VTU PREVIOUS QUESTION PAPER JUL/AUG 2022

QUESTION PAPER INDEX LIBRARY SECTION

Electronics & Communication Department

15,17 3rd sem EC

CBCS SCHEME

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

15EC32

Third Semester B.E. Degree Examination, July/August 2022
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. Draw the emitter follower circuit. Derive the expressions for i) Z_i ii) Z_0 iii) A_v. Using r_e model. **(08 Marks)**

b. Draw r_e and h-parameter models of a transistor in common-emitter configuration. Also give relation between r_e and h-parameters. **(08 Marks)**

OR

2 a. Derive expression for Z_i, Z_0, A_v and A_I for common –emitter fixed bias configuration using hybrid equivalent model. **(08 Marks)**

b.

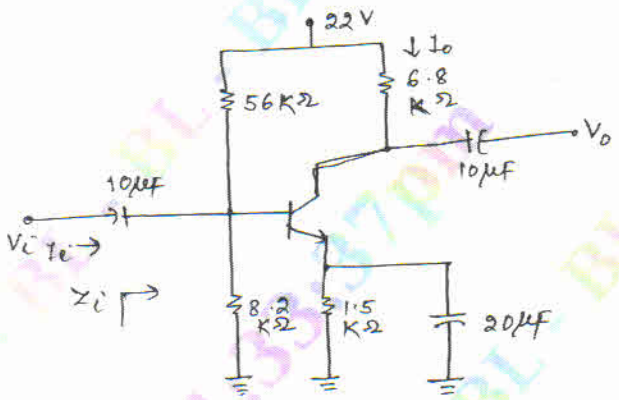

Fig Q2(b)

For the circuit shown determine : i) $-r_e$ ii) $-Z_i$ iii) Z_0 ($r_0 = \infty\Omega$) iv) A_v ($r_0 = \infty\Omega$). **(08 Marks)**

Module-2

3 a. Explain with neat diagram the construction and characteristics of a depletion type MOSFET. How a depletion type MOSFET is different than an enhancement type of MOSFET. **(08 Marks)**

b. Derive expression for Z_i, Z_0 and A_v for the JFET common-source amplifier fixed bias configuration. Suing ac equivalent circuit. **(08 Marks)**

OR

4 a. Draw JFET common drain configuration circuit. Derive Z_i, Z_0 and A_v using small signal model. **(08 Marks)**

b. A dc analysis of the source follower network of Fig Q4(b) results in V_{GSQ} = -2.86V and I_{DQ} = 4.56mA. Determine : i) -gm ii) $-r_d$ iii) $-Z_i$ iv) Z_0 with and without r_d v) A_v with and without r_d.

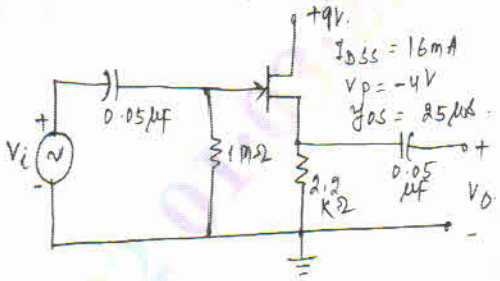

Fig Q4(b) **(08 Marks)**

Module-3

5 Explain the low frequency response of BJT amplifier and give expression for low frequency due to I/P coupling capacitor C_s and output coupling capacitor C_c with neat diagram. **(08 Marks)**

b. Describe Miller-effect. Derive an equation for Miller input and output capacitance. **(08 Marks)**

OR

6 a. Explain high frequency response of FET amplifier. Derive expression for cutoff frequencies defined by input and output circuits. **(08 Marks)**

b. Explain the multistage frequency effects on cutoff frequencies and the bandwidth with required waveforms and response curves. **(08 Marks)**

Module-4

7 a. What are the advantages of negative feedback in amplifier? **(04 Marks)**

b. Derive the expression for Z_{if} and Z_{of} for a voltage series feedback connection with neat diagram. **(06 Marks)**

c. Determine the voltage gain, input and output impedance with feedback for a voltage series feedback having A = -100, R_i = 10kΩ and R_0 = 20kΩ for feedback of β = -0.1. **(06 Marks)**

OR

8 a. What is Breackhausan's criteria for oscillation? How oscillation is generated in a circuit. **(04 Marks)**

b. Explain the working of a FET phase shift oscillator with neat diagram. Give the expression for oscillation. **(06 Marks)**

c. Draw the circuit diagram of uni-junction oscillator and explain the principle of operation and draw the characteristics curve. **(06 Marks)**

Module-5

9 a. What is Power Amplifier? Explain the operation of a transformation coupled class – A power amplifier and show that maximum efficiency is 50%. **(08 Marks)**

b. Define voltage Regulator. Explain series and shunt voltage regulator. **(08 Marks)**

OR

10 a. Explain the operation of a class – B push-pull amplifier and show that maximum conversions efficiency is 78.5%. **(08 Marks)**

b. For a class B amplifier using a supply of V_{CC} = 30V and driving a load of 16Ω, determine the maximum input power, output power, and transistor dissipation. **(08 Marks)**

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CBCS SCHEME

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

15EC33

Third Semester B.E. Degree Examination, July/August 2022
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. Place the following expression into proper canonical form:
i) $P = f(a, b, c) = a\bar{b} + a\bar{c} + bc$ ii) $T = f(a, b, c) = (a + \bar{b})(\bar{b} + \bar{c})$ **(06 Marks)**

b. Simplify the following using Quine-McCluskey method. Obtain the prime implicants and essential prime implicants: $P = f(a,b,c,d) = \Sigma m(4,5,6,8,9) + \Sigma d(0,7,15)$ verify using K-map. **(10 Marks)**

OR

2 a. Simplify the Boolean expression using 5-variable K-map.
$T = f(a, b, c, d, e) = \Sigma(0, 2, 8, 10, 16, 18, 24, 26)$. **(08 Marks)**

b. Design a 4-bit combinational circuit that generates a high output when only any of the two inputs are high. Obtain the Boolean expression. **(08 Marks)**

Module-2

3 a. Implement the full adder using 2-input NAND gates, with truth table and Boolean equations. **(08 Marks)**

b. Implement
$f(a, b, c, d) = \sum m(0, 1, 5, 6, 7, 9, 10, 15)$ using 8:1 and 4:1 multiplers. **(08 Marks)**

OR

4 a. Explain simple 4:2 encoder, with truth table. **(04 Marks)**

b. Implement $f(a, b, c) = \sum m(0, 1, 2, 5)$ using active low output dual 2:4 decoder IC74139. **(04 Marks)**

c. Explain the working principle of 4-bit parallel fast look ahead carry adder. **(08 Marks)**

Module-3

5 a. Define the following terms, and explain using a timing diagram.
i) Propogation delay ii) t_{PLH} and t_{PHL}. **(06 Marks)**

b. Explain the working of master slave J-K flipflop with logic diagram, function table, logical symbol and timing diagram. **(10 Marks)**

OR

6 a. Obtain the characteristic equations for T, D, SR and JK flipflops. **(08 Marks)**

b. With the timing diagram, explain the working of switch de bouncer, using SR latch. **(08 Marks)**

Module-4

7 a. Design a serial In serial Out unidirectional shift register and explain. **(06 Marks)**

b. Design a synchronous Mod-6 counter for the sequence (0, 2, 3, 6, 5, 1) using JK-flipflops. **(10 Marks)**

OR

8 a. Design a twisted ring counter using D flip flops, illustrate with truth table. **(06 Marks)**

b. With the help of neat block diagram, explain parallel in, serial out unidirectional shift register. **(10 Marks)**

Module-5

9 a. With a suitable example, explain Mealy and Moore model in a sequential circuit analysis. **(06 Marks)**

b. Construct the transition table, state table and state diagram in Fig.Q.9(b) for Moore Model. **(10 Marks)**

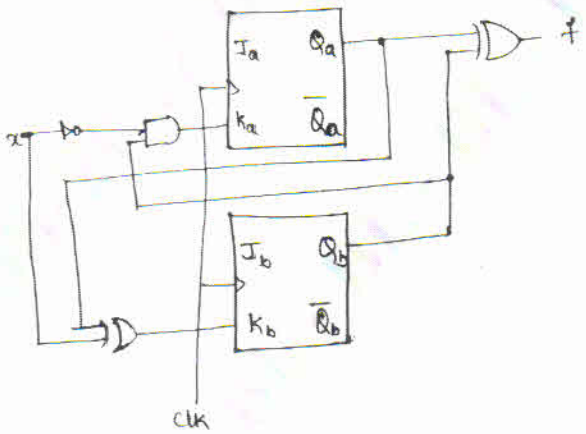

Fig.Q.9(b)

OR

10 a. A sequential circuit has one input and one output. Design a circuit using DFF for the state diagram shown in Fig.Q.10(a). **(08 Marks)**

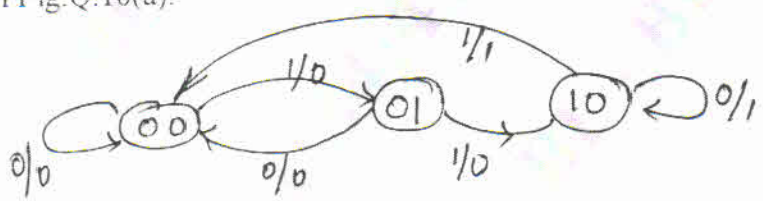

Fig.Q.10(a)

b. Construct the excitation table, transition table state table and state diagram for the sequential circuit given below in Fig.Q.10(b). **(08 Marks)**

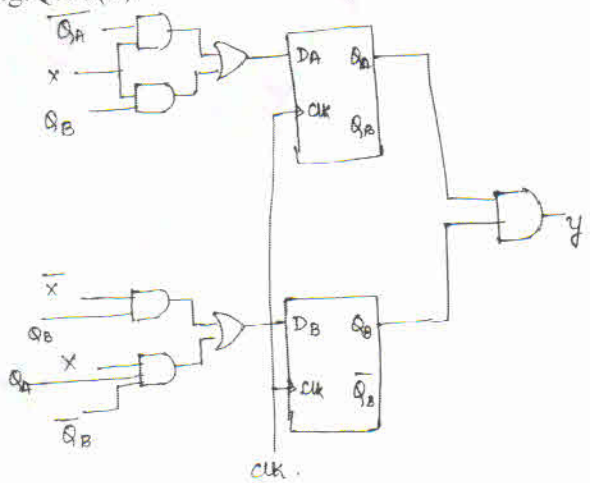

Fig.Q.10(b)

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15EC32

Third Semester B.E. Degree Examination, July/August 2022
Analog Electronics

Time: 3 hrs. Max. Marks: 80

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

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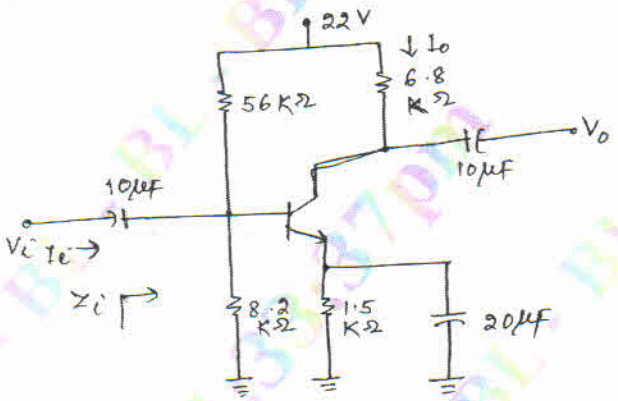

Fig Q2(b)

For the circuit shown determine : i) $-r_e$ ii) $-Z_i$ iii) Z_0 ($r_0 = \infty\Omega$) iv) A_v ($r_0 = \infty\Omega$). **(08 Marks)**

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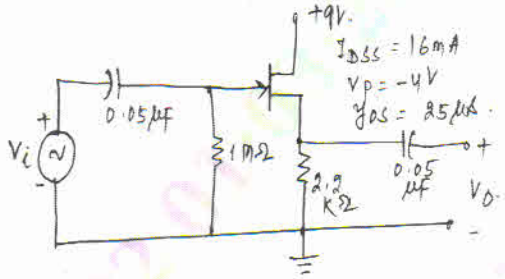

Fig Q4(b) **(08 Marks)**

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15EC34

Third Semester B.E. Degree Examination, July/August 2022
Network Analysis

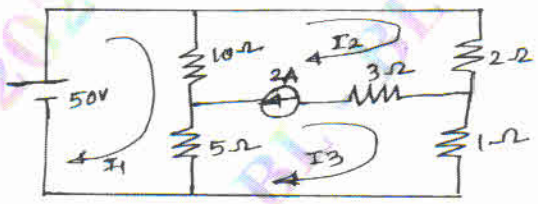
Time: 3 hrs. Max. Marks: 80

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

Module-1

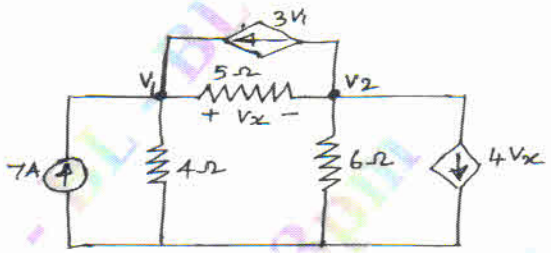
1 a. Find the current 'I' in 5Ω using Mesh analysis for Fig. Q1(a). **(08 Marks)**

Fig. Q1(a)



b. Find the voltage V_x using Node Analysis for Fig. Q1(b). **(08 Marks)**

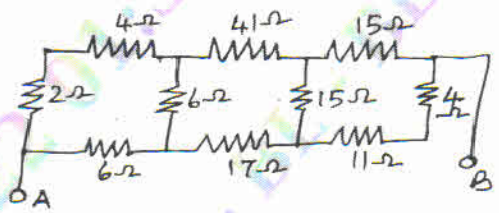
Fig. Q1(b)



OR

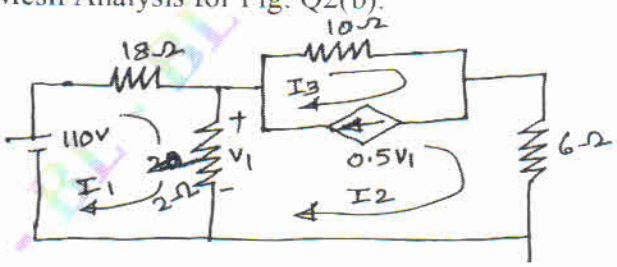
2 a. Determine the resistance between A and B using Δ to Y conversion for Fig. Q2(a). **(04 Marks)**

Fig. Q2(a)



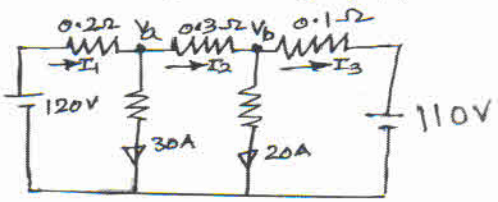
b. Find the current I_1 , I_2 using Mesh Analysis for Fig. Q2(b). **(06 Marks)**

Fig. Q2(b)



c. Calculate I_1 , I_2 , I_3 , V_a , V_b using Node analysis for Fig. Q2(c). **(06 Marks)**

Fig. Q2(c)



Module-2

3 a. State and prove Thevenin's theorem. **(05 Marks)**

b. Find I_x using Super position theorem for Fig. Q3(b). **(05 Marks)**

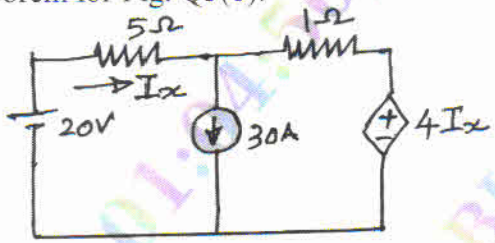


Fig. Q3 (b)

c. Verify the Reciprocity theorem for the circuit in Fig. Q3(c). **(06 Marks)**

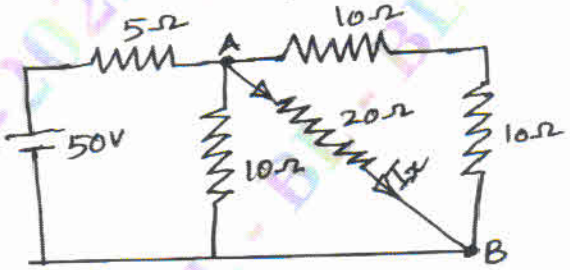


Fig. Q3 (c)

OR

4 a. State and prove Milliman's theorem. **(05 Marks)**

b. Determine I through 8Ω using Norton's theorem for Fig. Q4(b). **(05 Marks)**

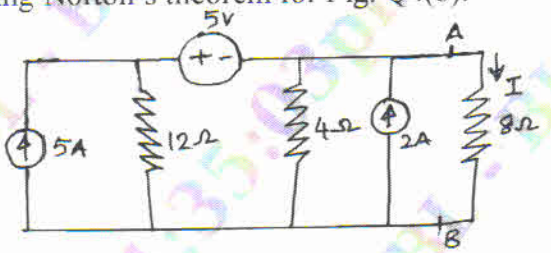


Fig. Q4 (b)

c. Find the value of R_L and Maxi Power delivered to R_L using Maxi Power theorem for Fig. Q4(c). **(06 Marks)**

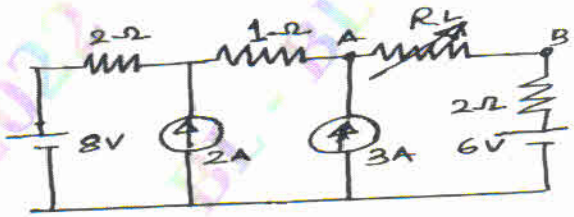


Fig. Q4 (c)

Module-3

5 a. S – opened at t = 0 for the circuit Fig. Q5(a). Calculate $V(0^+)$, $\frac{dv(0^+)}{dt}$, $\frac{d^2v(0^+)}{dt^2}$. **(05 Marks)**

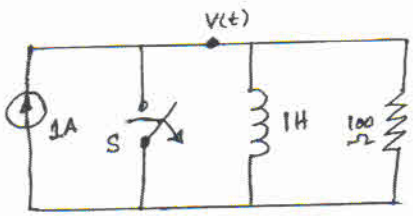
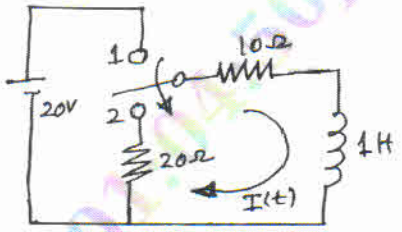


Fig. Q5(a)

b. S – is moved from 1 to 2 at t = 0 find $I(0^+)$, $\frac{dI(0^+)}{dt}$, $\frac{d^2I(0^+)}{dt^2}$ for the circuit in Fig. Q5(b).

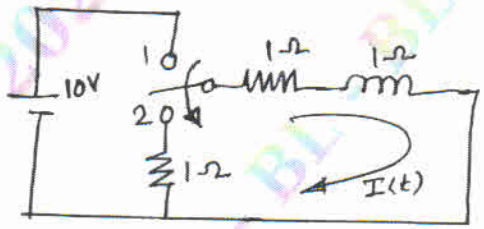
Fig. Q5 (b)



(05 Marks)

c. S – is moved from 1 to 2 at t = 0. Determine I(t) using Laplace Transformation for t > 0 in the circuit Fig. Q5(c). **(06 Marks)**

Fig. Q5 (c)

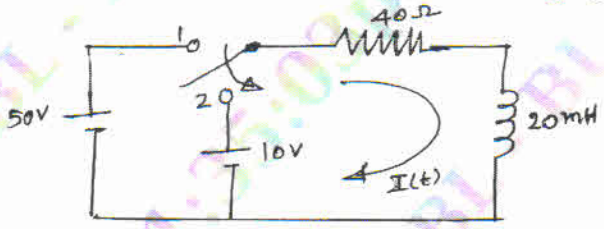


OR

6 a. Find Inverse Laplace Transform of $\frac{1}{s(s+1)}$. **(04 Marks)**

b. S – is changed from 1 to 2 at t = 0, find I(t) for t > 0 in the circuit Fig. Q6(b). **(06 Marks)**

Fig. Q6 (b)



c. A series R, L circuit with initial current I_O in inductor is connected to a D.C voltage V at t = 0. Derive an expression for I(t) through the inductor for t > 0. **(06 Marks)**

Module-4

7 a. Show the resonance frequency $f_0 = \sqrt{f_1 f_2}$ for series resonance circuit. **(05 Marks)**

b. Derive an expression for resonance frequency f_o in case of parallel resonance circuit when inductor L resistance R_L is considered. **(05 Marks)**

c. A series resonance circuit C = 1μF and its inductor L resistance is 16Ω. If the Bandwidth is 500rad/sec. Determine f_o, Q, L. **(06 Marks)**

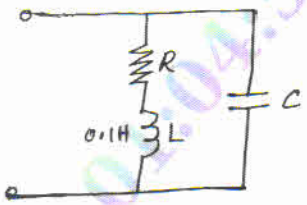
OR

8 a. Define Q – factor, Bandwidth , selectivity of series resonance circuit. **(06 Marks)**

b. Determine the frequency w_c, when the voltage across the capacitor is maximum incase of series resonance circuit. **(05 Marks)**

c. The inductor value L = 0.1H for the circuit Fig. Q8(c) and its Q value is 5. The resonance frequency of the circuit is 500rad/sec. Determine the values of capacitance C and R. **(05 Marks)**

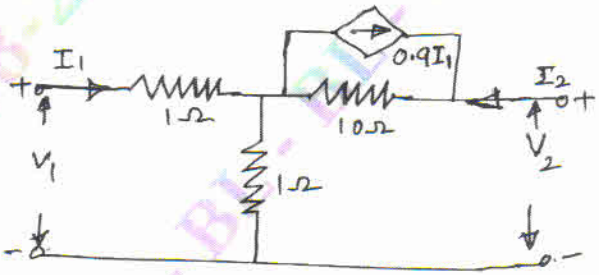
Fig. Q8 (c)



Module-5

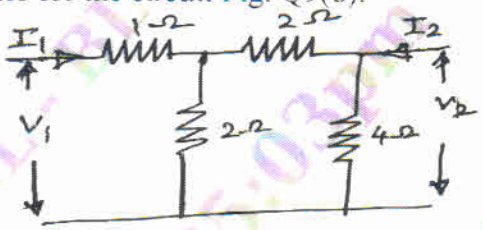
9 a. Determine Z – parameters for the circuit Fig. Q9(a). Using interrelationship between parameters, find Y parameters. **(08 Marks)**

Fig. Q9 (a)



b. Determine the h – parameters for the circuit Fig. Q9(b). **(08 Marks)**

Fig. Q9 (b)

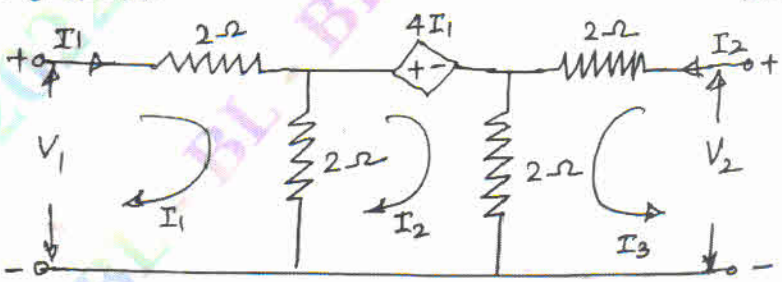


OR

10 a. Define Z – parameters and obtain the condition for symmetry. **(08 Marks)**

b. Determine Z – parameters, using Interrelationship between parameters, determine h parameters for the circuit Fig. Q10(b). **(08 Marks)**

Fig. Q10 (b)



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CBCS SCHEME

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

15EC35

Third Semester B.E. Degree Examination, July/August 2022
Electronic Instrumentation

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

b. Calculate multiplier resistance for a voltage range of (0-10)V. If a full-scale deflection current is 40 μA and internal resistance of the meter is 500 Ω. **(06 Marks)**

OR

2 a. Explain the various types of thermocouples used in RF ammeter with a sketch. **(08 Marks)**

b. Explain the operation of True RMS voltmeter with a diagram. **(08 Marks)**

Module-2

3 a. Explain the working principle of successive approximation DVM with a help of block diagram. **(10 Marks)**

b. Draw a neat block diagram and explain Digital pH meter. **(06 Marks)**

OR

4 a. Describe the working of V-F conversion integrating type DVM. **(08 Marks)**

b. Explain the operation of Digital frequency meter with a block diagram. **(08 Marks)**

Module-3

5 a. Explain the operation of vertical amplifier used in CRO with a block diagram. **(08 Marks)**

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

OR

6 a. Explain Digital Storage Oscilloscope with a block diagram. **(10 Marks)**

b. Explain AF sine and square wave generator with a block diagram. **(06 Marks)**

Module-4

7 a. Explain the measurement of phase using phase meter with a neat sketch. **(06 Marks)**

b. Describe the operation of Wien's bridge with a neat circuit diagram and derive the expression for the frequency. **(10 Marks)**

OR

8 a. The self-inductance of a coil is to be measured by Q-meter. The first measurement results are $f_1 = 8$ MHz and $C_1 = 550$ pF. The second measurement result is 3 times f_1 with a tuning capacitance of 50 pF. Find the stray capacitance and the inductance. **(08 Marks)**

b. State and derive the expression for Wheatstone bridge at balance condition. **(08 Marks)**

Module-5

9 a. Explain the Resistance Thermometer with a neat sketch. **(06 Marks)**

b. Explain the construction and working of LVDT with a necessary diagram. **(10 Marks)**

OR

10 a. Define gauge factor. Derive the expression for gauge factor and prove that $K = (1 + 2\mu)$. **(10 Marks)**

b. Explain the working of piezo-electric transducer with a neat sketch. **(06 Marks)**

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CBCS SCHEME

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

15EC36

Third Semester B.E. Degree Examination, July/August 2022
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. State and prove Coulomb's law. **(05 Marks)**

b. Three equal charges of 1 μC each are located at the three corners of a square of 10 cm side. Find the electric field intensity at the forth vacant corner of the square. **(06 Marks)**

c. A charge $Q_1 = -20\mu C$ is located at P(−6,4,6) and a charge $Q_2 = 50\mu C$ is located at R(5, 8, −2) in a free space. Find the force exerted on Q_2 by Q_1 in vector form. The distance given in meter. **(05 Marks)**

OR

2 a. Derive the expression of electric field intensity for infite line charge. **(08 Marks)**

b. Find the electric field $\vec{E}$ at the origin, if the following charge distributions are present in free space:

(i) Point charge 12 nC at P(2, 0, 6)

(ii) Uniform line charge of linear 3 nC at x = 2, y = 3. **(08 Marks)**

Module-2

3 a. State and prove the Gauss's law. **(05 Marks)**

b. State and prove Divergence theorem. **(05 Marks)**

c. If $\vec{D} = xy^2z^2\hat{a}_x + x^2yz^2\hat{a}_y + x^2y^2z\,\hat{a}_z\ C/m^2$.

Find :

(i) An expression for ρ_v

(ii) The total charge within the cube defined by $0 \le x \le 2,\ 0 \le y \le 2,\ 0 \le z \le 2$. **(06 Marks)**

OR

4 a. Derive the expression for work done interms of line integral. **(06 Marks)**

b. Given $V = \frac{\cos 2\phi}{r}$ in the free space, in cylindrical system:

(i) Find $\vec{E}$ at B(2, 30°, 1).

(ii) Find the volume charge density at point A(0.5, 60°, 1). **(10 Marks)**

Module-3

5 a. Derive the expression for Poisson's and Laplace's equation. **(04 Marks)**

b. Determine whether or not the following potential field satisfy the Laplace's equation:

(i) $V = x^2 - y^2 + z^2$

(ii) $V = r\cos\phi + z$ **(04 Marks)**

c. Use Laplace's equation to find the capacitance per unit length of a co-axial cable of inner radius 'a' in and outer radius 'b' m . Assume $V = V_0$ at r = a, V = 0 at r = b. **(08 Marks)**

OR

6 a. State and explain Biot-Savart law. **(05 Marks)**

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

c. Given $\vec{A} = (\sin 2\phi)\hat{a}_\phi$ in cylindrical coordinates. Find curl of $\vec{A}$ at $\left(2, \frac{\pi}{4}, 0\right)$. **(05 Marks)**

Module-4

7 a. Derive the expression for the force on a differential current element. **(06 Marks)**

b. A point charge of Q = 1.2C has velocity $\vec{v} = (5\hat{a}_x + 2\hat{a}_y - 3\hat{a}_z)$ m/s. Find the magnitude of the force exerted on the charge if,

(i) $\vec{E} = -18\hat{a}_x + 5\hat{a}_y - 10\hat{a}_z$ V/m

(ii) $\vec{B} = -4\hat{a}_x + 4\hat{a}_y + 3\hat{a}_z$ T. **(10 Marks)**

OR

8 a. Write short notes on Magnetization and Permeability. **(06 Marks)**

b. Derive the boundary condition for tangential component in magnetic field. **(05 Marks)**

c. A coil of 500 turns is wound on a closed iron ring of mean radius 10 cm and cross section area of 3 cm^2. Find the self inductance of the winding if the relative permeability of iron is 800. **(05 Marks)**

Module-5

9 a. Write the Maxwell equations in point form and integral form. **(06 Marks)**

b. Given $\vec{E} = E_m \sin(\omega t - \beta z)\hat{a}_y$ in free space. Find $\vec{D}$, $\vec{B}$ and $\vec{H}$. **(06 Marks)**

c. Prove that $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$. **(04 Marks)**

OR

10 a. Derive the general expression for uniform plane in free space. **(05 Marks)**

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

c. Calculate the attenuation constant and phase constant for a uniform plane wave with frequency of 10 GHz in polythelene for which $\mu = \mu_o$, $\varepsilon_r = 2.3$ and $\sigma = 256 \times 10^{-4}$ ʊ/m. **(04 Marks)**

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CBCS SCHEME

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17EC32

Third Semester B.E. Degree Examination, July/August 2022
Electronic Instrumentation

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the following terms briefly :
i) Accuracy
ii) Precision
iii) Resolution and significant figures
iv) Gross errors. **(10 Marks)**

b. What is thermocouple? Explain different types of thermocouple. **(10 Marks)**

OR

2 a. Explain multirange voltmeter With a neat diagram. **(05 Marks)**

b. 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 – 250V connect the multiplier resistance in series with 'D' Arsonval movement. [Fig.Q2(b)].

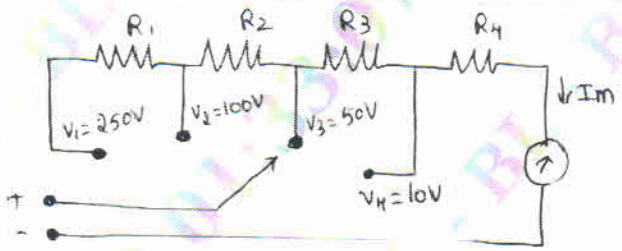

Fig.Q2(b)

c. Calculate the values of multiplier resistance on the 50V range of a DC voltmeter, that uses a 200μA , meter measurement with an internal resistance of 100Ω. **(10 Marks)** **(05 Marks)**

Module-2

3 a. Explain the operation of the ramp type digital voltmeter with voltage to time conversion waveform and block diagram. **(10 Marks)**

b. With the help of neat diagram, explain the working of successive approximation type DVM. **(10 Marks)**

OR

4 a. Explain the working of digital tachometer and digital pH meter. **(10 Marks)**

b. What is the principle used in measuring frequency of a signal digital technique, with diagram. Explain the operation of a digital frequency matter. **(10 Marks)**

Module-3

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

b. Draw the block diagram of CRT and explain the function of each block with CRT features. **(10 Marks)**

OR

6 a. Explain the operation of an AF sine and square wave generator with the help of a block diagram. **(10 Marks)**

b. Explain in detail the working of digital storage oscilloscope and list the advantages of digital storage oscilloscope. **(10 Marks)**

Module-4

7 a. Sketch and explain the operation of a phase sensitive detector to compare the phase of a signal with a reference signal. **(10 Marks)**

b. Derive the balance equation for Wheatstone's bridge and mention its advantages and limitations. **(10 Marks)**

OR

8 a. Find parallel R and C that causes a Wein's bridge to null with the following components values $R_1 = 2.7K\Omega$, $R_2 = 22K\Omega$, $C_1 = 5\mu F$, $R_4 = 100K\Omega$ and operating frequency is 2.2KHz. **(10 Marks)**

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

Module-5

9 a. Explain the operation of resistive position transducer with block diagram. **(10 Marks)**

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

OR

10 a. Explain the construction, principle and operation of LVDT. **(10 Marks)**

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

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CBCS SCHEME

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17EC34

Third Semester B.E. Degree Examination, July/August 2022
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 truthtable and write the Boolean equations when a output variable 'z' is true when input variable a and b are true and when input variables a and c are true but b is false. **(04 Marks)**

b. Find the prime implicants and the essential prime implicants of the following Boolean function using K-Map.
i) $f(a, b, c, d) = \sum m(1, 3, 5, 7, 8, 10, 12, 13, 14) + \sum d(4, 6, 15)$
ii) $f(a, b, c, d) = \pi(0, 1, 4, 5, 8, 9, 11) + \pi d(2, 10)$ **(06 Marks)**

c. Find the minimal sum for the following Boolean function using Quine McCluskey method.
$f(a, b, c, d) = \sum(2, 3, 4, 5, 13, 15,) + \sum d(8, 9, 10, 11)$. **(10 Marks)**

OR

2 a. Convert the following into proper canonical form
i) $P = (\overline{w} + x)(y + \overline{z})$ ii) $x = \overline{a}b + bc$ **(04 Marks)**

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

c. Find the prime implicants of the function using Quine McCluskey method.
$f(w, x, y, z) = \sum(1, 3, 4, 5, 6, 9, 11, 12, 13, 14)$ **(08 Marks)**

Module-2

3 a. Explain 4 bit look ahead carry adder with necessary diagram and relevant expression. **(10 Marks)**

b. Implement full subtractor using 74138 decoder. **(04 Marks)**

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

OR

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

b. Design a two bit magnitude comparator. **(08 Marks)**

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

Module-3

5 a. Explain the operation of switch debouncer using SR latch with the help of circuit and waveforms. **(06 Marks)**

b. What is the significance of edge triggering? Explain the working of positive edge triggered D flip-flop with their function table. **(08 Marks)**

c. Derive the characteristics equation for JK and T flip flop. **(06 Marks)**

OR

6 a. Explain the working of master slave JK flip-flop with the help of circuit diagram and waveform. **(10 Marks)**

b. Explain race around condition and how it is overcome. **(05 Marks)**

c. Explain with timing diagram (i) SR flip-flop ii) D flip-flop. **(05 Marks)**

Module-4

7 a. Design a register using positive edge triggered D flip-flop and multiplexes to operate as indicated below.

S_1	S_2	Register operation
0	0	Hold
0	1	Synchronous clear
1	0	Complement – contents
1	1	Circular shift left

(10 Marks)

b. Design a Mod 6 synchronous counter using D flip-flop to generate of sequence 0, 2, 3, 6, 5, 1, 0. **(10 Marks)**

OR

8 a. Design a 3 bit binary synchronous counter using the JK flip-flop. Write excitation table, transition table and logic diagram. **(12 Marks)**

b. With a neat diagram, explain the operation of universal shift register. **(08 Marks)**

Module-5

9 a. Explain the Mealy and Moose model of clocked synchronous sequential network. **(10 Marks)**

b. Analyse by given sequential circuit shown in Fig Q9(b), by writing input and output equations, state table and state diagram.

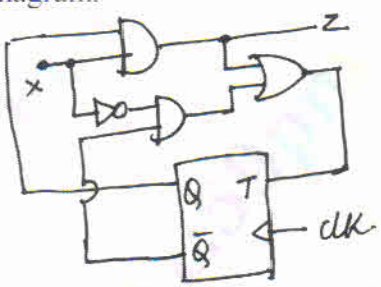

Fig Q9(b) **(10 Marks)**

OR

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

b. Design a sequential circuit for a state diagram shown in Fig Q10(b) using JK flip-flop.

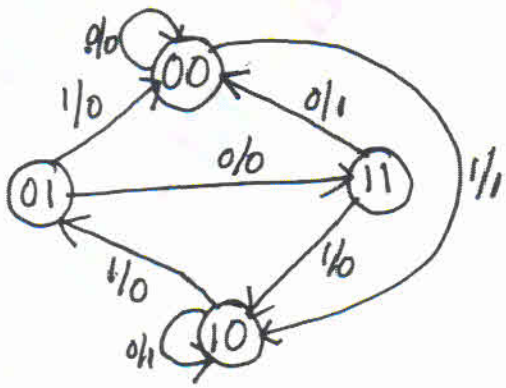

Fig Q10(b) **(10 Marks)**

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CBCS SCHEME

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17EC35

Third Semester B.E. Degree Examination, July/August 2022
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. Using Source transformation find 'V' for circuit shown in Fig. Q1 (a). **(10 Marks)**

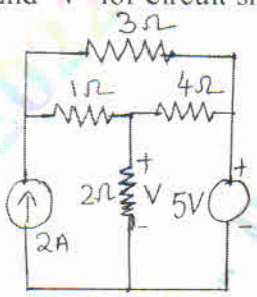

Fig. Q1 (a)

b. Using star-delta transformation find equivalent resistance across terminals a and b for circuit shown in Fig. Q1 (b). **(10 Marks)**

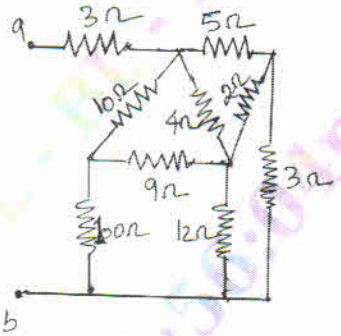

Fig. Q1 (b)

OR

2 a. Find magnitude of voltage source 'V_1' which results in effective voltage of 20 volts across 5 Ω resistor in the circuit, shown in Fig. Q2 (a). Also find power dissipated by inductance of reactance 2Ω. **(10 Marks)**

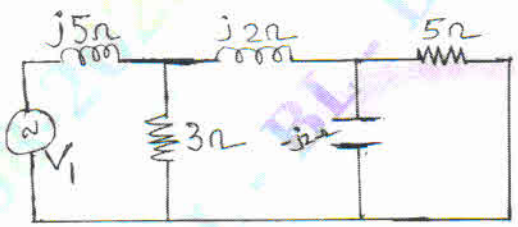

Fig. Q2 (a)

b. Find power delivered by each source for circuit shown in Fig. Q2 (b) using nodal analysis. **(10 Marks)**

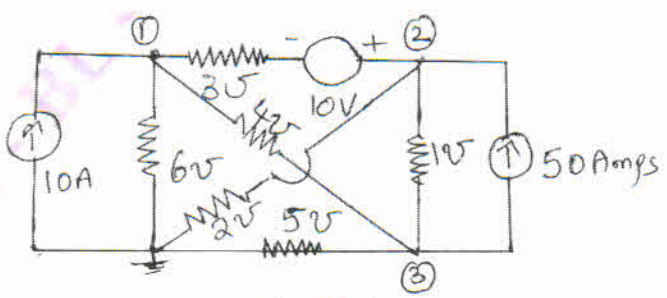

Fig. Q2 (b)

Module-2

3 a. Find current through 2 Ω resistor using superposition theorem for circuit shown in Fig. Q3 (a). Also state Millman's thorem and write expression for equivalent voltage and impedance. . **(10 Marks)**

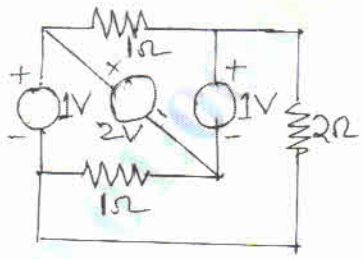

Fig. Q3 (a)

b. Verify Reciprocity theorem for circuit shown in Fig. Q3 (b). **(10 Marks)**

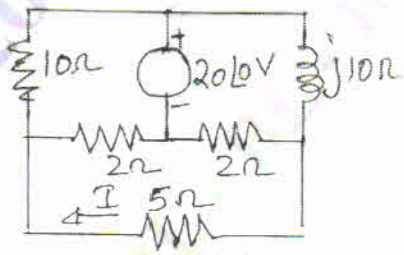

Fig. Q3 (b)

OR

4 a. Find current through galvanometer of resistance 50 Ω using Thevinin's Theorem for circuit shown in Fig. Q4 (a). **(10 Marks)**

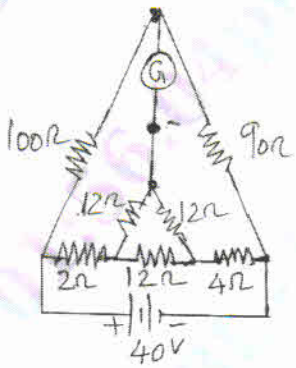

Fig. Q4 (a)

b. Write the conditions for maximum power for A.C. circuit when load is,

(i) Pure resistance (ii) Variable impedance

Find maximum power transferred to load of variable resistance connected across terminals ab for circuit shown in Fig. Q4 (b). **(10 Marks)**

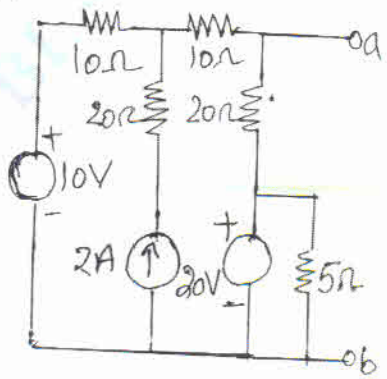

Fig. Q4 (b)

Module-3

5 a. Write equivalent form of initial and final conditions of elements resistance, inductance and capacitance. **(07 Marks)**

b. The network shown in Fig. Q5 (b), is in steady state with switch 'K' closed. At t = 0 switch is opened. Determine voltage across the switch, V_K and $\frac{dV_K}{dt}$ at $t = 0^+$ **(07 Marks)**

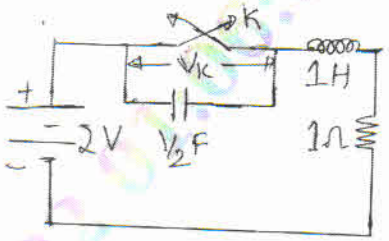

Fig. Q5 (b)

c. The network shown in Fig. Q5 (c) has switch 'K' opened at t = 0. Solve for V, $\frac{dV}{dt}$ and $\frac{d^2V}{dt^2}$ at $t = 0^+$ if I = 1 amp, R = 100 Ω and L = 1 Henry. Refer Fig. Q5 (c). **(06 Marks)**

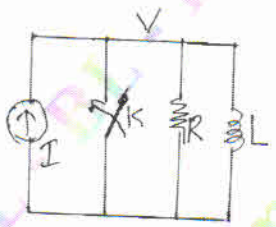

Fig. Q5 (c)

OR

6 a. Derive the expression for finding Laplace Transform of a periodic waveform of time period 'T' seconds. Also find the Laplace transform of the wave form shown in Fig. Q6 (a). **(10 Marks)**

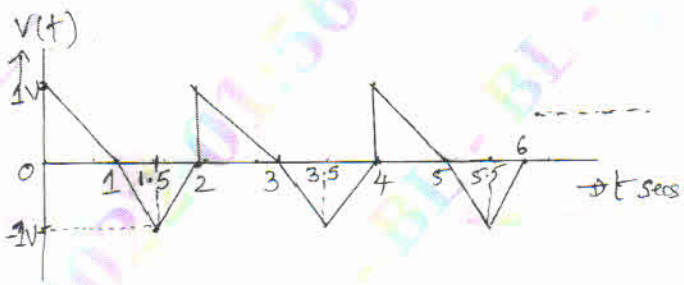

Fig. Q6 (a)

b. In given network shown in Fig. Q6 (b), find $i_2(t)$ if switch is closed at t = 0 using Laplace transform. **(10 Marks)**

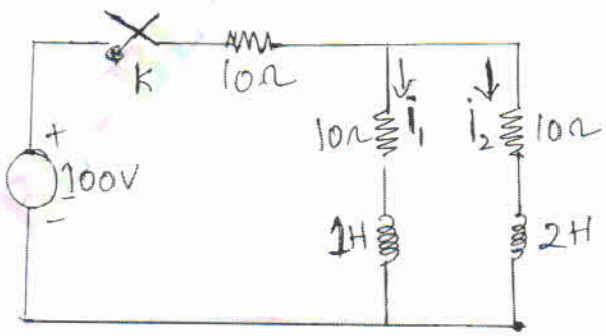

Fig. Q6 (b)

Module-4

7 a. Show that resonant frequency is the geometric mean of half power frequencies. (06 Marks)

b. Show that in a R-L-C series circuit with frequency 'W' of supply being varied at constant voltage the voltage across the capacitor becomes maximum at a frequency,

$$\omega_C = \left[\frac{1}{LC} - \frac{R^2}{2L^2}\right]^{\frac{1}{2}}.$$ (06 Marks)

c. A coil having a resistance of 5 Ω and an inductance of 100 mH is connected in series with a 50 μF capacitor across 200 V, variable supply frequency. Find voltage across coil and capacitor when the power factor of the circuit becomes unity. Also find power dissipated at resonance. (08 Marks)

OR

8 a. Define selectivity and Q-factor of a resonant circuit. Also discuss the frequency response curves for parallel resonance. (09 Marks)

b. Find the value of 'L' for which the circuit shown is resonant at a frequency ω = 5000 rad/sec. Refer Fig. Q8 (b). (07 Marks)

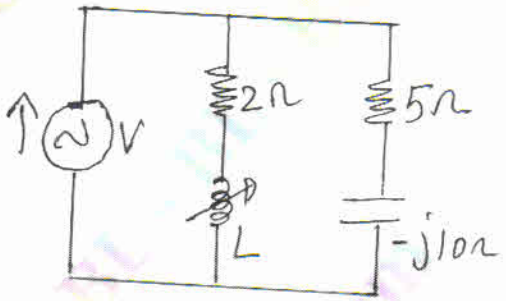

Fig. Q8 (b)

c. Determine the values of R_L and R_C which cause the circuit shown in Fig. Q8 (c) is resonant at all frequencies.

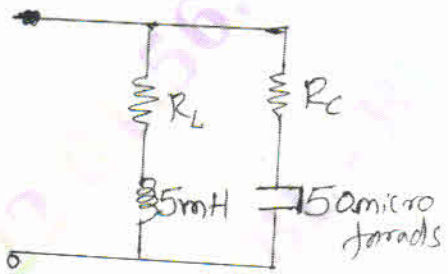

Fig. Q8 (c) (04 Marks)

Module-5

9 a. Define Y-parameters and express ABCD parameters in term of h-parameters. (08 Marks)

b. Find Y and h parameters for the network shown in Fig. Q9 (b). (12 Marks)

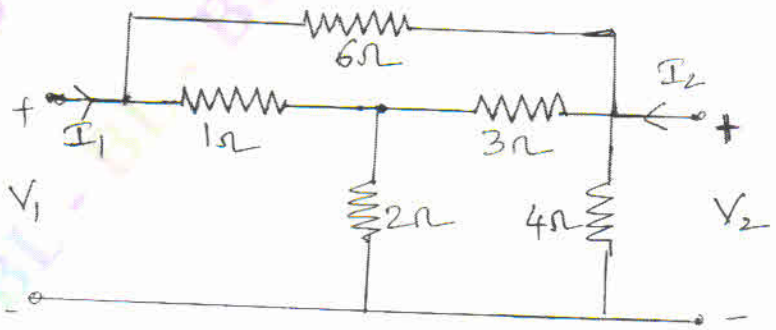

Fig. Q9 (b)

OR

10 a. Write the conditions for reciprocity and symmetry of Z, Y, T and h-parameters. **(08 Marks)**

b. For the network shown in Fig. Q10 (b), find Z and ABCD parameters and check for reciprocity. **(12 Marks)**

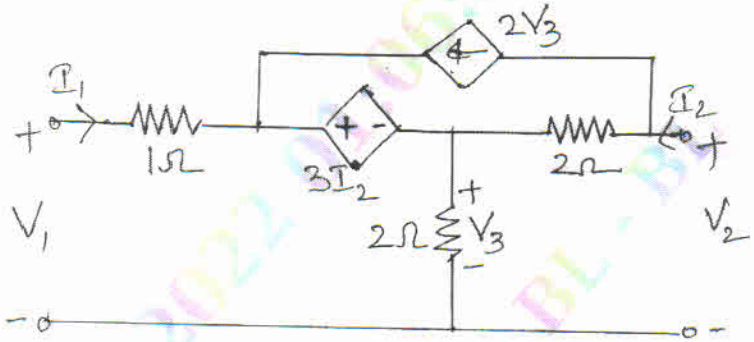

Fig. Q10 (b)

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17EC36

Third Semester B.E. Degree Examination, July/August 2022
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. Also explain how force due to many charges can be determined. **(10 Marks)**

b. Point charges of 50 nC each are located at A(1, 0, 0), B(–1, 0, 0), C(0, 1, 0) and D(0, –1, 0) in free space. Find the total force exerted on the charge at A. **(10 Marks)**

OR

2 a. Define the term Electric field intensity and derive the expression for the electric field intensity at any point due to an infinite line charge of density ρ_L C/m distributed along Z-axis. **(10 Marks)**

b. Calculate the flux density $\vec{D}$ at point P(2, –3, 6) produced by:
(i) Point charge Q_A = 55 mC at (–2, 3, 6)
(ii) A uniform line charge ρ_L = 200 mC/m on X-axis
(iii) A uniform surface charge $\rho_S = 120\ \mu c/m^2$ on the plane Z = –5 m. **(10 Marks)**

Module-2

3 a. State and explain Gauss's law. **(05 Marks)**

b. A surface charge of density ρ_S C/m^2 is uniformly spread over an infinite plane. Apply Gauss law to determine the electric field intensity at any point due to this charge distribution. **(07 Marks)**

c. Calculate the divergence of vector $\vec{D}$ at a point P due to charge distribution defined by the equation.

(i) $\vec{D} = \frac{1}{2}\left[10xyz\,\hat{a}_x + 5x^2z\,\hat{a}_y + [2z^3 - 5x^2y]\hat{a}_z\right]$ at P(–2, 3, 5)

(ii) $\vec{D} = 5z^2\,\hat{a}_\rho + 10\rho z\,\hat{a}_z$ at P(3, –45°, 5) **(08 Marks)**

OR

4 a. Show that electric field intensity is equal to negative gradient of electric potential :

$\vec{E} = -\nabla V$ **(05 Marks)**

b. Three identical point charges of 4PC each are located at the corners of an equilateral triangle of 0.5 mm on a side in free space. How much work must be done to move one charge to a point equidistant from the other two and on the line joining them? **(08 Marks)**

c. Obtain the expression for continuity equation of current and what is its significance. **(07 Marks)**

Module-3

5 a. Derive Laplace's and Poisson's equations form Gauss's law. **(05 Marks)**

b. Using Laplace's equation, derive the expression for the capacitance of a coaxial cable. Assume suitable boundary conditions. **(08 Marks)**

c. Given the potential field $V = [A\rho^4 + B\rho^{-4}]\sin 4\phi$:

(i) Show that $\nabla^2 V = 0$

(ii) Select A and B such that V = 100 V and |E| = 500 V/m at P(1, 22.5°, 2) **(07 Marks)**

OR

6 a. Derive the expression for the magnetic field intensity due to a long conductor carrying a steady current 'I'. **(07 Marks)**

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

c. Compare scalar and vector magnetic potentials. **(05 Marks)**

Module-4

7 a. Derive Lorentz force equation and mention the application of its solution. **(06 Marks)**

b. Derive an expression for the force between two differential current elements carrying steady currents I_1 and I_2 respectively. **(06 Marks)**

c. Point charge Q = 18 nC has a velocity 5×10^6 m/s in the direction :

$\hat{a}_v = 0.6\hat{a}_x + 0.75\hat{a}_y + 0.3\hat{a}_z$

Calculate the magnetic force exerted on the charge by the field

(i) $\vec{B} = [-3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z]$ mT (ii) $\vec{E} = [-3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z]$ KV/m

(iii) When both $\vec{B}$ and $\vec{E}$ acting together. **(08 Marks)**

OR

8 a. Derive the magnetic boundary conditions at the interface between two different magnetic materials. **(08 Marks)**

b. Obtain the expression for the magnetic force exerted on a magnetic material. **(06 Marks)**

c. Given a magnetic material for which $X_m = 3.1$ and within which $\vec{B} = 0.4y\,\hat{a}_z$ T. Find $\vec{H}$, μ, μ_r, $\vec{M}$ and $\vec{J}$. **(06 Marks)**

Module-5

9 a. Using Faraday's law, deduce the Maxwell's equation to relate time varying electric and magnetic fields. **(08 Marks)**

b. What is displacement current? For a harmonically varying field, show that the conduction and displacement currents densities are in phase quadrature. **(06 Marks)**

c. Let $\mu = 3 \times 10^{-5}$ H/m, $\epsilon = 1.2 \times 10^{-10}$ F/m and $\sigma = 0$ everywhere, if $\vec{H} = 2\cos(10^8 t - \beta x)\,\hat{a}_z$ A/m.

Use Maxwell's equations to obtain the expressions for $\vec{B}$, $\vec{D}$, $\vec{E}$ and β. **(06 Marks)**

OR

10 a. Derive the wave equation interms of $\vec{E}$ and $\vec{H}$ for a general medium. **(08 Marks)**

b. State and explain Poynting theorem. **(06 Marks)**

c. The $\vec{H}$ field in free space is given by $\vec{H}(x,t) = 10\cos(10^8 t - \beta x)\,\hat{a}_y$ A/m. Find β, λ and $\vec{E}(x,t)$. **(06 Marks)**

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CBCS SCHEME

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17MATDIP31

Third Semester B.E. Degree Examination, July/August 2022
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the modulus and amplitude of $1-i\sqrt{3}$ and hence express it in polar form. **(07 Marks)**

b. Express the following in the form $a+ib$ and also find the conjugate $\dfrac{1}{1-\cos\theta+i\sin\theta}$. **(07 Marks)**

c. Find the sine of the angle between $\vec{a}=2\hat{i}-2\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}+2\hat{k}$. **(06 Marks)**

OR

2 a. Prove that $(1+\cos\theta+i\sin\theta)^n+(1+\cos\theta-i\sin\theta)^n=2^{n+1}\cos\dfrac{n\theta}{2}\cos\dfrac{n\theta}{2}$. **(06 Marks)**

b. Find $\vec{a}\cdot\left(\vec{b}\times\vec{c}\right)$, $\vec{b}\times\left(\vec{a}\times\vec{c}\right)$ and $\vec{c}\cdot\left(\vec{a}\times\vec{b}\right)$ where $\vec{a}=\hat{i}+\hat{j}-\hat{k}$, $\vec{b}=2\hat{i}-\hat{j}+2\hat{k}$, $\vec{c}=3\hat{i}-\hat{j}-\hat{k}$. **(06 Marks)**

c. Find the value of λ so that the points A(−1,4,−3), B(3,2,−5), C(−3,8,−5) and D(−3,λ,1) may lie on one plane. **(08 Marks)**

Module-2

3 a. If $y=a\cos(\log x)+b\sin(\log x)$ prove that $x^2y_{n+2}+(2n+1)xy_{n+1}+(n^2+1)y_n=0$. **(08 Marks)**

b. Find the angle between the curves $r=a\cos\theta$, $2r=a$. **(06 Marks)**

c. Using Euler's theorem, prove that $xu_x+yu_y=2\tan u$, where $u=\sin^{-1}\left(\dfrac{x^3+y^3}{x+y}\right)$. **(06 Marks)**

OR

4 a. Obtain the Maclaurin's series expansion of the function $\sqrt{1+\sin 2x}$ upto x^4. **(08 Marks)**

b. Find the pedal equation of the curve $r=a(1-\cos\theta)$. **(06 Marks)**

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

Module-3

5 a. Obtain a reduction formula for $\int\sin^n x\,dx$ $(n>0)$. **(08 Marks)**

b. Evaluate $\displaystyle\int_0^\infty\frac{x^2}{(1+x^6)^{\frac{7}{2}}}dx$. **(06 Marks)**

c. Evaluate $\displaystyle\int_0^1\int_{x^2}^{x}(x^2+3y+2)\,dy\,dx$. **(06 Marks)**

OR

6 a. Evaluate $\int_0^1 \int_0^y xy\,dx\,dy$. **(08 Marks)**

b. Evaluate $\int_0^{2a} x^2\sqrt{2ax-x^2}\,dx$. **(06 Marks)**

c. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2yz\,dx\,dy\,dz$. **(06 Marks)**

Module-4

7 a. A particle moves along the curve $x = 1-t^3$, $y = 1+t^2$ and $z = 2t-5$. Find the components of velocity and acceleration at $t = 1$ in the direction $2i+j+2k$. **(08 Marks)**

b. Find the directional derivatives of $\phi = x^2yz+4xz^2$ at $(1,-2,-1)$ along $2i-j-2k$. **(06 Marks)**

c. Show that $\vec{F} = (y+z)i+(z+x)j+(x+y)k$ is irrotational. **(06 Marks)**

OR

8 a. If $\vec{F} = (x+y+z)\hat{i}+\hat{j}-(x+y)\hat{k}$, show that $\vec{F}\times \text{curl}\,\vec{F} = 0$. **(08 Marks)**

b. If $\phi(x,y,z) = x^3+y^3+z^3-3xyz$, find $\nabla\phi$, $|\nabla\phi|$ at $(1,-1,2)$. **(06 Marks)**

c. Find div $\vec{F}$ and curl $\vec{F}$ where $\vec{F} = (xz^3\hat{i}-2x^2yz\hat{j}+2yz^4\hat{k})$ at $(1,-1,1)$. **(06 Marks)**

Module-5

9 a. Solve $x^2ydx-(x^3+y^3)dy = 0$. **(08 Marks)**

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

c. Solve $(5x^4+3x^2y^2-2xy^3)dx+(2x^3y-3x^2y^2-5y^4)dy = 0$. **(06 Marks)**

OR

10 a. Solve $\frac{dy}{dx}+y\cot x = \sin x$. **(08 Marks)**

b. Solve $\frac{dy}{dx}-y\tan x = y^2\sec x$. **(06 Marks)**

c. Solve $(x^2y-2xy^2)dx-(x^3-3x^2y)dy = 0$. **(06 Marks)**

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CBCS SCHEME

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15MATDIP31

Third Semester B.E. Degree Examination, July/August 2022
Additional Mathematics - I

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Express $\frac{(2-3i)(2+i)^2}{1+i}$ in the form of x + iy. **(06 Marks)**

b. If $x+\frac{1}{x} = 2\cos\alpha$ then prove that $x^n + \frac{1}{x^n} = 2\cos n\alpha$. **(05 Marks)**

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

OR

2 a. Find the Fourth roots of $1 - i\sqrt{3}$ and represent them on an Argand plane. **(06 Marks)**

b. Show that the vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + 4\hat{j} - \hat{k}$ are co-planar. **(05 Marks)**

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

Module-2

3 a. Obtain the n^{th} derivative of $e^{ax}\cos(bx + c)$. **(06 Marks)**

b. Show that the curves $r = a(1+\cos\theta)$ and $r = a(1-\cos\theta)$ are orthogonal. **(05 Marks)**

c. If $u = x(1-y)$, $v = xy$ find the Jacobians $J = \frac{\partial(u,v)}{\partial(x,y)}$ and $J' = \frac{\partial(x,y)}{\partial(u,v)}$. **(05 Marks)**

OR

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

b. If $u = \sin^{-1}\left(\frac{x^3 - y^3}{x - y}\right)$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2\tan u$. **(05 Marks)**

c. If $z = xy^2 + x^2y$, where $x = at^2$, $y = 2at$. Find $\frac{dz}{dt}$. **(05 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi} x\sin^6 x\ dx$. **(06 Marks)**

b. Evaluate $\int_0^1\int_0^1 \frac{dx\,dy}{\sqrt{(1-x^2)(1-y^2)}}$. **(05 Marks)**

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

OR

6 a. Evaluate $\int_0^1 x^5(1-x^2)^{\frac{5}{2}}\, x.dx$. **(06 Marks)**

b. Evaluate $\int_0^{2a}\int_0^{\frac{x^2}{4a}} xy\ dy\,dx$. **(05 Marks)**

c. Evaluate $\int_0^1\int_0^1\int_0^y xyz\ dx\,dy\,dz$. **(05 Marks)**

Module-4

7 a. A particle moves along the curve $\vec{r} = 2t^2\,\hat{i} + (t^2 - 4t)\hat{j} + (3t-5)\hat{k}$. Find the components of velocity and acceleration at t = 2. **(06 Marks)**

b. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at (1, -2, -1) along $\vec{a} = 2\hat{i} - \hat{j} - 2\hat{k}$. **(05 Marks)**

c. Find div $\vec{f}$ for $\vec{f} = \nabla(x^3 + y^3 + z^3 - 3xyz)$. **(05 Marks)**

OR

8 a. Find the unit tangent vector to the curve $\vec{r} = t^2\,\hat{i} + 2t\,\hat{j} - t^3\,\hat{k}$ at $t = \pm 1$. **(06 Marks)**

b. Find the unit normal vector to the surface xy + yz + zx = c at the point (-1, 2, 3). **(05 Marks)**

c. Show that $\vec{f} = (z + \sin y)\,\hat{i} + (x\cos y - z)\,\hat{j} + (x-y)\,\hat{k}$ is irrotational. **(05 Marks)**

Module-5

9 a. Solve $\frac{dy}{dx} = \frac{y}{x} + \text{Sin}\left(\frac{y}{x}\right)$. **(06 Marks)**

b. Solve $\frac{dy}{dx} + y\cot x = \text{Sin}\,x$. **(05 Marks)**

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

OR

10 a. Solve $\frac{dy}{dx} = (4x + y + 1)^2$. **(06 Marks)**

b. Solve $\frac{dy}{dx} + \frac{2}{x}y = \frac{3x^2+1}{x^2}$. **(05 Marks)**

c. Solve $[y(1+\frac{1}{x}) + \text{Cos}\,y]\,dx + (x + \log x - x\,\text{Sin}\,y)\,dy = 0$. **(05 Marks)**

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18 III Sem EC

CBCS SCHEME

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18EC32

Third Semester B.E. Degree Examination, July/August 2022
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. Briefly explain the classification of electrical networks. **(10 Marks)**

b. Three resistance are connected in delta obtain the star equivalent of the network. **(05 Marks)**

c. Find the equivalent resistance between any 2 corners. (Ref. Fig Q1(c))

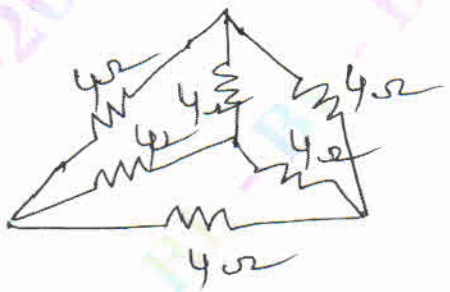

Fig Q1(c) **(05 Marks)**

OR

2 a. Using Mesh current analysis, find the currents in various branches in the circuit. (Ref. Fig Q2(a))

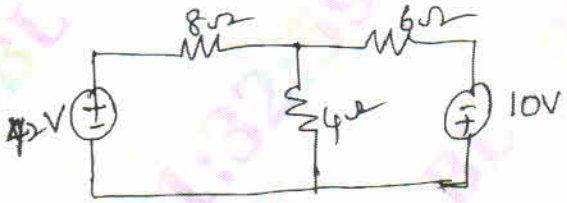

Fig Q2(a) **(10 Marks)**

b. Find the current through the braches using Nodal analysis. (Ref. Fig Q2(b)).

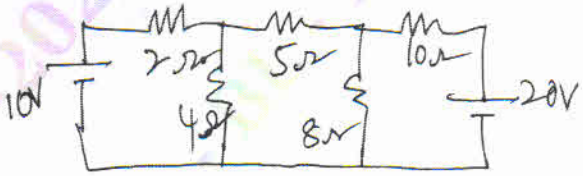

Fig Q2(b) **(10 Marks)**

Module-2

3 a. State and explain Thevenin's theorem. **(10 Marks)**

b. Find the Norton's equivalent for the given Fig Q3(b).

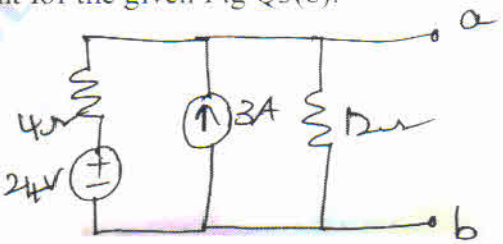

Fig Q3(b) **(10 Marks)**

OR

4 a. State and explain maximum power transfer when load impedance consisting of variable resistance and variable reactant.

b. Using Millman's theorem, find the current flowing through (4+j3) Ω of the circuit as in Fig Q4(a).

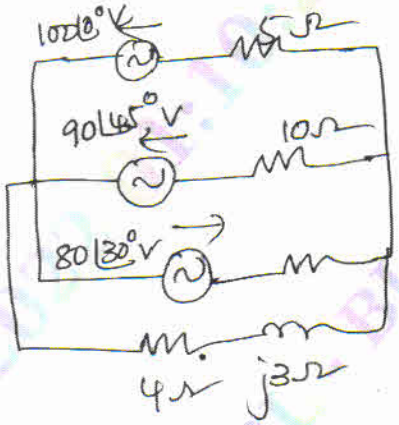

Fig Q4(a) **(10 Marks)**

Module-3

5 a. Discuss the initials and final conditions in inductor, capacitor and resistor. **(10 Marks)**

b. Find $V_c(0^+)$. Assume that the switch was in closed state for a long time. (Ref. Fig Q5(b))

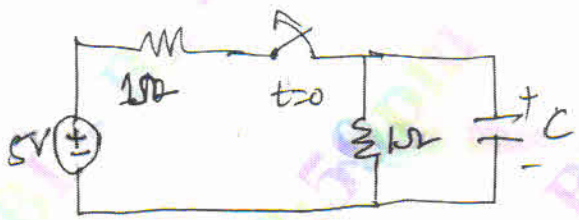

Fig Q5(b) **(10 Marks)**

OR

6 a. In the given network, K is closed at t = 0 with zero current in the inductor. Find the values of i, $\frac{di}{dt}$, $\frac{d^2i}{dt^2}$ at $t = 0^+$, if R = 8Ω and L = 0.2H. (Ref. Fig Q6(a))

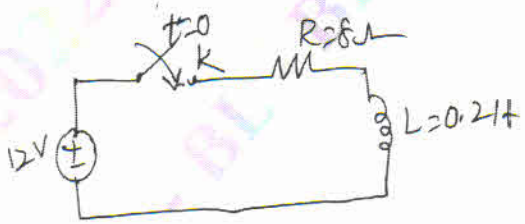

Fig Q6(a) **(10 Marks)**

b. In circuit shown in Fig Q6(b). The switch K is changed from position 1 to position 2 at t = 0. Steady state condition having been reached at position. Find the values of i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$.

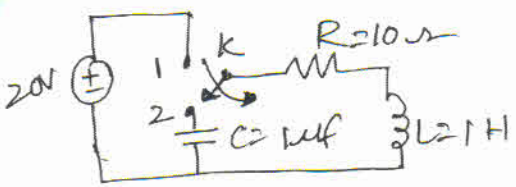

Fig Q6(b) **(10 Marks)**

Module-4

7 a. Obtain the Laplace transform of
i) Unit step function ii) Unit Ramp function iii) Unit impulse function. **(10 Marks)**

b. Find the Laplace transform of following :

(i) $x(t) = 2t\,u(t) - \frac{4d}{dt}\delta(t)$ ii) $x(t) = 5u(t/3)$ iii) $x(t) = 5e^{-t/2}u(t)$ **(10 Marks)**

OR

8 a. Find the Laplace transform for the given Figure Q8(a).

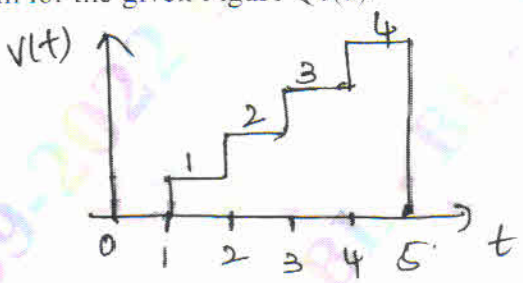

Fig Q8(a) **(10 Marks)**

b. Find the Laplace transform for the Fig Q8(b)

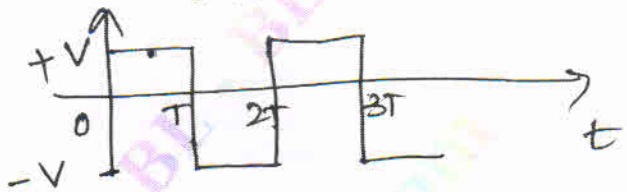

Fig Q8(b) **(10 Marks)**

Module-5

9 a. What is resonance? Derive as expression for half power frequencies in series RLC circuit. Define Q-factor, selectivity and Bandwidth. **(10 Marks)**

b. Find the value of R_L for which, circuit shown below in Fig Q9(b), is resonant.

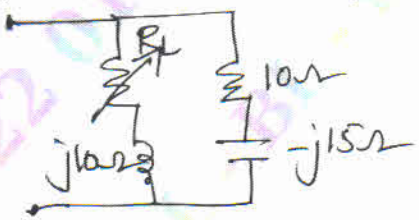

Fig Q9(b) **(10 Marks)**

OR

10 a. Find Y and Z parameters for the network (Ref. Fig Q10(a)).

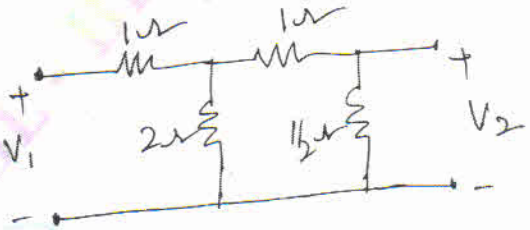

Fig Q10(a) **(10 Marks)**

b. Derive Y parameters in terms of ABCD parameters. **(10 Marks)**

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18EC33

Third Semester B.E. Degree Examination, July/August 2022
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. In a filled band, what is the net current density and if a hole is created, what is the net current generated? Describe the superposition of the (E,K) band structure for a semiconductor in an electric field. **(10 Marks)**

b. A Si bar 4 cm long and 500 μm^2 in cross sectional area is doped with $2.5\times10^{18}/cm^3$ phosphorus. Find the current at 300°K with 22 V applied voltage. How long it take an average electron to drift 4 cm in pure silicon at an electric field of 70 V/cm. Calculate the time required at 10^5 V/cm. Assume mobility of the electrons is 0.1675 m^2/Vsec and scattering limited velocity (V_S) in 10^7 cm/sec. **(10 Marks)**

OR

2 a. Show the random thermal motion of an electron in a solid and what happens when electric field is applied? Derive the equation which relates the current density and mobility in a semiconductor in an applied electric field. **(10 Marks)**

b. Consider a semiconductor bar with width = 0.02 cm, thickness = 15 μm and length = 8 mm. For B_Z = 15 kg and a current of 3.5 mA, $V_{AB} = -5$ V, V_{CD} = 400 mV, find the type, concentration and mobility of the majority carrier. **(10 Marks)**

Module-2

3 a. Analyze the effect of a bias at a pn junction on electric field, potential particle flow and current direction at (i) Equilibrium (ii) Forward bias (iii) Reverse bias. **(12 Marks)**

b. Explain the operation of pin photodetector. **(08 Marks)**

OR

4 a. What type of breakdown occurs in a lightly doped pn junction? Show the energy band diagram of a pn junction in a reverse bias, single ionizing collision by an incoming electron in the depletion region and primary, secondary and tertiary collisions. **(10 Marks)**

b. Obtain the relationship between the open circuit voltage and optical generation rate starting from the expression for the optically generated illuminated pn junction. **(10 Marks)**

Module-3

5 a. Derive the Ebers-Moll equations for the thermal currents in a transistor and represent the same. **(14 Marks)**

b. When the base narrowing effect occur in a transistor? **(06 Marks)**

OR

6 a. Illustrate the hole and electron flow in a pnp transistor with proper biasing. **(10 Marks)**

b. Show the switching effects in a common emitter transistor circuit. **(10 Marks)**

Module-4

7 a. Show the electric field direction, charge flow and induced charge region in a MOS capacitor with P-type substrate and n-type substrate when a moderate positive gate bias is applied. **(08 Marks)**

b. Represent the energy-band diagram through a MOS capacitor structure with P-type as a semiconductor and differential charge distribution for a differential change in gate voltage in the depletion and inversion mode. **(12 Marks)**

OR

8 a. Represent the energy band diagram of a MOS capacitor for the following cases :

(i) Negative gate bias in a MOS capacitor with ptype substrate.

(ii) Positive gate bias in a MOS capacitor with ntype as substrate.

(iii) Large negate gate bias in a MOS capacitor with n type as substrate. **(10 Marks)**

b. Show the channel formation in the MOS structure and I_D versus V_{DS} curve for the following cases :

(i) $V_{gs} > V_t$ and small V_{DS} value.

(ii) $V_{gs} > V_t$ and large V_{DS} value.

(iii) $V_{gs} > V_t$ and $V_{DS} = V_{DS}$ (sat). **(10 Marks)**

Module-5

9 a. Write the names of the different fabrication steps in a pn junction. **(08 Marks)**

b. Explain the evolution of ICs over the years. **(12 Marks)**

OR

10 a. Draw a neat sketch showing the ion implantation system in the fabrication of a pn junction and explain. **(10 Marks)**

b. Write the structure of a CMOS inverter and show the formation of p-channel and n-channel devices together. **(10 Marks)**

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CBCS SCHEME

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18EC34

Third Semester B.E. Degree Examination, July/August 2022
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. Convert the following Boolean function into minterm canonical or maxterm canonical form:
(i) $y = \bar{\omega}x + y\bar{z}$ (ii) $(A + \bar{B} + C)(\bar{A} + D)$ **(06 Marks)**

b. Simplify the Boolean function and identify the prime and essential prime implicants:
(i) $f(a,b,c,d) = \sum m(1, 5, 7, 8, 9, 10, 11, 13, 15)$
(ii) $f(a,b,c,d) = \pi M(0, 2, 3, 8, 9, 10, 12, 14)$ **(06 Marks)**

c. Simplify the given Boolean function using Quine-Mc Cluskey method.
$f(a,b,c,d) = \sum m(0, 1, 2, 3, 6, 7, 8, 9, 14, 15)$ **(08 Marks)**

OR

2 a. Design a combinational logic circuit that has three input variables and produces a logic 1 output when more than one input variables are logic 1. **(06 Marks)**

b. Simplify the following Boolean function using K-map.
(i) $f(w,x,y,z) = \pi(2, 3, 8, 9, 10, 11, 12, 13, 14, 15)$
(ii) $f(w,x,y,z) = \sum m(6, 7, 9, 10, 13) + \sum d(1, 4, 5, 11, 15)$ **(06 Marks)**

c. Simplify the given Boolean function using Quine-Mc Clusky method.
$f(w,x,y,z) = \sum m(1,3,13,15) + \sum d(8,9,10,11)$ **(08 Marks)**

Module-2

3 a. Design a combinational circuit using 3 : 8 decoder (IC – 74138) that generates a logic 1 output when majority of 4 inputs are true. **(06 Marks)**

b. Explain 4-bit carry look ahead adder with neat diagram. **(08 Marks)**

c. Implement a full adder using PAL. **(06 Marks)**

OR

4 a. Implement $f(w,x,y,z) = \sum m(0,1,2,4,5,7,8,9,12,13)$ using 8 : 1 MUX with w,x,y as select lines. **(06 Marks)**

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

c. Explain the Basic Architecture of a Xilinx XCR3064XL CPLD. **(06 Marks)**

Module-3

5 a. Explain the working of Master Slave JK Flip-Flop with function table and timing diagram. **(08 Marks)**

b. Differentiate between Flip Flops and Latches. **(04 Marks)**

c. Design an universal shift Register using positive edge triggered DFF having the behavior as specified.

Mode	Operation
00	Hold
01	Shift right
10	Shift left
11	Parallel load

(08 Marks)

OR

6 a. Explain positive edge Triggered D Flip Flop with the help of circuit diagram and waveform. **(08 Marks)**

b. Obtain the characteristic equation for the following Flip Flop (i) J.K. (ii) S.R. **(06 Marks)**

c. Design a mod-8 asynchronous upcounter using negative edge triggered JK FF. **(06 Marks)**

Module-4

7 a. Design a synchronous mod-6 counter using clocked JK Flip Flop for the sequence 0 – 2 – 3 – 6 – 5 – 1 **(08 Marks)**

b. Distinguish between Moore and Melay model with necessary block diagram. **(06 Marks)**

c. Analyze the following synchronous circuit. (Refer Fig. Q7 (c))

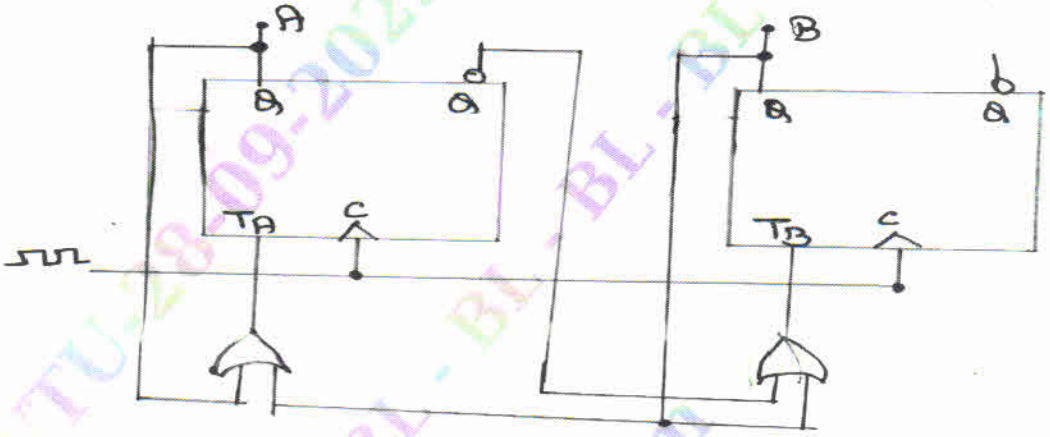

Fig. Q7 (c) **(06 Marks)**

OR

8 a. Design a synchronous mod-6 counter using clocked T-Flip Flop for the sequence, 0 – 2 – 3 – 6 – 5 – 1. **(06 Marks)**

b. Draw the state diagram, for the sequential circuit shown. (Refer Fig. Q8 (b))

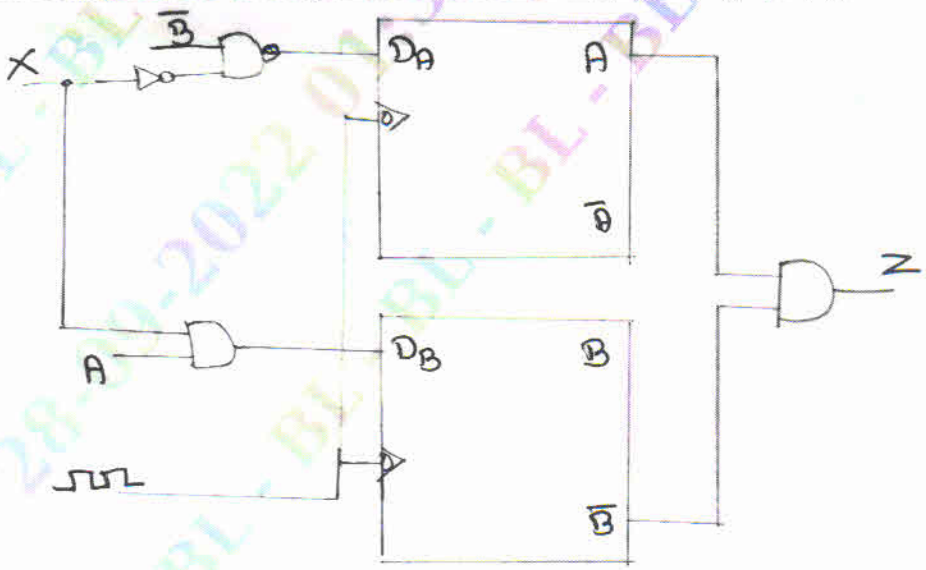

Fig. Q8 (b) **(06 Marks)**

c. Analyze the given synchronous sequential circuit. (Refer Fig. Q8 (c))

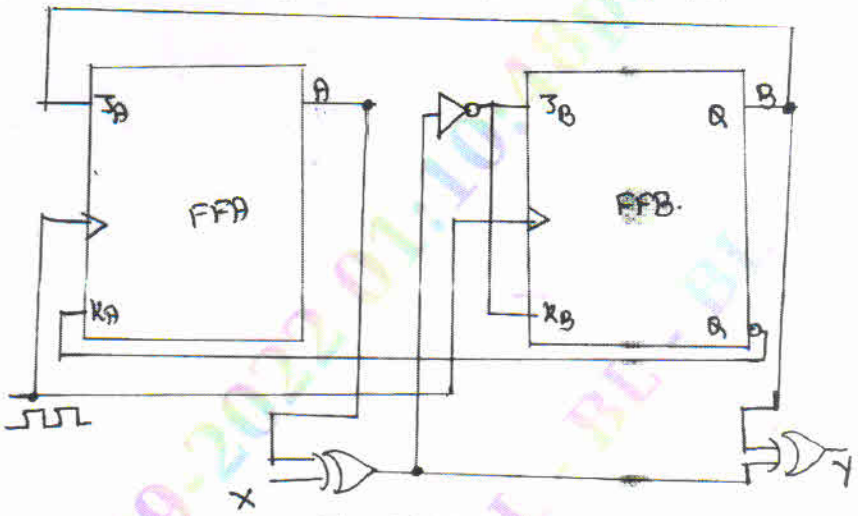

Fig. Q8 (c) **(08 Marks)**

Module-5

9 a. Design a Mealy type sequence detector to detect a serial input sequence of 101. **(08 Marks)**

b. List the guidelines for construction of state graphs. **(06 Marks)**

c. With the help of neat block diagram, explain serial adder with accumulator. **(06 Marks)**

OR

10 a. Design a Moore type sequence detector to detect a serial input sequence of 101. **(08 Marks)**

b. Construct Moore and Mealy state diagram, that will detect input sequence 10110, when input pattern is detected, z is asserted high. Give state diagrams for each state. **(06 Marks)**

c. With the help of neat block diagram, explain parallel binary divider. **(06 Marks)**

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CBCS SCHEME

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18EC35

Third Semester B.E. Degree Examination, July/August 2022
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, describe the functional units of a computer. (08 Marks)
b. Illustrate single bus structure of a computer. (06 Marks)
c. Explain Little-endian and Big-endian byte address assignment. (06 Marks)

OR

2 a. Explain the following with an example:
i) Three-address instruction
ii) Two-address instruction
iii) One-address instruction. (09 Marks)
b. List the functions of system software in computer. (06 Marks)
c. Discuss IEEE standard for single precision and double precision floating point numbers with standard notations. (05 Marks)

Module-2

3 a. Define addressing mode. Discuss the following addressing modes with example:
i) Register ii) Direct iii) Indirect iv) Index. (10 Marks)
b. Explain various assembler directives used in assembly language program. (06 Marks)
c. List the operations performed by call and return instructions. (04 Marks)

OR

4 a. With example illustrate logical and arithmetic shift and rotate instructions. (10 Marks)
b. Explain stack operation with example. (10 Marks)

Module-3

5 a. Illustrate interrupt priority schemes, with neat diagram. (08 Marks)
b. Describe the bus arbitration schemes, with neat diagram. (12 Marks)

OR

6 a. Explain use of DMA controllers in a computer system, with neat diagram. (08 Marks)
b. What are interrupts? Explain various ways of enabling and disabling interrupts. (08 Marks)
c. Write a explanatory note on interrupt hardware. (04 Marks)

Module-4

7 a. Illustrate internal organization of a 2M × 8 dynamic memory chip. (08 Marks)
b. What is mapping functions? Explain direct mapping scheme, with neat diagram. (06 Marks)
c. With neat diagram, explain virtual memory organization. (06 Marks)

OR

8 a. Explain principle of working of magnetic disk, with neat diagram. **(06 Marks)**
b. Discuss A single transistor dynamic memory cell. **(06 Marks)**
c. Explain different types of non-volatile memory concepts. **(08 Marks)**

Module-5

9 a. Illustrate multiple Bus organization concept, with neat diagram. **(10 Marks)**
b. Describe basic organization of a micro programmed control unit. Give an example of microinstructions. **(10 Marks)**

OR

10 a. Develop the complete control sequence for the execution of instruction Add (R3), R1. **(06 Marks)**
b. Discuss Hardwired control unit organization with relevant diagram. **(08 Marks)**
c. Illustrate the connection and control signals for register MDR with neat diagram. **(06 Marks)**

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CBCS SCHEME

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18EC36

Third Semester B.E. Degree Examination, July/August 2022
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. List and briefly explain the different types of power electronic convertors. **(10 Marks)**

b. Explain the different turn-on methods of thyristor. **(10 Marks)**

OR

2 a. With neat circuit diagram and waveforms, explain class-A and class-B commutation methods of a thyristor. **(10 Marks)**

b. With neat diagram, explain static anode-cathode characteristics of SCR. Define latching current and holding current. **(10 Marks)**

Module-2

3 a. With the help of neat circuit diagram and waveforms describe the operation of a 1ϕ FWCR for B-2 connection for R-load. Derive expressions for rms and average output voltages and for rms and average output currents. **(10 Marks)**

b. A single phase half-wave converter is operated from a 120V, 60Hz supply. The load is resistive with R = 10Ω. If the average output voltage is 75% of maximum possible average output voltage, determine: i) Firing angle ii) rms and average output currents iii) average and rms SCR currents. **(06 Marks)**

c. Explain different control techniques of phase control converters. **(04 Marks)**

OR

4 a. What is dc-dc converter? What are its applications? Explain the classification of chopper. **(06 Marks)**

b. Explain the operation of step-up chopper with neat circuit diagram and waveforms. **(08 Marks)**

c. For a chopper shown in Fig.Q.4(c), dc source voltage = 230V, load resistance = 10. Consider voltage drop of 2V across chopper when it is on. For a duty cycle of 0.4, calculate: i) Average and rms value of output voltage ii) Chopper efficiency. **(06 Marks)**

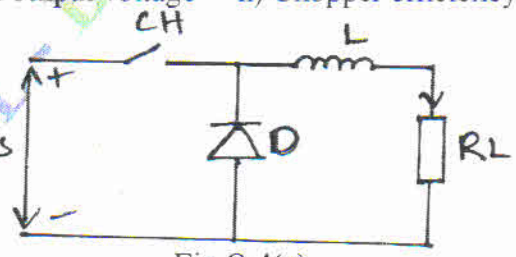

Fig.Q.4(c)

Module-3

5 a. Explain the operation of single-phase half bridge voltage source inverter with resistive load. Draw associated circuit diagram and waveforms. Derive the expressions for RMS output voltage and instantaneous output voltage. **(10 Marks)**

b. With the help of circuit diagram and waveforms explain the operation of flyback converter in discontinuous mode. Also list the advantages and disadvantages. **(10 Marks)**

OR

6 a. Explain different types of errors, and how to minimize them. **(06 Marks)**

b. Explain with a diagram how a PMMC can be used as an ammeter. How can a basic ammeter be converted into a multirange ammeter? **(08 Marks)**

c. Calculate the value of multiplier resistance for the multiple range dc voltmeter circuit shown in Fig.Q.6(c). **(06 Marks)**

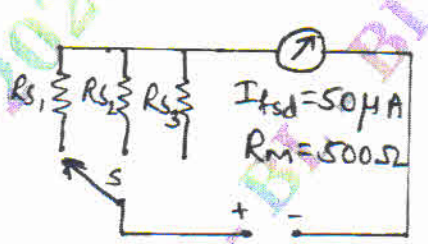

Fig.Q.6(c)

Module-4

7 a. Explain with the help of diagram and equations, the working principle of dual slope type DVM. **(10 Marks)**

b. With neat diagram, explain the operation of SAR type DVM. **(10 Marks)**

OR

8 a. Explain with the help of block diagram the operation of a function generator. **(06 Marks)**

b. Explain Wien's bridge with diagram. And derive the two balance conditions for a Wien bridge. **(06 Marks)**

c. If the sensitivity of the galvanometer in the circuit of Fig.Q.8(c) is 10mm/μA, and its internal resistance = 150Ω. Determine its deflection. **(08 Marks)**

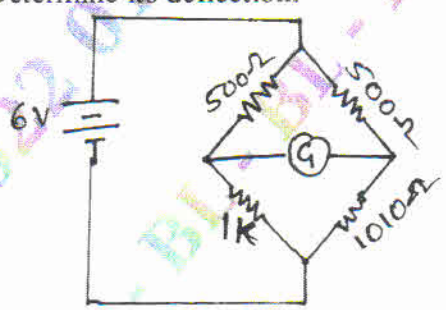

Fig.Q.8(c)

Module-5

9 a. State the various parameters and advantages of electrical transducer. **(06 Marks)**

b. Explain the working principle of thermistor. **(06 Marks)**

c. Explain with diagrams the structure and operation of a PLC. **(08 Marks)**

OR

10 a. Explain in brief bonded strain gauge. **(10 Marks)**

b. Explain how the strain gauge bridge circuit is used as analog weight scale. **(10 Marks)**

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CBCS SCHEME

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18MATDIP31

Third Semester B.E. Degree Examination, July/August 2022
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Express $\frac{(3+i)(1-3i)}{(2+i)}$ in the form $x + iy$. **(06 Marks)**

b. If $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$. Find the value of 'ρ' such that $\vec{a} - \rho\vec{b}$ is perpendicular to $\vec{c}$. **(07 Marks)**

c. Find the angle between the vector $\vec{a} = 5\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 3\hat{j} + 6\hat{k}$. **(07 Marks)**

OR

2 a. Find the modulus and amplitude of the complex number $1 + \cos\alpha + i\sin\alpha$. **(06 Marks)**

b. Prove that $\left(\frac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i\sin n\theta$. **(07 Marks)**

c. Find the sine of the angle between $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 2\hat{k}$. **(07 Marks)**

Module-2

3 a. Find the n^{th} derivative of $\cos x \cos 2x$. **(06 Marks)**

b. Obtain the Maclaurin's series expansion of the function $\sqrt{1+\sin 2x}$ upto the term containing x^4. **(07 Marks)**

c. If $u = f(y - z, z - x, x - y)$ prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. **(07 Marks)**

OR

4 a. If $u = \tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$ prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$. **(06 Marks)**

b. If $z = xy^2 + x^2y$ where $x = at^2$ and $y = 2at$. Find $\frac{dz}{dt}$. **(07 Marks)**

c. If $x = e^u \sec v$, $y = e^u \tan v$. Find $J\left(\frac{x, y}{u, v}\right)$. **(07 Marks)**

Module-3

5 a. A particle moves along the curve $\vec{r} = \cos 2t\hat{i} + \sin 2t\hat{j} + t\hat{k}$ where t is the time variable. Determine the components of velocity and acceleration vectors at $t = \pi/8$ in the direction of $\sqrt{2}\hat{i} + \sqrt{2}\hat{j} + \hat{k}$. **(06 Marks)**

b. Find $\text{div}\,\vec{f}$ for $\vec{f} = \nabla(x^3 + y^3 + z^3 - 3xyz)$. **(07 Marks)**

c. Show that $\vec{f} = (2xy + z^2)\hat{i} + (x^2 + 2yz)\hat{j} + (y^2 + 2xz)\hat{k}$ is irrotional and find φ such that $\vec{f} = \nabla\varphi$. **(07 Marks)**

OR

6 a. Find the unit normal to the surface $x^3y^3z^2 = 4$ at the point P(-1, -1, 2). **(06 Marks)**

b. If $\vec{f} = 2x^2\hat{i} - 3yz\hat{j} + xz^2\hat{k}$ and $\varphi = 2z - x^3y$, find $\vec{f} \bullet (\nabla\varphi)$ and $\vec{f} \times (\nabla\varphi)$ at (1, -1, 1). **(07 Marks)**

c. Show that $\vec{f} = \dfrac{xi + yj}{x^2 + y^2}$ is both solenoidal and irrotational. **(07 Marks)**

Module-4

7 a. Obtain a reduction formula for $\int_0^{\pi/2} \sin^n x\,dx\,(n > 0)$. **(06 Marks)**

b. Evaluate $\int_0^{2a} x^2\sqrt{2ax - x^2}\,dx$. **(07 Marks)**

c. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dz\,dy\,dx$. **(07 Marks)**

OR

8 a. Obtain a reduction formula for $\int_0^{\pi/2} \cos^n x\,dx\ (n > 0)$. **(06 Marks)**

b. Evaluate $\iint_R xy\,dx\,dy$ where R is the first quadrant of the circle $x^2 + y^2 = a^2$, $x \geq 0$, $y \geq 0$. **(07 Marks)**

c. Evaluate $\int_{-1}^{1} \int_0^z \int_{x-z}^{x+z} (x + y + z)\,dy\,dx\,dz$. **(07 Marks)**

Module-5

9 a. Solve $x^2\dfrac{dy}{dx} - 2xy - x + 1 = 0$. **(06 Marks)**

b. Solve $(3x^2y^2 + x^2)\,dx + (2x^3y + y^2)\,dy = 0$. **(07 Marks)**

c. Solve $3x(x + y^2)dy + (x^3 - 3xy - 2y^3)dx = 0$. **(07 Marks)**

OR

10 a. Solve $\left[y\left(1 + \dfrac{1}{x}\right) + \cos y\right]dx + [x + \log x - x\sin y]dy = 0$. **(06 Marks)**

b. Solve $\dfrac{dy}{dx} + y\cot x = \sin x$. **(07 Marks)**

c. Solve $\dfrac{dy}{dx} + \dfrac{y}{x} = y^2x$. **(07 Marks)**

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18MAT31

Third Semester B.E. Degree Examination, July/August 2022
Transform Calculus, Fourier Series and Numerical Techniques

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the Laplace transform,
(i) $e^{-2t}(2\cos 5t - \sin 5t)$ (ii) $\cosh^2 3t$ **(06 Marks)**

b. Find the Laplace transform of the full wave rectifier $f(t) = E\sin\omega t \quad 0 < t < \frac{\pi}{\omega}$ having a period $\frac{\pi}{\omega}$. **(07 Marks)**

c. Find the inverse Laplace transform $\left[\frac{s^2+4}{s(s+4)(s-4)}\right]$. **(07 Marks)**

OR

2 a. Find the Laplace transform, $\frac{\cos at - \cos bt}{t}$. **(06 Marks)**

b. Solve by using Laplace transform method $y'''(t) + 2y''(t) - y'(t) - 2y(t) = 0$, given $y(0) = y'(0) = 0$ and $y''(0) = 6$ **(07 Marks)**

c. Express the function f(t) in terms of unit step function and hence find its inverse LT.

$$f(t) = \begin{cases} \cos t & 0 < t \le \pi \\ 1 & \pi < t \le 2\pi \\ \sin t & t > 2\pi \end{cases}$$ **(07 Marks)**

Module-2

3 a. Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$, in $0 < x < 2\pi$. Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots = \frac{\pi}{4}$. **(06 Marks)**

b. Show that the sine half range series for the function, $f(x) = Lx - x^2$, in $0 < x < L$ is $\frac{8L^2}{\pi^3}\sum_{0}^{\infty}\frac{1}{(2n+1)^3}\sin\left(\frac{2n+1}{L}\right)\pi x$. **(07 Marks)**

c. Obtain the Fourier series of y up to the first harmonics for the following values :

x°	45	90	135	180	225	270	315	360
y	4.0	3.8	2.4	2.0	−1.5	0	2.6	3.4

(07 Marks)

OR

4 a. Expand the function $f(x) = x \sin x$, as a Fourier series in the interval $-\pi \le x \le \pi$. Deduce that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} ..... = \frac{\pi - 2}{4}$ **(06 Marks)**

b. Obtain the half range cosine series of $f(x) = x \sin x \quad 0 \le x \le \pi$. **(07 Marks)**

c. Obtain the constant term and the first three coefficients in the Fourier cosine series for y using the following data :

x	0	1	2	3	4	5
y	4	8	15	7	6	2

(07 Marks)

Module-3

5 a. Find the complex Fourier transform of the function, $f(x) = \begin{cases} 1 & \text{for } |x| \le a \\ 0 & \text{for } |x| > a \end{cases}$.

Hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(06 Marks)**

b. If $\overline{f(z)} = \frac{2z^2 + 3z + 12}{(z-1)^4}$ find the value of u_0, u_1, u_2, u_3 **(07 Marks)**

c. Solve by using z-transforms, $u_{n+2} + 5u_{n+1} + 6u_n = 2^n$: $u_1 = 0, u_0 = 0$ **(07 Marks)**

OR

6 a. Find the Fourier sine transform of e^{-ax}, $a > 0$. **(06 Marks)**

b. Find the Fourier sine and cosine transform of $2e^{-3x} + 3e^{-2x}$. **(07 Marks)**

c. Solve by using Z-transforms,
$y_{n+2} + 2y_{n+1} + y_n = n$, with $y(0) = 0 = y$ **(07 Marks)**

Module-4

7 a. Use Taylor's series method to find y(4.1) given that $\frac{dy}{dx} = \frac{1}{x^2 + y}$ and $y(4) = 4$. **(06 Marks)**

b. Use Fourth order Runge-Kutta method to solve $(x+y)\frac{dy}{dx} = 1$, $y(0.4) = 1$ at $x = 0.5$. Correct to four decimal places. **(07 Marks)**

c. The following table gives the solution of $5xy^1 + y^2 - 2 = 0$, find the value of y at x = 4.5 using Milne's Predictor and Corrector formulae, use the corrector formulae twice.

x	4	4.1	4.2	4.3	4.4
y	1	1.0049	1.0097	1.0143	1.0187

(07 Marks)

OR

8 a. Using modified Euler's method find y at x = 0.2 given $\frac{dy}{dx} = 3x + \frac{y}{2}$, with $y(0) = 1$ taking $h = 0.1$. **(06 Marks)**

b. Using Runge-Kutta method of fourth order find y(0.2) for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}$, $y(0) = 1$ taking $h = 0.2$ **(07 Marks)**

c. Apply Adams-Bashforth method to solve the equation $(y^2 + 1)dy - x^2 dx = 0$, at x = 1, given $y(0) = 1$, $y(0.25) = 1.0026$, $y(0.5) = 1.0206$, $y(0.75) = 1.0679$. Apply the corrector formulae twice. **(07 Marks)**

Module-5

9 a. Given $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} - 2xy = 1$, $y(0) = 1$, $y'(0) = 0$, Evaluate $y(0.1)$ using Runge-Kutta method of order 4. **(06 Marks)**

b. A necessary condition for the integral $I = \int_{x_1}^{x_2} f(x, y, y')dx$ where $y(x_1) = y_1$ and $y(x_2) = y_2$ to be extremum that $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. **(07 Marks)**

c. Show that the extremal of the functional $\int_0^1 y^2\{3x(y'^2 - 1) + yy'^3\}dx$, subject to the conditions $y(0) = 0, y(1) = 2$, is the circle $x^2 + y^2 - 5x = 0$. **(07 Marks)**

OR

10 a. Apply Milne's method to compute $y(0.8)$. Given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following table of initial values. **(06 Marks)**

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y'	0	0.1996	0.3937	0.5689

b. Find the extremal of the functional $\int_a^b (x^2y'^2 + 2y^2 + 2xy)dx$. **(07 Marks)**

c. Prove that Geodesics on a plane are straight line. **(07 Marks)**

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18 IVsem EC

CBCS SCHEME

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18EC42

Fourth Semester B.E. Degree Examination, July/August 2022
Analog Circuits

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 working of voltage dividing bias circuit using BJT. **(08 Marks)**

b. Design MOSFET drain to gate feedback circuit to establish $I_D = 0.5$ mA and $V_{DD} = 5$V. MOSFET parameters are : $V_t = 1$ V, $K_n'(W/L) = 1$ mA/V^2 and $\lambda = 0$. Use Standard resistor values and actual values obtained for I_D and V_D. **(06 Marks)**

c. Derive an expression for voltage gain A_V of small signal CE BJT amplifier. **(06 Marks)**

OR

2 a. Explain with neat circuit diagram the MOSFET drain to gate feedback resistor biasing. **(06 Marks)**

b. Design a voltage divider bias network using a supply of 24V, $\beta = 110$ and $I_{CQ} = 4$ mA, $V_{CEQ} = 8$V. Choose $V_E = V_{CC}/8$. **(08 Marks)**

c. Explain with neat circuit diagram MOSFET circuit using fixing V_G. **(06 Marks)**

Module-2

3 a. Derive the expression for characterizing parameters of CS MOSFET amplifier without source resistor using hybrid-π equivalent circuit. **(06 Marks)**

b. A phase shift oscillator is to be designed with FET having $g_m = 5000$ µs, $r_d = 40$ kΩ while the resistance in the feedback circuit is 9.7 kΩ. Select the proper value of C and R_D to have the frequency of oscillations as 5 kHz. **(08 Marks)**

c. Write a note on three basic configurations of MOSFET amplifier. **(06 Marks)**

OR

4 a. State Barkhausen criteria. **(04 Marks)**

b. A Quartz crystal has constants L = 50 mH, $C_1 = 0.02$ pF, R = 500Ω and $C_2 = 12$ pF. Find the values of series and parallel resonant frequencies. Also if the external capacitance across the crystal changes from 5 pF to 6 pF, find the change in frequency of oscillations. **(08 Marks)**

c. Draw and explain the frequency response characteristics of CS MOSFET amplifier. **(08 Marks)**

Module-3

5 a. Briefly explain the four basic feedback topologies with necessary block diagram. **(10 Marks)**

b. Show that the maximum efficiency of series fed, directly coupled class A power amplifier is 25%. **(06 Marks)**

c. An amplifier without negative feedback has a voltage gain of 400 with a distortion of 10%. Determine the amplifier voltage gain and distortion, when a negative feedback is applied with feedback ratio of 0.01. **(04 Marks)**

OR

6 a. With neat circuit diagram, explain the operation of a class B pushpull amplifier with relevant waveforms. Show that the maximum conversion efficiency of class B pushpull amplifier is 78.5%. **(10 Marks)**

b. For a class C tuned amplifier with load resistance of 10 kΩ and V_{CC} = 30V. Calculate
(i) Output power if the output voltage is 30 V_{pp}.
(ii) DC input power if current drain is 0.5 mA.
(iii) Efficiency. **(04 Marks)**

c. Derive the expression for input resistance for a voltage shunt feedback amplifier. **(06 Marks)**

Module-4

7 a. State the ideal characteristics of op-Amp. **(08 Marks)**

b. For a Schmitt trigger shown in the Fig.Q7(b) calculate threshold voltage levels and hysteresis. Assume $V_{sat} = 0.9\ V_c$.

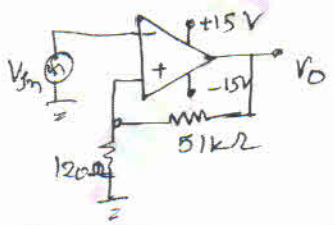

Fig.Q7(b) **(04 Marks)**

c. Draw a practical inverting amplifier and derive the expression for closed loop voltage gain, input resistance and output resistance. **(08 Marks)**

OR

8 a. Draw the circuit of 3 op-Amp instrumentation amplifier and derive expression for its output voltage. **(08 Marks)**

b. Explain the working of zero crossing detector. **(06 Marks)**

c. For a non-inverting amplifier, the values of R_1 and R_f are 1 kΩ and 10 kΩ respectively. The various op-Amp parameters are, open loop gain = 2×10^5, Input resistance = 2MΩ, Output resistance = 75Ω, Single break frequency = 5 Hz , Supply voltages = ±12V , Calculate the closed loop gain, input resistance, output resistance with feedback and bandwidth with feedback. **(06 Marks)**

Module-5

9 a. Draw and explain the working of precision full wave rectifier. **(08 Marks)**

b. Design a low pass filter using op-Amp at a cutoff frequency of 1 kHz with pass gain of 2. **(06 Marks)**

c. Explain the working of pulse width modulator using IC555 with waveforms. **(06 Marks)**

OR

10 a. Explain the functional block diagram of IC555. **(08 Marks)**

b. Design a monostable 555 timer circuit to produce an output pulse of 10 sec wide. Draw the circuit diagram. **(04 Marks)**

c. Explain with neat circuit diagram the operation of R-2R digital to analog converter. **(08 Marks)**

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18EC43

Fourth Semester B.E. Degree Examination, July/August 2022
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. What is Control System? Distinguish between open loop and closed loop system. Give one example for each. **(08 Marks)**

b. Write the differential equations governing the mechanical system shown in Fig.Q.1(b). Draw the force-voltage and force-current electrical analogous circuits. **(12 Marks)**

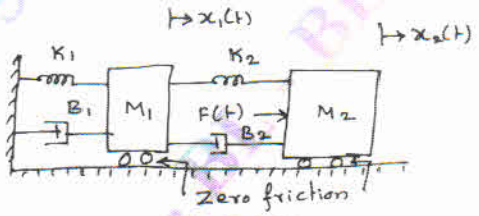

Fig.Q.1(b)

OR

2 a. Write the differential equations governing the mechanical rotational system shown in Fig.Q.2(a). Obtain the transfer function of the system. **(10 Marks)**

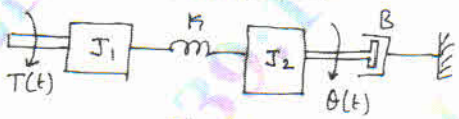

Fig.Q.2(a)

b. Write the differential equations governing the mechanical rotational system shown in Fig.Q.2(b). Draw the torque-voltage analogous circuit. **(10 Marks)**

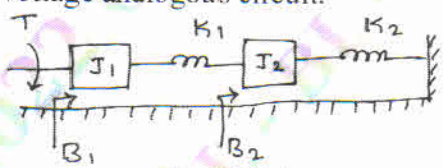

Fig.Q.2(b)

Module-2

3 a. Determine the overall transfer function $\frac{C(S)}{R(S)}$ for the system shown in Fig.Q.3(a) using block diagram reduction technique. **(10 Marks)**

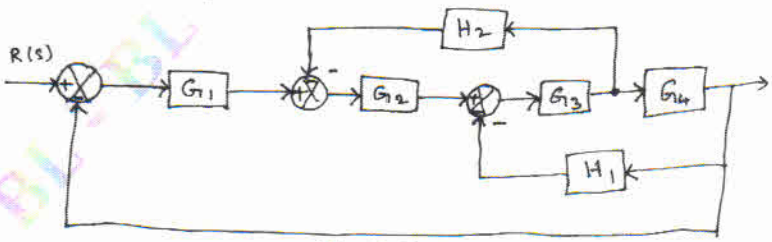

Fig.Q.3(a)

b. Find the overall T.F by Mason's gain formula for the SFG given in the Fig.Q.3(b). **(10 Marks)**

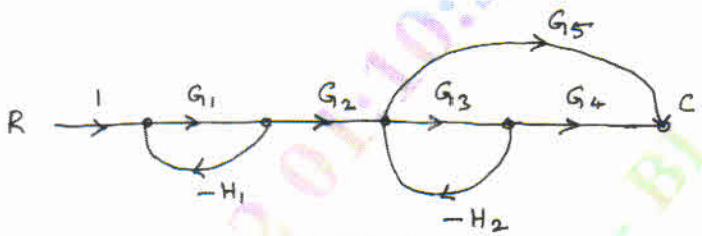

Fig.Q.3(b)

OR

4 a. Draw the SFG and obtain the FF transfer function for a system which is described by the set of following algebraic equations.

$y_2 = a_{12}y_1 + a_{32}y_3$

$y_3 = a_{23}y_2 + a_{43}y_4$

$y_4 = a_{24}y_2 + a_{34}y_3 + a_{44}y_4$

$y_5 = a_{25}y_2 + a_{45}y_4$ **(10 Marks)**

b. Find out the transfer function shown in Fig.Q.4(b) using Mason's gain formula. **(10 Marks)**

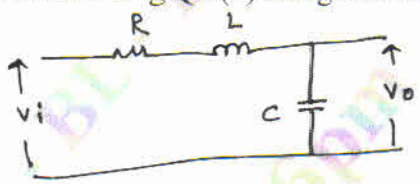

Fig.Q.4(b)

Module-3

5 a. Derive the expression of response of first order system for unit step input. **(10 Marks)**

b. With neat graph explain the time domain specifications of second order system. **(10 Marks)**

OR

6 a. Obtain the response of unity feed back system whose open loop transfer function $G(S) = \frac{4}{S(S+5)}$ and when input is unit step. **(10 Marks)**

b. A unity feed back system with $G(S) = \frac{100}{S^2(S+1)(S+2)}$

i) What is the type of system?

ii) Find static error coefficients.

iii) Find steady state error if the input is $r(t) = 2t^2 + 5t + 1$. **(10 Marks)**

Module-4

7 a. Derive the expression for condition of stability of control system. **(05 Marks)**

b. Explain Routh-Hurwitz criterion for stability of the system and what are its limitations. **(05 Marks)**

c. Find the range of K so that the system with characteristic equation as: $s^4 + 25s^3 + 15s^2 + 20s + k = 0$ is stable. Also find frequency of oscillation at marginal value of K. **(10 Marks)**

OR

8 a. Sketch the root Locus plot for all values of K ranging from o to ∞ for a negative feed back control system characterized by $GH(S) = \frac{K(S+6)}{S(S+1)(S+2)}$. **(10 Marks)**

b. Plot the Bode diagram for open loop transfer function

$G(S) = \frac{10}{S(1+0.4s)(1+0.1s)}$ and obtain the gain and phase cross over frequencies. **(10 Marks)**

Module-5

9 a. Using Nyquist stability criterion, investigate the stability of a closed loop system whose OLTF is given by

$G(S)H(S) = \frac{K}{(S+1)(S+2)}$. **(10 Marks)**

b. Distinguish between classical method and state space approach. **(10 Marks)**

OR

10 a. A negative feed back control system is characterized by an open loop transfer function.

$GH(S) = \frac{5}{S(S+1)}$

Investigate the closed loop stability of the system using Nyquist stability criterion. **(10 Marks)**

b. Write a state model for differential equation

$4\frac{d^3}{dt^3}y + 8\frac{d^2}{dt^2}y + 24\frac{dy}{dt} + 4y = 32\,U(t)$

Using phase variable canonical form. **(10 Marks)**

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CBCS SCHEME

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18EC44

Fourth Semester B.E. Degree Examination, July/August 2022
Engineering Statistics and Linear Algebra

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define an uniform random variable. Obtain the characteristic function of an uniform random variable and using the characteristic function derive its mean and variance. **(08 Marks)**

b. If the probability density function of a random variable is given by

$$f_X(x) = \begin{cases} C\exp(-x/4), & 0 \le x < 1 \\ 0, & \text{otherwise} \end{cases}$$

Find the value that C must have and evaluate $F_X(0.5)$. **(06 Marks)**

c. The density function of a random variable is given as

$$f_X(x) = a\,e^{-bx} \quad x \ge 0$$

Find the characteristic function and the first two moments. **(06 Marks)**

OR

2 a. Define a Poisson random variable. Obtain the characteristic function of a Poisson random variable and hence find mean and variance using the characteristic function. **(08 Marks)**

b. Suppose 'X' is a general discrete random variable with following probability distribution. Calculate mean and variance for X.

X	0	1	3	5	7
P(X)	0.05	0.2	0.6	0.1	0.05

(06 Marks)

c. The number of defects in a thin copper wire follows Poisson distribution with mean of 2.3 defects per millimeter. Determine the probability of exactly two defects per millimeter of wire. **(06 Marks)**

Module-2

3 a. Define and explain Central Limit theorem and show that the sum of the two independent Gaussian random variables is also Gaussian. **(08 Marks)**

b. Let 'X' and 'Y' be exponentially distributed random variable with

$$f_X(x) = \begin{cases} \lambda\,e^{-\lambda x} & x \ge 0 \\ 0 & x < 0 \end{cases}$$

Then obtain the characteristic function and Pdf of W = X + Y. **(06 Marks)**

c. Determine a constant b such that the given function is a valid joint density function.

$$f_{XY}(x,y) = \begin{cases} b(x^2+4y^2) & 0 \le |x| < 1 \text{ and } 0 \le y < 2 \\ 0 & \text{elsewhere} \end{cases}$$

(06 Marks)

OR

4 a. Explain briefly the following random variables :
(i) Chi-square Random Variable
(ii) Rayleigh Random Variable. **(04 Marks)**

b. The joint density function of two random variables X and Y is

$$f_{X,Y}(x,y)=\begin{cases}\dfrac{(x+y)^2}{40}, & -1<x<1 \text{ and } -3<y<3\\ 0, & \text{elsewhere}\end{cases}$$

Find (i) the variances of X and Y (ii) the correlation coefficient. **(08 Marks)**

c. Gaussian random variables X_1 and X_2 whose $\overline{X}_1=2$, $\sigma^2_{X_1}=9$, $\overline{X}_2=-1$, $\sigma^2_{X_2}=4$ and $C_{X_1X_2}=-3$ are transformed to new random variables Y_1 and Y_2 such that

$Y_1=-X_1+X_2$

$Y_2=-2X_1-3X_2$

Find (i) $\overline{X_1^2}$ (ii) $\overline{X_2^2}$ (iii) $\rho_{X_1X_2}$ (iv) $\sigma^2_{Y_1}$ (v) $\sigma^2_{Y_2}$ (vi) $C_{Y_1Y_2}$ (vii) $\rho_{Y_1Y_2}$ **(08 Marks)**

Module-3

5 a. With the help of an example, define Random process and discuss distribution and density functions of a random process. Mention the differences between Random variable and Random process. **(08 Marks)**

b. Define the Autocorrelation function of the random process X(t) and discuss its properties. **(06 Marks)**

c. A stationary ergodic random process has the autocorrelation function with periodic components as $R_{XX}(\tau)=25+\dfrac{4}{1+6\tau^2}$

Find the mean and variance of X(t). **(06 Marks)**

OR

6 a. The autocorrelation function of a wide sense stationary process.

$$R_X(\tau)=\begin{cases}1-\dfrac{|\tau|}{T}, & -T\le|\tau|\le T\\ 0, & \text{elsewhere}\end{cases}$$

Obtain the Power Spectral Density of the process. **(06 Marks)**

b. Show that the random process $X(t) = A\cos(w_c t + \theta)$ is wide sense stationary. Here θ is uniformly distributed in the range $-\pi$ to π. **(08 Marks)**

c. X(t) and Y(t) are independent, jointly wide sense stationary random processes given by

$X(t) = A\cos(w_1 t + \theta_1)$

$Y(t) = B\cos(w_2 t + \theta_2)$

If $W(t) = X(t)\cdot Y(t)$ then find the Autocorrelation function $R_W(\tau)$. **(06 Marks)**

Module-4

7 a. Define vector subspaces and explain the four fundamental subspaces. **(06 Marks)**

b. Show that the vectors (1, 2, 1), (2, 1, 0), (1, –1, 2) form a basis of R^3. **(06 Marks)**

c. Apply Gram-Schmidt process to the vectors $v_1 = (2, 2, 1)$, $v_2 = (1, 3, 1)$, $v_3 = (1, 2, 2)$ to obtain an orthonormal basis for $v_3(R)$ with the standard inner product. **(08 Marks)**

OR

8 a. Determine the null space of each of the following matrices:

(i) $A=\begin{bmatrix}2 & 0\\ -4 & 10\end{bmatrix}$ (ii) $\begin{bmatrix}1 & -7\\ -3 & 21\end{bmatrix}$ **(06 Marks)**

b. Determine whether the vectors (2, –2, 4), (3, –5, 4) and (0, 1, 1) are linearly dependent or independent. **(06 Marks)**

c. Find the QR-decomposition for the matrix

$$A = \begin{bmatrix} 2 & 1 & 3 \\ -1 & 0 & 7 \\ 0 & -1 & -1 \end{bmatrix}$$

and write the result in the form of $A = QR$. **(08 Marks)**

Module-5

9 a. If $A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$

find eigen values and corresponding eigen vectors for matrix A. **(08 Marks)**

b. Diagonalize the following matrix:

$$A = \begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$$

Find an invertible matrix P and a diagonal matrix D such that $A = PDP^{-1}$. **(08 Marks)**

c. What is the positive definite matrix? Mention the methods of testing positive definiteness. **(04 Marks)**

OR

10 a. Factorize the matrix A into $A = U \Sigma V^T$ using SVD.

$$A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ -1 & 1 \end{bmatrix}$$ **(08 Marks)**

b. If $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ show that A is positive definite matrix. **(04 Marks)**

c. Find a matrix P, which transforms the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ to diagonal form. **(08 Marks)**

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CBCS SCHEME

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18EC45

Fourth Semester B.E. Degree Examination, July/August 2022
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. Differentiate between Energy and Power signals. Identify whether u(t) is energy or power signals. Compute its energy / power. **(08 Marks)**

b. Given the signals x(t) & y(t) in the Fig. Q1(b), sketch
i) x(t - 2) + y(1 - t) ii) x(t) – y(t + 2). **(08 Marks)**

Fig. Q1(b)

c. Sketch the signal Z(t) = r(t + 2) – r(t + 1) – 2u(t) + u(t – 1). **(04 Marks)**

OR

2 a. For the signal shown in Fig. Q2(a), sketch its Even and Odd components. **(06 Marks)**

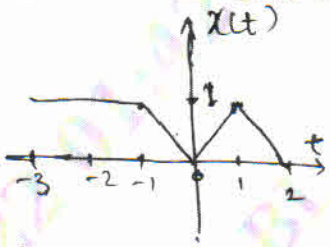


Fig. Q2(a)

b. Identify whether the following signals are periodic of not? If Periodic what is the period of it? i) $x(t) = \cos \sqrt{2}\, t + \sin 2\pi t$ ii) $x(t) = \cos 8\pi t$ iii) $x(n) = \sin \frac{\pi}{6} n + \sin \frac{\pi}{3} n$. **(08 Marks)**

c. Sketch the signals : i) u(t – 2) – 2u(t) + u(t + 2) ii) $e^{-2t}\{u(t) - u(t-2)\}$. **(06 Marks)**

Module-2

3 a. Check whether the following system is linear, time variant , causal , static and stable.
Y[n] = 2x[1 – n] + 2. **(08 Marks)**

b. Compute the following convolutions :
i) y(t) = x(t) * h(t) , where x(t) = u(t + 2) and $h(t) = e^{-2t} u(t)$.
ii) y(t) = x(t) * h(t) , where $x(t) = e^{-|t|}$ and h(t) = u(t). **(12 Marks)**

OR

4 a. The system is described by the differential equation

$$\frac{dy(t)}{dt} = 2x(t) + \frac{d}{dt}x(t).$$

State whether this system is linear , time variant , causal and static. **(08 Marks)**

b. i) Evaluate $y(n) = x(n) * h(n)$, if $x(n) = \alpha^n u(n)$ $\alpha < 1$ & $h(n) = u(n)$.
ii) Evaluate $y(t) = x(t) * h(t)$, if x(t) & h(t) are as shown in Fig. Q4(b(ii)). **(12 Marks)**

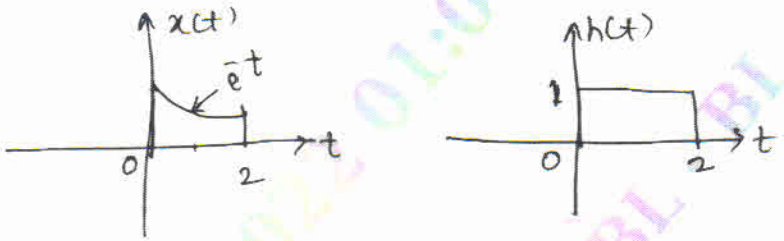


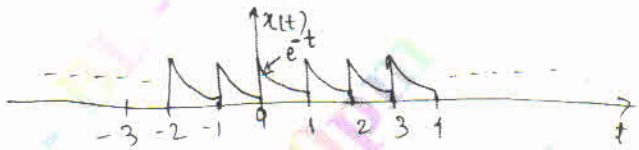
Fig. Q4(b(ii))

Module-3

5 a. Impulse responses of the various systems are described below. Identify whether these systems are memoryless, causal and stable.
i) $h(n) = 2\delta(n)$ ii) $h(t) = e^{-2t} u(t+2)$ iii) $h(t) = 2\{u(t) - u(t-2)\}$. **(10 Marks)**

b. Obtain the Fourier representations of the signals :
i) $x(n) = \cos 2\pi n + \sin 4\pi n$ with $\Omega_0 = 2\pi$ ii) x(t) shown in Fig. Q5(b(ii)). **(10 Marks)**

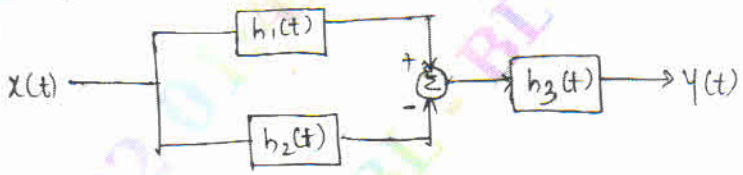
Fig. Q5(b(ii))



OR

6 a. Find the overall impulse response of the system shown in Fig. Q6(a). **(08 Marks)**

Fig. Q6(a)



where $h_1(t) = u(t+1)$, $h_2(t) = u(t-2)$, $h_3(t) = e^{-3t} u(t)$.

b. State and prove time shift property of Fourier Series. **(06 Marks)**

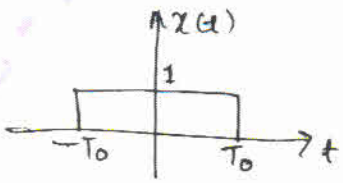
c. Obtain DTFS coefficients of x(n) if $\Omega_0 = 3\pi$.
i) $x(n) = \sin 6\pi n$ ii) $x(n) = \cos 3\pi n + \sin 9\pi n$. **(06 Marks)**

Module-4

7 a. State and prove Convolution property of DTFT. **(06 Marks)**

b. Find F.T. of the signal shown in Fig. Q7(b). **(06 Marks)**

Fig. Q7(b)



c. Find the time domain signal x(t) if its F.T. X(jw) given below :
i) $X(jw) = \dfrac{jw}{(jw)^2 + 5jw + 6jw}$ ii) $X(jw) = \dfrac{1 - jw}{1 + w^2}$ **(08 Marks)**

OR

8 a. State and prove Parseval's theorem for Fourier transform. **(06 Marks)**

b. Using properties, find the DTFT of the signals.

i) $x(n) = (\frac{1}{2})^n u(n+2)$ ii) $x(n) = n \cdot a^n u(n)$. **(06 Marks)**

c. Obtain the signal x(t) , if its Fourier transform is

i) $X(jw) = \dfrac{1}{2 + j(w-3)}$ ii) $X(jw) = e^{-j3w} \dfrac{1}{jw+2}$ **(08 Marks)**

Module-5

9 a. Find the Z – transform of the signals.

i) $x(n) = (\frac{1}{2})^n u(n) - (\frac{3}{2})^n u(-n-1)$ ii) $x(n) = (-\frac{1}{3})^n u(n)$. **(07 Marks)**

b. State and prove differentiation in the Z – domain property of Z – transform. **(06 Marks)**

c. Use Partial fraction expansion to find the inverse Z – transform of

$$X(z) = \frac{z^2 - 3z}{z^2 - \frac{3}{2}z - 1} \quad |\tfrac{1}{2}| < |z| < |2|$$ **(07 Marks)**

OR

10 a. Use properties to find Z – transform of the following signals :

i) $x(n) = 3^n u(n-2)$ ii) $x(n) = n \sin\left(\frac{\pi}{2}n\right) u(n)$. **(08 Marks)**

b. Find the Inverse Z - transform.

i) $X(z) = \dfrac{1}{1 - \frac{1}{2}z^{-1}} + \dfrac{2}{1 - 2z^{-1}} \quad |z| > |2|$.

ii) $X(z) = \dfrac{2 + z^{-1}}{1 - \frac{1}{2}z^{-1}} \quad |z| < |\tfrac{1}{2}|$, Use Power Series Expansion method. **(12 Marks)**

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CBCS SCHEME

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

18EC46

Fourth Semester B.E. Degree Examination, July/August 2022
Microcontrollers

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Write the block diagram of 8051 and explain its main features. **(08 Marks)**

b. What is an embedded system and write its characters. **(06 Marks)**

c. Write the starting address and ending address of internal RAM used in 8051 and how it is classified. **(06 Marks)**

OR

2 a. Show how 8K RAM and 8K EPROM can be interfaced to 8051 micro controller. Assume the EPROM starts from address 0000H. **(08 Marks)**

b. How many ports are present in 8051 and explain the different functions of each port. **(06 Marks)**

c. Compare microprocessor and micro controllers. **(06 Marks)**

Module-2

3 a. How the instruction set of 8051 is classified depending on the addressing mode and explain all of them with example. **(08 Marks)**

b. List the different SFR's present in 8051 and also write the address of them. **(04 Marks)**

c. Write an assembly level program to multiply the number present in external memory location 800AH and 8050H. Store the lower byte of result obtained in R0 and higher byte in R1. **(08 Marks)**

OR

4 a. Explain the different rotate instructions present in 8051 μC with an example. Also explain the working of SWAP instruction. **(08 Marks)**

b. Explain the working of the following instructions and also find the time required to execute each instruction :

i) MOVC A, @A+PC XTAL = 12 MHz used
ii) XCHD A, @R1 XTAL = 11.0592 MHz used
iii) ADDC A, R5 XTAL = 10MHz used
iv) DIV AB XTAL = 11.0592MHz. **(08 Marks)**

c. Write an assembly level program to set the bits 1, 4, 6, 7 of port 0 use bit level instructions to set the bits. **(04 Marks)**

Module-3

5 a. Explain the working of PUSH and POP instruction with necessary diagram. **(04 Marks)**

b. Write a program to toggle all bits of P1 every 200ms. Assume crystal frequency is 11.0592MHz. Show all the calculations. **(08 Marks)**

c. Write an assembly level program to count the number 1's and 0's present in the content of external memory location 8000H. Store the count of number 1's in reg. R0 and count of number of 0's in reg. R1. **(08 Marks)**

OR

6 a. What is the need of subroutine and explain the instructions associated with subroutine. **(08 Marks)**

b. Write an assembly level program to mutually exchange the 10 bytes of data stored in external memory location starting from 8000H and 8020H. **(06 Marks)**

c. Find the delay produced in the 8051 program.

```
Delay : MOVR3, # 200
Here :  NOD
        NOP
        DJN2 R3, here
        RET
```

Assume XTAL used 11.0592 MHz. **(06 Marks)**

Module-4

7 a. Explain all the bits of TMOD and TCON register. **(08 Marks)**

b. Assuming XTAL frequency as 11.0592MHz write a program to generate 4 KHz square wave on P2.1. Use timer 0 in model show all the calculations. **(08 Marks)**

c. Write the steps to program the timer of 8051 in mode 2. **(04 Marks)**

OR

8 a. In asynchronous method of communication how the framing is done explain with necessary diagram. Also mention the different pins of DB – 9 pin connector. **(08 Marks)**

b. A switch is connected to pin 2.0 monitor the status of the switch if SW = 0. Write an 8051C program to send the message 'READ' and if SW = 1 send the message 'WRITE' XTAL frequency = 11.0592MHz. **(08 Marks)**

c. Compare parallel and serial data transfer. **(04 Marks)**

Module-5

9 a. Name the external hardware interrupts present in 8051 and how the activation of them will be done. **(06 Marks)**

b. Write a program to read the data from port P1 and send it to P2 continuously. While incoming data from the serial port is sent to P0. Assume XTAL = 11.0592MHz set the baud rate at 2400. **(06 Marks)**

c. Write the interrupt priority upon reset in 8051. Also explain how the priority of the interrupts can be set using IP register. **(08 Marks)**

OR

10 a. Write a table to find the digital value to be send to DAC for generating sine wave in steps of 30°. Using the table write an assembly level program to generate a sine wave using DAC interfaced to microcontroller 8051. Assume full scale voltage for DAC is 10V and XTAL = 11.0592MHz. **(10 Marks)**

b. How draw the diagram to inter face a stepper motor to 8051MC. Also write a program to monitor the status of switch connected to port P2.7. If SW = 0. The stepper should rotate clockwise else it should rotate in anticlockwise direction. **(10 Marks)**

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CBCS SCHEME

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18MAT41

Fourth Semester B.E. Degree Examination, July/August 2022
Complex Analysis, Probability and Statistical Methods

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive Cauchy-Riemann equation in Polar form. **(06 Marks)**

b. Find the analytic function f(z) whose real part is
$x \sin x \cosh y - y \cos x \sinh y$ **(07 Marks)**

c. If f(z) is analytic show that
$$\left[\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right]|f(z)|^2 = 4|f'(z)|^2$$ **(07 Marks)**

OR

2 a. Find the analytic function f(z) given that the sum of its real and imaginary part is
$x^3 - y^3 + 3xy(x - y)$ **(06 Marks)**

b. Find the analytic function $f(z) = u + iv$ if
$v = r^2\cos 2\theta - r\cos\theta + 2$ **(07 Marks)**

c. If f(z) is analytic function then show that
$$\left\{\frac{\partial}{\partial x}|f(z)|\right\}^2+\left\{\frac{\partial}{\partial y}|f(z)|\right\}^2 = |f'(z)|^2$$ **(07 Marks)**

Module-2

3 a. State and prove Cauchy's Integral formula. **(06 Marks)**

b. Evaluate $\int_0^{2+i}\bar{z}^2\,dz$ along (i) the line $y = \frac{x}{2}$ (ii) The real axis to 2 and then vertically to 2 + i. **(07 Marks)**

c. Find the bilinear transformation which maps the points 1, i, –1 onto the points i, 0, –i respectively. **(07 Marks)**

OR

4 a. Discuss the transformation $w = e^z$, with respect to straight lines parallel to x and y axis. **(06 Marks)**

b. Using Cauchy's integral formula evaluate
$$\int_c \frac{\sin\pi z^2 + \cos\pi z^2}{(z-1)(z-2)}\,dz \text{ , where } c : |z| = 3$$ **(07 Marks)**

c. Find the bilinear transformation which maps the points 0, 1, ∞ on to the points –5, –1, 3 respectively. **(07 Marks)**

Module-3

5 a. A random variable X has the following probability function for various values of X.

X	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

Find i) k ii) $P(X < 6)$ iii) $P(3 < X \le 6)$ **(06 Marks)**

b. Out of 800 families with 5 children each, how many families would you expect to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys (iv) atmost 2 girls, assuming equal probabilities for boys and girls. **(07 Marks)**

c. The length in time (minutes) that a certain lady speaks on a telephone is a random variable with probability density function

$$f(x) = \begin{cases} Ae^{-x/5} & \text{for } x > 0 \\ 0 & \text{elsewhere} \end{cases}$$

Find the value of the constant A. What is the probability that she will speak over the phone for (i) More than 10 minutes (ii) Less than 5 minutes (iii) Between 5 and 10 minutes. **(07 Marks)**

OR

6 a. Find the constant C such that the function

$$f(x) = \begin{cases} Cx^2, & 0 < x < 3 \\ 0 & \text{otherwise} \end{cases}$$ is a probability density function. Also compute $P(1 < x < 2)$, $P(x \leq 1)$ and $P(x > 1)$ **(06 Marks)**

b. 2% fuses manufactured by a firm are found to be defective. Find the probability that the box containing 200 fuses contains
(i) No defective fuses (ii) 3 or more defective fuses (iii) At least one defective fuse. **(07 Marks)**

c. If x is a normal variate with mean 30 and standard deviation 5 find the probabilities that
(i) $26 \leq x \leq 40$ (ii) $x \geq 45$ (iii) $|x - 30| > 5$
Given that $\phi(1) = 0.3413$, $\phi(0.8) = 0.2881$, $\phi(2) = 0.4772$, $\phi(3) = 0.4987$ **(07 Marks)**

Module-4

7 a. The following table gives the ages (in years) of 10 married couples. Calculate Karl Pearson's coefficient of correlation between their ages:

Age of husband (x)	23	27	28	29	30	31	33	35	36	39
Age of wife (y)	18	22	23	24	25	26	28	29	30	32

(06 Marks)

b. In a partially destroyed laboratory record of correlation data only the following results are available:
Variance of x is 9 and regression lines are $8x - 10y + 66 = 0$, $40x - 18y = 214$. Find
(i) Mean value of x and y
(ii) Standard deviation of y
(iii) Coefficient of correlation between x and y. **(07 Marks)**

c. Fit a parabola of the form $y = ax^2 + bx + c$ for the data

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(07 Marks)

OR

8 a. Obtain the lines of regression and hence find the coefficient of correlation of the data:

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

(06 Marks)

b. Show that if θ is the angle between the lines of regression

$$\tan\theta = \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2}\left(\frac{1 - r^2}{r}\right)$$ **(07 Marks)**

c. Fit a straight line $y = a + bx$ to the data

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

(07 Marks)

Module-5

9 a. The joint probability distribution of the random variables X and Y is given below.

X \ Y	-4	2	7
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
5	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

Find (i) E[X] and E[Y] (ii) E[XY] (iii) cov(X, Y) iv) $\rho(X, Y)$.
Also, show that X and Y are not independent. **(06 Marks)**

b. A manufacturer claimed that atleast 95% of the equipment which he supplied to a factory confirmed to specifications. An examination of a sample of 200 pieces of equipment revealed that 18 of them were faulty. Test his claim at a significance level of 1% and 5% ($z_{0.05} = 1.96$, $z_{0.01} = 2.58$). **(07 Marks)**

c. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, –1, 3, 0, 6, –2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure ($t_{0.05}$ for 11 d.f. is 2.201) **(07 Marks)**

OR

10 a. Define the terms :
(i) Null hypothesis (ii) Type-I and Type – II errors (iii) Significance level **(06 Marks)**

b. In an experiment of pea breeding the following frequencies of seeds were obtained:

Round Yellow	Wrinkled Yellow	Round Green	Wrinkled Green	Total
315	101	108	32	556

Theory predicts that the frequencies should be in proportions 9:3:3:1
Is the experiment in agreement with theory ($\chi^2_{0.5}$ for 3 d.f is 7.815) **(07 Marks)**

c. The joint probability distribution of two discrete random variable X and Y is given by $f(x, y) = k(2x + y)$ where x and y are integers such that $0 \le x \le 2$, $0 \le y \le 3$. Find k and the marginal probability distribution of X and Y. Show that the random variables X and Y are dependent. Also, find $P(X \ge 1, Y \le 2)$. **(07 Marks)**

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CBCS SCHEME

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

18MATDIP41

Fourth Semester B.E. Degree Examination, July/August 2022
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the rank of the matrix

$$A = \begin{bmatrix} 1 & 0 & -3 & -1 \\ 0 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$$ **(06 Marks)**

b. Solve the system of equations: $x + y + z = 9$; $x - 2y + 3z = 8$; $2x + y - z = 3$ by Gauss elimination method. **(07 Marks)**

c. Find all the eigen values and corresponding eigen vectors of $\begin{pmatrix} -5 & 9 \\ -6 & 10 \end{pmatrix}$ **(07 Marks)**

OR

2 a. Find the rank of the matrix

$$\begin{pmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{pmatrix}$$ **(06 Marks)**

b. Using Gauss elimination method solve the system of equations
$x + 2y + 3z = 6$; $2x + 4y + z = 7$; $3x + 2y + 9z = 14$. **(07 Marks)**

c. Find the eigen values of the matrix $\begin{pmatrix} 1 & 2 & 3 \\ 0 & -2 & 6 \\ 0 & 0 & -3 \end{pmatrix}$ **(07 Marks)**

Module-2

3 a. Use an appropriate Interpolation formula to compute f(6).

x	1	2	3	4	5
y	1	-1	1	-1	1

(07 Marks)

b. Evaluate $\int_0^6 3x^2 dx$ by using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule by taking n = 6. **(07 Marks)**

c. Find a real root of the equation $x^3 - 2x - 5 = 0$ by Newton Raphson method. **(06 Marks)**

OR

4 a. Find solution using Newton's Interpolation formula, at $x = -1$.

x	0	1	2	3
f(x)	1	0	1	10

(07 Marks)

b. Find the real root of the equation $\cos x = 3x - 1$ using Regula Falsi method. **(07 Marks)**

c. Evaluate $\int_4^{5.2} \log_e x$ taking n = 6 by Weddle's rule. **(06 Marks)**

Module-3

5 a. Solve : $(D^3 - 2D^2 + 4D - 8)y = 0$ **(06 Marks)**

b. Solve : $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = e^{2x}$ **(07 Marks)**

c. Solve : $\frac{d^2y}{dx^2} + 4y = \cos 4x$ **(07 Marks)**

OR

6 a. Solve : $\frac{d^3y}{dx^3} - 3\frac{dy}{dx} + 2y = 0$ **(06 Marks)**

b. Solve : $(D^2 - 6D + 9)y = 7e^{-2x} - \log 2$ **(07 Marks)**

c. Solve : $\frac{d^2y}{dx^2} - 16y = \sin 16x$ **(07 Marks)**

Module-4

7 a. Form the partial differential equation by eliminating the arbitrary constants from $z = (x - a)^2 + (y - b)^2$ **(06 Marks)**

b. Solve : $\frac{\partial^2 z}{\partial x \partial y} = x^2 y$ **(07 Marks)**

c. Solve : $\frac{\partial^2 z}{\partial y^2} - z = 0$; given that $z = \cos x$ and $\frac{\partial z}{\partial y} = \sin x$, when $y = 0$. **(07 Marks)**

OR

8 a. Form the partial differential equation by eliminating the arbitrary function 'f' from $f(x^2 + y^2, z - xy) = 0$ **(06 Marks)**

b. Solve the equation $\frac{\partial^2 z}{\partial y^2} = \sin xy$ **(07 Marks)**

c. Form the partial differential equation by eliminating the arbitrary constants

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$ **(07 Marks)**

Module-5

9 a. Define : (i) Mathematical definition of probability
(ii) Mutually exclusive events
(iii) Independent events **(06 Marks)**

b. If A and B are two events with $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A \cap B) = \frac{1}{4}$.

Find (i) P(A/B) (ii) P(B/A) (iii) $P(\overline{A}/\overline{B})$ (iv) $P(\overline{B}/\overline{A})$ **(07 Marks)**

c. In a bolt factory there are four machines A, B, C, D manufacturing respectively 20%, 15%, 25%, 40% of the total production. Out of these 5%, 4%, 3%, 2% are defective. If a bolt drawn at random was found defective, what is the probability that it was manufactured by A? **(07 Marks)**

OR

10 a. State and prove Baye's theorem. **(06 Marks)**

b. A card is drawn at random from a pack of cards. (i) What is the probability that it is a heart? (ii) If it is known that the card drawn is red, what is the probability that it is a heart? **(07 Marks)**

c. An Urn 'A' contains 2 white and 4 black balls. Another Urn 'B' contains 5 white and 7 black balls. A ball is transferred from the Urn A to the Urn B. Then a ball is drawn from the Urn B. Find the probability that it is white. **(07 Marks)**

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2015-17 IV Sem EC

CBCS SCHEME

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15EC43

Fourth Semester B.E. Degree Examination, July/August 2022
Control Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define control system. What are the requirements of a good control system? **(04 Marks)**

b. For the mechanical system shown in Fig.Q1(b).
(i) Draw the mechanical network
(ii) Write the differential equations
(iii) Draw an electrical network based on Force-Voltage Analogy

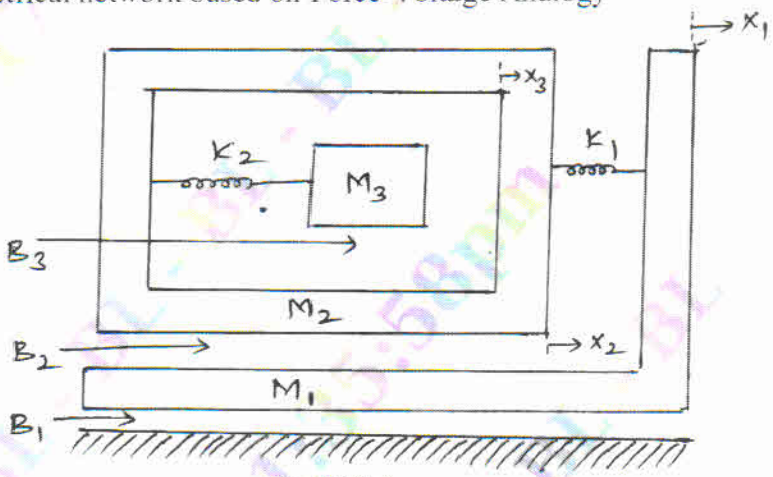

Fig.Q1(b) **(06 Marks)**

c. Draw the signal flow graph shown in Fig.Q1(c). Determine the transfer function using Mason's gain formulae.

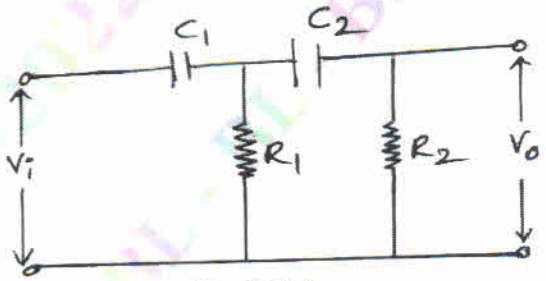

Fig.Q1(c) **(06 Marks)**

OR

2 a. Define the following terms related to signal-flow graph with a neat schematic:
(i) Forward path
(ii) Feedback loop
(iii) Self loop
(iv) Source node **(04 Marks)**

b. For the mechanical system shown in Fig.Q2(b).
   (i) Draw equivalent mechanical network.
   (ii) Write the performance equations.
   (iii) Draw torque-current analogy.

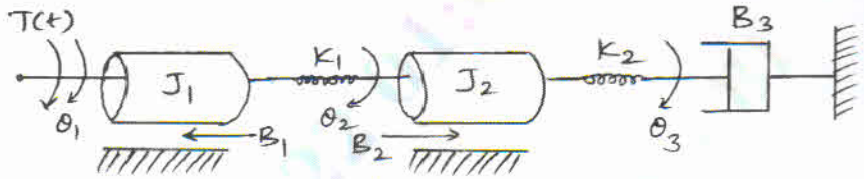

Fig.Q2(b) **(06 Marks)**

c. Obtain the transfer function of the control system whose block diagram is shown in Fig.Q2(c) using block diagram reduction techniques.

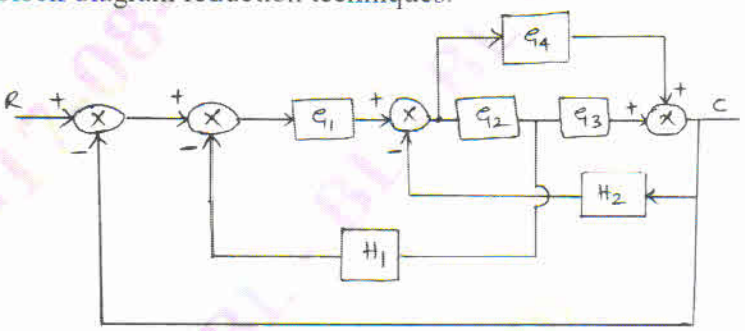

Fig.Q2(c) **(06 Marks)**

Module-2

3 a. Draw the transient characteristics of a control system to a unit step input and define the following:
   (i) Delay time (ii) Rise time (iii) Peak time
   (iv) Settling time (v) Maximum overshoot **(06 Marks)**

b. A unity feedback control system has an open-loop transfer function $G(s) = \frac{5}{s(s+1)}$, find the rise time, percentage overshoot, peak time and settling time for a step input of 10 units. **(06 Marks)**

c. Determine the static error coefficients for a unity feedback system given by

$$G(s) = \frac{K}{s^2(s+20)(s+30)}$$ **(04 Marks)**

OR

4 a The response of a serve mechanism is $c(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$ when subjected to a unit step input. Obtain an expression for closed loop transfer function. Determine the undamped natural frequency and damping ratio. **(04 Marks)**

b. A second order control system is represented by a transfer function given below:

$$\frac{\theta_0(s)}{T(s)} = \frac{1}{Js^2 + Fs + K}$$

where $\theta_0(s)$ = proportional output; T = input torque. A step unit of 10 N-m is applied to the system and test results are given below:
   (i) Maximum overshoot is 6%.
   (ii) Peak time is 1 sec
   (iii) The steady state value of the output is 0.5 radian.
   Determine the values of J, F and K. **(06 Marks)**

c. Find K_p, K_v and K_a for the unity feedback system represented by the following open loop transfer function $G(s) = \frac{100}{s^2(s+2)(s+5)}$. Determine the steady state error when input is $r(t) = 1 + t + 2t^2$. **(06 Marks)**

Module-3

5 a. For system $s^4 + 22s^3 + 10s^2 + s + K = 0$, find K_{mar} and 'ω' at K_{mar}. **(04 Marks)**

b. A given system shown in Fig.Q5(b) oscillates with frequency 2 rad/sec. Find the value of K_{mar} and P. No poles are in RHS.

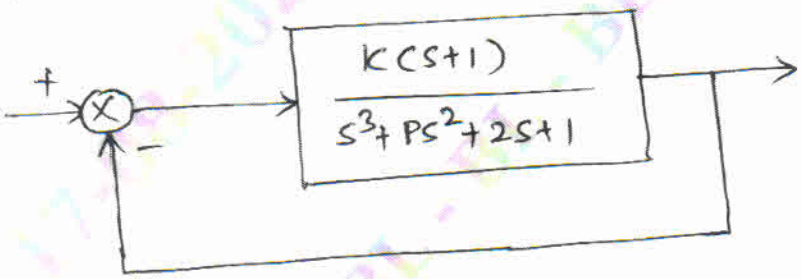

Fig.Q5(b) **(06 Marks)**

c. The open loop transfer function of control system is given by

$$G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+5s+20)}.$$

Determine the valid break away points. **(06 Marks)**

OR

6 a. What are the necessary and sufficient conditions for a system to be stable according to Routh-Hurwitz criterion. **(04 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 complete root locus for K = 0 to ∞. Indicate all the points on it. **(10 Marks)**

c. Examine the stability of given equation using Routh's method $s^3 + 6s^2 + 11s + 6 = 0$. **(02 Marks)**

Module-4

7 a. Plot the polar plot for the transfer function given $G(s)H(s) = \frac{1}{s(Ts+1)}$. **(06 Marks)**

b. For a certain control system $G(s)H(s) = \frac{K}{s(s+2)(s+10)}$. Sketch the Nyquist pl. , and hence calculate the range of value of 'K' for stability. **(10 Marks)**

OR

8 a. List the limitations of lead and lag compensations. **(06 Marks)**

b. A unity feedback control system has $G(s) = \frac{80}{s(s+2)(s+20)}$. Draw the Bode plot. Determine GM, PM, ω_{gc} and ω_{pc}. **(10 Marks)**

Module-5

9 a. Define the following terms:
(i) State (ii) State variable (iii) State space (iv) State trajectory **(04 Marks)**

b. Construct the state model using phase variables if the system is described by the differential equation

$$\frac{d^3y(t)}{dt^3}+4\frac{d^2y(t)}{dt^2}+7\frac{dy(t)}{dt}+2y(t)=5U(t)$$

where y(t) = output; U(t) = input to the system. Draw the state diagram. **(06 Marks)**

c. Consider a system having state model

$$\begin{bmatrix}\dot{X}_1\\ \dot{X}_2\end{bmatrix}=\begin{bmatrix}-2 & -3\\ 4 & 2\end{bmatrix}\begin{bmatrix}X_1\\ X_2\end{bmatrix}+\begin{bmatrix}3\\ 5\end{bmatrix}U \quad \text{and} \quad Y[1\ \ 1]\begin{bmatrix}X_1\\ X_2\end{bmatrix}$$

with D = 0 obtain its transfer function. **(06 Marks)**

OR

10 a. With a block diagram, explain sampled-data control system. **(04 Marks)**

b. Consider a matrix 'A' given below:

$$A=\begin{bmatrix}0 & 1 & 0\\ 3 & 0 & 2\\ -12 & -7 & -6\end{bmatrix}$$

Determine: (i) Eigen values (ii) Eigen vectors (iii) Modal matrix **(06 Marks)**

c. Obtain the appropriate state model for a system represented by an electric circuit shown in Fig.Q10(c).

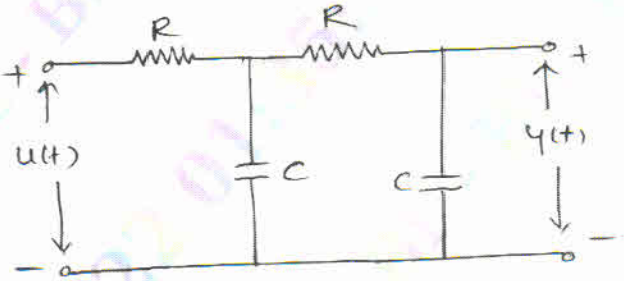

Fig.Q10(c) **(06 Marks)**

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CBCS SCHEME

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15EC44

Fourth Semester B.E. Degree Examination, July/August 2022
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. Determine whether the discrete-time signal,

$x(n) = \cos\left(\frac{n\pi}{4}\right) \sin\left(\frac{2\pi}{5}\right)$ is periodic. If periodic, find the fundamental period. **(05 Marks)**

b. Determine and sketch even and odd parts of the signal shown in the Fig.Q1(b).

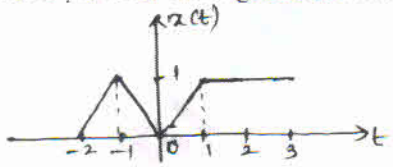


Fig.Q1(b) **(06 Marks)**

c. Prove the following properties of Impulse function:

i) $x(t) * \delta(t) = x(t)$ (ii) $x(t) * \delta(t - t_0) = x(t_0)$ **(05 Marks)**

OR

2 a. Determine whether the following systems are memoryless, causal, linear, time invariant and stable:

(i) $y(n) = n\,x(n)$ (ii) $y(t) = x(t/2)$ $|x(t)| \le Mx < \infty$ **(10 Marks)**

b. Sketch the waveforms of the following signals :

(i) $x(t) = u(t + 1) - 2u(t) + u(t - 1)$

(ii) $y(t) = r(t + 1) - r(t) + r(t - 2)$

(iii) $z(t) = -u(t + 3) + 2u(t + 1) - 2u(t - 1) + u(t - 3)$ **(06 Marks)**

Module-2

3 a. An LTI system is characterized by an impulse response $h(n) = (1/2)^n u(n)$. Find the response of the system for the input $x(n) = (1/4)^n u(n)$. **(06 Marks)**

b. Find the convolution sum of the given two sequences $x(n) = \{1, 2, 3, 2\}$, $h(n) = \{1, 2, 2\}$ by using graphical convolution method. **(10 Marks)**

OR

4 a. Determine the convolution sum of the given sequences

$x(n) = \{3, 5, \underset{\uparrow}{-2}, 4\}$ and $h(n) = \{3, 1, 3\}$. **(08 Marks)**

b. Perform graphical convolution to determine the output of the system, when the input and impulse response are given by $x(t) = e^{-4t}[u(t) - u(t - 2)]$; $h(t) = e^{-2t} u(t)$. **(08 Marks)**

Module-3

5 a. For each impulse response listed below, determine whether the corresponding system is memoryless, causal and stable.

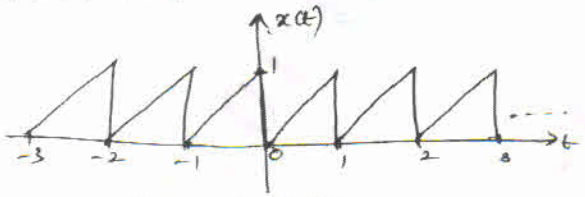
i) $h(n) = (0.99)^n u(n - 3)$ ii) $h(t) = e^{-3t} u(t - 1)$ **(08 Marks)**

b. Find the complex exponential fourier series representation of the following signals:

i) $x(t) = \sin(2t + \pi/4)$ ii) $x(t) = \cos^2(t)$ **(08 Marks)**

OR

6 a. Find the complex fourier series coefficients for the periodic waveform shown in Fig.Q6(a). Also draw the amplitude and phase spectra.



$x(t) = t \; ; \quad 0 < t < 1.$

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

b. Find the step response of an LTI system, whose impulse response is given by the following:
i) $h(t) = t^2 u(t)$ ii) $h(t) = e^{-t} u(t)$ **(08 Marks)**

Module-4

7 a. Show that the fourier transform of a rectangular pulse described by :

$x(t) = 1 \quad ; \quad -T \le t \le T$

$= 0 \quad ; \quad |t| > T$

is a sinc function. Plot its magnitude and phase spectrum. **(08 Marks)**

b. If $x(t) \xleftrightarrow{FT} X(jw)$ or $X(e^{jw})$ and $y(t) \xleftrightarrow{FT} Y(jw)$ or $Y(e^{jw})$,
Show that $z(t) = x(t) * y(t) \xleftrightarrow{FT} X(jw)Y(jw)$ or $X(e^{jw})Y(e^{jw})$ **(08 Marks)**

OR

8 a. State sampling theorem and explain aliasing effect with relevant waveforms. **(04 Marks)**

b. Specify Nyquist rate and Nyquist interval for each of the following signals.
i) $x(t) = \sin c^2(2000t)$
ii) $y(t) = \sin c(200t) + \sin c^2(200t)$ **(06 Marks)**

c. Find the DTFT of the signal $a^n u(n)$ its magnitude and phase spectrum. **(06 Marks)**

Module-5

9 a. Using properties of z-transform, find the convolution of
$x(n) = \{\underset{\uparrow}{1}, 2, -1, 0, 3\}$ and $y(n) = \{\underset{\uparrow}{1}, 2, -1\}$ **(05 Marks)**

b. State and prove differentiation property of Z-transform. **(06 Marks)**

c. Find the z-transform of $x(n) = \alpha^{|n|}$, $|\alpha| \# 1$ and determine its ROC. **(05 Marks)**

OR

10 a. A causal discrete-time LTI system is described by

$$y(n) - \frac{3}{4} y(n-1) + \frac{1}{8} y(n-2) = x(n)$$

where x(n) and y(n) are the input and output of the system respectively.
i) Determine the system function, H(z)
ii) Find the impulse response, h(n)
iii) Find the step response of the system
iv) Find the frequency response of the system.
v) Find BIBO stability of the system. **(10 Marks)**

b. Find the inverse z-transform of the funciton

$$X[z] = \frac{z-4}{z^2 - 5z + 6}$$ **(06 Marks)**

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CBCS SCHEME

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15EC45

Fourth Semester B.E. Degree Examination, July/August 2022
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 an expression for time domain description of an AM wave with neat waveforms. **(07 Marks)**

b. Explain the method of obtaining practical synchronous receiving system with DSBSC modulated wave using COSTAS LOOP. **(06 Marks)**

c. A 400W carrier is modulated on a depth of 75%, calculate the total power in the modulated wave for the following form of AM.
i) Double Side Band with Full Carrier (DSBFC)
ii) Double Side Band with Suppressed Carrier (DSBSC)
iii) Single Side Band suppressed carrier (SSB). **(03 Marks)**

OR

2 a. Explain the generation of DSB-SC modulated waves using ring modulator. **(07 Marks)**

b. With a relevant block diagram, explain the working of FDM system. **(05 Marks)**

c. What is the significance of single side band modulation? Give the frequency domain description of the same. **(04 Marks)**

Module-2

3 a. Derive the equation for single tone FM wave. Define modulation index, maximum deviation of a frequency modulated signal. **(05 Marks)**

b. With a neat diagram, explain FM demodulation using balanced slope detector. **(06 Marks)**

c. A single tone FM signal is given by $s(t) = 10\sin[16\pi \times 10^6 t + 20\sin 2\pi \times 10^3 t]$ volts. Determine: i) Modulation index ii) Modulation frequency iii) Frequency deviation iv) Carrier frequency v) Power of FM signal across 100Ω resistor. **(05 Marks)**

OR

4 a. Explain generation of frequency modulated signal using direct method. **(05 Marks)**

b. Explain the non linear model of Phase Lock Loop (PLL). **(06 Marks)**

c. With relevant block diagram, explain FM stereo multiplexing and demultiplexing. **(05 Marks)**

Module-3

5 a. Define mean and covariance function with respect to stationary random process. **(04 Marks)**

b. Define PDF. Explain its important properties. **(06 Marks)**

c. Prove the following two properties of the auto correlation function $R_x(\tau)$ of a random process x(t).
i) If x(t) contains a d.c component equal to A, then $R_x(\tau)$ will contain a constant component equal to A^2.
ii) If x(t) contains a sinusoidal component then $R_x(\tau)$ will also contain a sinusoidal component of the same frequency. **(06 Marks)**

OR

6 a. Define white noise. Plot Power Spectral Density (PSD) and autocorrelation function of white noise. **(06 Marks)**

b. Define noise equivalent band width. Derive the expression for the same. **(06 Marks)**

c. Let x be a continuous random variable having a uniform probability distribution defined in the range $2 \leq x \leq 4$. Let $y = 3x + 2$. Find mean m_x and m_y. **(04 Marks)**

Module-4

7 a. Prove that the figure of merit of a DSB-SC system is unity. **(08 Marks)**

b. Explain pre-emphasis and de-emphasis in frequency modulation. **(08 Marks)**

OR

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

b. Find the figure of merit in AM when depth of modulation is i) 100% ii) 60% iii) 25% **(03 Marks)**

c. Write a short note on FM threshold reduction. **(05 Marks)**

Module-5

9 a. With necessary diagram, explain the generation and reconstruction of Pulse Code Modulation (PCM). **(06 Marks)**

b. Explain the sampling theorem for low pass signals. Derive the equation for sampled signal in the frequency domain and sketch the spectrum. **(07 Marks)**

c. What are the advantages of digital signals over analog? **(03 Marks)**

OR

10 a. With neat diagram, explain the generation of Pulse-Position Modulation (PPM). **(06 Marks)**

b. With neat diagram, explain the concept of Time-Division Multiplexing (TDM). **(06 Marks)**

c. Show that the signal-to-noise ratio of an uniform quantizer is equal to 1.8 + 6N. **(04 Marks)**

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15EC46

Fourth Semester B.E. Degree Examination, July/August 2022
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. Discuss the effect of using resistors that are too large at the input terminals of a bipolar op-amp. Write an equation for calculating a suitable, maximum resistance value. **(06 Marks)**

b. Using a 741 op-amp design a non-inverting amplifier to have a voltage gain of approximately 66. The signal amplitude is to be 15 mV. **(06 Marks)**

c. Sketch an illustration to show the effect of op-amp slew rate and explain it. **(04 Marks)**

OR

2 a. Explain the method of dealing with input offset voltage and current. **(04 Marks)**

b. Design a inverting summing amplifier using 741 op-amp to give the direct sum of two inputs which each range from 0.1 V to 1 V. **(06 Marks)**

c. Derive the expression of $V_o = \frac{R_2}{R_1}(V_2 - V_1)$ of a difference amplifier. **(06 Marks)**

Module-2

3 a. Explain the operation of capacitor coupled voltage follower and also write the equations for calculating the capacitance values. **(06 Marks)**

b. A capacitor coupled non-inverting amplifier is to have a +24 V supply, a voltage gain of 100, an output amplitude of 5 V, a lower cutoff frequency of 75 Hz and a minimum load resistance of 5.6 KΩ. Using 741 op-amp, design a suitable circuits. **(08 Marks)**

c. What is the problem associated with voltage source using zener diode and how it can be solved? **(02 Marks)**

OR

4 a. Design an instrumentation amplifier to have an overall voltage gain of 900. The input signal amplitude of 15 mV and supply is ±15V. Use 741 op-amp. **(08 Marks)**

b. Draw the fullwave precision rectifier using summing circuit and a precision halfwave rectifier and explain it with necessary mathematical analysis. **(08 Marks)**

Module-3

5 a. Draw the op-amp sample and hold circuit. Sketch the signal, control and output waveforms. Explain the circuit operation. **(08 Marks)**

b. For the circuit shown in Fig. Q5 (b) is to handle a 1 kHz square wave input with a peak-to-peak amplitude of 6 V. Design a circuit elements using a 741 op-amp with a ±12 V supply. Assume $V_B = 0.1$ V and $\Delta V = 1$ V. **(08 Marks)**

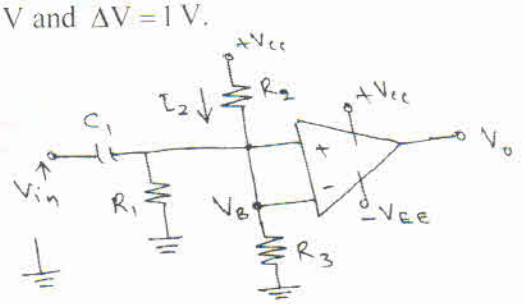

Fig. Q5 (b)

OR

6 a. Using a bipolar op-amp with a ± 18 V supply, design an inverting Schmitt Triggering circuit is to have UTP = 1.5 V and LTP = -3 V. Draw input and output waveforms. Assume $R_1 = 27\ K\Omega$. **(08 Marks)**

b. With mathematical equations and circuits of log amplifier, explain the problem of variation of emitter saturation current and dependence of an device parameter and temperature. **(08 Marks)**

Module-4

7 a. Explain the circuit operation of second order Lowpass Filter. Write the design equations for calculating circuit elements. **(08 Marks)**

b. List and explain the characteristics of a three terminal IC regulator. **(08 Marks)**

OR

8 a. Design a second order high pass active filter to have a cutoff frequency of 12 kHz. Use a 715 op-amp with $F_B(max) = 1.5\ \mu A$ and also estimate the highest signal frequency that will be passed. Assume $f_u = 11$ MHz. **(04 Marks)**

b. Design an adjustable regulator from 7805 regulator to get an output voltage of 7.5 V. Assume $I_Q = 4.2$ mA and $I_{R_1} = 25$ mA. **(04 Marks)**

c. Draw the Functional diagram of 723 regulator and explain it. **(08 Marks)**

Module-5

9 a. Draw the circuit diagram of a digital type XOR phase detector and waveforms. Explain its operation. **(08 Marks)**

b. For a Astable multivibrator using 555 Timer has $R_A = 6.8\ K\Omega$, $R_B = 3.3\ K\Omega$ and $C = 0.1\ \mu F$. Calculate (i) t_{High} (ii) t_{Low} (iii) Free running frequency (iv) Duty cycle. **(08 Marks)**

OR

10 a. Explain the operation of a ADC using Successive Approximation. **(08 Marks)**

b. Draw the block diagram of a PLL and explain it. **(08 Marks)**

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17MATDIP41

Fourth Semester B.E. Degree Examination, July/August 2022
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the rank of a matrix $A = \begin{bmatrix} 1 & 2 & -2 & 3 \\ 2 & 5 & -4 & 6 \\ -1 & -3 & 2 & -2 \\ 2 & 4 & -1 & 6 \end{bmatrix}$ by reducing to echelon form. **(07 Marks)**

b. Use Cayley-Hamilton theorem to find the inverse of a matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$. **(07 Marks)**

c. Solve the following system of equation of Gauss Elimination method:
$x + y + z = 9$
$x - 2y + 3z = 8$
$2x + y - z = 3$. **(06 Marks)**

OR

2 a. Test for consistency and solve
$5x_1 + x_2 + 3x_3 = 20$
$2x_1 + 5x_2 + 2x_3 = 18$
$3x_1 + 2x_2 + x_3 = 14$. **(07 Marks)**

b. Find all the Eigenvalues of the matrix
$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$. **(07 Marks)**

c. Find the rank of the matrix $A = \begin{bmatrix} 2 & 3 & 4 \\ -1 & 2 & 3 \\ 1 & 5 & 7 \end{bmatrix}$. **(06 Marks)**

Module-2

3 a. Solve $\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 8y = 0$. **(07 Marks)**

b. Solve $y'' - 4y' + 13y = \cos 2x$. **(07 Marks)**

c. Solve $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^3$. **(06 Marks)**

OR

4 a. Solve by the method of variation of parameters, $y'' - 2y' + y = e^x.\log x$. **(07 Marks)**

b. Solve by the method of undetermined coefficients $(D^2 + 1)y = \sin x$. **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} - 4y = 3^x$. **(06 Marks)**

Module-3

5 a. Find the Laplace transform of $\cos t \times \cos 2t.\cos 3t$. **(07 Marks)**

b. Find the Laplace transform of $e^{3t} \sin 5t.\sin 3t$. **(07 Marks)**

c. Find the Laplace transform of $t^3 \sin t$. **(06 Marks)**

OR

6 a. If f(t) is a periodic function of period $T > 0$, then prove that $L\{f(t)\} = \frac{1}{1-e^{-sT}} \int_0^T e^{-st} f(t)dt$. **(07 Marks)**

b. Find the Laplace transform of $f(t) = E\sin wt$, $0 < t < \pi/w$ having period π/w. **(07 Marks)**

c. Express $f(t) = \begin{cases} \cos t & 0 < t < \pi \\ \cos 2t & \pi < t < 2\pi \\ \cos 3t & t > 2\pi \end{cases}$ as a unit step function and hence find its Laplace transform. **(06 Marks)**

Module-4

7 a. Find the Laplace of $\frac{1}{(s-1)(s+1)(s+2)}$. **(07 Marks)**

b. Solve $y''' + 2y'' - y' - 2y = 0$ given $y(0) = y'(0) = 0$ and $y''(0) = 6$ by using Laplace transform. **(07 Marks)**

c. Find: $L^{-1}\left[\frac{3s+2}{(s-2)(s+1)}\right]$. **(06 Marks)**

OR

8 a. Find $L^{-1}[\cot^{-1}(s/a)]$. **(07 Marks)**

b. Employ Laplace transform to solve the equation $y'' + 5y' + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$. **(07 Marks)**

c. Find the inverse Laplace transform of $\log\left[\frac{s+4}{s-4}\right]$. **(06 Marks)**

Module-5

9 a. State and prove Bayes theorem. **(07 Marks)**

b. Prove that
$P(A \cup B \cup C) = P(A) + P(B) + P(C) + P(A \cap B \cap C) - P(A \cap B) - P(B \cap C) - P(C \cap A)$. **(07 Marks)**

c. A pair of dice is tossed twice. Find the probability of scoring 7 points
i) Once ii) atlesat once iii) twice. **(06 Marks)**

OR

10 a. If A and B are two events having $P(A) = 1/2$, $P(B) = 1/3$ and $P(A \cap B) = 1/4$ compute
i) $P(A/B)$ ii) $P(B/A)$ iii) $P(\overline{A}/\overline{B})$. **(07 Marks)**

b. Three machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentage of defective output of these machines are respectively 2%, 3% and 4%. An item is selected at random and is found defective. Find the probability that the item was produced by machine C. **(07 Marks)**

c. In a school 25% of the students failed in first language, 15% of the students failed in second language and 10% of the students failed in both. If a student is selected at random find the probability that.
i) He failed in first language if he had failed in the second language.
ii) He failed in second language if he had failed in the first language.
iii) He failed in either of the two languages. **(06 Marks)**

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15MAT41

Fourth Semester B.E. Degree Examination, July/August 2022
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 80

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Use statistical table is permitted.

Module-1

1 a. Using Taylor's series method, solve $dy = (xy - 1)dx$, $y(1) = 2$ at $x = 1.02$ considering upto 3rd degree term. **(05 Marks)**

b. Using Runge – Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ at the point $x = 0.2$ by taking step length $h = 0.2$. **(05 Marks)**

c. Given that $\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$. Compute y at $x = 0.8$ by Adams – Bashforth predictor – corrector method. **(06 Marks)**

OR

2 a. Using modified Euler's method, find an approximate value of y when $x = 0.1$ given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$. Take $h = 0.1$ and perform three iterations. **(05 Marks)**

b. Solve $\frac{dy}{dx} = 2y + 3e^x$ $y(0) = 0$ using Taylors series method an find $y(0.1)$. **(05 Marks)**

c. Apply Milne's method to compute $y(1.4)$ correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ the data $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.4649$, $y(1.3) = 2.7514$. **(06 Marks)**

Module-2

3 a. Given $\frac{d^2y}{dx^2} = x^3\left(y + \frac{dy}{dx}\right)$ $y(0) = 1$, $y'(0.1) = 0.5$, evaluate $y(0.1)$ using 4th order – Runge – Kutta method. **(05 Marks)**

b. Express $f(x) = x^3 + 2x^2 - 4x + 5$ interms of Legendre polynomials. **(05 Marks)**

c. If α and β are the roots of $J_n(x) = 0$ then prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(06 Marks)**

OR

4 a. Using the Milne's method obtain the approximate solution at the point $x = 0.4$ of the problem $\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0$, $y(0) = 1$, $y'(0.1) = 0.1$. Given :

$y(0.1) = 1.03995$ $y'(0.1) = 0.6955$ $y(0.2) = 1.138036$
$y'(0.2) = 1.258$ $y(0.3) = 1.29865$ $y'(0.3) = 1.873$ **(05 Marks)**

b. Prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\sin x$. **(05 Marks)**

c. State and prove Rodrigue's formula. **(06 Marks)**

Module-3

5 a. Derive Cauchy's Riemann equations in Cartesian form. **(05 Marks)**

b. Using Cauchy's residue theorem evaluate the integral $\int_C \frac{e^{2z}}{(z+1)^4} dz$ where C is the circle $|z| = 3$. **(05 Marks)**

c. Find the bilinear transformation which maps the points $Z = 0, i, \infty$ onto the points $W = 1, -i, -1$, respectively. Find the invariant points. **(06 Marks)**

OR

6 a. State and prove Cauchy's theorem. **(05 Marks)**

b. Given $u - v = (x - y)(x^2 + 4xy + y^2)$ find the analytic function $f(z) = u + iv$. **(05 Marks)**

c. Discuss the transformation $W = e^z$. **(06 Marks)**

Module-4

7 a. Derive mean and variance of the Binomial distribution. **(05 Marks)**

b. The probability that an individual suffers a bad reaction from an injection is 0.001. Find the probability that out of 2000 individuals more than 2 will get a bad reaction. **(05 Marks)**

c. The joint probability distribution of two random variable X and Y as follows :

x \ y	–2	–1	4	6
1	0.1	0.2	0.0	0.3
2	0.2	0.1	0.1	0.0

Determine :

i) Marginal distribution of X and Y

ii) Covariance of X and Y

iii) Correlation of X and Y. **(06 Marks)**

OR

8 a. Derive mean and standard deviation of exponential distribution. **(05 Marks)**

b. The life of an electric bulb is normally distributed with average life of 2000 hours and standard deviation of 60 hours. Out of 2500 bulbs find the number of bulbs that are likely to last between 1900 and 2100 hours. Given that $P(0 < z < 1.67) = 0.4525$. **(05 Marks)**

c. The joint probability distribution of two random variable X and Y as follows :

x \ y	–4	2	7
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
5	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

Determine :

i) Marginal distribution of X and Y

ii) Covariance of X and Y

iii) Correlation of X and Y. **(06 Marks)**

Module-5

9 a. Explain the following terms :
   i) Null hypothesis
   ii) Type I and Type II error
   iii) Significance level. **(05 Marks)**

   b. Find he student 't' for the following variables values in a sample of eight – 4, –2, –2, 0, 2, 2, 3, 3 taking the mean of the universe to be zero. **(05 Marks)**

   c. Find the fixed probability vector of the regular stochastic matrix :

$$A = \begin{bmatrix} 1/2 & 1/4 & 1/4 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{bmatrix}.$$ **(06 Marks)**

OR

10 a. A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased. **(05 Marks)**

   b. A set of five similar coins is tossed 320 times and the result is

Number of heads	0	1	2	3	4	5
Frequency	6	27	72	112	71	32

   Test the hypothesis that the data follow a binomial distribution for v = 5 we have $\chi^2_{0.05} = 11.07$. **(05 Marks)**

   c. A students study habits are as follows. If he studies one night, he is 60% sure not study the next night. On the other hand if he does not study one night, he is 80% sure not to study the next night. In the long run how often does he study? **(06 Marks)**

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17EC43

Fourth Semester B.E. Degree Examination, July/August 2022
Control Systems

Time: 3 hrs. Max. Marks: 100

Note: 1.Answer any FIVE full questions, choosing ONE full question from each module.
2.No Handbook, No Charts, No Tables permitted.

Module-1

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

b. Find the transfer function $\frac{X(s)}{E(s)}$ for a electrochemical system shown in Fig.Q1(b).

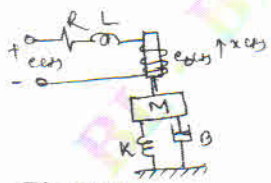

Fig.Q1(b) **(06 Marks)**

c. The system block diagram is shown in Fig.Q1(c). Find C(s)/R(s).

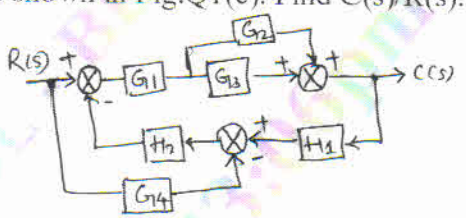

Fig.Q1(c) **(08 Marks)**

OR

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

b. Find C(s)/R(s) by Mason's gain formula shown in Fig.Q2(b).

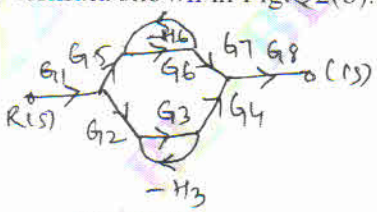

Fig.Q2(b) **(08 Marks)**

c. For the mechanical system shown in Fig.Q2(c)
(i) Draw the mechanical network (ii) Draw force – voltage analogous electric network.

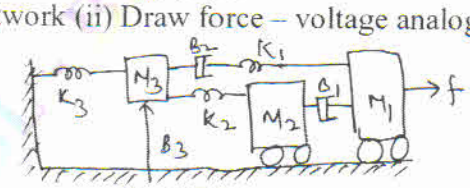

Fig.Q2(c) **(06 Marks)**

Module-2

3 a. Define the following time response specifications for an underdamped 2nd 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. For the system shown in the Fig.Q3(b) obtain the closed loop transfer function damping ratio natural frequency and expression for the output response if subjected to unit step input.

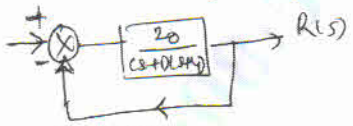

Fig.Q3(b) **(08 Marks)**

c. The response of servo mechanism is $c(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$ when subjected to a unit step input, obtain an expression for the closed loop transfer function. Determine natural frequency and damping ratio. **(08 Marks)**

OR

4 a. Explain the PID controller and its effect. **(04 Marks)**

b. For a unity feedback control system with $G(s)=\frac{10(s+2)}{s^2(s+1)}$, find

(i) The static error coefficients

(ii) Steady state error when the input transform is $R(s) = 3/s + 2/s^2 + 1/3s^3$. **(08 Marks)**

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

(i) Determine All error coefficient (ii) Error for ramp input and magnitude of 4. **(08 Marks)**

Module-3

5 a. State and explain Routh's stability criterion for determining stability of the system. **(04 Marks)**

b. A unity feedback control system has $G(s) = 20k / [s(s+1)(s+5)+20]$, where $r(t) = 2t$

It is desired that for ramp input $e_{ss} \leq 1.5$. What minimum value must k have for this condition to be satisfied? With this k, is the system stable? **(08 Marks)**

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

OR

6 a. Derive the condition used to determine the trajectories of the root loci in the S-plane. **(04 Marks)**

b. For a system having $G(s)H(s)=\frac{k}{s(s+3)(s^2+3s+11.25)}$

Find the valid break away points and angle of departure. **(08 Marks)**

c. Sketch the rough nature of the root locus of a certain control system whose characteristics equation is given by $s^3 + 9s^2 + Ks + K = 0$. Comment on stability. **(08 Marks)**

Module-4

7 a. Derive the expression for resonant peak M_r and resonant frequency W_r for a standard second order system in terms of ξ and ω_n. **(06 Marks)**

b. The closed loop transfer function of a feedback system is given by

$T(s) = 1000/(s+22.5)(s^2 + 2.45s + 44.4)$

Determine

(i) resonance peak M_r and resonant frequency (W_r) of the system by drawing the frequency response curve.

(ii) What should be values of damping ratio (ξ) and undamped natural frequency (ω_n) of an equivalent 2nd system which will produce the same M_r and W_r as determined in part (i)

(iii)Determine the bandwidth of the equivalent 2nd order system. **(14 Marks)**

OR

8 a. Sketch the Bode plot for the transfer function
$G(s) = ks^2 / (1 + 0.2s)(1 + 0.2s)$
Determine the value of 'k' for the gain cross-over frequency to be 5 Rad/sec. **(10 Marks)**

b. What is polar plot and list its applications. **(04 Marks)**

c. State the effects of lag and lead compensating networks. **(06 Marks)**

Module-5

9 a. Explain the terms (i) State (ii) State variable (iii) State vector (iv) State space **(04 Marks)**

b. Obtain the state equation and output equation of the electric network as shown in Fig.Q9(b).

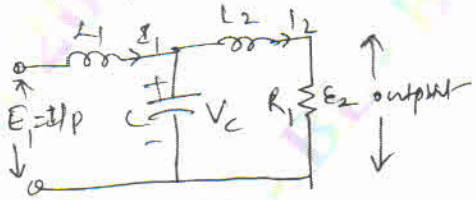

Fig.Q9(b) **(10 Marks)**

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

OR

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

b. What is Signal Reconstruction? Explain it with SAMPLE and HOLD circuit. **(06 Marks)**

c. Obtain the transition matrix Q(t) of the following system

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$

Also obtain the inverse of the transition matrix $\phi^{-1}(t)$ **(08 Marks)**

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17EC44

Fourth Semester B.E. Degree Examination, July/August 2022
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. Define amplitude modulation and modulation index sketch the standard AM wave for $\mu < 1$, $\mu = 1$ and $\mu > 1$. Also derive the equation for μ interms of A_{max} and A_{min}. **(06 Marks)**

b. With the help of necessary circuit diagram, waveforms and equations, explain the generation of standard AM signal. Using switching modulator. **(07 Marks)**

c. An audio frequency signal 10 sin 2π 500t is used to amplitude modulate a carrier signal 50 sin $2\pi \times 10^5$t. If $\mu = 0.2$, determine sideband frequencies, amplitude of teach sideband, bandwidth required, PC and PT. Also sketch frequency spectrum. Assume R = 600Ω. **(07 Marks)**

OR

2 a. Explain the operation of QCM system. **(06 Marks)**

b. What is quadrature null effect of the coherent detector? Explain the practical synchronous receiving system. **(07 Marks)**

c. Explain the VSB transmission of analog and digital television signals. **(07 Marks)**

Module-2

3 a. Derive the equation of signal tone frequency modulated signal. Also explain the relationship between FM and PM. **(06 Marks)**

b. With the help of necessary circuit diagram and equations, explain the working FM generation using VCO. Draw the block diagram of feedback scheme for generation of frequency stabilized FM wave. **(07 Marks)**

c. An angle modulated signal is represented by,
$s(t) = 10 \cos [2\pi \times 10^6 t + 5 \sin 2000\pi t + 10 \sin 3000\pi t]$ volts. Determine the following :
i) The power in the modulated signal
ii) The frequency deviation
iii) The deviation ratio
iv) The phase deviation
v) Transmission bandwidth. **(07 Marks)**

OR

4 a. Explain the operation of FM stereo multiplexing. **(06 Marks)**

b. What is PLL? Explain the linear model and nonlinear model of PLL for demodulation of FM signals. **(09 Marks)**

c. Write short notes on nonlinear effects in FM systems. **(05 Marks)**

Module-3

5 a. Describe mean autocorrelation and co-variance functions with respect to random process. **(06 Marks)**

b. What is noise equivalent bandwidth? Derive the expression for noise equivalent bandwidth of low pass filter. **(08 Marks)**

c. A random variable 'X' has the following distribution function :

$$F_X(x) = \begin{cases} 0 & ; \quad x < 0 \\ x/8 & ; \quad 0 \le x \le 2 \\ x^2/16 & ; \quad 2 \le x \le 4 \\ 1 & ; \quad 4 \le x \end{cases}$$

Determine mean, variance and standard deviation. **(06 Marks)**

OR

6 a. Explain the following :
i) Short noise
ii) Thermal noise
iii) White noise. **(06 Marks)**

b. What is cross correlation? Explain the properties of cross-correlation. **(08 Marks)**

c. Calculate the RMS noise voltage and thermal noise power appearing across a 20KΩ resistor at 25°C temperature with an effective noise bandwidth of 10KHz. **(06 Marks)**

Module-4

7 a. Discuss the noise in DSBSC receiver with a model receiver using coherent detection. Prove that the figure of merit for such a receiver is unity. **(07 Marks)**

b. Derive the expression for output signal – to – noise ratio of an AM receiver using an envelope detector. **(08 Marks)**

c. A carrier reaching an envelope detector in an AM receiver has an RMS value equal to 1 volt in the absence of modulation. The noise at the input of the envelope detector has a PSD equal to 10^{-3}watts/Hz. If the carrier is modulated to a depth of 100% and message bandwidth W = 3.2KHz, determine output signal – to – noise ratio. **(05 Marks)**

OR

8 a. Explain the concepts of capture effect, FM threshold effect and FM threshold reduction. **(07 Marks)**

b. Derive the expression for figure of merit of a noisy FM receiver using the frequency discriminator. **(08 Marks)**

c. An FM signal with a deviation of 75KHz is applied to an FM demodulator. When the input SNR is 15dB, the modulating frequency is 10KHz determine the SNR at the demodulator output. **(05 Marks)**

Module-5

9 a. State sampling theorem for low pan signals find the Nyquist rate and Nyquist interval of $m(t) = \frac{1}{2\pi}\cos 4000\pi t \cdot \cos 1000\pi t$. **(05 Marks)**

b. With the help of relevant block diagram and waveforms, explain the generation and detection of PAM signal. **(08 Marks)**

c. Explain the operation of TDM system. **(07 Marks)**

OR

10 a. An analog waveform with bandwidth 15KHz 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. **(05 Marks)**

b. Explain the generation and detection of PPM waves. **(08 Marks)**

c. With the help of block diagram explain the working VOCODER. **(07 Marks)**

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17EC45

Fourth Semester B.E. Degree Examination, July/August 2022
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. With a neat circuit diagram, explain Basic Op-amp circuit. **(08 Marks)**

b. Define CMRR. Derive an expression to relate $V_{i(cm)}$ and $V_{o(cm)}$ voltages of non – inverting amplifier. **(06 Marks)**

c. Explain Input – Offset voltage and Current levels for an Op-amp. Discuss Offset nulling. **(06 Marks)**

OR

2 a. Using an 741 Op – amp, design a non – inverting amplifier to have a voltage gain of 66. The signal amplitude is to be 15mV. **(08 Marks)**

b. Sketch a two input non – inverting summing circuit and derive an equation for the output voltage. **(06 Marks)**

c. With neat circuit diagram, explain Op-amp difference amplifier and explain its operation. Derive the equation for the output voltage. **(06 Marks)**

Module-2

3 a. Sketch the circuit of a high input impedance capacitor coupled voltage follower. Briefly explain the circuit operation. Show its design steps. **(08 Marks)**

b. Using a LF 353 BIFET Op-Amp, design a high Z_{in} capacitor coupled non – inverting amplifier to have a low cutoff frequency of 200Hz. The input and output voltages are to be 15mV and 3V respectively and the minimum load resistance of 12kΩ. **(06 Marks)**

c. Sketch the circuit of a low – resistance voltage source using an Op-amp and a bipolar transistor. Show how a potential divider or a Zener diode may be used to determine the output voltage. Explain. **(06 Marks)**

OR

4 a. With a neat circuit diagram, explain the operation of current amplifier with floating load and derive an equation for load current and hence current gain. **(06 Marks)**

b. Design an instrumentation amplifier to have an overall voltage gain of 900. The input signal amplitude is 15mV, 741 Op-amps are to be used. Power supply of ± 15V, is used. **(08 Marks)**

c. Draw the circuit of a saturating – type of half – wave precision rectifier. Draw the input and output waveforms and explain its operation. **(06 Marks)**

Module-3

5 a. Show how Zener diodes can be used to limit the output voltage of an Op – amp circuit (Peak clipper circuit). Briefly explain **(06 Marks)**

b. Draw an Op – amp Sample – and – hold circuit. Sketch the Signal , Control and Output waveforms. Explain its operation. **(08 Marks)**

c. With neat circuit diagram, explain dc and ac Operation of Op – amp differentiation circuit. **(06 Marks)**

OR

6 a. Sketch the circuit of an Op – amp employed as a non – inverting zero crossing detector and explain. Draw its input and output waveforms. **(04 Marks)**

b. Draw a Op-amp inverting Schmitt trigger circuit. Sketch typical input and output waveforms. Explain the circuit operation and shape of the waveform. **(08 Marks)**

c. With neat circuit diagram, explain the operation of Wein bridge oscillator. Sketch the output and feedback voltage waveforms. **(08 Marks)**

Module-4

7 a. Draw the circuit diagram of a Second – order active low – pass filter and explain its operation. Show its design steps. **(06 Marks)**

b. Design a Second – order high – pass active filter to have a cut off frequency of 12KHz. Use a 715 Op-amp and estimate the highest signal frequency that will be passed. Assume V_i is 70mV. **(06 Marks)**

c. Sketch the circuit of a Single – stage bandpass filter. Explain Low – pass and High – pass Operation of the circuit and briefly discuss the design procedure. **(08 Marks)**

OR

8 a. Show how a bandstop filter circuit can be constructed by the use of low pass and high pass filters and explain. Sketch expected frequency response. **(06 Marks)**

b. Show the standard representation of three – terminal IC voltage regulator and explain the characteristics of three – terminal IC regulators. **(06 Marks)**

c. Explain i) 723 General purpose regulator with use of functional block diagram.
ii) Simple positive Low – voltage (2V to 7V) regulator using 723 regulator with help of relevant diagram. **(08 Marks)**

Module-5

9 a. Draw Basic Functional block diagram of NE/SE 566 VCO [Voltage Controlled Oscillator] and explain in detail. **(10 Marks)**

b. Explain the working of Successive approximation type Analog to Digital Converter (ADC) with the help of relevant diagram. **(10 Marks)**

OR

10 a. With a neat functional block diagram and waveforms, explain the working of Astable multivibrator using 555 timer. Derive the expression for output frequency. **(10 Marks)**

b. Explain the working of 4 bit DAC using R – 2R ladder network with help of neat circuit diagram. **(10 Marks)**

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17EC46

Fourth Semester B.E. Degree Examination, July/August 2022
Microprocessor

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 architecture of 8086 microprocessor with neat block diagram. **(10 Marks)**

b. Explain the flag register bits of 8086 and write its format. **(08 Marks)**

c. Explain the significance of the following pins: **(02 Marks)**

(i) M/$\overline{IO}$ ii) ALE

OR

2 a. Explain the addressing modes of 8086 and give an example for each addressing mode. **(10 Marks)**

b. Write a program to exchange a block of 5 bytes data between two memory locations. **(10 Marks)**

Module-2

3 a. What are assembler directives? Explain any four directives. **(10 Marks)**

b. Write 8086 program to arrange the number in ascending order. **(10 Marks)**

OR

4 a. List and explain the string manipulation instructions of 8086 microprocessor. **(10 Marks)**

b. Write an ALP to convert packed BCD number to its ASCII equivalent. **(10 Marks)**

Module-3

5 a. Explain the dedicated interrupts of 8086. **(10 Marks)**

b. Explain the operation of (i) Push and Pop instructions (ii) Call and ret instructions. **(10 Marks)**

OR

6 a. Draw the interrupt vector table and write the sequence of operations that are performed when an interrupt is recognized. **(10 Marks)**

b. Write a program to generate a delay of 100ms that runs on 10 MHz frequency in 8086 microprocessor. Also show the calculations. **(10 Marks)**

Module-4

7 a. Explain the maximum mode operation of 8086 with block diagram. **(10 Marks)**

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

OR

8 a. Draw a timing diagram for read and write operation in minimum mode. **(10 Marks)**

b. Explain the PID 8255 with the block diagram. **(10 Marks)**

Module-5

9 a. Differentiate between :
(i) Harvard and Von-Neumann architectures
(ii) CISC and RISC architecture **(10 Marks)**

b. Explain the following INT-21 DOS function calls:
i) Function 09h ii) Function 01h
iii) Function 0Ah iv) Function 02h **(10 Marks)**

OR

10 a. Write an ALP to rotate the stepper motor one rotation in clockwise and one rotation in anticlockwise direction. **(10 Marks)**

b. Write a program to generate a square wave in 8086. Also show the interfacing diagram. **(10 Marks)**

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18ES51

Fifth Semester B.E. Degree Examination, July/August 2022
Technological Innovation Management & Entrepreneurship

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain ten different roles played by managers. **(10 Marks)**
b. Explain different management levels and skills using skill-mix diagram. **(10 Marks)**

OR

2 a. Explain the hierarchy of organizational plans with the help of a diagram. **(10 Marks)**
b. Explain programmed and non-programmed decision making in management. **(10 Marks)**

Module-2

3 a. Explain the meaning and importance of span of management. **(10 Marks)**
b. Explain different sources of recruitment. **(10 Marks)**

OR

4 a. Explain Maslow's need-hierarchy motivational theory with the help of neat diagram. **(10 Marks)**
b. Explain five types of managerial styles using managerial grid chart. **(10 Marks)**

Module-3

5 a. Explain benefits and limitations of social audit. **(10 Marks)**
b. Explain Corporate governance in India. **(10 Marks)**

OR

6 a. Explain different types of entrepreneurs. **(10 Marks)**
b. Explain sociological models of entrepreneurial development. **(10 Marks)**

Module-4

7 a. Explain the stages of development of a family business. **(10 Marks)**
b. Explain the characteristics of a family-owned business in India. **(10 Marks)**

OR

8 a. Explain different methods to generate business ideas. **(10 Marks)**
b. Explain external changes which leads to the creation of opportunities. **(10 Marks)**

Module-5

9 a. Explain executive summary and management summary of business plans. **(10 Marks)**
b. Explain government schemes for Micro, Small and Medium Enterprises (MSME). **(10 Marks)**

OR

10 a. Explain selection of a project for setting up an enterprise. **(10 Marks)**
b. Explain two important ways of raising long-term debt fund. **(06 Marks)**
c. List some advantages of PERT and CPM. **(04 Marks)**

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18EC53

Fifth Semester B.E. Degree Examination, July/August 2022
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. Illustrate the item domain and frequency domain characteristics of standard amplitude modulation produced by a single tone. **(10 Marks)**

b. Explain switching modulator with circuit diagram and characteristic curve. **(10 Marks)**

OR

2 a. Explain the generation of DSBSC wave using a Ring modulator. **(07 Marks)**

b. Explain the scheme of generation and demodulation of VSB modulated wave with relevant spectrum of signals and mathematical expressions. **(07 Marks)**

c. Explain with block diagram of FDM system. **(06 Marks)**

Module-2

3 a. Explain with block diagram generation of FM wave using PM and PM wave using FM. **(07 Marks)**

b. Explain the indirect method of generation FM wave with relevant equation and diagram. **(07 Marks)**

c. Explain FM stereo multiplexing. **(06 Marks)**

OR

4 a. Derive the expression for Linear model of PLL. **(08 Marks)**

b. Explain with diagram for superheterodyne receiver. **(08 Marks)**

c. Determine the bandwidth of an FM signal. If the maximum value of the frequency deviation Δf is fixed at 75KHz for commercial FM broadcasting by radio and modulation frequency is W = 15KHz. Bycarson's rule. **(04 Marks)**

Module-3

5 a. Derive the expression for figure of merit for DSB-SC receiver. **(07 Marks)**

b. Write short notes on :
i) Shot noise
ii) Thermal noise
iii) Whit noise. **(06 Marks)**

c. Find figure of merit for single tone AM. **(07 Marks)**

OR

6 a. With FM receiver model, derive the expression for figure of merit. **(07 Marks)**

b. Briefly explain the following as applicable to FM
i) Pre–emphasis
ii) De-emphasis. **(06 Marks)**

c. Explain about FM threshold effect and its reduction method. **(07 Marks)**

Module-4

7	a.	What are the advantages of digital signal over analog signal?	**(06 Marks)**
	b.	State sampling theorem and explain same with neat sketches and equation.	**(07 Marks)**
	c.	Explain with block diagram for TDM.	**(07 Marks)**

OR

8	a.	Explain with diagram the generation of PPM waves.	**(07 Marks)**
	b.	Explain the detection of PPM waves.	**(07 Marks)**
	c.	Explain the following terms : i) Under sampling ii) Over sampling iii) Nyquist rate.	**(06 Marks)**

Module-5

9	a.	Explain the midtread and midrise related to quantization noise.	**(06 Marks)**
	b.	Explain with diagram for pulse-code modulation.	**(07 Marks)**
	c.	Explain Delta modulation with transmitter and receiver systems.	**(07 Marks)**

OR

10	a.	Explain the unipolar NRZ, polar NRZ and Bipolar RZ with an example.	**(06 Marks)**
	b.	Write a note on MPEG + Video.	**(07 Marks)**
	c.	Explain Linear prediction coding VOCODER.	**(07 Marks)**

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18EC54

Fifth Semester B.E. Degree Examination, July/August 2022
Information Theory and Coding

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Choose a facsimile transmission of a picture, which there are about 2.25×10^6 pixels/frame. For a good reproduction at the receiver 12 brightness levels are necessary. Assume all these levels are equally likely to occur. Find the rate of information if one picture is to be transmitted every 3 min. Also compute source efficiency. **(08 Marks)**

b. State and prove External property of Entropy. **(06 Marks)**

c. A zero memory source has alphabet S = {S_1 S_2 S_3} with P = $\left\{\frac{1}{2}, \frac{1}{4}, \frac{1}{4}\right\}$. Find the entropy of this source. Also determine the entropy of its 2nd extension and verify that H(s = 2H(s). **(06 Marks)**

OR

2 a. State and prove Extension of zero-memory source. **(08 Marks)**

b. For the first order Markoff source shown in Fig.Q2(b).
(i) Find the stationary distribution (ii) Find the entropy of each state and hence the entropy of the source (iii) Find the entropy of the adjoint source and verify that H(s)< H($\bar{s}$).

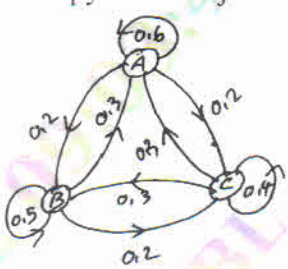

Fig.Q2(b) **(12 Marks)**

Module-2

3 a. Select a source S = {S_1 , S_2} with probabilities ¾ and ¼ respectively. Obtain Shannon Fano code for source S and its 2nd extension. Calculate efficiencies for each case. **(10 Marks)**

b. Construct Huffman Binary Code and determine its efficiency for a source with alphabets A to H with probabilities of
0.22, 0.20, 0.18, 0.15, 0.10, 0.08, 0.05, 0.02. **(10 Marks)**

OR

4 a. Apply Shannon encoding algorithm for the following message and obtain efficiency, redundancy and draw code tree.
S = {S_1 S_2 S_3 S_4}
P = {0.4, 0.3, 0.2, 0.1} **(10 Marks)**

b. Explain with examples Prefix Codes. (min 4 examples two not prefix and two prefix.) **(06 Marks)**

c. State and explain Kraft's inequality. **(04 Marks)**

Module-3

5 a. What is Mutual information? Mention its properties. **(04 Marks)**

b. The noise characteristics of a channel is as shown in Fig.Q5(b). Find the capacity of a channel using Muroga's method.

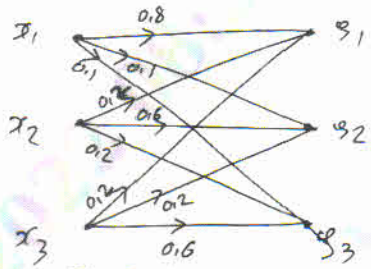

Fig.Q5(b) **(08 Marks)**

c. Explain Binary Symmetric and Binary Erroneous channel, with neat figure and JPM. **(08 Marks)**

OR

6 a. A binary symmetric channel has the following noise matrix

$$P(Y/X) = \begin{matrix} \\ x_1 \\ x_2 \end{matrix}\begin{matrix} \begin{matrix} y_1 & y_2 \end{matrix} \\ \begin{bmatrix} 3/4 & 1/4 \\ 1/4 & 3/4 \end{bmatrix} \end{matrix}$$

The source probabilities are $P(x_1) = 2/3$, $P(x_2) = 1/3$.

i) Determine H(x), H(y), H(x, y), H(y/x), H(x/y) and I(x,y)

ii) Find the channel capacity C

iii) Find channel η. **(08 Marks)**

b. What is Joint Probability matrix? Explain their properties. **(08 Marks)**

c. For the given channel matrix P(B/A), find H(B) by find P(A, B)

$$P(B/A) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1/4 & 3/4 & 0 & 0 \\ 0 & 1/3 & 2/3 & 0 \\ 0 & 0 & 1/3 & 2/3 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

The symbol probabilities are 0.2, 0.3, 0.2, 0.1 and 0.2. **(04 Marks)**

Module-4

7 a. Consider a (6, 3) linear block code whose generator matrix is given by

$$\begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

(i) Find all codewords.

(ii) Draw encoder circuit

(iii) Find minimum weight parity check matrix

(iv) Draw syndrome computation circuit. **(12 Marks)**

b. What is Syndrome Decoding Standard Array? Mention steps to decode using Syndrome Standard Array. **(08 Marks)**

OR

8 a. The generator polynomial of a (7, 4) cyclic code is $g(x) = 1 + x + x^3$, find the 16 code words of this code by forming the code polynomials V(x) using V(x) = D(x) g(x), where D(x) is message polynomial. **(10 Marks)**

b. For a (7, 4) cyclic code, the received vector Z(x) is 1110101 and the generator polynomial is $g(x) = 1 + x + x^3$. Draw the syndrome calculation circuit and correct the single error in the received vector. **(10 Marks)**

Module-5

9 a. Consider a (3, 1, 2) convolution encoder with g(1) = 110, g(2) = 101 and g(3) = 111

(i) Draw encoder diagram

(ii) Find the code word for the message sequence (11101) using (a) Generator Matrix / time Domain approach and (b) Transformation approach. **(15 Marks)**

b. Explain Viterbi decoding Algorithm. **(05 Marks)**

OR

10 a. Explain importance of Convolution Code. **(05 Marks)**

b. Construct (2, 1, 3) convolution encoder circuit with $g^1 = 1011$ and $g^2 = 1101$ and obtain

(i) State diagram

(ii) Code tree

(iii) The encoder output produced by the message sequence 11101 by traversing the code tree. **(15 Marks)**

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18EC55

Fifth Semester B.E. Degree Examination, July/August 2022
Electromagnetic Waves

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Convert point P(1, 3, 5) from Cartesian to cylindrical and spherical coordinates. Also write the equation for differential surface and differential volume for cylindrical and spherical system. **(08 Marks)**

b. A line charge of 2 nc/m lies along y-axis while surface charge densities of 0.1 and -0.1 nc/m^2 exist on the plane z = 3 and z = –4 respectively. Find the electric field intensity at a point (1, –7, 2). **(06 Marks)**

c. A point charge of 50 nc each are located at A(1, 0, 0), B(–1, 0, 0), C(0, 1, 0) and D(0, –1, 0) in free space. Find the total force on the charge at A. **(06 Marks)**

OR

2 a. Compute the value of $\bar{E}$ at P(1, 1, 1) caused by four identical 3nc charges located at $P_1(1, 1, 0)$, $P_2(-1, 1, 0)$, $P_3(-1, -1, 0)$ and $P_4(1, -1, 0)$. **(08 Marks)**

b. Define electric field intensity and flux density. Derive the expression for electric field intensity due to several point charges. **(06 Marks)**

c. Calculate the total charge for the defined volume. Given that $0.1 \le |x|, |y|, |z| \le 0.2$

$$\rho_V = \frac{1}{x^3 y^3 z^3}$$ **(06 Marks)**

Module-2

3 a. Evaluate both sides of divergence theorem for the defined plane in which $1 \le x \le 2$, $2 \le y \le 3$, $3 \le z \le 4$. $\bar{D} = 4x\bar{a}_x + 3y^2\bar{a}_y + 2z^3\bar{a}_z$ c/m^2. **(10 Marks)**

b. Determine workdone in carrying a charge of –2c from (2, 1, –1) to (8, 2, –1) in the electric field $\bar{E} = y\bar{a}_x + x\bar{a}_y$ V/m, (in Cartesian system). **(05 Marks)**

c. Considering the path along the parabola $x = 2y^2$, obtain the equation of continuity in integral and differential form. **(05 Marks)**

OR

4 a. Let $V = \frac{\cos 2\phi}{r}$ in the free space in cylindrical system:

(i) Find $\bar{E}$ at B(2, 30°, 1)

(ii) Find the volume charge density at point A(0.5, 60°, 1) **(08 Marks)**

b. Calculate the numerical value for div $\bar{D}$ at the point P(2, 3, –1) for $\bar{D} = (2xyz - y^2)\bar{a}_x + (x^2z - 2xy)\bar{a}_y + x^2y\bar{a}_z$ c/m^2 **(06 Marks)**

c. Define potential difference. Derive the expression for potential due to several point charges. **(06 Marks)**

Module-3

5 a. Solve the Laplace's equation for the potential field in the homogeneous region between the two concentric conducting spheres with radii a and b, such that b > a if potential V = 0 at r = b and V = V_0 at r = a. Also find the capacitance between the two concentric spheres. **(09 Marks)**

b. State and explain Biot-Savart law. **(05 Marks)**

c. If the magnetic field intensity in a region is $\bar{H} = (3y - 2)\bar{a}_z + 2x\bar{a}_y$. Find the current density at the origin. **(06 Marks)**

OR

6 a. State and prove uniqueness theorem. **(07 Marks)**

b. Find $\bar{E}$ at P(3, 1, 2) for the field of two coaxial conducting cylinders V = 50 V at ρ = 2m and V = 20 V at ρ = 3m. **(06 Marks)**

c. Evaluate both side of the Stoke's theorem for the filed $\bar{H} = 6xy\bar{a}_x - 3y^2\bar{a}_y$ A/m and the rectangular path around the region $2 \le x \le 5$, $-1 \le y \le 1$, z = 0. Let the direction of $\bar{d}_s$ to be $\bar{a}_z$. **(07 Marks)**

Module-4

7 a. Obtain the expression for magnetic force between differential current elements. **(06 Marks)**

b. Calculate the normal components of the magnetic field which traversal from medium 1 to medium 2 having $\mu_{r_1} = 2.5$ and $\mu_{r_2} = 4$. Given that $\bar{H}_1 = -30\bar{a}_x + 50\bar{a}_y + 70\bar{a}_z$ V/m. **(06 Marks)**

c. Derive the integral and differential form of Faraday's law. **(08 Marks)**

OR

8 a. A current element $I_1 dL_1 = 10^{-4}\bar{a}_z$ Am is located at P_1(2, 0, 0) and another current element $I_2 dL_2 = 10^{-6}[\bar{a}_x - 2\bar{a}_y + 3\bar{a}_z]$ Am is located at P_2(–2, 0, 0). Both are in free space. Find:

(i) Force exerted on $I_2 dL_2$ by $I_1 dL_1$

(ii) Force exerted on $I_1 dL_1$ by $I_2 dL_2$ **(06 Marks)**

b. Calculate the magnetization in magnetic material where:

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

(ii) μ_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)

(iii) B = 300 (μT) and χ_m = 15. **(06 Marks)**

c. Obtain the magnetic boundary conditions at interface between two different magnetic material. **(08 Marks)**

Module-5

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

b. Calculate intrinsic impedance η_1 the propagation constant γ and wave velocity υ for a conducting medium in which σ = 58 Ms/m, μ_r = 1, ε_r = 1 at a frequency of 100 MHz. **(06 Marks)**

c. The $\bar{H}$ field in free space is given by $\bar{H}(x,t) = 10\cos(10^8 t - \beta x)\bar{a}_y$ A/m. Find β, λ and E(x, t) at P(0.1, 0.2, 0.3) and t = 1 ns. **(08 Marks)**

OR

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

b. A metal sheet of aluminium has σ = 38.2 M $\mho$/m and μ_r = 1. Calculate the skin depth δ, propagation constant γ and velocity of propagation v at the frequency of 1.6 MHz. **(06 Marks)**

c. Do the field $\bar{E} = E_m \sin x \sin t\, \bar{a}_y$ and $\bar{H} = \frac{E_m}{\mu_0}\cos x \cos t\, \bar{a}_z$. Satisfy Maxwell's equation. **(06 Marks)**

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18EC56

Fifth Semester B.E. Degree Examination, July/August 2022
Verilog HDL

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With neat block diagram of 4-bit Ripple carry counter. Explain the design hierarchy. **(10 Marks)**

b. Explain typical design flow for designing VLSI circuit, using the flow chart diagram. **(10 Marks)**

OR

2 a. What are the two styles of stimulus application? Explain each method in brief. **(08 Marks)**

b. Explain the following terms with examples : (i) module (ii) instances **(06 Marks)**

c. What are the advantages of verilog HDL? List out importance of HDL's. **(06 Marks)**

Module-2

3 a. What is ports? Explain the two methods of connecting Ports to external signals with examples. **(06 Marks)**

b. Explain the following data types with an example in verilog:
(i) Nets (ii) Register (iii) Vectors (iv) Parameters **(08 Marks)**

c. What are the basic components of module? Explain all components of verilog module. **(06 Marks)**

OR

4 a. What are the four values and eight strengths support in verilog HDL? List out in neat table. **(06 Marks)**

b. With example explain different types of lexical conventions. **(08 Marks)**

c. Declare following variables in verilog :
(i) Decimal number 123 as a sized 8 bit number in binary. Use for readability.
(ii) A 16-bit hexadecimal unknown number with all X's.
(iii) A 4-bit negative 2 in decimal. Write the 2's complement form for this number.
(iv) An unsized hex number 1234. **(06 Marks)**

Module-3

5 a. Write a verilog data flow description for 4-bit full adder with carry look ahead. **(10 Marks)**

b. What would be the output of the following:
a = 4'b1010 , b = 4'b1111
(i) a&b (ii) a&&b (iii) &a (iv) a>>1 (v) a>>>1
(vi) y = {2{a}} (vii) a ∧ b (viii) z = {a,b} **(10 Marks)**

OR

6 a. Discuss AND/OR and NOT gates with respect to logic symbols, gate installation and truth table. **(10 Marks)**

b. Define butif/notif and write gate installation of bufit, notif gates. **(10 Marks)**

Module-4

7 a. Explain the blocking assignment statements and non blocking assignment statements with relevant examples. **(06 Marks)**

b. Write a verilog program for 8 : 1 mux using case statement and test bends. **(08 Marks)**

c. Using forever statement, design a clock with period time = 10 and duty cycle = 40%, initial value of clock is 0. **(06 Marks)**

OR

8 a. Explain sequential and parallel blocks with examples. **(06 Marks)**

b. Write the verilog behavioural description of a 4 bit binary counter with test cases. **(08 Marks)**

c. Using the for loop, initialize locations 0 to 1023 of a 4 bit register array cache_Var to 0. **(06 Marks)**

Module-5

9 a. Explain the synthesis flow for 4 bit magnitude comparator. **(10 Marks)**

b. Write a note on verification of gate-level netlist. **(10 Marks)**

OR

10 a. Write a note on : (i) Force and release (ii) defparam statement (iii) time scale (iv) file output **(10 Marks)**

b. Define the term logic synthesis with neat flow chart, explain computer Aided logic synthesis process. **(10 Marks)**

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CBCS SCHEME

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

Question Paper Version : A

Fifth Semester B.E. Degree Examination, July/August 2022
Environmental Studies
(COMMON TO ALL BRANCHES)

Time: 2 hrs.] [Max. Marks: 100

INSTRUCTIONS TO THE CANDIDATES

1. Answer all the hundred questions, each question carries one mark.
2. Use only **Black ball point pen** for writing / darkening the circles.
3. **For each question, after selecting your answer, darken the appropriate circle corresponding to the same question number on the OMR sheet.**
4. Darkening two circles for the same question makes the answer invalid.
5. **Damaging/overwriting, using whiteners** on the **OMR** sheets are strictly prohibited.

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1. The word Tsunami is derived from Two Japanese word
   a) TSU (Big) and Nami (flow) b) TSU(harbor) and Name(wave)
   c) TSU (Big wave)and Nami (wave) d) None of the above.

2. Green house gasses are
   a) Chloro fluro carbon b) Oxygen
   c) Chlorine d) Chloro Benzene.

3. Taj Mahal at Agra may be damaged by
   a) Sulphur Dioxide b) Chlorine c) Earth quake d) All of these.

4. Ozone day is observed on
   a) January 30 b) April 21 c) September 16 d) December 25.

5. ELISA Test is used to detect
   a) Malaria b) AIDS c) Cholera d) Tuberculosis.

6. Earth day is observed on
   a) 1st December b) 5th June c) April 22nd d) 1st January.

7. Lead Poisoning may cause
a) Reduction in hemoglobin
b) Kidney damage
c) Mental retardation
d) All of these.

8. Noise pollution limits at residential areas at Night is
a) 45dB
b) 80 dB
c) 55dB
d) 90dB.

9. Major purpose of most of the dams around the world is
a) Power generation
b) Drinking water supply
c) Flood control
d) Irrigation.

10. Herpetology is a branch of science which deals with
a) Reptiles only
b) Amphibians and Reptiles
c) Mammals
d) Fishes.

11. Water logging is a phenomenon in which
a) Crop patterns are rotated
b) Soil root zone becomes saturated due to over irrigation
c) Erosion of soil occurs
d) All of the above.

12. Coral reefs in India can be seen in
a) Goa
b) Himalayan region
c) Andaman and Nicobar Islands
d) Uttar Pradesh.

13. In which year salient valley was declared as National park
a) 1984
b) 1987
c) 1983
d) 1989.

14. SMOG is a mixture of
a) Snow and fog
b) Smoke and fog
c) Sulpher dioxide and fog
d) Snow and dust

15. Effect of modern Agriculture on soil is due to
a) Erosion
b) Acidification
c) Salinization
d) All of the above.

16. What percentage of its geographical area of a country should be under forest cover?
a) 23%
b) 43%
c) 13%
d) 33%.

17. About _____ % of the earth surface is covered by water
a) 53%
b) 19%
c) 71%
d) 90%.

18. Forest prevent soil erosion by binding soil particles in their
a) Stems
b) Roots
c) Leaves
d) Buds.

19. Blue baby syndrome (methane moglabinemia) is caused by contamination of water due to
a) Phosphates
b) Sulpher
c) Arsenic
d) Nitrates.

20. India has the largest share of which of the following
a) Manganese b) Mica c) Copper d) Diamond.

21. What is the minimum Allowable concentration of fluorides in drinking water
a) 1.0 mg/L b) 1.25 mg/L c) 1.50 mg/L d) 1.75 mg/L.

22. Nitrogen fixing Bacteria exists in – of plants
a) Leaf b) Roots c) Stem d) Flower.

23. ___ are referred to as Earth's lungs
a) Forests b) Carbon cycle c) Water sources d) Mines.

24. GIS means
a) Geographic information source
b) Spatial information system
c) Geological information system
d) Geographical information system.

25. Cholera and Typhoid are caused by
a) Warms b) Virus c) Bacteria d) Fungus.

26. Remote sensing includes gathering of
a) Images b) Changes c) Movements d) Sounds.

27. First satellites launched by India was and when
a) Aryabhatta - 1975 b) Apple - 1981 c) Bhaskara - 1981 d) Kalpana – 1983.

28. Biomedical waste may be disposed off by
a) Incineration
b) Autoclaving and land filling
c) Both a) and b)
d) None of the above.

29. Which atmospheric layer is closest to the earth surface
a) Mesosphere b) Troposphere c) Stratosphere d) Thermosphere.

30. Sulabha Bio-gas plants are based on the use of
a) Human excreta b) Cattle dung c) Agricultural wastes d) All of these.

31. National law day is celebrated on
a) 1st April b) 26th January c) 26th November d) 1st June.

32. Geology is the study of
a) Animals b) Mammals c) Science of earth d) Space.

33. Housing has become inaccessible to the poor due to
a) Increased population
b) Non-availability of food
c) High cost
d) None of above.

34. Major source of fluoride available in
a) River water b) Ground water c) Food product d) Both a) and c)

35. World AIDS Day is celebrated on
a) 15th Aug b) 1st Sept c) 1st Jan d) 1st December.

36. A food web consists of
a) Portion of food chain
b) Producers, Consumers and Decomposers
c) Inter locking of food chains
d) A set of similar consumers.

37. Eutrification is
a) An improved water quality status of lakes
b) The Result of Accumulation of plant nutrients in water bodies
c) A process in carbon cycle
d) A water purification techniques.

38. EIA can be expanded as
a) Environmental and Industrial Activities
b) Environment impact activities
c) Environment impact assessment
d) Environmental internal activities.

39. Identity the non renewable source of energy from the following :
a) Coal b) Tidal power c) Wind power d) Wave power.

40. An Alternative eco-friendly fuel for Automobiles is
a) Petrol b) Diesel c) CNG d) Kerosene.

41. Chernobyl nuclear disaster occurred in the year
a) 1984 b) 1952 c) 1986 d) 1987.

42. Minamata disease is caused by
a) Lead b) Mercury c) Cadmium d) Arsenic.

43. Bhopal gas Tragedy occur due to leakage of
a) Methyl/iso cyanate b) Sulphur dioxide c) Mustard gas d) Methane gas.

44. Nuclear fusion reaction occurs in the
a) Sun b) Stars c) Hydrogen bomb d) All of these.

45. Definition of noise is
a) Loud sound
b) Unwanted sound
c) Constant sound
d) Sound of high frequency.

46. Demography is the study of
a) Animal behavior b) Geography c) Rivers d) Population growth.

47. Acid Rain is caused by increase in the atmospheric concentration of
a) Ozone and dust b) SO_2 and NO_2 c) SO_3 and CO d) CO_2 and CO.

48. Global warming could affect
a) Climate b) increase in sea level
c) Melting of glaciers d) All of these.

49. The Wild Life Protection Act in India was passed in
a) 1978 b) 1972 c) 1986 d) 1992.

50. Environment Protection Act was enacted in year.
a) 1986 b) 1974 c) 1992 d) 1984.

51. Environment protection is the fundamental duties of the citizen of India under the article
a) 48 – A b) 47 – A c) 51 – A d) 21 – B.

52. The Forest Conservation Act was enacted in the year
a) 1986 b) 1974 c) 1980 d) 1972.

53. The major contributors of the acid rain are known as
a) Pre cursors b) Processors c) Protons d) Pollutants.

54. Typical Acid Rain pH is
a) 4.0 b) 5.5 c) 6.0 d) 4.0 - 6.0.

55. Pesticide causes
a) Eye irritation b) Skin irritation
c) Respiratory ailments d) All of Above.

56. Percentage of fresh water available below the earth is
a) 2.8% b) 2.2% c) 9.8% d) 2.15%.

57. The Quantity of solar energy received by the earth
a) 71% b) 99% c) 45% d) 15%.

58. Which pyramid is always upright
a) Energy b) Biomass c) Number d) Food chain.

59. The leader of Chipko movement is
a) Sunderlal Bahuguna b) Medha Patkar
c) Vandana Shiva d) Suresh Heblikar.

60. Padma Shri was received by immense contribution toward conservation of Trees Recently
a) Saalumarada Thimakka b) Tulsi Gowda
c) Vandana d) Ramnath.

61. The first international earth summit was held in
a) New Delhi b) Kyoto c) Stockholm d) Rio de Janeiro.

62. Ozone layer thickness is measured in
a) PPM b) PPb c) Decibels d) Dobson unit.

63. Who first discovered ozone hole
a) Shankliln b) Charles Fabry c) Henri Baisson d) John Macculay.

64. Noise is measured in
a) Decibels b) Jouls c) PPM d) NTU.

65. Terrace farming is practiced in
a) Coastal areas b) Deserts c) plains d) Hills.

66. _____ was awarded Padma Shri for constructing primary school at his village by his earnings
a) Harekala Hajabba b) Tulsi gowda c) Chalus Fabry d) None of above.

67. Geothermal energy is a
a) Heat energy b) Current energy c) Wind energy d) Solar energy.

68. Cauvery water dispute is between
a) Karnataka and Maharastra
b) Karnataka and Kerala
c) Karnataka and Tamil Nadu
d) Uttar Pradesh and Madya Pradesh.

69. The word ecology is produced by
a) Ernst Haeckel
b) Helena Curtis
c) Charels south wick
d) Charles Alton.

70. Mining means
a) To conserve and preserve minerals
b) To extract minerals and ores
c) To check pollution due to mineral resources
d) None.

71. Fossil fuels are converted into energy by
a) Burning b) Cooling c) Sublimation d) Melting.

72. Physical pollution of water due to
a) Dissolved oxygen b) P^{11} c) Turbidity d) None of above.

73. Molasses from sugar industry is used to generate
a) Biodiesel b) Hydrogen c) Bio-ethanol d) Bio-methanol.

74. The most important fuel used by Nuclear power plant is
a) U – 235 b) U – 238 c) U – 245 d) U – 248.

75. Liquid waste generated from Bath rooms and kitchens are called
a) Domestic sewage b) Runoff c) Salvage d) All of above.

76. Water day is celebrated on this day
a) 22nd March b) 25th April c) 15th June d) 5th June.

77. Loss of water content through the plants into the atmosphere is called
a) Evaporation b) Vaporization c) Hydraulic cycle d) Transpiration.

78. The hydrological cycle is related to
a) Water and electricity
b) Water characterization
c) Hydro power
d) Water cycle and Balance.

79. The World Environment Day is celebrated on
a) June 5th b) November 5th c) April 5th d) December 26th.

80. Nuclear power plant in Karnataka is located at
a) Bhadravathi b) Sandur c) Raichur d) Kaiga.

81. Cell phones emits _____ type of Radiation
a) Radio frequency Radiation
b) UV radiation
c) X ray radiation
d) None of Above.

82. Water bearing rock readily Transmitts water to well and springs
a) Aquifer b) Porosity c) Permeability d) None of Above.

83. Karnataka State Pollution Control Board (KSPCB) was established in the year.
a) 1947 b) 1982 c) 1986 d) 1974.

84. In the world's population, India Accounts for
a) 10% b) 5% c) 17.7% d) 16%.

85. Which of the following is not a biodegradable pollutant
a) Plastic
b) Skins of vegetable and Fruits
c) Dry leaves
d) Paper.

86. Sundarbans is the name of place in
a) Assam b) West Bengal c) Karnataka d) None of these.

87. Western ghats are locate in
a) North East India b) Maharashtra c) Peninsular India d) Gujarat.

88. DDT is a
a) Fungicide b) Pesticide c) Fertilizer d) Disinfectant.

89. Kala Azar is spread by
a) Sand files b) Mosquitoes c) Rats d) Tapeworms.

90. SARA refer to
a) Severe acute respiratory syndrome
b) Self acute respiratory system
c) Severe acute respiratory system
d) Self accurate rest syndrome

91. Landslides are caused by
a) Earth quakes b) Dam buildings c) Mining d) All of these.

92. The virus that causes AIDS is
a) HIV b) TMV c) HMV d) None of these.

93. Rearing fish is called
a) Sericulture b) Fish culture c) Pisci culture d) Horti culture.

94. Percentage methane content of Biogas is
a) 50 to 70% b) 85% c) 5% d) 95%

95. Environment means
a) A beautiful land scape
b) Industrial production
c) Air and water
d) Sum of total all condition.

96. Taungya system is
a) Agro forestry b) Mining c) Exhaustable d) None of these.

97. Lithosphere means
a) Air b) Water c) Micro-organisms d) Rock and Soils.

98. Which among the following is a climate factor
a) Pressure b) Humidity c) Temperature d) All of these.

99. The forest is
a) Abiotic b) Biotic c) Both A and B d) None of these.

100. Store hours of minerals is
a) Soil b) Water c) Forest d) All of these.

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18 VI sem EC

CBCS SCHEME

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18EC61

Sixth Semester B.E. Degree Examination, July/August 2022
Digital Communication

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What are the applications of Hilbert transform? Prove that a signal g(t) and its Hilbert transform $\hat{g}(t)$ are orthogonal over the entire time interval $(-\infty, \infty)$. **(08 Marks)**

b. For a binary sequence 0 1 0 0 0 0 0 0 0 0 1 0 1 1 construct :
i) RZ Bipolar format ii) Manchester format iii) B3ZS format iv) B6ZS format v) HDB3 format. **(08 Marks)**

c. Define Pre-envelope of a real valued signal. Given a band pass signal S(t), sketch the amplitude spectra of signal S(t), Pre-envelope $S_+(t)$ and Complex envelope $\tilde{S}(t)$. **(04 Marks)**

OR

2 a. Express Bandpass signal S(t) in canonical form. Also explain the scheme for deriving the in-phase and quadrature components of the band pass signal S(t). **(08 Marks)**

b. Derive the expression for the complex low pass representation of band pass systems. **(08 Marks)**

c. Write a note on HDBN signaling. **(04 Marks)**

Module-2

3 a. Explain the geometric representation of set of M energy signals as linear combination of N orthonormal basis functions. Illustrate for the case N = 2 and M = 3 with necessary diagrams and expressions. **(10 Marks)**

b. Explain the Correlation receiver using product integrator and matched filter. **(10 Marks)**

OR

4 a. Using the Gram – Schmidt Orthogonalization procedure, find a set of orthonormal basis functions to represent the three signals $S_1(t)$, $S_2(t)$ and $S_3(t)$ shown in Fig. Q4(a). Also express each of these signals in terms of the set of basis functions. **(12 Marks)**

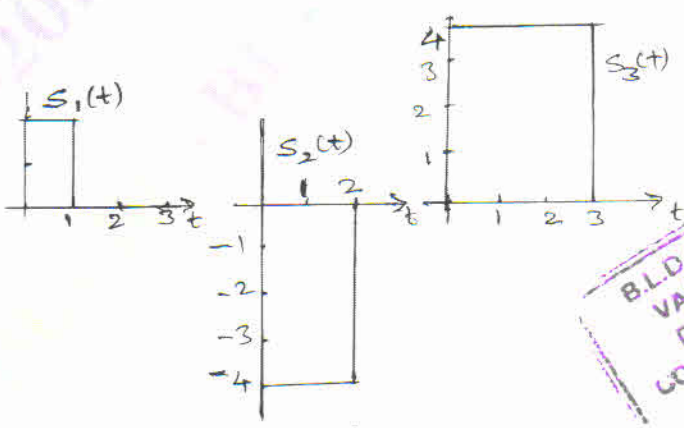

Fig. Q4(a)

b. Show that for a noisy input, the mean value of the j^{th} correlator output X_j depends only on S_{ij} and all the correlator outputs X_j, j = 1, 2, ...N have a variance equal to the PSD $N_0/2$ of the additive noise process W(t). **(08 Marks)**

Module-3

5 a. Derive the expression for error probability of binary PSK using coherent detection. **(06 Marks)**

b. Explain the generation and optimum detection of differential phase – shift keying, with neat block diagram. **(08 Marks)**

c. A binary data is transmitted over a microwave link at a rate of 10^6 bits/sec and the PSD of noise at the receiver is 10^{-10} watts/Hz. Find the average carrier power required to maintain an average probability of error $P_e \leq 10^{-4}$ for coherent binary FSK. What is the required channel bandwidth? (Given erf (2.6) = 0.9998). **(06 Marks)**

OR

6 a. With a neat block diagram, explain the non – coherent detection of binary frequency shift keying technique. **(08 Marks)**

b. In a FSK system, following data are observed. Transmitted binary data rate = 2.5×10^6 bits/second PSD of zero mean AWGN = 10^{-20} Watts/Hz. Amplitude of received signal in the absence of noise = 1μV. Determine the average probability of symbol error assuming coherent detection. (Given erf (2.5) = 0.99959). **(08 Marks)**

c. What is the advantage of M – ary QAM over M – ary PSK system? Obtain the constellation of QAM for M = 4 and draw signal space diagram. **(04 Marks)**

Module-4

7 a. With a neat block diagram, explain the digital PAM technique through band limited base band channels. Also obtain the expression for inter symbol interference. **(08 Marks)**

b. State and prove Nyquist condition for zero ISI. **(08 Marks)**

c. With neat diagram and relevant expression, explain the concept of adaptive equalization. **(04 Marks)**

OR

8 a. For a binary data sequence $\{d_n\}$ given by 1 1 1 0 1 0 0 1. Determine the precoded sequence, transmitted sequence, received sequence and the decoded sequence. **(06 Marks)**

b. Draw and explain the time – domain and frequency domain of duo – binary and modified duo binary signal. **(08 Marks)**

c. With neat diagram, explain the timing features pertaining to eye diagram and its interpretation for base band binary data transmission system. **(06 Marks)**

Module-5

9 a. Explain the model of a Spread Spectrum digital Communication system. **(08 Marks)**

b. Explain the effect of dispreading on a narrow band interference in Direct Sequence Spread Spectrum System (DSSS). A DSSS signal is designed to have the power ratio P_R/P_N at the intended receiver is 10^{-2}. If the desired $E_b/N_0 = 10$ for acceptable performance determine the minimum value of processing gain. **(08 Marks)**

c. What is a PN sequence? Explain the generation of maximum length (ML – Sequence). What are the properties of ML sequences? **(04 Marks)**

OR

10 a. With a neat block diagram, explain frequency Hopped Spread Spectrum Technique. Explain the terms Chip rate , Jamming Margin and Processing gain. **(10 Marks)**

b. With a neat block diagram, explain the CDMA System based on IS - 95. **(10 Marks)**

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CBCS SCHEME

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18EC62

Sixth Semester B.E. Degree Examination, July/August 2022
Embedded Systems

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 block Schematic, explain the function of various units in ARM cortex M3 processor architecture, in brief. **(10 Marks)**

b. Explain any 5 application of ARM cortex M3 based on its features. **(05 Marks)**

c. With diagram, explain 2 operation modes and 2 privilege levels in cortex M3, when exceptions are to be handled. **(05 Marks)**

OR

2 a. With tables, describe the various interrupts and exception along with the vector addresses. **(10 Marks)**

b. Explain Program Status Registers (PSRs) in cortex M3 along with the 2 instructions used for accessing PSRS, with a diagram. **(05 Marks)**

c. Describe the reset sequence with a diagram. **(05 Marks)**

Module-2

3 a. Explain the 16 bit instructions: CMP, ASR, SBC and LDMIA, with an example for each. **(08 Marks)**

b. Describe signed and unsigned saturation instructions with diagram and examples. **(08 Marks)**

c. Explain IT instruction with an example to convert a High level language instruction to its equivalent assembly instructions in cortex M3. **(04 Marks)**

OR

4 a. Explain the following 32 bit instructions with an example for each : ADC, BFC, LSL and PUSH. **(08 Marks)**

b. Describe CMSIS with diagram and its functions, organization and scope. **(08 Marks)**

c. Write an ALP to add the first 10 integer numbers using cortex M3 processor. **(04 Marks)**

Module-3

5 a. Describe the elements of an embedded system with a block diagram. **(10 Marks)**

b. Classify the embedded systems based on the complexities and give 2 examples for each category. **(06 Marks)**

c. Differentiate between RISC and CISC architectures. **(04 Marks)**

OR

6 a. Describe the functions of Optocoupler, I2C and IrDA for embedded system. **(10 Marks)**

b. Explain EPROM, EEPROM, FLASH, DRAM, NVRAM and Sensors required for embedded systems. **(06 Marks)**

c. Differentiate between Embedded and general computing systems. **(04 Marks)**

Module-4

7 a. Describe coin operated telephone system with a FSM, function of states and state transition diagram. **(08 Marks)**

b. Explain any 5 characteristics of embedded systems. **(05 Marks)**

c. With a block schematic, explain the ALP based embedded firmware design with its disadvantages. **(07 Marks)**

OR

8 a. Describe the sequential program model for seat belt warning system along with the operation of the system. **(08 Marks)**

b. Explain any 5 operational quality attributes of embedded systems. **(05 Marks)**

c. With a functional block diagram, explain the working of a washing machine. **(07 Marks)**

Module-5

9 a. With the state transition diagram, structure of a process and memory organization, explain the functions of status and the scheduler function for process management. **(10 Marks)**

b. With an example, describe preemptive SJF scheduling and calculate all the performance factors. **(10 Marks)**

OR

10 a. Describe out-of-circuit programming and In-system-programming. **(10 Marks)**

b. With a block diagram, explain the embedded system development environment with the functions of the components used in brief. **(10 Marks)**

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CBCS SCHEME

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18EC646

Sixth Semester B.E. Degree Examination, July/August 2022
Python Application Programming

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain Conditional Execution , Alternative execution , Chained conditionals and Nested conditionals with examples. **(08 Marks)**

b. Explain the rules of precedence used by Python to evaluate an expression. **(04 Marks)**

c. Write a Python Program to prompt the user for hours and rate per hour for pay computation with time and a half for overtime. To give the employee 1.5 time the hourly rate for hours worked above 40 hours. **(08 Marks)**

OR

2 a. List the features of Python Programming Language (at least FIVE). **(05 Marks)**

b. What are User defined functions? How can we pass parameters in user defined functions? Explain with suitable example. **(06 Marks)**

c. Write a program to prompt for a score between 0.0 and 1.0. if the score is out of range print an error manage and exit. If the score is between 0.0 and 1.0 print a grade using the following table : **(09 Marks)**

Score	>= 0.9	>= 0.8	>= 0.7	>= 0.6	< 0.6
Grade	A	B	C	D	F

Module-2

3 a. With Syntax, explain the finite and infinite looping constructs in Python. What is the need for break and continue statements? Explain with examples. **(08 Marks)**

b. What are String Slices? Explain the Slicing Operator in Python with examples. **(05 Marks)**

c. Write a Python program to accept a file name from the user :
i) Display the number of characters in the file.
ii) Find the frequency of occurrence of the lines which started with a word 'From'. **(07 Marks)**

OR

4 a. List and explain any four built in string manipulation functions supported by Python with examples. **(06 Marks)**

b. Explain file open , file close , file read and file write concepts in Python with examples. **(08 Marks)**

c. Write a Python program to find the largest value from the given set of accepted values. **(06 Marks)**

Module-3

5 a. Lists are mutable. Justify the statement with examples. Discuss the list handling functions in Python with examples. **(08 Marks)**

b. Differentiate between List and Dictionary. **(04 Marks)**

c. Write a Python program to search lines that start with the word 'from' and a character followed by a two digit number between 00 and 99 followed : Print the number if it greater than zero. Assume any input file. **(08 Marks)**

OR

6 a. Compare and contrast tuples with tests. Explain the following operation in tuples with examples : i) Sum of two tuples ii) Slicing operations iii) Compression of two tuples iv) Assignment to variables. **(10 Marks)**

b. Write a Python program that accept a sentence and build dictionary with LETTERS , DIGITS , UPPERCASE , LOWERCASE as key values and their count in sentence as values. **(06 Marks)**

c. Explain the need of Regular expression in Python language, with an example. **(04 Marks)**

Module-4

7 a. Explain Classes and Attributes in Python language with examples. **(06 Marks)**

b. What is the difference between Method and Function? Explain the working of init method with suitable code. **(06 Marks)**

c. Write a function named move – rectangle that takes a Rectangle and two numbers named dx and dy. It should change the location of the rectangle by adding dx to the x co-ordinate of corner and adding dy to the y co-ordinate of corner. **(08 Marks)**

OR

8 a. Show using a Python code how_ str_ method is invoked when you print an object. Explain its working. **(06 Marks)**

b. Illustrate the concept of Pure function and Modifier with examples. **(06 Marks)**

c. What is Operator Overloading? Write Python code to overload "+" , "-" and "*" operator by providing the methods _ _ add_ _ , _ _ sub _ _ and _ _ mul _ _. **(08 Marks)**

Module-5

9 a. Define Socket. Explain how socket connection can be established to the internet using Python code over the TCP/IP connection and the http protocol to get the web document. **(08 Marks)**

b. Compare and Contrast the Javascript Object Notation (JSON) and XML. Explain parsing of XML with example. **(06 Marks)**

c. Define Cursor. Explain Connect, Execute and Close command of databases with a snippet code. **(06 Marks)**

OR

10 a. What is Embedded SQL? Explain the importance of SQLite data base. **(04 Marks)**

b. Write a note on Google Geo coding Web service. Using Python supported libraries demonstrate with a snippet code. **(08 Marks)**

c. Write a Python code to read the file from web using urllib and retrieve the data of the file. Also compute the frequency of each word in the file. **(08 Marks)**

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CBCS SCHEME

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

18EC655

Sixth Semester B.E. Degree Examination, July/August 2022
Basic VLSI Design

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Describe with a neat sketch, the CMOS N Well process steps to fabricate a CMOS Inverter. **(10 Marks)**

b. Derive the expression for MOS transistor transconduction g_m from output current I_{ds} and Input voltage V_{gs}. **(10 Marks)**

OR

2 a. Define Moore's Law. Compare CMOS and Bipolar Technologies. **(10 Marks)**

b. Explain the Important Aspects of MOS transistor threshold voltage V_t. **(10 Marks)**

Module-2

3 a. Determine the PULL – UP to PULL – DOWN ratio for an nMOS inverter driven through one or more pass transistor. **(10 Marks)**

b. Define Sheet Resistance and Standard unit of Capacitance. Calculate on Resistance of CMOS Inverter with $R_{SN} = 20k\Omega$, $R_{SP} = 15k\Omega$, $Z_{pu} = 1$ and $Z_{pd} = 1$, $V_{DD} = 5V$. Also calculate Power dissipation. **(10 Marks)**

OR

4 a. With a neat diagram, explain the different arrangements of BiCMOS Inverter. **(10 Marks)**

b. Estimate the Rise time and Fall time for CMOS Inverter. **(10 Marks)**

Module-3

5 a. Draw the stick diagram for CMOS implementation :

i) two Input AND gate ii) $Y = \overline{AB + CD}$.

b. What do you mean by Lambda – based design rules and write the design rules for wires of n-MOS CMOS and transistors. **(10 Marks)**

(10 Marks)

OR

6 a. Draw the stick diagram for NMOS Implementation.

i) $Y = \overline{A + BC}$ ii) $Y = A(B + C)D$.

b. Determine the Scaling factors for the following : **(10 Marks)**

i) Gate Area (A_g) ii) Parasitic Capacitance (C_x).

iii) Power dissipation per gate (P_g) iv) Maximum Operating Frequency (f_o).

v) Power Speed Product (P_T).

(10 Marks)

Module-4

7 a. Describe the Dynamic CMOS Logic using CMOS three – input NAND gates. **(10 Marks)**

b. With a neat diagram and relevant expressions, explain Parity Generator Structural Design. **(10 Marks)**

OR

8 a. Describe the Gate Logic Inverter arrangement for 2 – Input nMOS , 2 – Input CMOS NAND gates. **(10 Marks)**

b. Describe Switch Logic Implementation of a four – way multiplexer. **(10 Marks)**

Module-5

9 a. List the general considerations and explain the illustration of Design processes. **(10 Marks)**

b. Explain the essential methods of CAD Tools for design and simulation. **(10 Marks)**

OR

10 a. Describe the Optimization methods of nMOS and CMOS Inverters. **(10 Marks)**

b. Explain the design of a 4 – bit Shifter, with a diagram of 4 × 4 Barrel Shifter. **(10 Marks)**

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2015-17 VII Sem EC

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17EC72

Seventh Semester B.E. Degree Examination, July/August 2022
Digital Image Processing

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 fundamental steps in digital image processing. **(10 Marks)**

b. Explain various image sensing and acquisition methods. **(10 Marks)**

OR

2 a. Explain the process of image sampling and quantization in digital image processing. **(08 Marks)**

b. Explain the significance of isoference curve in an image processing. **(06 Marks)**

c. Consider the image segment shown in Fig.Q2(c). Let V = {1, 2} and compute the length of the shortest 4–, 8– and m-path between p and q. If particular path does not exist between these two points, explain why? **(06 Marks)**

	3	1	2	1 (q)
	2	2	0	2
	1	2	1	1
(p)	1	0	1	2

Fig.Q2(c)

Module-2

3 a. Explain the widely used gray level transformations. **(10 Marks)**

b. Perform histogram equalization of the image shown in Fig.Q3(b), where the intensity levels are integers in the range [0, 9].

$$\begin{bmatrix} 2 & 3 & 3 & 2 \\ 4 & 2 & 4 & 3 \\ 3 & 2 & 3 & 5 \\ 2 & 4 & 2 & 4 \end{bmatrix}$$

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

OR

4 a. Explain the development of digital Laplacian method used for image enhancement. **(10 Marks)**

b. Explain the procedure used in frequency domain for simultaneous gray level range compression and contrast enhancement. **(10 Marks)**

Module-3

5 a. Discuss how periodic noise can be reduced by frequency domain filtering. **(10 Marks)**

b. Explain the ordered statistic filter's used for image restoration. **(10 Marks)**

OR

6 a. Explain the following methods to estimate the degradation function used in image restoration:
(i) Estimation by image observation.
(ii) Estimation by experiment **(10 Marks)**

b. Explain the Weiner filtering method of restoring images in presence of noise and blur. **(10 Marks)**

Module-4

7 a. Explain the procedure in converting colors from HSI to RGB. **(10 Marks)**

b. Explain the relationship between scaling and wavelet function spaces. **(10 Marks)**

OR

8 a. Explain in brief the techniques used for pseudocolour image processing. **(10 Marks)**

b. Describe in brief the following terms:
(i) Morphological hit-or-miss transform
(ii) Morphological opening and closing. **(10 Marks)**

Module-5

9 a. Discuss various masks used to compute the gradient of an image. **(10 Marks)**

b. Explain region splitting and merging. **(10 Marks)**

OR

10 a. Explain the following image representation techniques:
(i) Signatures
(ii) Skeletons **(10 Marks)**

b. Discuss segmentation using morphological watersheds. **(10 Marks)**

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17EC73

Seventh Semester B.E. Degree Examination, July/August 2022
Power Electronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Draw symbols and control characteristics of the following power semiconductor devices i) SCR ii) GTO iii) SITH iv) IGBT v) BJT. **(10 Marks)**

b. Explain different types of power electronics circuits and mention their applications. **(10 Marks)**

OR

2 a. Explain the switching characteristics of power BJT with the help of its transient model. **(10 Marks)**

b. Explain the operation of n-channel enhancement types MOSFET with its transfer characteristics. **(10 Marks)**

Module-2

3 a. Illustrate V-I characteristics of SCR with its different modes of operation. **(10 Marks)**

b. Describe turn on methods of SCR. **(04 Marks)**

c. Draw two transistor model of SCR and derive expression for anode current. **(06 Marks)**

OR

4 a. Define Communication. List the differences between Natural and Forced commutation. **(06 Marks)**

b. Describe the operation of SCR. Resistance firing circuit with neat circuit and waveforms. **(08 Marks)**

c. Explain Class – A commutation circuit with waveforms. **(06 Marks)**

Module-3

5 a. With circuit diagram, explain single phase full converter with RL load derive equation for average output voltage and rms output voltage. **(10 Marks)**

b. With neat diagram and waveforms, explain the principle of phase controlled converter operation. **(08 Marks)**

c. What is the role of freewheeling diode in controlled rectifiers with R-L load? **(02 Marks)**

OR

6 a. An ac voltage controller has resistance load R = 10Ω and root mean square input voltage (rms) is V_s = 120V, 60Hz. The thyristors switch is 'ON' for n = 25 cycles and is 'OFF' for m = 75 cycles. Calculate i) The rms output voltage V_0 ii) The input power factor (PF) iii) The average and rms current of thyristors. (Refer Fig Q6(a))

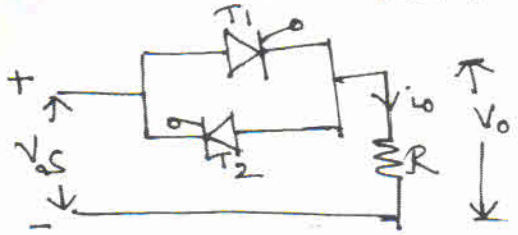

Fig Q6(a) **(06 Marks)**

b. Explain the principle of phase control, with the help of waveforms and obtain an expression for average value of output voltage. **(08 Marks)**

c. Explain the operation of a single phase bidirectional controller with resistive load and write an equation for rms output voltage. **(06 Marks)**

Module-4

7 a. The dc chopper has a resistive load R = 10Ω and the input voltage is V_s = 220V. When the convertor switch remains 'ON' its voltage drop is V_{ch} = 2V and the chopping frequency is f = 1KHz. It the duty cycle is 50%, calculate

i) The average output voltage
ii) The rms output voltage
iii) The converter efficiency
iv) The effective input resistance R_i of the converter **(10 Marks)**

b. Explain the operation of step down chopper with RL load and derive an expression for peak to peak load ripple current. **(10 Marks)**

OR

8 a. With the help of circuit diagram, explain four quadrant type E chopper. **(10 Marks)**

b. With the help of circuit diagram and waveforms, explain the operation of a Boost regulator. Derive the expression for peak – to – peak ripple current. **(10 Marks)**

Module-5

9 a. Explain the performance parameters of inverters. **(08 Marks)**

b. Give the comparison between Current Source Inverter (CSI) and Voltage Source Inverter (VSI). **(04 Marks)**

c. With circuit diagram, explain single phase bridge inverter. **(08 Marks)**

OR

10 a. Writ a short notes on

i) Single phase AC switches
ii) Solid state Relays **(10 Marks)**

b. Explain the working of variable dc-link inverter. **(10 Marks)**

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17EC743

Seventh Semester B.E. Degree Examination, July/August 2022
Real Time 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 Real – Time System. Classify Real Time system base on time constraints. **(05 Marks)**

b. Explain with neat diagram, the generalized computer control system showing Hardware and Software interface. **(08 Marks)**

c. Explain the classification of programs. **(07 Marks)**

OR

2 a. Explain sequence control for a single chemical reactor vessel with neat diagram. **(08 Marks)**

b. With a neat diagram, explain supervisory control. **(07 Marks)**

c. List out the activities and objectives carried out by computer in computer control application. **(05 Marks)**

Module-2

3 a. Explain the different forms of parallel computer architecture. **(10 Marks)**

b. Explain General purpose digital computer with schematic diagram. **(06 Marks)**

c. Mention features of specialized processors. **(04 Marks)**

OR

4 a. Explain with a neat diagram analog input and analog output system. **(10 Marks)**

b. With a neat diagram, explain digital input and output interface. **(10 Marks)**

Module-3

5 a. Explain exception handling. **(05 Marks)**

b. Explain Co-routine. **(07 Marks)**

c. Explain the following :
   i) Security
   ii) Readability
   iii) Flexibility
   iv) Efficiency. **(08 Marks)**

OR

6 a. Explain the following with respect to programming languages.
   i) Scope and visibility of variable
   ii) Global and local variables
   iii) Data types **(12 Marks)**

b. Explain the low level facilities in programming languages. **(08 Marks)**

Module-4

7 a. With a neat diagram, explain the typical structure of RTOS. **(08 Marks)**

b. Explain the priority structure with neat diagram. **(07 Marks)**

c. Explain scheduling strategies. **(05 Marks)**

OR

8 a. What is Code Sharing? Explain the two methods of code sharing with neat diagram. **(10 Marks)**

b. Draw and explain task state diagram. **(10 Marks)**

Module-5

9 a. With flow chart, explain the single program approach. **(07 Marks)**

b. Explain planning phases involved in the design of a RTS with diagram. **(05 Marks)**

c. With flow chart, explain foreground/background approach. **(08 Marks)**

OR

10 a. Explain software modeling with neat diagram. **(07 Marks)**

b. Explain the outline of abstract modeling approach of Ward and Meller with diagram. **(08 Marks)**

c. Explain Yourdon methodology. **(05 Marks)**

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17EC752

Seventh Semester B.E. Degree Examination, July/August 2022
IOT and Wireless Sensor Networks

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define IOT and explain IOT reference model suggested by CISCO. **(10 Marks)**
b. Explain any two IOT conceptual frameworks in detail. **(10 Marks)**

OR

2 a. With a neat diagram, explain M2M architecture. **(10 Marks)**
b. Explain MQTT and XMPP protocols for IOT. **(10 Marks)**

Module-2

3 a. Explain IPV4 header format. **(10 Marks)**
b. Write a note on: i) IPV6 addressing ii) HTTP protocol and its ports. **(10 Marks)**

OR

4 a. Explain cloud-based data collection storage and computing services. **(10 Marks)**
b. Explain cloud service models. **(10 Marks)**

Module-3

5 a. Explain how Ardiuino platform is programmed using IDE. **(10 Marks)**
b. Describe how the data is read from sensors and devices. **(10 Marks)**

OR

6 a. Explain with a neat diagram of Microsoft threat analysis model. **(10 Marks)**
b. Explain layered attackes model with possible attacks and suggest solutions for mitigating attacks. **(10 Marks)**

Module-4

7 a. Explain single mode architecture of WSN with neat diagram. **(10 Marks)**
b. Explain enabling technologies and characteristics requirement of WSN. **(10 Marks)**

OR

8 a. Explain process based and event based programming. **(10 Marks)**
b. With neat diagram, explain the operation of gateways. **(10 Marks)**

Module-5

9 a. Explain low duty cycle and wake-up concepts in WSN. **(10 Marks)**
b. With neat diagram, explain CSMA protocol. **(10 Marks)**

OR

10 a. With neat diagram, explain LEACH protocol. **(10 Marks)**
b. Write a note on:
i) SMAC protocol
ii) Energy efficient unicast routing. **(10 Marks)**

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15EC71

Seventh Semester B.E. Degree Examination, July/August 2022
Microwaves and Antennas

Time: 3 hrs. Max. Marks: 80

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Use of Smith chart is permitted.

Module-1

1 a. With the aid of neat sketches, describe Reflex Klystron operation. What do you understand by velocity modulation? **(10 Marks)**

b. Derive the expressions for attenuation and phase constants for RF lines. **(06 Marks)**

OR

2 a. Describe the importance and significance of transit time and mode curve of reflex Klystron tube. **(08 Marks)**

b. A lossless line of characteristic impedance $R_0 = 50\Omega$ is to be matched to a load $Z_l = 50/(2+J(2+\sqrt{3})$ ohms by means of a lossless short circuitedstub. The characteristic impedance of the stub is 100Ω. Find the stub position (closest to the load) and length so that a match is obtained (using smith chart). **(08 Marks)**

Module-2

3 a. Justify "Microwave circuits are analysed using scattering parameters and not by the measurement of z, y and ABCD parameters". **(06 Marks)**

b. Show that impedance and admittance matrices are symmetrical for a reciprocal junction. **(04 Marks)**

c. With the aid of neat sketch, explain the working of a Magic–Tee. What are the applications of Magic Tee? **(06 Marks)**

OR

4 a. State and prove symmetry and phase shift property of S-parameters, for junction of ports having common characteristic impedance. **(08 Marks)**

b. A lossless air filled rectangular waveguide has internal dimensions of 'a' cm X 'b' cm. If a = 2b and the cut off frequency of the TE_{02} mode is 12 GHz. Find the cut off frequency of dominant mode. **(04 Marks)**

c. Describe the working of microwave phase shifters. **(04 Marks)**

Module-3

5 a. Write a brief note on coplanar and shielded strip lines. **(06 Marks)**

b. Prove that effective height and effective aperature are related via radiation resistance and the intrinsic impedance of the space. **(06 Marks)**

c. Define directivity and HPBW of an antenna. **(04 Marks)**

OR

6 a. Obtain the expressions for characteristic impedance and attenuation losses of a parallel strip lines. **(06 Marks)**

b. Derive Frii's transmission formula. **(06 Marks)**

c. Define aperture efficiency of an antenna. **(04 Marks)**

Module-4

7 a. A source with a unidirectional radiation intensity pattern is given by :
$U = U_m COS\theta$
where n is any number n = 1, 2, 3 . . .
Show that the directivity of the source is D = 1(n + 1). **(04 Marks)**

b. Derive expression for total field at par point 'P' when two point sources with currents in equal magnitude but in opposite phase and are separated by $\lambda/2$ apart. Draw the field pattern. **(10 Marks)**

c. What are parasitic arrays? **(02 Marks)**

OR

8 a. Using electric and magnetic potentials obtain the far field components of a short dipole. **(08 Marks)**

b. Write the far – field E_θ of a symmetrical, center fed thin linear antenna. Write pattern factors for $\lambda/2$, full wave, three half wave antenna. **(08 Marks)**

Module-5

9 a. Derive the instantaneous electric field at a large distance 'r' from a loop antenna of any radius a. **(08 Marks)**

b. Describe Log-periodic array geometry. What is the basic concept of LPDA? What is YUCOLP array? **(08 Marks)**

OR

10 a. Discuss the practical design considerations for the axial mode helical antenna. List the important applications of helical antenna. **(08 Marks)**

b. With the aid of diagram, explain Fermat's principle as applicable to the horn antenna design. **(06 Marks)**

c. What is Aperture matched horn? **(02 Marks)**

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15EC72

Seventh Semester B.E. Degree Examination, July/August 2022
Digital Image Processing

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. With a neat block diagram, explain the fundamental steps involved in digital image processing. **(10 Marks)**

b. Let p and q be the pixels at coordinates (10, 12) and (15, 20) respectively. Find which distance measure gives the minimum distance between the pixels. **(06 Marks)**

OR

2 a. Explain in brief how an image can be sensed and acquired using multiple arrays. **(10 Marks)**

b. Consider the two image subsets S_1 and S_2, shown in Fig.Q2(b), for V = {1}, determine whether two subsets are (i) 4-adjacent (ii) 8-adjacent (iii) m-adjacent.

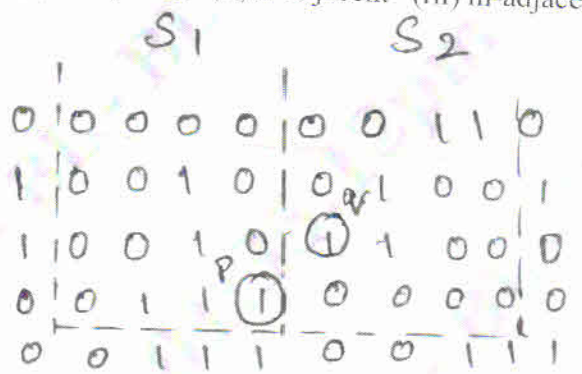

Fig.Q2(b) **(06 Marks)**

Module-2

3 a. Explain the basic gray level transformation functions with necessary graphs. **(08 Marks)**

b. The histogram of 3-bit image of 64 × 64 pixels is shown in Fig.Q3(b). Construct the histogram of original image and equalized histogram.

r_k	0	1	2	3	4	5	6	7
n_k	790	1023	850	656	329	245	122	81

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

OR

4 a. Using the second derivative develop a Laplacian mask for image sharpening. **(08 Marks)**

b. Explain the homomorphic filtering approach for image enhancement. **(08 Marks)**

Module-3

5 a. With a neat diagram, explain a model of the image degradation/restoration process. **(04 Marks)**

b. Explain common noise probability density functions in image processing. **(04 Marks)**

c. Explain the ordered statistic filters used for image restoration. **(08 Marks)**

OR

6 a. Explain the following methods to estimate the degradation function used in image restoration:
(i) Estimation by image observation
(ii) Estimation by experiment **(08 Marks)**

b. Explain the inverse filtering and Weiner filtering image restoration. **(08 Marks)**

Module-4

7 a. Explain the procedure in converting colors from RGB to HSI. **(08 Marks)**

b. Name the different techniques of wavelet coding and explain in brief any one techniques of wavelet coding of an image. **(08 Marks)**

OR

8 a. Explain the different methods of pseudocolor image processing. **(08 Marks)**

b. Explain the following basic morphological algorithms:
(i) Convex hull
(ii) Thinning
(iii) Pruning
(iv) Skeleton **(08 Marks)**

Module-5

9 a. What is thresholding? Describe the algorithm used for basic global thresholding. **(08 Marks)**

b. With the help of basic formulation, explain the concept of region splitting and merging. **(08 Marks)**

OR

10 a. With a neat sketch illustrate boundary-following algorithm and explain. **(08 Marks)**

b. Briefly explain the watershed segmentation algorithm. **(08 Marks)**

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15EC75

Seventh Semester B.E. Degree Examination, July/August 2022
Power Electronics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain five different types of power electronics converter circuits with their input and output wave forms. **(10 Marks)**

b. A BJT switch has β in the range of 8 to 40, calculate (i) The value of R_B that will result in saturation with an overdrive factor of 5 (ii) The forced beta β_f and the power loss in the transistor. $V_{CC} = 200$ V, $V_{bb} = 10$ V, $V_{be(sat)} = 1.5$ V, $V_{ce(sat)} = 1$ V, $R_C = 10\ \Omega$. **(06 Marks)**

OR

2 a. Explain any five power electronics devices with VI characteristics and their symbols. **(10 Marks)**

b. An IGBT switch has $t_{ON} = 3\ \mu$sec, $t_{OFF} = 1.2\ \mu$sec , duty cycle D = 0.7, $V_{CE(sat)} = 2$ V, $f_s = 1$ kHz. Determine

(i) Average load current.
(ii) Conduction power loss.
(iii) Switching power loss during turn on and turn off. **(06 Marks)**

Module-2

3 a. With two transistor analogy, explain the working of a Thyristor and obtain the equation for anode current. **(08 Marks)**

b. Distinguish between holding current and latching current of a Thyristor. **(02 Marks)**

c. A SCR circuit operates from 300 V DC supply has series inductance of 4 μH. A resistance of 4 Ω and capacitance of 0.2 μF is connected across the SCR. Calculate the safe $\frac{dv}{dt}$ and $\frac{di}{dt}$ ratings of SCR. **(06 Marks)**

OR

4 a. With necessary circuit diagram and waveforms explain the resonant pulse commutation. **(08 Marks)**

b. The resonant pulse commutation circuit has a capacitance of C = 30 μF and L = 4 μH . The initial capacitor voltage is $V_0 = 200$ V. Determine the circuit turn-off time for the load current $I_m = 250$ A. **(08 Marks)**

Module-3

5 a. With neat circuit diagrams and suitable waveforms explain the working of a single phase dual converter. **(06 Marks)**

b. Derive an expression for RMS output voltage of a single phase full controller having inductive load for discontinuous load current. Draw the relevant wave forms. **(06 Marks)**

c. A single phase full wave ACVC has a resistive load of R = 10 Ω and the input voltage is $V_S = 200$ V rms/ 60 Hz. The firing angles of T_1 and T_2 are $\alpha_1 = \alpha_2 = \frac{\pi}{2}$. Determine (i) RMS output voltage V_0 (ii) Input PF (iii) The average current of thyristors I_a. (iv) The rms current of the thyristor. **(04 Marks)**

OR

6 a. With the help of neat circuit diagram and wave forms explain the operation of single phase full wave bidirectional controller using diode bridge and single SCR with R load. Derive the equation for V_O(RMS). **(10 Marks)**

b. Obtain an expression for RMS value of load voltage in on-off A.C. voltage controller. For a 230 V/50 Hz ON-OFF controller ON time is 10 cycles and off time is 4 cycles. Calculate $V_{0(RMS)}$ output voltage. **(06 Marks)**

Module-4

7 a. Explain the working of step-down choppers with necessary circuit diagram and waveforms. Derive the equation for $V_{O(av)}$ and V_{ORMS}. **(06 Marks)**

b. Give the classification of chopper. Explain briefly each one of them. **(10 Marks)**

OR

8 a. With the help of circuit diagram and waveforms, explain the operation of step-up chopper. **(06 Marks)**

b. With a neat circuit diagram and wave forms explain the working principle of Buck regulator. Derive the expression for peak to peak ripple voltage of the capacitor, present across the load. **(10 Marks)**

Module-5

9 a. With circuit diagram and waveforms explain the working of a single phase full bridge inverter with RL load. **(10 Marks)**

b. With neat circuit diagram, explain the variable DC link inverter. **(06 Marks)**

OR

10 a. With neat circuit diagram, explain the working of a transistorized current source inverter. **(06 Marks)**

b. Explain the working of a solid state relay with suitable diagram. **(06 Marks)**

c. Considering a single phase bridge inverter, if the DC voltage is 200 V and the required RMS fundamental output voltage is 90 V, determine the delay angle β. **(04 Marks)**

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15EC743

Seventh Semester B.E. Degree Examination, July/August 2022
Real Time Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define Real Time Systems. Explain difference classification of RTS. **(08 Marks)**

b. Explain the elements of a computer control system with the example of a simple plant. **(08 Marks)**

OR

2 a. Explain sequence control with the help of diagram. **(08 Marks)**

b. Explain hierarchical systems and batch central using a hierarchical system. **(08 Marks)**

Module-2

3 a. What are parallel computers? Write the different architecture of parallel computer systems and explain their working principles. **(08 Marks)**

b. Explain process related interface. **(08 Marks)**

OR

4 a. Explain analog interface. **(08 Marks)**

b. Explain Communication Techniques. **(08 Marks)**

Module-3

5 a. Explain the features of real time languages. **(08 Marks)**

b. Explain different data types. **(08 Marks)**

OR

6 Write short note on :

a. Exception handling **(05 Marks)**

b. Co routines **(06 Marks)**

c. Central structure. **(05 Marks)**

Module-4

7 a. Explain real-time multi-tasking OS. **(08 Marks)**

b. Explain various scheduling strategies. **(04 Marks)**

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

OR

8 a. List the functions of task management. Explain with task states diagram and task states. **(08 Marks)**

b. Explain task chaining and swapping. **(08 Marks)**

Module-5

9 a. Explain Yourdon methodology. **(06 Marks)**

b. Explain Ward and Meller method. **(10 Marks)**

OR

10 a. Explain the context diagram for drying over in case of Ward and Mellor method. **(06 Marks)**

b. Explain the requirement model and architectural model for Hatley and Pirbhai method. **(10 Marks)**

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15EC752

Seventh Semester B.E. Degree Examination, July/August 2022
IoT and Wireless Sensor Networks

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain IBM IoT conceptual frame work with a neat diagram (08 Marks)
b. Explain in detail LWM2M with a neat diagram. (08 Marks)

OR

2 a. Explain with a block diagram Constrained Application Protocol (CoAP) in detail. (08 Marks)
b. Explain the MQTT protocol with a neat diagram. (08 Marks)

Module-2

3 a. Explain 6LowPAN protocol with a neat diagram. (08 Marks)
b. Explain IP addressing in IoT. (08 Marks)

OR

4 a. Explain the service models of cloud computing with a neat diagram. (08 Marks)
b. Discuss with a neat diagram IoT cloud for application and service using Nimbits server. (08 Marks)

Module-3

5 a. Write a C/C++ program for Arduino controlled traffic –control lights using multithreading OS function. (10 Marks)
b. Explain IoT security tomography and layered – attacker model. (06 Marks)

OR

6 a. Explain privacy, vulnerabilities and security requirements of IoT. (08 Marks)
b. Explain Eclipse paho with java implementation of MQTT clients broker architecture. (08 Marks)

Module-4

7 a. Discuss the transceiver tasks and characteristics with its RF front end structure. (08 Marks)
b. Discuss the energy consumption of sensor nodes in detail. (08 Marks)

OR

8 a. Discuss the application programming interfaces and its paradigms. (08 Marks)
b. Explain the types of source and sink in a sensor communication network. (08 Marks)

Module-5

9 a. Explain S-MAC protocol with a neat diagram. (08 Marks)
b. Explain low energy adaptive clustering hierarchy (LEACH) protocol in detail. (08 Marks)

OR

10 a. Explain multipath unicast routing protocol in detail. (08 Marks)
b. Explain multihop clusters in an hierarchical networks. (08 Marks)

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2015-17 VIII Sem EC

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17EC82

Eighth Semester B.E. Degree Examination, July/August 2022
Fiber Optics and Networks

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With help of neat diagram, explain the main block of an optical fiber communication. **(10 Marks)**

b. Explain the advantages, disadvantages and applications of OFC. **(10 Marks)**

OR

2 a. With a neat diagram, discuss the structure of single mode and multimode step index fiber with advantages of each type. **(10 Marks)**

b. Calculate the R.I of core and cladding materials of an fiber whose NA = 0.35 and $\Delta = 0.001$. **(04 Marks)**

c. A step-index multimode fiber with NA = 0.20 supports 1000 modes at 850nm. What is diameter of core? How many does the fiber supports at 1320nm. **(06 Marks)**

Module-2

3 a. Explain different absorption mechanism in optical fiber. **(10 Marks)**

b. Silica has an estimated fictive temperature of 1400K with an ISO thermal compressibility of 7×10^{-11} m^2N^{-1}. RI and photo elastic coefficient for silica are 1.46 and 0.286 respectively. Determine attenuation in dB/km due to Rayleigh scattering in silica at $\lambda = 0.65$, 1 and 1.3km, K = Boltzman constant = $1.381 \times 10^{-23} JK^{-1}$. **(10 Marks)**

OR

4 a. Discuss inter modal dispersion with necessary equations. **(10 Marks)**

b. Explain Macro and Micro bending losses with a neat diagram **(10 Marks)**

Module-3

5 a. Draw the diagram of a typical GaAiAS double hetro structure LED along with energy band diagram and refractive index profile and explain. **(10 Marks)**

b. Discuss internal quantum efficiency and power in detail. **(10 Marks)**

OR

6 a. Explain Fabry-Perot resonator cavity of laser with a neat diagram. **(10 Marks)**

b. Explain the following:
   i) Spontaneous emission
   ii) Stimulated emission
   iii) Quantum efficiency. **(06 Marks)**

c. For an alloy $In_{0.74} + Ga_{0.26}$ $As_{0.57}$ $P_{0.43}$ used in LED find wavelength emitted by the source. **(04 Marks)**

Module-4

7 a. Explain the implementation of WDM networks with various types of optical amplifiers. **(10 Marks)**

b. Explain MZI multiplex with necessary equations. **(10 Marks)**

OR

8 a. Describe the principles of working of isolators and circulators, with a neat diagram. **(10 Marks)**

b. With help of neat diagram, explain three possible EDFA configurations. **(10 Marks)**

Module-5

9 a. Discuss in detail about optical networking terminology. Mention the merits and demerits of each. **(10 Marks)**

b. Describe optical networking node elements with a neat diagram. **(10 Marks)**

OR

10 a. Explain the concept of wavelength routing with appropriate diagrams. **(10 Marks)**

b. With a neat diagram, explain the public telecommunication network overview **(10 Marks)**

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17EC831

Eighth Semester B.E. Degree Examination, July/August 2022
Micro Electro Mechanical System

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 help of neat block diagram, explain the multidisciplinary nature of Microsystems design and manufacturing. **(10 Marks)**

b. Discuss evolution of Microfabrication. **(04 Marks)**

c. Discuss the applications of Microsystems in the Aerospace Industry. **(06 Marks)**

OR

2 a. What is micro system? Make a comparison between microelectronics and Microsystems. **(10 Marks)**

b. Mention the application of smart material and Microsystems. **(10 Marks)**

Module-2

3 a. Describe in detail about Acoustic Wave Sensors and Chemical Sensors. **(10 Marks)**

b. Explain the types of Electrohydrodynamics. **(10 Marks)**

OR

4 a. Describe the four popular actuation techniques for microdevices. Provide atleast major advantages and one disadvantage of each of these techniques. **(10 Marks)**

b. Explain the principle of operation and types of micro accelerometers. **(10 Marks)**

Module-3

5 a. Describe the overview of finite element stress analysis. **(10 Marks)**

b. Determine the equivalent spring constant K and the natural frequency W_n of a cantilever beam element in a micro accelerometer in Fig.Q5(b). The beam is made of silicon with a Young's modulus of 190,000 MPa.

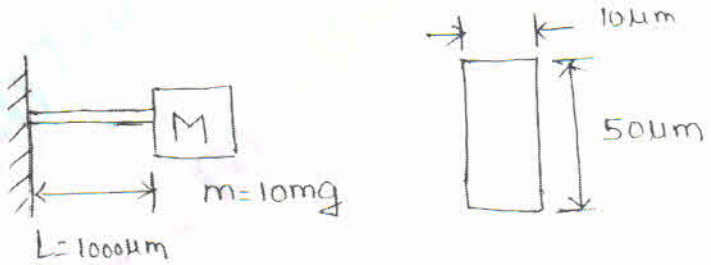

Fig.Q5(b) **(06 Marks)**

c. Derive an expression for bending of circular plates with edge fixed. **(04 Marks)**

OR

6 a. Derive a formula for estimating the natural frequency of a micro accelerometer with negligible damping effect. **(05 Marks)**

b. Write short notes on Thin-Film mechanics. **(10 Marks)**

c. Explain stresses in Thin Plates with temperature variation through the thickness. **(05 Marks)**

Module-4

7 a. Obtain the scaling factors in:
(i) Scaling of heat flux
(ii) Scaling in thermal conductivity in submicrometer regime **(10 Marks)**

b. Obtain the scaling factors in fluid mechanics. **(10 Marks)**

OR

8 a. Define force scaling vector and obtain the scaling factors:
(i) Acceleration a
(ii) Time t
(iii) Power density P/V_0 **(10 Marks)**

b. Explain scaling in electrostatic forces with respect to MEMS. **(10 Marks)**

Module-5

9 a. List the principle advantages and disadvantages of the LIGA process. **(10 Marks)**

b. Describe the DRIE process. How can DRIE achieve virtually perfect vertical etching? **(10 Marks)**

OR

10 a. Why is electroplating necessary in a LIGA process? **(10 Marks)**

b. What are the limitations of the height of microstructures that can be produced by bulk manufacturing technique? **(10 Marks)**

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15EC82

Eighth Semester B.E. Degree Examination, July/August 2022
Fiber Optics and Networks

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Describe any five important advantages of optical fiber communication over other communication. **(10 Marks)**

b. A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine

(i) The critical angle at the core-cladding interface.
(ii) The NA for the fiber.
(iii) The acceptance angle in air for the fiber. **(06 Marks)**

OR

2 a. With relevant diagrams, explain the different types of optical fibers, considering the refractive index profile, number of modes and material used. **(12 Marks)**

b. A multimode step index fiber with a core diameter of 80 μm and a relative index difference of 1.5% is operating at a wavelength of 0.85 μm. If the core refractive index is 1.48, estimate:

(i) The normalized frequency for the fiber;
(ii) The number of guided modes. **(04 Marks)**

Module-2

3 a. Derive an expression for r.m.s pulse broadening due to intermodal dispersion in multimode step index fiber. **(08 Marks)**

b. Explain different absorption mechanisms in optical fiber. **(08 Marks)**

OR

4 a. Explain the different types of bending losses in optical fiber. **(06 Marks)**

b. A step index fiber has a core refractive index of 1.5 and a core diameter of 50 μm. The fiber is jointed with a lateral misalignment between the core axes of 5 μm. Estimate the insertion loss at the joint due to the lateral misalignment assuming a uniform distribution of power between all guided modes when :

(i) There is a small air gap at the joint ;
(ii) The joint is considered index matched. **(06 Marks)**

c. Explain V-groove optical fiber splices technique. **(04 Marks)**

Module-3

5 a. Derive the expression for quantum efficiency and output power for an LED. **(08 Marks)**

b. Describe the different noise sources affecting the photo-detector along with appropriate expressions. **(08 Marks)**

OR

6 a. Starting from rate equations, derive the expression for the number of photons / unit volume resulting from stimulated and spontaneous emissions in LASER diode. **(10 Marks)**

b. Draw and explain two types of front-end amplifier used in optical fiber communication. **(06 Marks)**

Module-4

7 a. Explain the operational principle and implementations of WDM with diagram. **(08 Marks)**

b. Describe the working principle of isolators and circulators with suitable diagram. **(08 Marks)**

OR

8 a. Draw the energy-level diagram indicating the transition processes in erubium – doped silica fiber amplifier and explain the amplification mechanism. **(06 Marks)**

b. Based on general application, explain three types of optical amplifiers with relevant diagram. **(10 Marks)**

Module-5

9 a. Explain the different types of optical networking node elements. **(10 Marks)**

b. Explain ATM protocol architecture. **(06 Marks)**

OR

10 a. Explain public telecommunications networks review with neat diagram. **(10 Marks)**

b. Explain an optical packet switching network with neat diagram. **(06 Marks)**

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15EC831

Eighth Semester B.E. Degree Examination, July/August 2022
Micro Electro Mechanical 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 MEMS as a Microsensors? Explain different types of microsensors. **(08 Marks)**

b. How micro electronics is different from Microsystems? Bring out the differences between the two technologies. **(08 Marks)**

OR

2 a. Explain the different principal science and engineering disciplanes involved in microsystem design and manufacture? **(08 Marks)**

b. What do you mean by intelligent microsystems? Write a short note on applications of these micro systems in automobile industry. **(08 Marks)**

Module-2

3 a. What are the different types in micropressure sensors? Explain. **(08 Marks)**

b. Explain the role of plasma physics in microfabrication along with plasma generation. **(08 Marks)**

OR

4 a. Write a short note on molecular structure of matters. Explain variation of intermolecular forms with inter molecular distance. **(08 Marks)**

b. What do you mean by actuator? Explain the actuation using :
   i) Piezoelectric crystals
   ii) Electrostatic forces. **(08 Marks)**

Module-3

5 a. Explain simple mechanical vibration system for different damping ratios. **(08 Marks)**

b. Determine the equivalent spring constant k and the natural frequency w_n of a cantilever beam element in a micro accelerometer illustrated in Fig.Q5(b). Beam s made up of silicon with a Young's modulus of 1,90,000MPa.

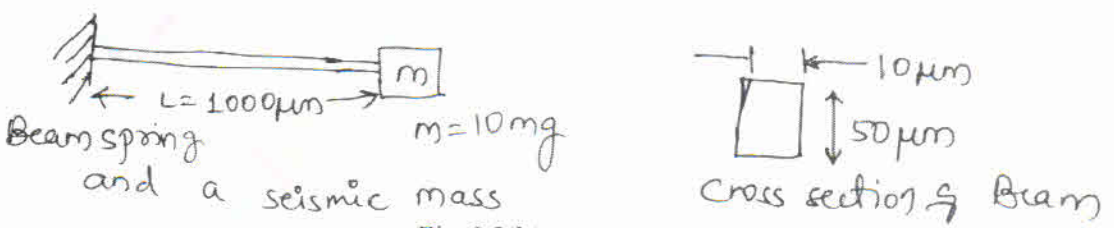

Fig.Q5(b) **(04 Marks)**

c. For the simple mass spring system explain how resonant vibration occurs. **(04 Marks)**

OR

6 a. Explain static bending of thin plates with neat diagram. List the different cases. **(08 Marks)**

b. Explain the principle and design theory involved in micro accelerometers. **(08 Marks)**

Module-4

7 a. Explain how Paschen effect is utilized to study scaling in electro – static forces. **(06 Marks)**

b. Explain scaling in Rigid body Dynamics. **(10 Marks)**

OR

8 a. Explain scaling principle used in fluid mechanics. **(06 Marks)**

b. Explain scaling in heat transfer. **(10 Marks)**

Module-5

9 a. Explain the mechanical problems associated with surface micromachining. **(08 Marks)**

b. Explain the different dry etching techniques. **(08 Marks)**

OR

10 a. Explain major fabrication steps in LIGA process. Demonstrate with an example. **(10 Marks)**

b. Write short note on :

i) An isotropic etching

ii) Substrate materials for LIGA process. **(06 Marks)**

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2018-VIII Sem EC

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18EC81

Eighth Semester B.E. Degree Examination, July/August 2022
Wireless and Cellular Communication

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain in brief the basic three propagation mechanisms. **(06 Marks)**

b. Define :
i) Delay spread
ii) Coherence bandwidth
iii) Doppler spread
iv) Coherence time. **(08 Marks)**

c. Assume a receiver is located 10km from a 50W transmitter. The carrier frequency is 900MHz, free space propagation is assumed, $G_t = 1$, $G_r = 2$, find :
i) The power at the receiver
ii) The magnitude of E-field at the receiver antenna
iii) The rms voltage applied to the receiver input assuming that the receiver antenna has real impedance of 50Ω and is matched to the receivers. **(06 Marks)**

OR

2 a. Explain cell splitting and cell sectoring. **(06 Marks)**

b. Explain the three statistical channel model of a broadband fading channel. **(09 Marks)**

c. If a transmitter produces 50Watts of power, express the transmit power in units of
i) dBm and dBw
ii) if 50Watts is applied to a unity gain antenna with a 900MHz frequency of carrier, find the received power in dBm at a free space distance of 100m from the antenna. **(05 Marks)**

Module-2

3 a. Explain with neat block diagram GSM network architecture. **(10 Marks)**

b. Explain GSM Hyper frame with neat sketch. **(10 Marks)**

OR

4 a. Explain GSM identities. **(10 Marks)**

b. Explain the types of GSM location updating. **(10 Marks)**

Module-3

5 a. Explain the CDMA basic spectrum spreading operation with necessary sketches. **(10 Marks)**

b. Explain forward logical channels of CDMA. **(10 Marks)**

OR

6 a. Explain CDMA mobile station initialization and call processing states. **(12 Marks)**

b. Explain the types of handoff used in CDMA. **(08 Marks)**

Module-4

7 a. Explain OFDM advantages and disadvantages. **(10 Marks)**

b. Explain with neat block diagram flat LTE SAE architecture. **(10 Marks)**

OR

8 a. Explain the differences between OFDM and SCFDE with neat block diagrams. **(10 Marks)**

b. Write a note on :

i) Frequency synchronization

ii) The Peak to Average Ratio (PAR) **(10 Marks)**

Module-5

9 a. Explain with neat block diagram OFDMA downlink transmitter. **(10 Marks)**

b. Mention SC-FDMA advantages and disadvantages. **(05 Marks)**

c. Mention OFDMA advantages and disadvantages. **(05 Marks)**

OR

10 a. Explain LTE end to end network architecture with neat block diagram. **(10 Marks)**

b. Explain LTE frame structures. **(10 Marks)**

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18EC822

Eighth Semester B.E. Degree Examination, July/August 2022
Micro Electro Mechanical 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 MEMS as a micro sensor and micro actuator, with neat block diagram. **(08 Marks)**

b. Explain with a neat block diagram, the working principle of Intelligent micro system. **(06 Marks)**

c. Describe the applications of Microsystems in Aerospace and consumer product industry. **(06 Marks)**

OR

2 a. With a neat figure, explain the role of principal science and Engineering disciplines involved in design and manufacture of a micro system design. **(10 Marks)**

b. Explain the difference between MEMS and Micro system. **(06 Marks)**

c. Describe the applications of Micro system in Automotive Industry. **(04 Marks)**

Module-2

3 a. Explain the working principles of a common surface Acoustic wave sensor using Piezo electric crystal as transmission medium. **(08 Marks)**

b. Explain in detail Pressure Sensors. **(08 Marks)**

c. Calculate the capacitance of a parallel plate capacitor. The two plates have identical dimensions of L = W = 1000μm with a gap d = 2μm. The air is the dielectric medium. **(04 Marks)**

OR

4 a. Explain the operating / working principle of : i) Thermocouple ii) Thermopiles. Give relevant Mathematical equations. **(08 Marks)**

b. Describe in detail about the Chemical Sensor. **(06 Marks)**

c. Explain the working of Microvalves with a neat schematic diagram. **(06 Marks)**

Module-3

5 a. With relevant diagrams, explain the concept of rectangular plate. Write mathematical expressions for bending moment and bending stresses. **(08 Marks)**

b. Determine the minimum thickness of the circular diaphragm of a micropressure sensor made of silicon shown in Fig. Q5(b). The diaphragm has a diameter of 600μm and its edge is rigidly fixed to the silicon die. The diaphragm is designed to withstand a pressure of 20MPa without exceeding the plastic yielding strength of 7000MPa. Assume Young's modulus. E = 190.000MPa and Poisson's ratio V = 0.25. **(06 Marks)**

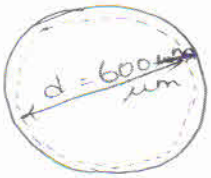

Fig. Q5 (b)

c. Write a short note on Thin – film mechanics. **(06 Marks)**

OR

6 a. Explain the concept of bending of square plates with all edges fixed. Give equation for maximum stress, maximum deflection stress at the centre of the plate and strain at the centre of plate. **(06 Marks)**

b. Determine the equivalent spring constant K and the natural frequency W_n of a cantilever beam element in a micro accelerometer shown in Fig. Q6(b). The beam is made of silicon with a Young's modulus of 190.000MPa. **(06 Marks)**

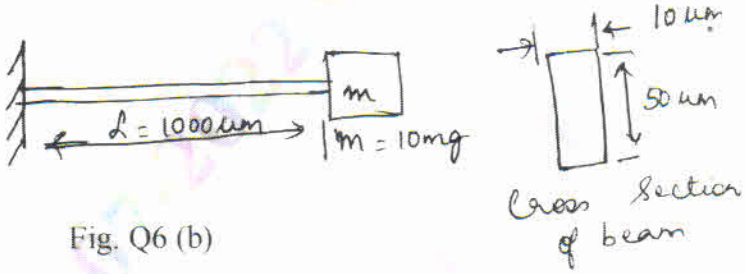

Fig. Q6 (b)

c. Explain the input information to FEA and output in stress analysis from FEA along with equations. **(08 Marks)**

Module-4

7 a. Derive the expression for scaling Acceleration a , time t and power density P/V, of a system in motion by using Trimmer force scaling vector. **(08 Marks)**

b. Explain Scaling in Electrostatic forces with respect to MEMS. **(08 Marks)**

c. Derive equations for the effective heat flux, considering gas flow in a micro - channel. **(04 Marks)**

OR

8 a. Derive the expression for scaling of dynamic force. **(08 Marks)**

b. Write a short note on :

i) Scaling of heat flux ii) Scaling in thermal conductivity in sub micro meter regime

iii) Scaling in effect of heat conduction in solids of MESO and micro – scales.

Give required equation. **(06 Marks)**

c. Derive the expression of scaling in Electricity. **(06 Marks)**

Module-5

9 a. Explain Isotropic and Anisotropic etching process of Bulk Micro manufacturing. **(08 Marks)**

b. Give comparison of Wet versus Dry etching process in Bulk Micro manufacturing. **(04 Marks)**

c. Demonstrate production of Cantilever beam by Surface Micro Machining Technique. **(08 Marks)**

OR

10 a. Explain the DIRE process and advantages of DIRE process compared with Plasma etching. **(10 Marks)**

b. Explain LIGA process used in Micro manufacturing. **(10 Marks)**

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