell's equations in integral form and word statement form for free space. (06 Marks)

b. In a certain dielectric medium , $\epsilon_r = 5$, $\sigma = 0$ and displacement current density $\vec{J}_d = 20 \cos(1.5 \times 10^8\ t - bx)\ \hat{a}_y$, $\mu A/m^2$. Determine electric flux density and electric field intensity. (06 Marks)

c. A radial magnetic field $\vec{H} = \frac{2.239 \times 10^6}{r} \cos\phi\ \hat{a}_r$, a/m exists in free space. Find the magnetic flux, ϕ crossing the surface defined by $-\frac{\pi}{4} \le \phi \le \frac{\pi}{4}$, $0 \le z \le 1$, m. (04 Marks)

OR

10 a. Discuss the wave propagation of a uniform plane wave in a good conducting medium. (06 Marks)

b. Derive the relation between $\vec{E}$ and $\vec{H}$ for a perfect dielectric medium. (05 Marks)

c. Determine the skin depth for copper with conductivity of 58×10^6 , S/m at a frequency , 10 MHz. Also find α , β and V_p. (05 Marks)

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CBCS SCHEME

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17EC42

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Signals and Systems

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Missing data, if any, may be suitably assumed.

Module-1

1 a. Explain the following with an example each :
i) Even and odd signal
ii) Aperiodic and periodic signal
iii) Energy and power signal. **(06 Marks)**

b. Sketch the following signal :
i) $y(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$
ii) $y(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$ **(06 Marks)**

c. Verify the following properties of system :
memoryless, casual, stable and some invariant $y(n) = n\,x(n)$. **(08 Marks)**

OR

2 a. Sketch the even and odd parts of the signal shown in the Fig.Q2(a).

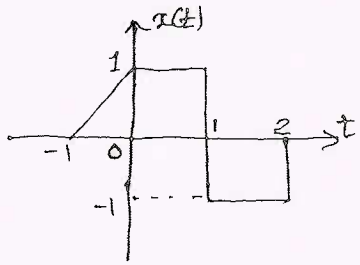

Fig.Q2(a) **(06 Marks)**

b. Classify the following the following as an energy or power signal
i) $y(t) = r(t) - r(t-2)$
ii) $x(t) = (1 + e^{-5t})u(t)$. **(08 Marks)**

c. Determine whether the following signals are periodic or not. If periodic find its fundamental time period.

i) $x[n] = 5\sin\left(\frac{7\pi n}{12}\right) + 8\cos\left(\frac{14\pi n}{8}\right)$

ii) $x(t) = \cos t + \sin\sqrt{2}t$. **(06 Marks)**

Module-2

3 a. Prove the following properties of convolution :
i) Commutative ii) Distributive. **(06 Marks)**

b. Determine the convolution of the following two signals $x(t) = e^{-3t}u(t)$ and $h(t) = u(t+2)$. **(07 Marks)**

c. Find the convolution of the following sequences
$x(n) = \beta^n u(n)$ with $|\beta| < 1$ and $h(n) = u(n-3)$. **(07 Marks)**

OR

4 a. Determine the convolution sum of the given sequence $x(n) = \{\underset{\uparrow}{1}, 2, 3, 1\}$ and $h(n) = \{1, \underset{\uparrow}{2}, 1, -1\}$ sketch output. **(06 Marks)**

b. The impulse response of the system is given by h(t) = u(t). Determine the output of the system for an input $x(t) = e^{-\alpha t} u(t)$. **(08 Marks)**

c. Prove the associative property of convolution. **(06 Marks)**

Module-3

5 a. Find the step response for the impulse response h(t) = u(t + 1) – u(t – 1). **(06 Marks)**

b. 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)**

c. Find the Fourier series coefficients X(k) for the signal $x(t) = \sum_{m=-\infty}^{\infty} [\delta(t - \frac{1}{2}m)]$. Sketch the magnitude and phase spectra. **(08 Marks)**

OR

6 a. Determine whether following system with the given impulse response is memoryless, causal and stable $h[n] = \left[\frac{1}{2}\right]^n u[n]$. **(06 Marks)**

b. Evaluate the DTFS representation for the signal x(n) shown in Fig.6(b) and sketch its spectra.

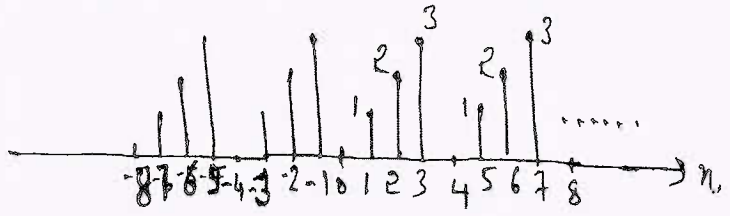

Fig.Q6(b) **(08 Marks)**

c. Find the Fourier series representation for the signal x(t) = sin (2πt) + cos(3πt). Sketch the magnitude and phase spectra. **(06 Marks)**

Module-4

7 a. Prove the following properties of Fourier transform :

i) Time shifting

ii) Time domain convolution. **(08 Marks)**

b. Find the Fourier transform of the signal. **(06 Marks)**

c. Find the DTFT of the signal shown in the Fig.Q7(c).

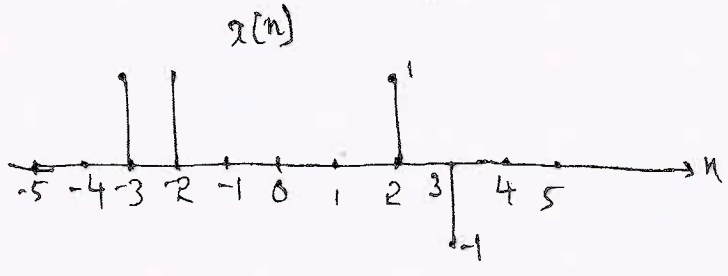

Fig.Q7(c) **(06 Marks)**

OR

8 a. Explain the concept of sampling theorem and reconstruction of signals. **(06 Marks)**

b. Find the DTFT of the sequence $x(n) = -a^n u[-n-1]$. **(08 Marks)**

c. Find the Fourier transform of the signal $x(t) = e^{-3t} u(t-1)$. **(06 Marks)**

Module-5

9 a. Explain the properties of ROC. **(05 Marks)**

b. Find the Z-transform and the ROC of the discrete sinusoid signal.
$x[n] = [\sin(\Omega n)]u[n]$. **(07 Marks)**

c. Find the transfer function and difference equation if the impulse response is

$$h[n] = \left[\frac{1}{3}\right]^n u[n] + \left[\frac{1}{2}\right]^n u[n-1].$$ **(08 Marks)**

OR

10 a. Using power series expansion technique or long division method find the inverse z-transform of the following X(z).

i) $X(z) = \dfrac{z}{2z^2 - 3z + 1}$; ROC $|z| < 1/2$

ii) $X(z) = \dfrac{z}{2z^2 - 3z + 1}$; ROC $|z| > 1$. **(08 Marks)**

b. Determine the z-transform of the following signal $x[n] = 2^n u[n]$.
Also obtain ROC and locations of poles and zeroes of X(z). **(06 Marks)**

c. Using z-transform find the convolution of the following two sequences

$h[n] = \left\{1, \underset{\uparrow}{\frac{1}{2}}, \frac{1}{4}\right\}$ and

$x[n] = \delta[n] + \delta[n-1] + 4\delta(n-2)$. **(06 Marks)**

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CBCS SCHEME

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17EC43

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
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. Draw the general block diagrams of an automatic control system and explain. **(05 Marks)**

b. Show that the two system shown in Fig Q1(b) are analogous systems.

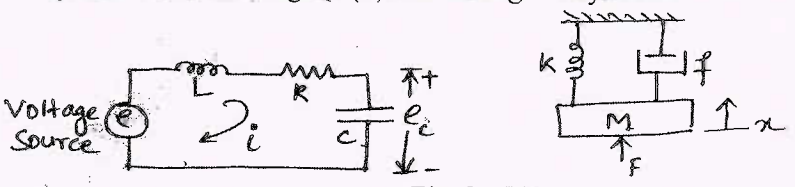

Fig Q1(b) **(05 Marks)**

c. Obtain the Force-current analogous electrical network for the mechanical system shown in Fig Q1(c).

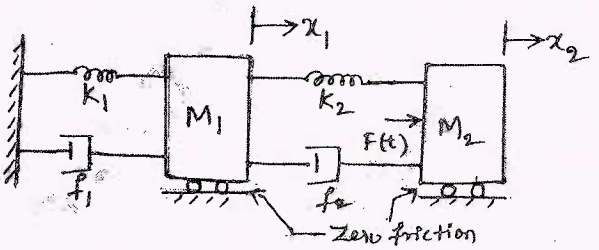

Fig Q1(c). **(10 Marks)**

OR

2 a. Obtain the transfer function for the block diagram, shown in Fig Q2(a). Using block diagram reduction.

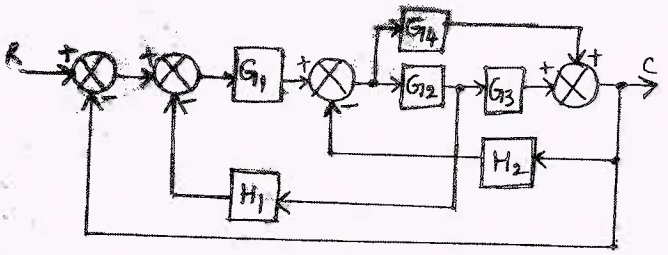

Fig Q2(a) **(10 Marks)**

b. Obtain the transfer function of the system shown in Fig Q2(b). Using Mason's gain formula.

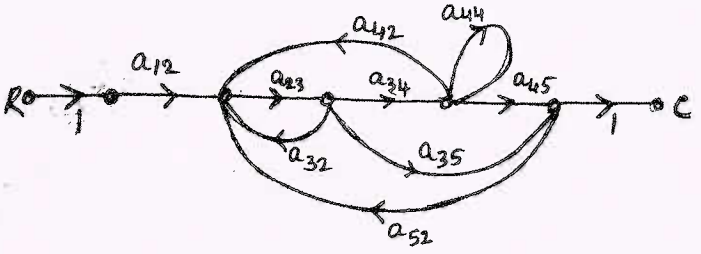

Fig Q2(b) **(10 Marks)**

Module-2

3 a. Obtain the time response of a first order system subjected to unit step input. Plot the response. **(06 Marks)**

b. Derive an expression for Peak time t_p of an under damped second order systems, subjected to step input. **(06 Marks)**

c. For the system shown in Fig Q3(c), determine K and T so that the maximum overshoot is 25% and the settling time is 3 seconds for a 5% tolerance band when subjected to step input.

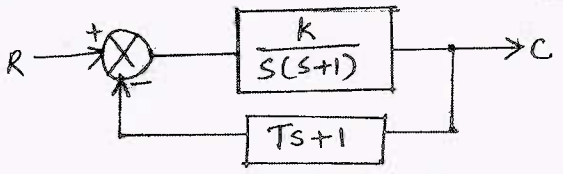

Fig Q3(c) **(08 Marks)**

OR

4 a. Obtain the steady state error e_{ss} of Type – 0, Type – 1 and Type – 2 systems for standard inputs. **(10 Marks)**

b. A unity feedback system is characterized by an open loop transfer function $G(s) = \frac{K}{s(s+10)}$.

Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K determine settling time, peak overshoot and time to peak overshoot for a unit step input. **(10 Marks)**

Module-3

5 a. Define Routh's stability criterion. Describe the necessary conditions for stability. **(10 Marks)**

b. The open loop transfer function of unity negative feedback control system is given by, $G(s) = \frac{K}{s(s^2+s+1)(s+4)}$.

i) Using the Routh's criterion, calculate the range of 'K' values for the system to be stable

ii) Determine the value of K which causes sustained oscillations in the closed loop system. What is the corresponding frequency of sustained oscillations? **(10 Marks)**

OR

6 a. State Angle criterion and Magnitude criterion of Root locus. For a system with $G(s) = H(s)\frac{K}{s(s+2)(s+4)}$, find whether $s = -0.75$ is on Root locus or not, using Angle criterion. **(04 Marks)**

b. The open loop transfer function of a control system is given by $G(s) = \frac{K}{s(s+1)(s+2)}$.

Sketch the complete root locus. Find the critical value of K and location of roots on jw – axis. **(16 Marks)**

Module-4

7 a. Derive an expression for Resonant Peak M_r and Resonant frequency W_r for a second order system in frequency response analysis. **(08 Marks)**

b. Sketch the Bode plot for the system having $G(s) = \frac{20}{s(1+0.1s)}$. **(12 Marks)**

OR

8 a. Explain the concept of Polar – Plots by considering a simple RC filter circuit. **(10 Marks)**

b. State and explain Nyquist criterion **(05 Marks)**

c. Write a short note on Lead compensator. **(05 Marks)**

Module-5

9 a. Draw the block diagram of a typical system with Digital controller and explain. **(06 Marks)**

b. What is uniform sampling? Mention the circumstances that lead to the use of sampled data control system. **(06 Marks)**

c. Define state and state variable. Compare the transfer function approach and state variable approach of analyzing control system. **(08 Marks)**

OR

10 a. Obtain the state model of the mechanical system shown in Fig Q10(a).

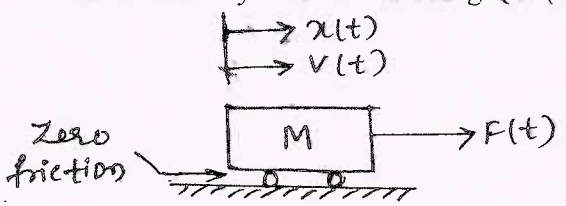

Fig Q10(a) **(10 Marks)**

b. Construct the state model for a system characterized by differential equation

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

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CBCS SCHEME

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17EC44

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Principles of Communication Systems

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the operation of the switching modulator with suitable circuit diagram and waveforms. **(08 Marks)**

b. With suitable block diagram approach explain the operation of the Costas receiver. Write the relevant expressions. **(06 Marks)**

c. What is the significance of VSB modulation? With spectrum of message signal and spectrum of VSB modulated wave explain briefly. **(06 Marks)**

OR

2 a. Explain the operation of the envelope detector with circuit diagram and waveforms. **(08 Marks)**

b. With suitable block diagram approach explain the operation of the quadrature carries multiplexing process. **(06 Marks)**

c. With relevant block diagram, explain the operation of the frequency division multiplexing method. **(06 Marks)**

Module-2

3 a. A 93.2MHz carrier is frequency modulated by a 5KHz sine wave. The resultant FM signal has a frequency deviation of 40KHz.

i) Find the carrier frequency swing of the FM signal

ii) What are the highest and lowest frequencies obtained by the frequency modulated waves

iii) Calculate the modulation index of the same? **(04 Marks)**

b. Explain the operation of the FM stereo multiplexing system (transmitter) using block diagram and spectrum. **(08 Marks)**

c. Explain the operation of the super heterodyne receiver with block diagram. Mention the function of each block. **(08 Marks)**

OR

4 a. A modulating signal $5 \cos 2\pi\ 15 \times 10^3 t$, angle modulates a carrier $A \cos \omega_c t$. Find the modulation index and the bandwidth for the FM system. Determine the change in the bandwidth and modulation index if FM is reduced to 5KHz. What is the conclusion of the two results? **(05 Marks)**

b. With relevant block diagram approach explain the operation of the linear model of phase locked loop. Derive an expression. **(07 Marks)**

c. Explain the process of demodulation of FM waves. Write suitable circuit and relevant graphs. **(08 Marks)**

Module-3

5 a. Explain the properties of the auto correlation functions. Mention the three properties. **(06 Marks)**

b. Explain the noise equivalent bandwidth in noise system, with circuit and derivation. **(08 Marks)**

c. Three 5kΩ resistors are connected in series. For room temperature ($KT = 4 \times 10^{-21}$) and an effective noise bandwidth of 1MHz. Determine :

i) The noise voltage appearing across each resistor

ii) The noise voltage appearing across the series combination

iii) What is the rms noise voltage which appears across same three resistors connected in parallel under the same conditions? **(06 Marks)**

OR

6 a. Mathematically write the expression and define briefly for :
i) Conditional probability ii) Mean. **(06 Marks)**

b. Explain the shot noise with relevant expression. And also explain the white noise with power spectral density and auto correlation function. **(08 Marks)**

c. An amplifier is fed from a 100Ω, 15μV rms sinusoidal signal source. Its equivalent input noise resistance and equivalent input short current are 250Ω and 6μA, respectively. Calculate the individual noise voltages at the input and the input signal to noise ratio. Assume noise bandwidth is 10MHz and temperature is 30°C. **(06 Marks)**

Module-4

7 a. Explain the noise in DSBSC receivers using model of DSBSC receiver using coherent detection. **(08 Marks)**

b. Explain the significance of pre-emphasis and de-emphasis in FM system with circuit, relevant graph and derivation. **(08 Marks)**

c. Find the figure of merit when the depth of modulation is :
i) 100% ii) 150% iii) 30%. **(04 Marks)**

OR

8 a. Explain the noise in FM receivers. Derive an expression for "Figure of Merit' for FM receiver. **(08 Marks)**

b. Explain the FM threshold effect with nature of graph representing the relationship between P and $(SNR)_0$. And also explain the FM threshold reduction with block diagram and relevant graph. **(08 Marks)**

c. An AM receiver operating with a sinusoidal wave and 80% modulation has an output signal to noise ratio of 30dB. Calculate the corresponding carrier to noise ratio. **(04 Marks)**

Module-5

9 a. Why digitize analog signals? Explain the sampling process with CT and DT signals. **(08 Marks)**

b. With block diagram approach. Explain pulse amplitude modulation. Draw the suitable (relevant) waveforms. **(08 Marks)**

c. For a PAM transmission of voice signal with W = 3KHz, calculate B_T. if f_s = 8KHz and $\tau = 0.1T_s$. **(04 Marks)**

OR

10 a. With suitable PPM generator circuit and relevant waveforms explain the operation of pulse position modulation. **(08 Marks)**

b. Write on applications to vocoders, considering speech model used in voice coders and block diagram of vocoder. **(08 Marks)**

c. An analog waveform with bandwidth 15Hz is to be quantized with 200 levels and transmitted via binary PCM signal. Find the rate of transmission and bandwidth required. If 10 such signals are to be multiplexed find the bandwidth requirement. **(04 Marks)**

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CBCS SCHEME

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17EC45

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Linear Integrated Circuits

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 parameters :
(i) Input Offset Voltage
(ii) CMRR
(iii) Slewrate
Mention their typical values for opamp 741. **(06 Marks)**

b. Suggest the circuit for two signal which are received as an input at the same time and output must be taken together. Sketch the circuit. Derive the equation for the output voltage. (Note: Output and Inputs are considered DC voltages). Explain the operation. **(08 Marks)**

c. A non-inverting amplifier is to amplify a 100 mV signal to a level of 3V. Using a 741 opamp, design a suitable circuit. (Let I_{Bmax} = 500 nA). **(06 Marks)**

OR

2 a. What is the significance of a typical gain versus frequency graph for an operational amplifier? Sketch and explain. **(06 Marks)**

b. With a neat circuit diagram, explain basic operational amplifier circuit. **(06 Marks)**

c. Which are different biasing methods used for opamp? Explain with neat diagram. **(04 Marks)**

d. Compare emitter follower and voltage follower. **(04 Marks)**

Module-2

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

b. Design High input impedance capacitor coupled voltage follower using as opamp having lower cutoff frequency of 50 Hz and maximum input bias current of 500 nA. The load resistance is 3.6 kΩ. If the open loop gain is 2×10^5, find value of input impedance of the circuit. **(08 Marks)**

c. With a neat circuit diagram explain the working of capacitor coupled difference amplifier. Derive the equation. **(06 Marks)**

OR

4 a. Realize the precision voltage source using opamp and explain. **(06 Marks)**

b. Draw the circuit diagram of current amplifier using opamp. Explain the circuit operation. **(06 Marks)**

c. With a suitable circuit diagram, explain the operation of instrumentation amplifier consisting of a differential input/output amplifier input stage and a difference amplifier output stage. The circuit has adjustable voltage gain, common mode output nulling and dc output voltage level shifting. **(08 Marks)**

Module-3

5 a. Design a RC phase-shift oscillator with following specifications: f_0 = 5 kHz, Supply voltage = ±15V, IC 741 is to be used. (Assume I_{Bmax} = 500 nA). **(06 Marks)**

b. Explain the operation of an inverting Schmitt trigger circuit with different UTP and LTP levels. Also indicate the input/output characteristics for the circuit. **(08 Marks)**

c. Explain sample and hold circuit with a neat circuit diagram using opamp. **(06 Marks)**

OR

6 a. Show the realization of logarithmic amplifier using an opamp. Obtain the expression for the output voltage. **(08 Marks)**

b. Write a note on multiplier IC and its applications. **(06 Marks)**

c. With waveforms, explain the working of :
(i) Zero-crossing detector (ii) Voltage-level detector. **(06 Marks)**

Module-4

7 a. Design a single-stage bandpass filter to have a voltage gain of 1 and a pass band from 300 Hz to 30 kHz. **(06 Marks)**

b. Design a second order low pass filter using 741 for a cutoff frequency of 5 kHz. Draw its frequency response and comment on the same. **(08 Marks)**

c. Show how a bandstop filter circuit can be constructed using low-pass and high-pass filters. Sketch the expected frequency response and explain. **(06 Marks)**

OR

8 a. State and explain the following terms for 3 pin IC regulators:
(i) Load regulation
(ii) Source regulation
(iii) Drop out voltage. **(06 Marks)**

b. Design an adjustable voltage regulator circuit to get V_0 = 7.5V with load current of 25 mA using 7805 regulator IC. Given I_Q = 4.2 mA. **(06 Marks)**

c. With a neat schematic, explain the salient features of 723 regulator. **(08 Marks)**

Module-5

9 a. Define capture range, lock-in range and pull-in time. Also specify which range is greater-capture range or 'Lock-in range'? **(08 Marks)**

b. Explain about voltage to frequency conversion factor. Which IC can be used to obtain this factor? Derive the equation for that IC. **(06 Marks)**

c. What output voltage would be produced by a D/A converter whose output range is 0 to 10V and whose input binary number is
(i) 10 (for a 2-bit DAC)
(ii) 0110 (for a 4-bit DAC)
(iii) 10111100 (for a 8-bit DAC) **(06 Marks)**

OR

10 a. Explain the working of a monostable multivibrator using 555 timer with a neat functional diagram and waveforms. Derive the equations for its pulse width. **(08 Marks)**

b. Explain the principle of switch type analog phase detector. **(06 Marks)**

c. A 555 astable multivibrator has R_A = 2.2 kΩ and R_B = 6.8 kΩ and C = 0.01 μF. Calculate
(i) T_{on} (ii) T_{off} (iii) Free-running frequency (iv) Duty cycle, D. **(06 Marks)**

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CBCS SCHEME

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17EC46

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Microprocessors

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain with neat diagram, the flag register of 8086 processor. **(08 Marks)**

b. Show with an example, how the physical address is calculated for an instruction in 8086. **(04 Marks)**

c. Write an ALP to add a sequence of 10-8 bit numbers and save that result in memory location RESULT. Ensure carry is properly handled. **(08 Marks)**

OR

2 a. Draw a neat architectural diagram of 8086 processor and explain each block. **(10 Marks)**

b. Explain the immediate and register addressing mode of 8086 with one example. **(04 Marks)**

c. Write an ALP to find the absolute difference between registers AX and BX and place the result in DX. **(06 Marks)**

Module-2

3 a. Explain the working of following instructions with examples RCR, DAA, IMUL, DIV and SCAS. **(10 Marks)**

b. Write an ALP to find the number of EVEN and ODD numbers from a sequence of 20-8 bit numbers. In the memory and save the result COUNT at EVEN and ODD. **(10 Marks)**

OR

4 a. Explain the working of following instructions with examples: XLAT, AAA, REP, LOOP and ROL. **(10 Marks)**

b. Write an ALP to find the number of positive and negative numbers from a sequence of 20-8 bit numbers in the memory and save the counted result at NEG and POS. **(10 Marks)**

Module-3

5 a. Explain any four differences between MACRO and PROCEDURE. **(04 Marks)**

b. Write an ALP to convert a two digit ASCII number saved in memory into its equivalent binary number with a macro ASC2BIN. **(12 Marks)**

c. Explain the working of stack memory of 8086 with an example. **(04 Marks)**

OR

6 a. Write procedure to generate a delay of 20 msec using 8086 processor running at 10 MHz. Show the calculations for the delay. **(08 Marks)**

b. Explain the interrupt vector table of 8086 briefly. **(04 Marks)**

c. Explain the interrupt acknowledgement cycle of 8086 with a neat diagram. **(08 Marks)**

Module-4

7 a. Sketch the minimum mode operation of 8086 and explain its operation. **(10 Marks)**

b. Interface two 4K × 8 EPROM and two 4K × 8 static RAM chips to 8086. Address of ROM at FE000H and RAM at FC000H. **(10 Marks)**

OR

8 a. Explain mode 0 and BSR mode of operation of 8255 PIO device with neat diagram of control register. **(10 Marks)**

b. In an 8086 system, 8255 is mapped at IO location con. Read the 4 bit port PC4-7 of the 8255 and output the values to the LED connected on PCO-3. Write the ALP for this along with appropriate setup. **(10 Marks)**

Module-5

9 a. Write an ALP to rotate the stepper motor in clockwise direction by 180° and then in anticlockwise direction by 180° with suitable "delay" procedure. **(08 Marks)**

b. Write an ALP to generate a triangular wave of 500 Hz using the DAC0800 interface to the 8086 CPU at 8 MHz. Amplitude of triangular wave should be +5 V. Show the interface diagram. **(12 Marks)**

OR

10 a. Explain the following DOS function calls of INT21H:
(i) Function 01H (ii) Function 02H (iii) Function 4CH
(iv) Function 06H (v) Function 09H **(10 Marks)**

b. Mention 4 differences between RISC and CISC architecture. **(04 Marks)**

c. Explain how to generate interrupt on terminal count using a 8254 timer with a diagram. **(06 Marks)**

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CBCS SCHEME

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15EC42

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Microprocessor

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Draw the internal architecture of the 8086 and explain briefly. **(08 Marks)**

b. Define offset address, effective address and physical address. If DS = 1000, offset (displacement) = 5000 H, [AX] = 1000H, [BX] = 2000H, [SI] = 3000H, [DI] = 4000H, [BP] = 5000H, [SP] = 6000H, [CS] = 0000H, [DS] = 1000H, [SS] = 2000H, [IP] = 7000H, then effective address of the following instructions:
(i) MOV AX, [5000H] (ii) MOV AX, 5000 [BX] [SI] **(08 Marks)**

OR

2 a. Explain Move instruction format, generate machine code for following instructions assuming the opcode for MOV as 100010.
(i) MOV AX, [BX] (ii) MOV AL, [SI + 05H] **(10 Marks)**

b. Write the single instruction equivalent for the following program if available and justify your answer; assume these programs segments are starting from memory location FFF0h and 8086 is reset just before execution.

(i) FFF0 : MOV CL, 10h
XCHG AX, BX
ROR AX, CL
XCHG AX, BX

(ii) FFF0 : PUSH Ax
PUSH Bx
POP Ax
POP Bx

(06 Marks)

Module-2

3 a. Write a program to given string is palindrome or not. **(08 Marks)**

b. What is an assembler directives? Explain ALLIGN, MACRO and ENDM, SEGMENT and Ends. **(08 Marks)**

OR

4 a. Use appropriate logic instructions that do following:
(i) Set (1) rightmost four bits of Ax
(ii) Clear (0) leftmost three bits of Ax
(iii) Invert 7, 8, 9^{th} bit of Ax
(iv) Clear the register Ax **(04 Marks)**

b. What is wrong with following instruction:
(i) POP CS (ii) MOV [AX], 20H
(iii) MOV SS, DS (iv) MOV BL, SI **(04 Marks)**

c. Write a program to set parity flag, auxiliary flag, carry flag, overflow flag, interrupt flag and trap flags, and reset them after certain delay. **(08 Marks)**

Module-3

5 a. Write a program to change a sequence of sixteen two byte numbers from ascending to descending order the numbers are stored in the data segment, store the new series at address starting from 6000 H. Use LIFO property of the stack. **(08 Marks)**

b. Briefly explain non maskable interrupt and maskable interrupt (INTR). **(08 Marks)**

OR

6 a. Differentiate between macros and procedures. **(06 Marks)**

b. Write a MACRO function:
(i) To read a character with echo
(ii) To display a character
(iii) To read a character without echo
(iv) To display a text message
(v) To read a string of characters from keyboard. **(10 Marks)**

Module-4

7 a. Write a note on physical memory organization of 8086. **(06 Marks)**

b. Draw the timing diagram to execute memory read operation in an inlet 8086 processor. **(04 Marks)**

c. Bring out the differences between minimum mode and maximum mode of 8086. **(06 Marks)**

OR

8 a. Explain the block schematic of 8255. **(08 Marks)**

b. Write a program for seven segment display using 8255. **(08 Marks)**

Module-5

9 a. List the features of ADC 0808/0809 and write a flow chart for analog to digital conversion using ADC 0808. **(08 Marks)**

b. Write a program to rotate stepper motor by 360° in clockwise direction. **(08 Marks)**

OR

10 a. Explain the architecture of 8087 with the help of neat block diagram. **(08 Marks)**

b. Briefly explain Timer 8253/8254 modes. **(08 Marks)**

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CBCS SCHEME

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15EC43

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
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. Distinguish between open loop and closed loop systems. **(04Marks)**

b. For the circuit shown in Fig.Q1(b) find the transfer function.

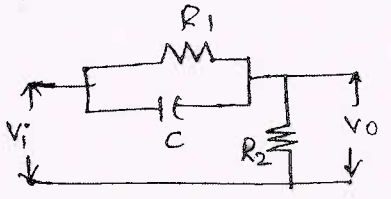

Fig.Q1(b) **(06 Marks)**

c. For the block diagram shown n Fig.Q1(c) determine the transfer function $T(s) = \frac{C(s)}{R(s)}$.

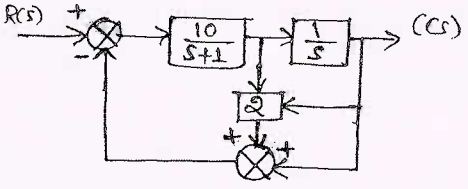

Fig.Q1(c) **(06 Marks)**

OR

2 a. For the mechanical system shown in Fig.Q2(a) draw the F-V analogous network. Find the transfer function $X_2(s)/X_1(s)$.

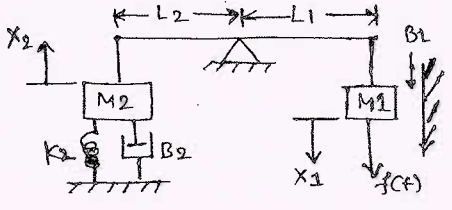

Fig.Q2(a) **(08 Marks)**

b. Using Mason's gain formula find the transfer function of the signal flow graph shown in Fig.Q2(b).

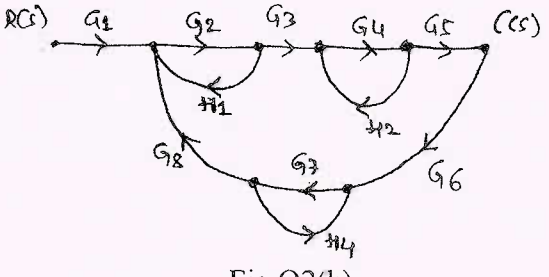

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. Define following time response specifications for under damped system :
i) Peak time
ii) Rise time
iii) Peak over shoot
iv) Settling time. **(08 Marks)**

b. The open loop transfer function of a unity feedback control system is given by

$$G(s) = \frac{K}{S(ST+1)}$$

i) By what factor should K be multiplied so that damping ratio is increased from 0.2 to 0.8
ii) By what factor should T be multiplied so that damping ratio is reduced from 0.6 to 0.3. **(08 Marks)**

OR

4 a. A unity feedback control system is described by the given transfer function :

$$G(s) = \frac{k}{s^2(s+20)(s+30)}.$$

Determine steady state error coefficients also determine the value of K to limit the steady state error to 10 units due to input $r(t) = 1 + 10t + 20t^2$. **(08 Marks)**

b. Explain PD type controller with block diagram, also define with key points for effect of PD controller on the system. **(08 Marks)**

Module-3

5 a. Define stability. Explain necessary conditions for stability. **(06 Marks)**

b. For the unity feedback system with

$$G(s) = \frac{K}{(s+1)^3(s+4)}$$

i) Find range of K for stability
ii) Find the frequency of oscillations when the system is marghally stable. **(10 Marks)**

OR

6 a. List the general rules for construction of root locus. **(04 Marks)**

b. A negative feedback control system is characterized by

$$G(s)H(s) = \frac{K(s+4)}{s(s^2+6s+13)}.$$

Sketch the root locus plot and find the value of K for a system having damping ratio 0.707. **(12 Marks)**

Module-4

7 a. Define gain cross over and phase cross over related to frequency analysis. **(04 Marks)**

b. Draw the bode plot and also find the gain and phase margin for the system equation.

$$G(s)H(s) = \frac{100(1+S/10)(1+S/100)}{(s^2+s+4)}.$$ **(12 Marks)**

OR

8 a. Explain lag compensator circuit, list the effects and limitations of lag comparator network on a system. **(08 Marks)**

b. Sketch the Nyquist plot and calculate the range of 'K' for stability, for the system function : **(08 Marks)**

Module-5

9 a. Define advantages of state variable analysis, also define state, state variables and state space. **(08 Marks)**

b. Obtain the state model for the electrical circuit shown in Fig.Q9(b).

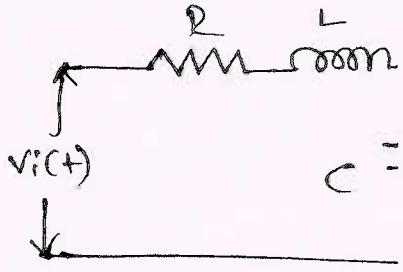

Fig.Q9(b) **(08 Marks)**

OR

10 a. State the usefull properties of the state transition matrix. **(07 Marks)**

b. Obtain the state transition matrix for the matrix given : $A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$ **(09 Marks)**

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CBCS SCHEME

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15EC44

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
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. Explain how the continuous-time signals are classified into even and odd signals. Derive the equations for decomposing the given signal into even and odd components. Find the even and odd components of the signal: $x(t) = e^{-2t}\cos(t)$. **(06 Marks)**

b. Derive the condition under which a discrete time signal $x(n) = \cos(2\pi f_o n)$ is periodic. Determine whether the signal $x(n) = \cos(2\pi n) + \sin(3\pi n)$ is periodic or not. If periodic, find its fundamental period. **(06 Marks)**

c. Sketch the signal: $x(t) = r(t+1) - r(t) - r(t-2) + r(t-3)$ **(04 Marks)**

OR

2 a. Explain how continuous-time non-periodic signals are classified as energy or power signals. Classify the given signal x(t), and determine its energy or average power $x(t) = e^{-3t}u(t)$. **(06 Marks)**

b. Signal x(n)is shown in Fig.Q.2(b). Draw $y(n) = x(-3n+2)$. **(06 Marks)**

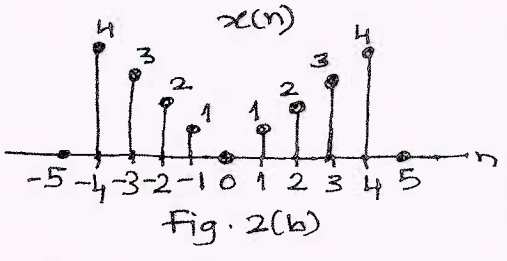

Fig.Q.2(b)

c. Determine if the system given by $y(t) = x(t/2)$ is i) Linear ii) Time-invariant iii) Causal and iv) Stable. Here, $|x(t)| < M_x$ **(04 Marks)**

Module-2

3 a. Derive the equation to determine the output of a linear time-invariant discrete-time system having impulse response h(n) and input x(n). Graphically illustrate with an example taking $x(n) = \{\underset{\uparrow}{1}, 2, 3\}$ and $h(n) = \{\underset{\uparrow}{3}, 2, 1\}$. **(08 Marks)**

b. A continuous-time LTI system has impulse response $h(t) = e^{-2t}u(t)$. Compute the output of the system for input signal $x(t) = u(t) - u(t-5)$. **(08 Marks)**

OR

4 a. Prove that output of a linear time-invariant continuous-time system can be determined by computing the convolution integral of input signal and impulse response. Illustrate with an example taking $x(t) = u(t)$ and $h(t) = u(t)$. **(08 Marks)**

b. A discrete-time LTI system has impulse response $h(n) = 0.5^n u(n)$. Determine the output of the system for the input $x(n) = u(n) - u(n-10)$. **(08 Marks)**

Module-3

5 a. A discrete-time periodic signal is given by: $x(n) = \cos\left(\frac{6\pi n}{17} + \frac{\pi}{3}\right)$. Determine its DTFS representation. **(08 Marks)**

b. Impulse response of an LTI system is given by $h(t) = \cos(\pi t).u(t)$. Determine if the system is causal and stable. **(04 Marks)**

c. Determine the step response of a system whose impulse response is given by: $h(n) = (-0.5)^n u(n)$. **(04 Marks)**

OR

6 a. A continuous time periodic signal is given by: $x(t) = \text{Sin}(3\pi t) + \cos(4\pi t)$. Determine its Fourier series representation. **(08 Marks)**

b. Determine the step response of a system whose impulse response is given by: $h(t) = t.u(t)$. **(04 Marks)**

c. The impulse response of a system is given by:
$h(n) = \sin(\pi n/3)\,[u(n) - u(n-4)]$. Determine if the system is causal and stable. **(04 Marks)**

Module-4

7 a. Obtain the Fourier transform of the signal $x(t) = e^{-at} u(t)$. Plot its magnitude and phase spectra, taking $a = 1$. **(08 Marks)**

b. State and prove the time-shift property of DTFT. **(04 Marks)**

c. Obtain the Fourier Transform of a rectangular pulse given by $x(t) = \begin{cases} 1, & -T < t < +T \\ 0, & \text{otherwise} \end{cases}$ **(04 Marks)**

OR

8 a. Find the DTFT of $x(n) = -a^n u(-n-1)$, where 'a' is real. **(06 Marks)**

b. Find the DTFT of $x(n) = (1/2)^n u(n-4)$ using the properties of DTFT. **(06 Marks)**

c. State and prove frequency shift property of continuous time Fourier Transform. **(04 Marks)**

Module-5

9 a. Determine the Z-transform of the signal:
$x(n) = \cos(\Omega_0 n).u(n)$, and plot its ROC. **(08 Marks)**

b. State the properties of region of convergence of Z-transform of a signal. **(04 Marks)**

c. Find the inverse Z-transform of the following by long division method:

$$x(z) = \frac{z}{z-a}, \quad \text{ROC} : |z| > a$$ **(04 Marks)**

OR

10 a. The difference equation of a discrete time LTI system is given by:
$y(n) = 0.5y(n-1) + x(n)$
Determine: i) System function ii) Pole-zero plot of the system function iii) Impulse response of the system. **(08 Marks)**

c. Determine the inverse z-transform of

$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

For i) $|z| > 1$ ii) $|z| < 0.5$ iii) $0.5 < |z| < 1$ **(08 Marks)**

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CBCS SCHEME

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15EC45

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
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. Derive the expression for transmission band width of a standard - Am wave using frequency domain description. **(06 Marks)**

b. Discuss the role of 'ϕ' in the coherent detection of DSBSCM – wave. **(06 Marks)**

c. Carrier wave with amplitude 12V and frequency 10MHz is amplitude modulated to 50% with message signal frequency 1KHz. Draw the spectrum and calculate the bandwidth B_T. **(04 Marks)**

OR

2 a. Derive the condition for $H_{(f)}$ of a BPF that shapes DSBSCM–wave into a VSBM-wave. **(06 Marks)**

b. Discuss the requirements that a message signal and BPF has to fulfill to generate SSBM – signal from a DSBSC-wave. **(06 Marks)**

c. Assuming message signal with W = 2KHz draw the spectrum of a DSBSCM wave for f_C = 4KHz and f_C = 1.5KHz separately. **(04 Marks)**

Module-2

3 a. Discuss the transmission–bandwidth approximation rules for single–tone FM–wave. **(06 Marks)**

b. Derive the expression for a NBFM – wave using single–tone message signal. **(06 Marks)**

c. Explain FM – sterio multiplexing. **(04 Marks)**

OR

4 a. Prove that under lock – condition the response of a linear – PLL is a scaled version of the message signal. **(08 Marks)**

b. Derive the condition for eliminating the unwanted - components if an FM wave is transmitted over a non linear channel. **(08 Marks)**

Module-3

5 a. List out the properties of the auto correlation function. **(06 Marks)**

b. Discuss the first two moments of the pdf of a random – variable X. **(06 Marks)**

If $Y = g_{(x)} = \cos(X)$, where $X \rightarrow$ is a random variable uniformly distributed in the interval $(-\pi, \pi)$ ie

$$f_X(x) = \begin{cases} \frac{1}{2\pi} & -\pi < x < \pi \\ 0 & \text{otherwise} \end{cases}$$

Find the expected value of Y. **(04 Marks)**

OR

6 a. In brief discuss the
i) Thermal noise
ii) Shot noise. **(06 Marks)**

b. Write Gaussian noise w(t) of zeromean and psd $= \frac{N_0}{2}$ is applied to an ideal – LPF of bandwidth B and pass band response of one. Find the :
i) Psd of the noise n(t)
ii) Auto correlation function of n(t). **(06 Marks)**

c. Write a short note on : "Noise Figure". **(04 Marks)**

Module-4

7 a. Derive the expression for $(SNR)_0$ using BSBSC – Model. **(08 Marks)**

b. Write short note on :
i) Capture effect
ii) Threshold effect
In FM receivers. **(08 Marks)**

OR

8 a. Derive the expression for $(SNR)_0$ using FM – system. **(08 Marks)**

b. Write short note on :
i) Pre-emphasis
ii) De-emphasis. **(08 Marks)**

Module-5

9 a. List out the advantages and limitations of digital system over analog system. **(08 Marks)**

b. Explain the method of generation and recovery of PPM signal. **(08 Marks)**

OR

10 a. Explain the PCM-system. **(08 Marks)**

b. Write short note on :
i) Regeneration
ii) VOCODER. **(08 Marks)**

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USN 2VD15EC025

15EC46

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain the working of a basic operational amplifier, circuit with $R_C = 6.8k\Omega$, $R_E = 4.7k\Omega$ and powered by ± 10V supply. **(08 Marks)**

b. Solve direct coupled inverting amplifier to amplifier a DC input of 150mV by a factor of 40 use a Bi-polar op-amp with $I_{B(max)} = 500nA$. **(04 Marks)**

c. Define CMRR of an op-amp. If an non-inverting amplifier is having a gain of 100 with 95dB CMRR, calculate the common mode output ($V_{0(cm)}$) for a common mode input ($V_{i(cm)}$) of 2V. **(04 Marks)**

OR

2 a. Define the following op-amp parameters and mention their typical values for 1C741 :
   i) Input voltage range
   ii) PSRR
   iii) Input offset voltage
   iv) Slew rate. **(08 Marks)**

b. With a neat circuit diagram, explain direct coupled non-inverting amplifier. **(04 Marks)**

c. Two signals each ranging from 0.1V to1V are to be summed using 741 op-amp. Design suitable inverting summing circuit. **(04 Marks)**

Module-2

3 a. Explain the realization of a high Z_{in} capacitor coupled voltage follower for AC amplifier obtain the expression for Z_{in} of the circuit. **(08 Marks)**

b. Solve precision voltage source to provide an output of 9V. The available supply is ±12V. Allow for approximately ± 10% tolerance on the zener diode voltage. Use 741 op-amp and $I_{B(max)} = 500nA$, $I_Z = 20mA$. **(08 Marks)**

OR

4 a. Derive an expression for the differential gain of an instrumentation amplifier. **(08 Marks)**

b. Design a capacitor coupled inverting amplifier for a gain of 50 and output voltage 2.5V, $f_1 = 10Hz$, $f_2 = 1KHz$, $R_L = 250\Omega$, use bipolar op-amp. **(08 Marks)**

Module-3

5 a. Explain the working of a sample and hold circuit with signal control and output waveform. **(06 Marks)**

b. Using a 741 op-amp with a supply of ±12V design an inverting Schmitt trigger circuit to have trigger points of ±2V. **(04 Marks)**

c. With a neat sketch, explain the working Wein bridge oscillator circuit. **(06 Marks)**

OR

6 a. With a suitable derivation, explain logarithmic amplifier. **(06 Marks)**

b. Design RC phase shift oscillator for a output frequency of 5KHz use μA741 op-amp with ±15V supply and $I_{B(max)}$ = 500nA. **(05 Marks)**

c. With a neat circuit diagram, explain op-amp integrating circuit. **(05 Marks)**

Module-4

7 a. Sketch the circuit of a second order active high pass filter. Explain its working. **(06 Marks)**

b. Mention the advantages of IC voltage regulators. Draw the functional diagram for IC723 regulator. Briefly explain the working. **(10 Marks)**

OR

8 a. What are the advantages of active filters over passive filters? **(04 Marks)**

b. Explain the working of series voltage regulator with current limiting protection. **(06 Marks)**

c. Design 2nd order low pass filter to have cutoff frequency of 1KHz. **(06 Marks)**

Module-5

9 Explain the following with neat circuit diagrams and waveforms.

a. PLL **(08 Marks)**

b. 555 timer as Astable Multivirator. **(08 Marks)**

OR

10 Explain the following with neat circuit diagrams and wave forms.

a. 566 voltage controlled oscillator **(08 Marks)**

b. Successive approximation ADC. **(08 Marks)**

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