B.L.D.E.A's V.P.Dr.P.G.HALAKATTI COLLEGE OF ENGINERING AND TECHNOLOGY VIJYAPUR 586103

INDEX FILE QUESTION PAPERS JUN/JUL 2024

ELECTRONICS AND COMMUNICATION

18-VII Sem EC

CBCS SCHEME

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

18EC71

Seventh Semester B.E. Degree Examination, June/July 2024
Computer Networks

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain four fundamental characteristics on which effectiveness of data communications system depends on. **(04 Marks)**

b. Name the four basic network topologies and discuss advantages and disadvantages of each type. For 'n' devices in network, what is the number of cable links required for each topology? **(06 Marks)**

c. Write a neat diagram showing logical connections between layers of TCP/IP model of source and destination hosts. Explain responsibilities of each layer of TCP/IP model in brief. **(10 Marks)**

OR

2 a. Explain the basic principles of protocol layering that needs to be followed in network communication. **(04 Marks)**

b. With a neat diagram and example explain various modes of communication. **(06 Marks)**

c. With a neat diagram, explain the process of encapsulation and decapsulation of data in layers of TCP/IP model at source host, at router and destination host. **(10 Marks)**

Module-2

3 a. Explain the concept of bit stuffing and byte stuffing used in framing with a neat diagram clearly showing flag bytes in both the cases and also mention the importance of flag bytes. **(07 Marks)**

b. With a neat diagram, explain various field of Ethernet frame format. What are the minimum and maximum length of the frame considering the header field? **(07 Marks)**

c. Explain the 10Base-S and 10Base-T standard Ethernet implementation with all necessary details and diagram. **(06 Marks)**

OR

4 a. What are the three persistence methods used in CSMA mechanism to avoid the collisions? Explain them in detail with neat diagram. **(06 Marks)**

b. In the standard Ethernet with the transmission rate of 10 mbps, we assume that the length of the medium is 2500 m and the frame size is 512 bits. The propagation speed of a signal in a cable is 2×10^8 m/s.

(i) Calculate the efficiency of Standard Ethernet for given specification.

(ii) If length of the medium and frame size is changed to 3500 m and 1024 bits, find the efficiency. **(06 Marks)**

c. Write a neat finite state machine diagram of stop-and-wait protocol and explain various states the sender and receiver will undergo. **(08 Marks)**

Module-3

5 a. Explain in detail, various services provided by network layer. **(04 Marks)**

b. Explain various classes of IP address clearly specifying the total number of bits required for host I_D and network I_D for each class. **(06 Marks)**

c. Convert following IP addresses into dotted-decimal notation and also mention for which class the IP address belongs to,

(i) 01011110 10110000 01110101 00010101
(ii) 10001001 10001110 11010000 00110001
(iii) 01010111 10000100 00110111 00001111
(iv) 01110111 11110011 10000111 11011101 **(04 Marks)**

d. What is Network Address Translation (NAT)? Explain how NAT helps in address translation with a neat diagram. **(06 Marks)**

OR

6 a. With a neat diagram, explain datagram approach and virtual circuit approach of packet switching network. **(08 Marks)**

b. Explain various fields of IPV_4 datagram with a neat diagram. **(08 Marks)**

c. Identify the classes for which the following IP addresses belong to and also represent them in binary notation.

(i) 110.11.5.88
(ii) 12.74.16.18
(iii) 201.24.44.32
(iv) 245.34.2.8 **(04 Marks)**

Module-4

7 a. Explain connection lens and connection-oriented service showing movements of packets using timeline. **(10 Marks)**

b. Explain why the size of send window in Go-Back-N must be less than 2^n. **(06 Marks)**

c. Explain various fields of UDP header diagram. **(04 Marks)**

OR

8 a. With relevant diagrams, explain working principle Go-Back-N ARQ flow control protocol. **(10 Marks)**

b. List and explain various services provided by User Datagram Protocol (UDP). **(05 Marks)**

c. Explain the flow control and Error Control Services of transport layer in brief. **(05 Marks)**

Module-5

9 a. Explain request and response message formats of HTTP with a neat diagram. **(10 Marks)**

b. List and explain actions carried out by HTTP methods. **(04 Marks)**

c. What is File Transfer Protocol (FTP)? Explain components of client and server of FTP model with a neat diagram. **(06 Marks)**

OR

10 a. Write a neat diagram, showing various components of E-mail architecture and explain steps involved in e-mail communication between sender and receiver. **(10 Marks)**

b. What is Secure Shell (SSH)? Explain various components of Secure Shell. **(06 Marks)**

c. Bring out the key differences between TELNET and SSH. **(04 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | **18EC72**

Seventh Semester B.E. Degree Examination, June/July 2024
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. Define Moore's law. **(02 Marks)**

b. Consider the design of a CMOS compound OR-OR-AND invert gate computing $F = \overline{(A+B)\cdot(C+D)}$.
(i) Sketch a transistor level schematic
(ii) Sketch a stick diagram
(iii) Estimate area from a stick diagram. **(10 Marks)**

c. Derive the transfer characteristics of CMOS Inverter (graphical). **(08 Marks)**

OR

2 a. Explain all the non-ideal effects in MOS transistor. **(10 Marks)**

b. With neat sketches explain the operation of MOSFET and derive the equation for drain current in all the regions. **(10 Marks)**

Module-2

3 a. Explain VLSI design flow. **(10 Marks)**

b. What is scaling? What are types of scaling and write scaling factors for device parameters? **(10 Marks)**

OR

4 a. Draw the schematic and layout of two input NAND gate. **(06 Marks)**

b. Explain layout design rules for well, transistor rule and metal rules. **(08 Marks)**

c. Define terms: (i) Metallization (ii) Passivation (iii) Metrology **(06 Marks)**

Module-3

5 a. Explain Elmore delay model. **(03 Marks)**

b. Define logical effort. Write the logical efforts of common gates. **(10 Marks)**

c. Estimate the delay of the Fanout - of - 4 (FO4) inverter shown in Fig.Q5(c). Assume the inverter is constructed in a 180 nm process with $\tau = 15$ ps.

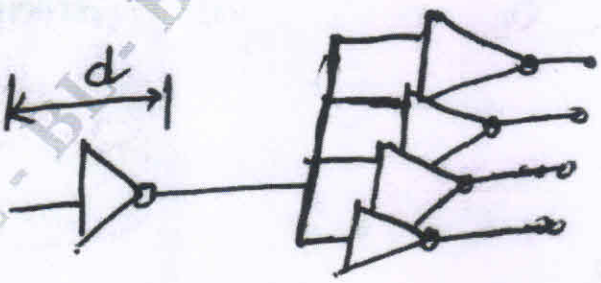

Fig.Q5(c) **(07 Marks)**

OR

6 a. What is Ratioed logic? Explain following ratioed logic circuits:
(i) Pseudo nMOS
(ii) Ganged CMOS
(iii) Source follower pull-up logic **(12 Marks)**

b. Explain Cascade Voltage Switch Logic (CVSL). Realize the input AND/NAND using CVSL. **(08 Marks)**

Module-4

7 a. Explain the general structure of ratioed synchronous dynamic circuits. **(05 Marks)**

b. With necessary circuit diagram, explain dynamic shift register (ratioless) with enhancement load. **(08 Marks)**

c. What are the advantages of dynamic CMOS logic and explain the working of dynamic CMOS inverter. **(07 Marks)**

OR

8 a. Write the basic building block of a CMOS transmission gate dynamic shift register. **(04 Marks)**

b. With generalized circuit diagram, explain domino CMOS logic and using the same realize the following Boolean function: $Z = AB + (C + D)(E + F) + GH$ **(11 Marks)**

c. With necessary diagram, explain a D flipflop with two phase non-overlapping clocks. **(05 Marks)**

Module-5

9 a. With neat circuit diagram, explain full CMOS SRAM cell. **(08 Marks)**

b. Draw the circuit of 3-bit BIST register and explain. **(06 Marks)**

c. Explain the terms: (i) Observability (ii) Fault coverage (iii) Controllability **(06 Marks)**

OR

10 a. With necessary circuit diagram, explain the operation of three transistor DRAM cell. **(08 Marks)**

b. What is a fault model? Explain stuck-at model with examples. **(07 Marks)**

c. Explain the logic verification principles. **(05 Marks)**

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CBCS SCHEME

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18EC751

Seventh Semester B.E. Degree Examination, June/July 2024
Communication Theory

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List the Electromagnetic frequency spectrum and its applications, advantages of radio waves. **(08 Marks)**

b. Discuss primary communication Resources. **(10 Marks)**

c. Convert +36dBm of power level to absolute power to be expressed in watts (without using the conversion formula). **(02 Marks)**

OR

2 a. Discuss the element of Digital communication system with neat block diagram. List the advantages of digital communication system. **(10 Marks)**

b. What is modulation and explain the need of modulation. **(10 Marks)**

Module-2

3 a. Discuss the classification and source of noise. **(10 Marks)**

b. Explain the principle of amplitude modulation and AM power distribution. **(10 Marks)**

OR

4 a. A modulating signal with the instantaneous value of 150mV modulates the frequency of a carrier signal, f_c = 100MHz, k_f = 30 kH_3/V. Find the output signal frequency of the resultant FM wave. **(02 Marks)**

b. Discuss Low-level and High level AM transmitter with its block diagram. **(10 Marks)**

c. With a neat block diagram, explain AM super Heterodyne Receiver. **(08 Marks)**

Module-3

5 a. Compare Digital and Analog Transmission Systems. **(06 Marks)**

b. Consider an analog information signal $s(t) = 3\cos(50\pi t) + 10\sin(300\pi t) - \cos(100\pi t)$. Find

i) Highest frequency component present in the signal

ii) Nyquist rate

iii) Recommended sampling frequency **(04 Marks)**

c. Discuss the process of uniform Quantization. **(10 Marks)**

OR

6 a. Compare PMA, PWM and PPM. **(10 Marks)**

b. Discuss the Block diagram of a single channel simplex PCM system. **(10 Marks)**

Module-4

7 a. Discuss ASK modulator and coherent Demodulator. **(10 Marks)**

b. Explain Shannon's source coding theorem. **(05 Marks)**

c. Consider there are four message generated by a source having their respective probabilities of occurrence as 1/2, 1/4, 1/8, 1/8. Assuming noiseless channel, compute the coding efficiency if a binary code is applied for coding the message. **(05 Marks)**

OR

8 a. Discuss QPSK modulator and coherent QPSK demodulator. **(10 Marks)**

b. List and explain Four Basic types of Redundancy checks in Error detection techniques. **(10 Marks)**

Module-5

9 a. Discuss the advantage ad disadvantages of wireless communication. **(10 Marks)**

b. List the key features of the IMT – 2000 system defining the ITU's view of 3G cellular network capacities. **(10 Marks)**

OR

10 a. Explain frequency Reuse concept of cellular communication. **(10 Marks)**

b. i) Assume a cellular system of 32 cells with a cell radius of 1.6km, a total spectrum allocation that supports 336 traffic channels, and reuse pattern of 7. Calculate the total service area covered with the this configuration, the number of channel per cell and a total system capacity. Assume regular hexagonal cellular topology.

ii) Let the cell size be reduced to the extent that the same area as covered in part (i) with 128 cells. Find the radius of the new cell, and new system capacity.

Comment on the results obtained. **(10 Marks)**

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CBCS SCHEME

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18EC733

Seventh Semester B.E. Degree Examination, June/July 2024
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. With the help of a neat figure, explain the main elements of the human eye. **(10 Marks)**

b. Consider the image segment shown in Fig.Q1(b). Let V = {1, 2, 3, 4}, compute the lengths of the shortest 4, 8 and m-path between p and q. If a particular path does not exist between the two points, explain why.

(p)	4	1	2	6	8	3	5
	8	6	5	1	4	6	3
	4	6	5	2	5	8	7
	2	3	4	8	3	7	2
	4	5	3	2	3	8	7
	2	2	5	4	3	2	1 (q)

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

OR

2 a. Explain D_m distance with example. **(08 Marks)**

b. What is image sampling and quantization? What are the different parameters which will decide the number of storage bits of the image in the discrete domain? **(12 Marks)**

Module-2

3 a. Write a short note on unsharp masking and high boost filtering. **(08 Marks)**

b. Perform histogram equalization for the 8-level 64 × 64 image. The histogram of which is given as:

r	0	1	2	3	4	5	6	7
n_r	790	1023	850	656	329	245	122	81

(12 Marks)

OR

4 a. Explain some basic gray level transformation used for image enhancement. **(10 Marks)**

b. Explain image sharpening in spatial domain using second order Laplacian derivative. **(10 Marks)**

Module-3

5 a. Briefly explain any four properties of 2D-DFT. **(08 Marks)**

b. List and explain any three high pass filters in frequency domain and comment on ringing effect. **(12 Marks)**

OR

6 a. Briefly explain ideal lowpass filtering in frequency domain. **(08 Marks)**

b. Explain homomorphic filtering in image processing with neat block diagram. **(12 Marks)**

Module-4

7 a. Comment on various methods used in estimation of degradation model. **(10 Marks)**

b. Write a short note on inverse filtering and its drawbacks. **(10 Marks)**

OR

8 a. With neat block diagram explain image degradation and restoration model. **(10 Marks)**

b. Explain the need for adaptive median filters and its working. **(10 Marks)**

Module-5

9 a. With necessary diagram explain the RGB and CMY colour models. **(08 Marks)**

b. Explain and illustrate Erosion and dilation operations used in morphological image processing. **(12 Marks)**

OR

10 a. Explain with necessary diagram the HSI colour model. **(08 Marks)**

b. Explain and illustrate opening and closing operations used in morphological image processing. **(12 Marks)**

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18 VIII sem. EC

CBCS SCHEME

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

18EC81

Eighth Semester B.E. Degree Examination, June/July 2024
Wireless and Cellular Communication

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain path loss modal for free space propagation. **(06 Marks)**
b. Explain briefly three basic propagation mechanisms. **(06 Marks)**
c. If a transmitter produces 50 W of power, express the transmit power in units of (i) dBm (ii) dBW. If 50 W is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBm at a free space distance of 100 m from the antenna what is P_r(10 km)? Assume unity gain for the receiver antenna? **(08 Marks)**

OR

2 a. Distinguish between delay spread and coherence bandwidth. **(06 Marks)**
b. Distinguish between Doppler spread and coherence time. **(06 Marks)**
c. Explain the analysis of cellular systems. **(08 Marks)**

Module-2

3 a. Describe GSM protocols and signaling model with a neat diagram. **(10 Marks)**
b. Explain the various logical channels used in GSM. **(10 Marks)**

OR

4 a. List out the ten operations in call set up in GSM system. Explain in detail authentication and ciphering mode operation. **(10 Marks)**
b. Explain the intra BSC hand over operation in GSM. **(10 Marks)**

Module-3

5 a. Explain frequency planning issues for intersystems in CDMA. **(08 Marks)**
b. Explain the network nodes found in CDMA 2000 wireless system. **(12 Marks)**

OR

6 a. Explain basic spectrum spreading operation in CDMA. **(10 Marks)**
b. Explain the generation of the pilot channel signal. **(10 Marks)**

Module-4

7 a. List the advantages of OFDM leading to its selection for LTE and explain. **(10 Marks)**
b. With a neat block diagram, explain LTE network architecture and describe briefly the new elements provided in it. **(10 Marks)**

OR

8 a. With the help of neat diagrams, explain how the timing and frequency synchronization is performed by the receiver to demodulate an OFDM signal. **(12 Marks)**
b. What is PAR problem? Explain the methods used for PAR reduction. **(08 Marks)**

Module-5

9 a. Explain basic design principles followed in LTE specifications. **(10 Marks)**
b. Explain downlink OFDMA radio resources. **(10 Marks)**

OR

10 a. Explain uplink SC-FDMA radio resources. **(10 Marks)**
b. Explain the layers of LTE radio interface protocol. **(10 Marks)**

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18 VIII sem. EC

CBCS SCHEME

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18EC81

Eighth Semester B.E. Degree Examination, June/July 2024
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 path loss modal for free space propagation. **(06 Marks)**

b. Explain briefly three basic propagation mechanisms. **(06 Marks)**

c. If a transmitter produces 50 W of power, express the transmit power in units of (i) dBm (ii) dBW. If 50 W is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBm at a free space distance of 100 m from the antenna what is P_r(10 km)? Assume unity gain for the receiver antenna? **(08 Marks)**

OR

2 a. Distinguish between delay spread and coherence bandwidth. **(06 Marks)**

b. Distinguish between Doppler spread and coherence time. **(06 Marks)**

c. Explain the analysis of cellular systems. **(08 Marks)**

Module-2

3 a. Describe GSM protocols and signaling model with a neat diagram. **(10 Marks)**

b. Explain the various logical channels used in GSM. **(10 Marks)**

OR

4 a. List out the ten operations in call set up in GSM system. Explain in detail authentication and ciphering mode operation. **(10 Marks)**

b. Explain the intra BSC hand over operation in GSM. **(10 Marks)**

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5 a. Explain frequency planning issues for intersystems in CDMA. **(08 Marks)**

b. Explain the network nodes found in CDMA 2000 wireless system. **(12 Marks)**

OR

6 a. Explain basic spectrum spreading operation in CDMA. **(10 Marks)**

b. Explain the generation of the pilot channel signal. **(10 Marks)**

Module-4

7 a. List the advantages of OFDM leading to its selection for LTE and explain. **(10 Marks)**

b. With a neat block diagram, explain LTE network architecture and describe briefly the new elements provided in it. **(10 Marks)**

OR

8 a. With the help of neat diagrams, explain how the timing and frequency synchronization is performed by the receiver to demodulate an OFDM signal. **(12 Marks)**

b. What is PAR problem? Explain the methods used for PAR reduction. **(08 Marks)**

Module-5

9 a. Explain basic design principles followed in LTE specifications. **(10 Marks)**

b. Explain downlink OFDMA radio resources. **(10 Marks)**

OR

10 a. Explain uplink SC-FDMA radio resources. **(10 Marks)**

b. Explain the layers of LTE radio interface protocol. **(10 Marks)**

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CBCS SCHEME

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

18EC822

Eighth Semester B.E. Degree Examination, June/July 2024
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. With the help of neat diagram, explain MEMS as a microsensor and as microactuator. **(10 Marks)**

b. Differentiate between Microsystems and micro-electronics. **(10 Marks)**

OR

2 a. Explain with a neat diagram about multi-disciplinary nature of micro-systems. **(10 Marks)**

b. Explain different applications of micro-systems. **(10 Marks)**

Module-2

3 a. With neat block diagram, explain working principle of chemical sensors. **(10 Marks)**

b. Explain working principle of i) Biomedical sensor ii) Biosensors **(10 Marks)**

OR

4 a. Explain different types of microactuations used in microsystems. **(10 Marks)**

b. With mathematical model, explain Fick's law and diffusion process. **(10 Marks)**

Module-3

5 a. Explain the concept of rectangular plate. Write mathematical expression for bending moment and bending stress. **(04 Marks)**

b. A circular diaphragm used as micropressure sensor has a diameter of 600μm and its edge is rigidly fixed to silicon die. The diaphragm is designed to withstand a pressure of 20MPa without exceeding the plastic yielding strength of 7000MPa. Determine the minimum thickness of diaphragm assuming Young's modulus as 190,000MPa and Poisson's ratio of 0.25. **(06 Marks)**

c. Explain overview of finite element stress analysis. **(10 Marks)**

OR

6 a. Explain the concept of thin-film mechanics. **(04 Marks)**

b. A square silicon diaphragm with 532μm edge length is subjected to pressure loading of 20Mpa. The diaphragm has thickness of 13.88μm. Calculate maximum stress and the deflection of the diaphragm under applied pressure. Take Young's modulus as 190,000MPa and Poisson's ratio of 0.25. **(06 Marks)**

c. Explain the concept of thermo-mechanics. **(10 Marks)**

Module-4

7 a. Derive the expression for scaling in acceleration a, time t, and power density P/V of a system in motion using Trimmer force scaling vector. **(08 Marks)**

b. Explain scaling in Electromagnetic force. **(08 Marks)**

c. Explain scaling in heat convection. **(04 Marks)**

OR

8 a. Estimate the associated changes in acceleration a, time t, and power supply to actuate a MEMS component if its area is reduced by a factor of 10. **(08 Marks)**

b. Discuss the effect of scaling in fluid mechanics. **(08 Marks)**

c. Explain scaling in Electricity. **(04 Marks)**

Module-5

9 a. Give comparison of Wet and dry etching process used in Bulk micro-manufacturing. **(10 Marks)**

b. Summarize the micro-manufacturing. **(10 Marks)**

OR

10 a. Explain plasma etching and DRIE process. **(10 Marks)**

b. Explain LIGA process used in micro-manufacturing. **(10 Marks)**

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18 III sem EC

CBCS SCHEME

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

18EC32

Third Semester B.E. Degree Examination, June/July 2024
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. Derive the expression for,
(i) Δ to Y transformation
(ii) Y to Δ transformation **(10 Marks)**

b. Determine the equivalent resistance between A and B of the network shown in Fig. Q1 (b). **(10 Marks)**

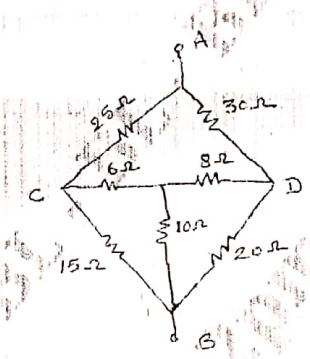

Fig. Q1 (b)

OR

2 a. Determine the current i_2 and voltage v_1 for the circuit shown in Fig. Q2 (a). **(10 Marks)**

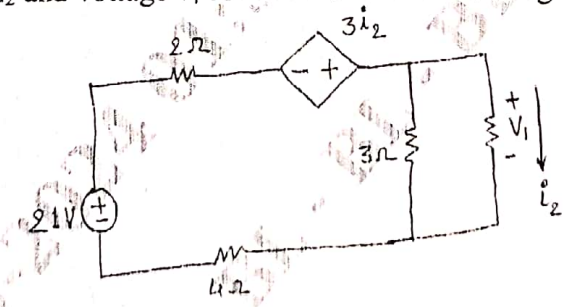

Fig. Q2 (a)

b. Determine the value of V_2, such that current through 4 Ω resistor is zero, using mesh current analysis method for the network shown in Fig.Q2 (b). **(10 Marks)**

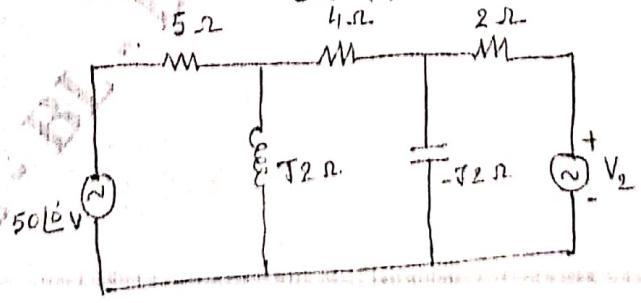

Fig. Q2 (b)

Module-2

3 a. State Super position theorem. Using superposition theorem, find the voltage V_1 across 3Ω resistor for the Network shown in Fig. Q3 (a). **(10 Marks)**

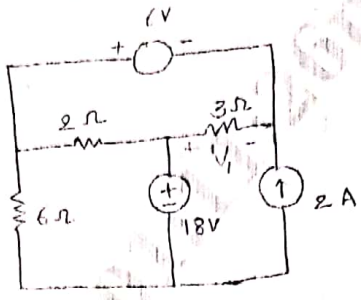

Fig. Q3 (a)

b. Evaluate the current through the load resistor R_L for the circuit shown in Fig. Q3 (b) using Millman's Theorem. **(10 Marks)**

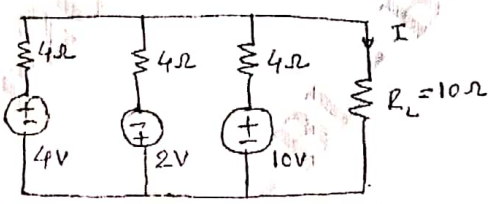

Fig. Q3 (b)

OR

4 a. Explain the procedure to find Norton's equivalent resistance in a network which has both dependent and independent sources with an example. **(06 Marks)**

b. Find the value of Z_L for which maximum power transfer occurs in the circuit shown in Fig. Q4 (b). **(04 Marks)**

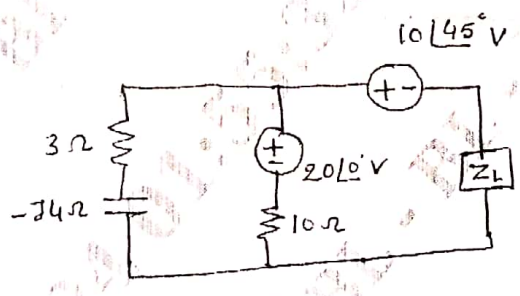

Fig.Q4 (b)

c. Determine the current flowing through the 6 Ω resistor for the circuit shown in Fig. Q4 (c) using Thevenin's theorem. **(10 Marks)**

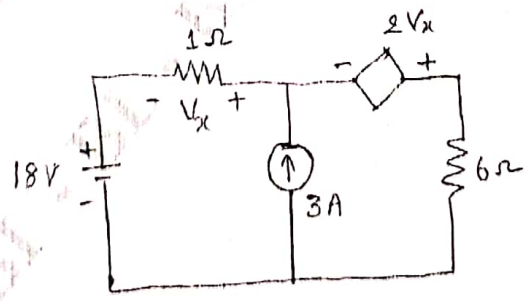

Fig. Q4 (c)

Module-3

5 a. Explain the transient behavior of R, L and C. Also explain the procedure for evaluating transient behavior. **(10 Marks)**

b. In the circuit shown in Fig. Q5 (b) the switch 'S' is moved from a to b at t = 0. Evaluate the values of i, $\frac{di}{dt}$, $\frac{d^2i}{dt^2}$ at $t = 0^+$. If R = 1 Ω, L = 1 H, C = 0.1 μF and V = 100 V. Assume steady state is achieved when K is at 'a'. **(10 Marks)**

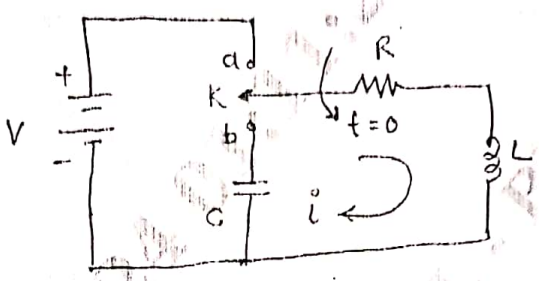

Fig. Q5 (b)

OR

6 a. Evaluate i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$ for the circuit shown in Fig. Q6 (a), when switch K is changed from position 1 to 2 at t = 0, the steady state having been reached before switching. **(10 Marks)**

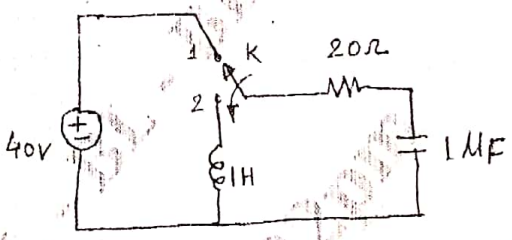

Fig. Q6 (a)

b. Find the values of i_1, i_2, $\frac{di_1}{dt}$, $\frac{di_2}{dt}$, $\frac{d^2i_1}{dt^2}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$ for the circuit shown in Fig. Q6 (b). **(10 Marks)**

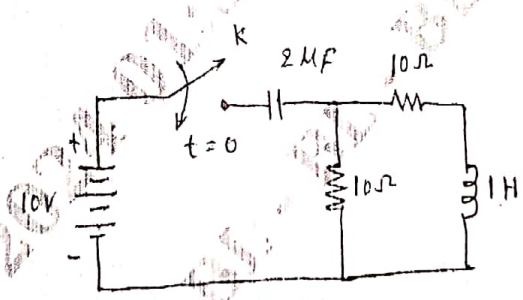

Fig. Q6 (b)

Module-4

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

b. Find the Laplace transform of the periodic waveform shown in Fig. Q7 (b). **(10 Marks)**

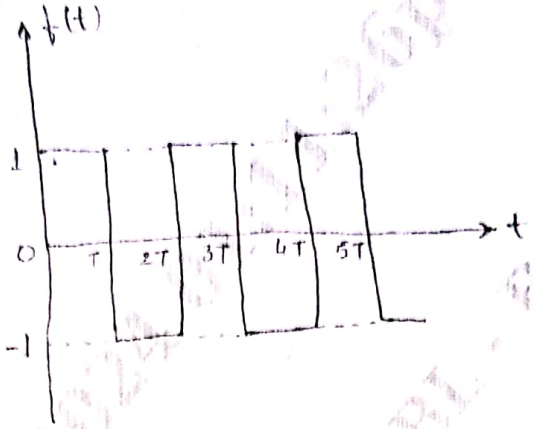

Fig. Q7 (b)

OR

8 a. Deduce the Laplace transform of the following :

(i) $\sin^2 t$

(ii) $\cos^2 t$

(iii) $\sin \omega t$ **(10 Marks)**

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

Module-5

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

b. Determine the transmission parameters for the network shown in Fig. Q9 (b).

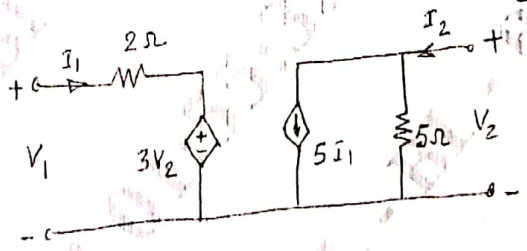

Fig. Q9 (b) **(10 Marks)**

OR

10 a. Define the followings :

(i) Resonance

(ii) Q-factor

(iii) Band width

(iv) Selectivity. **(08 Marks)**

b. Prove that the resonating frequency in a R-L-C series circuit is geometrical mean of half power frequencies is $f_0 = \sqrt{f_1 f_2}$. **(12 Marks)**

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CBCS SCHEME

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18EC33

Third Semester B.E. Degree Examination, June/July 2024
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. With neat diagrams, explain the different types of bonding forces in solids. **(06 Marks)**

b. Write explanatory notes on Intrinsic material with respect to electron hole pairs creation, generation rate and recombination rate. **(06 Marks)**

c. With a neat diagram, explain Hall effect and Hall voltage with necessary equations. Explain how Hall effect can be used to detect whether a given unknown sample of semi-conductor is p-type of n-type. **(08 Marks)**

OR

2 a. Explain the energy band structure of solids for insulator, semi-conductor and metal with neat diagram. **(04 Marks)**

b. With neat energy band diagrams and chemical bond model of dopants, explain the formation of n-type and p-type semi-conductors. **(08 Marks)**

c. Derive the expression for drift velocity of electrons with applied electric field. **(08 Marks)**

Module-2

3 a. With neat diagram, explain the effect of Forward bias of a p-n junction, with respect to transition width, electric field, electrostatic potential barrier, energy band diagram and particle flow and current direction within transition region 'W', **(08 Marks)**

b. Explain Zener Breakdown with neat energy band diagram. Explain the significance of impact ionization in Avalanche Breakdown with neat diagrams. Derive the expression for Electron multiplication factor M_n. **(08 Marks)**

c. Draw the Piecewise-Linear approximations of a junction diode and explain how a diode can be used as rectifier. **(04 Marks)**

OR

4 a. What are Photodiodes? Explain the significance of current in an illuminated junction and derive the equation for photodiode current and open circuit voltage V_{OC}. **(09 Marks)**

b. What are the necessary requirements to utilize maximum amount of optical energy to design a solar cell, with neat diagrams. **(05 Marks)**

c. Explain the principle of operation of Light Emitting Diode (LED) with necessary biasing and requirement of energy band gap energy. **(06 Marks)**

Module-3

5 a. With neat diagrams of normal biasing and I-V characteristics, explain the working of a p-n-p transistor. **(06 Marks)**

b. Derive the expression for 'α' and 'β' of a transistor in terms of base transport factor 'B' and emitter injection efficiency 'γ'. **(06 Marks)**

c. Starting from the current component of emitter current I_{EN} collects current I_{CN} in normal mode and I_{EI} and I_{CI} in inverted mode with hole concentrations Δ_{PE} and Δ_{PC}, derive the Ebers Moll equations. **(08 Marks)**

OR

6 a. With a neat equivalent circuit diagram, explain the coupled-diode property of Ebers Moll equations. **(08 Marks)**

b. With a neat switching circuit of BJT in common-emitter configuration, explain the switching operation. **(08 Marks)**

c. With a neat waveform of collector current during transient define the terms delay time (t_d), rise time (t_r) and fall time t_f. **(04 Marks)**

Module-4

7 a. With neat cross sectional diagrams, I-V characteristics and zero gate voltage, explain the effect of drain voltage on drain current. **(06 Marks)**

b. With a neat diagram, explain the small signal equivalent circuit of JFET, Arriving at ideal small-signal equivalent circuit derive the expression for the drain current I_{ds}. **(08 Marks)**

c. What are the two frequency limitation factors in a JFET? With small signal equivalent circuit with capacitance, derive the expression for cutoff frequency f_T. **(06 Marks)**

OR

8 a. With a cross section diagrams and circuit symbols, explain the operation of
   i) a n-channel enhancement mode MOSFET
   ii) a-n-channel depletion mode MOSFET. **(06 Marks)**

b. Explain the energy band diagrams of the MOS capacitor with a n-type substrate for various Gate biases. **(06 Marks)**

c. With neat cross section diagram and I_D versus V_{DS} curve when $V_{GS} > V_T$, explain the operation of the MOS structure for :
   i) a small V_{DS} ii) a larger V_{DS} iii) $V_{DS} = V_{DS(sat)}$ iv) $V_{DS} > V_{DS(sat)}$. **(08 Marks)**

Module-5

9 a. With a neat Schematic diagram, explain Rapid Thermal Processing. **(06 Marks)**

b. Explain about Ion implantation with a neat Schematic diagram. **(08 Marks)**

c. With a neat diagram, explain Low Chemical Vapor Deposition (LPCVD). **(06 Marks)**

OR

10 a. Discuss the advantages of Integration of circuits. **(08 Marks)**

b. With a neat diagram of simplified description to steps describe the fabrication of p-n diodes on a wafer. **(08 Marks)**

c. Describe the types of Integrated circuits. **(04 Marks)**

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18EC34

Third Semester B.E. Degree Examination, June/July 2024
Digital System Design

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Design a combinational logic circuit so that an output is generated indicating when a majority of four inputs is true. **(06 Marks)**

b. Place the following equations into the proper canonical form
i) $f(w, x, y, z) = \overline{w}x + y\overline{z}$ ii) $f(A, B, C, D) = A + \overline{B} + C)(\overline{A} + D)$ **(06 Marks)**

c. Using K-map determine minimal sum of product expressions and implement the simplified equation using only NAND gates $f(w, x, y, z) = \Sigma m(1, 2, 3, 4, 9) + \Sigma d(10, 11, 12, 13, 14, 15)$ **(08 Marks)**

OR

2 a. Define the following terms literal, canonical sum of products, Karnaugh Map, Prime implicatns. **(04 Marks)**

b. Find the minimal sum of the following Boolean function using Quine McClusky method $f(w, x, y, z) = \Sigma(1, 3, 13, 15) + \Sigma d(8, 9, 10, 11)$ **(08 Marks)**

c. Using K-map determine minimal product of sum expression and implement the simplified equation using only NOR gates $f(a, b, c, d) = \pi M(0, 4, 5, 7, 8, 9, 11, 12, 13, 15)$. **(08 Marks)**

Module-2

3 a. Implement following multiple output function using 74LS138 decoder
$F_1(A, B, C) = \Sigma m(1, 4, 5, 7)$
$F_2(A, B, C) = \pi m(2, 3, 6, 7)$ **(06 Marks)**

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

c. Implement $f(a, b, c, d) = \Sigma m(0, 1, 5, 6, 7, 9, 10, 15)$ using 8 : 1 MUX with a, b, c as select lines **(04 Marks)**

OR

4 a. Implement full adder using 74138 decoder. **(06 Marks)**

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

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

Module-3

5 a. What is race around condition? Explain JK master slave flip-flop with diagram function table and timing diagram. **(08 Marks)**

b. Explain the working of 4-bit Johnson counter using necessary diagram and waveform. **(06 Marks)**

c. Explain with a neat diagram and truth table, a 4-bit SIPO shift register to store binary number 1010. **(06 Marks)**

OR

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

b. Explain the working of 3-bit Asynchronous up-down counter with necessary waveform and truth table. **(10 Marks)**

c. Write the difference between combinational circuits and sequential circuits. **(04 Marks)**

Module-4

7 a. Design a synchronous Mod -6 counter using clocked D- Flip-Flop. **(10 Marks)**

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

OR

8 a. Construct the excitation table, transition table and state diagram for the sequential circuit shown in Fig Q8(a).

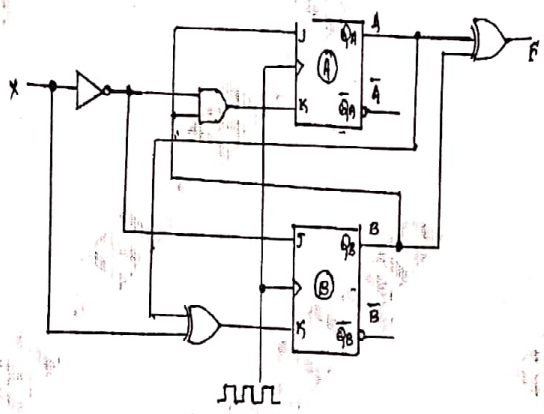

Fig Q8(a) **(10 Marks)**

b. Design a synchronous decade counter using T-flip flop and draw the logic diagram. **(10 Marks)**

Module-5

9 a. List the guidelines for construction of state graphs. **(10 Marks)**

b. Design a sequential circuit to convert BCD to excess – 3 code with state table state graph and transition table. **(10 Marks)**

OR

10 a. Explain with block diagram design of serial Adder with accumulator. **(10 Marks)**

b. Explain with block diagram design of Binary multiplier. **(10 Marks)**

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18EC35

Third Semester B.E. Degree Examination, June/July 2024
Computer Organization and Architecture

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain the operation of a computer with neat block diagram. **(10 Marks)**
b. Explain system software functions in detail. **(05 Marks)**
c. Explain bus structures. **(05 Marks)**

OR

2 a. Define byte addressability, Big-endian and Little-endian assignment **(06 Marks)**
b. Explain following registers :
i) PC ii) IR iii) MAR. **(06 Marks)**
c. Explain basic performance equation. **(08 Marks)**

Module-2

3 a. List and explain the generic addressing modes with assembler syntax and addressing function. **(10 Marks)**
b. What are assembler directives? Explain any five assembler directives. **(10 Marks)**

OR

4 a. Explain stack concepts with diagram. **(08 Marks)**
b. Explain shift and rotate operations with examples. **(06 Marks)**
c. List the steps involved in 'CALL' and 'RETURN' instructions. **(06 Marks)**

Module-3

5 a. Explain memory mapped I/O access. **(10 Marks)**
b. What is an interrupt? With an example explain the concept of interrupt. **(10 Marks)**

OR

6 a. Explain Daisy chain method used for handling simultaneous interrupt request. **(08 Marks)**
b. Explain the use of DMA controller in computer system. **(06 Marks)**
c. Explain the concept of vectored interrupt. **(06 Marks)**

Module-4

7 a. Explain the internal organization of 2M × 8 dynamic memory chip. **(10 Marks)**
b. Explain virtual memory organization. **(10 Marks)**

OR

8	a.	Explain secondary storage device.	(08 Marks)
	b.	Explain cache memory and its relevant terms.	(06 Marks)
	c.	Explain different types of non volatile memory.	(06 Marks)

Module-5

9	a.	Discuss the single bus organization of data path inside a processor.	(10 Marks)
	b.	Draw and explain multiple bus organization of CPU.	(10 Marks)

OR

10	a.	Explain block diagram of a complete processor.	(08 Marks)
	b.	Explain micro programmed control concept.	(06 Marks)
	c.	Discuss the organization of hardwired controlled unit.	(06 Marks)

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18EC36

Third Semester B.E. Degree Examination, June/July 2024
Power Electronics and Instrumentation

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain the V.I. characteristics of SCR by clearly indicating different states on characteristic. Also explain different modes of operation. **(10 Marks)**

b. Explain the UJT Relaxation oscillator circuit working with circuit diagram and waveforms. **(10 Marks)**

OR

2 a. Explain class A – self commutation by resonating the load with proper circuit and waveforms. **(10 Marks)**

b. What are the gate triggering schemes? Explain the operation of resistor-capacitor firing circuit with appropriate waveforms. **(10 Marks)**

Module-2

3 a. Explain the effect of freewheeling diode with a neat circuit diagram and waveform for single phase half wave controlled rectifier with RL load. **(10 Marks)**

b. Explain the principle of step up chopper with a neat circuit diagram and waveforms. Also derive the expression for output voltage. **(10 Marks)**

OR

4 a. If the half wave controlled rectifier has a purely resistive load R and the delay angle is $\alpha = \frac{\pi}{3}$. Identify: (i) Rectification efficiency (ii) Form factor (iii) Ripple factor (iv) TUF (v) PIV **(10 Marks)**

b. Explain the principle of step up / down chopper with a neat circuit diagram and waveforms. Also derive the expressions for output voltage. **(10 Marks)**

Module-3

5 a. Explain the working of single phase half bridge inverter connected to RL load with the help of necessary circuit diagram and waveforms. **(10 Marks)**

b. Explain the working of continuous mode fly back converter with necessary circuit diagram and waveform. **(10 Marks)**

OR

6 a. Define the following terms as applied to an electronic instrument:
(i) Instrument (ii) Measurement (iii) Accuracy (iv) Resolution
(v) Precision (vi) Expected value (vii) Error (viii) Sensitivity **(10 Marks)**

b. Sketch and explain the operation of a multirange voltmeter. **(10 Marks)**

Module-4

7 a. Discuss the operation of dual slope integrating type DVM with the help of block diagram. **(10 Marks)**

b. Explain the operation of the Wein's bridge with a neat circuit diagram. Derive the expression for the frequency. **(10 Marks)**

OR

8 a. Explain the operation of a function generator with the help of block diagram. **(10 Marks)**

b. With the aid of diagram, explain the working of balanced wheat stone bridge and derive for a galvanometer current expression. **(10 Marks)**

Module-5

9 a. Explain the construction, working principle and operation of LVDT. Show the characteristics curve. **(10 Marks)**

b. Explain the construction of temperature indicators using thermistor. **(10 Marks)**

OR

10 a. Explain the construction and working of instrumentation amplifier using transducer bridge. **(10 Marks)**

b. Explain the structure and operation of programmable logic controller. **(10 Marks)**

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CBCS SCHEME

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18MATDIP31

Third Semester B.E. Degree Examination, June/July 2024
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. Show that $(1+\cos\theta+i\sin\theta)^n+(1+\cos\theta-i\sin\theta)^n = 2^{n+1}\cos^n\left(\frac{\theta}{2}\right)\cdot\cos\left(\frac{n\theta}{2}\right)$ **(07 Marks)**

b. Express $\sqrt{3}+i$ in the polar form and hence find its modulus and amplitude. **(07 Marks)**

c. Find the argument of $\frac{1+i\sqrt{3}}{1-i\sqrt{3}}$ **(06 Marks)**

OR

2 a. If $\vec{A}=i+2j+3k$, $\vec{B}=-i+2j+k$ and $\vec{C}=3i+j$, find P such that $\vec{A}+P\vec{B}$ is perpendicular to $\vec{C}$. **(07 Marks)**

b. Find the area of the parallelogram whose adjacent sides are the vectors $\vec{A}=2i+4j-5k$ and $\vec{B}=i+2j+3k$. **(06 Marks)**

c. If $\vec{A}=4i+3j+k$ and $\vec{B}=2i-j+2k$, find a unit vector N form a right handed system. **(07 Marks)**

Module-2

3 a. Obtain the Maclaurin's series expansion of $\sin x$ up to term containing x^4. **(07 Marks)**

b. If $U=\sin^{-1}\left[\frac{x^2+y^2}{x-y}\right]$, prove that $x\frac{\partial U}{\partial x}+y\frac{\partial U}{\partial y}=\tan U$. **(07 Marks)**

c. If $U=f(x-y, y-z, z-x)$ prove that $\frac{\partial U}{\partial x}+\frac{\partial U}{\partial y}+\frac{\partial U}{\partial z}=0$. **(06 Marks)**

OR

4 a. Prove that $\log(1+x)=x-\frac{x^2}{2}+\frac{x^3}{3}-\frac{x^4}{4}+\ldots\ldots$ by using Maclaurin's series notation. **(07 Marks)**

b. Using Euler's theorem prove that

$$x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=4u\log u, \text{ if } u=e^{\left(\frac{x^3y^3}{x^2+y^2}\right)}$$ **(07 Marks)**

c. If $u=x+y$, $v=y+z$ and $w=z+x$ then find $J\left(\frac{u,v,w}{x,y,z}\right)$. **(06 Marks)**

Module-3

5 a. A particle moves along a curve $x = e^{-t}$, $y = 2\cos 3t$ and $z = 2\sin 3t$, where t is the time variable. Determine the components of velocity and acceleration vectors at $t = 0$ in the direction of $i + j + k$. **(07 Marks)**

b. Find the unit normal to the surface $x^2y + 2xz = 4$ at $(2, -2, 3)$. **(06 Marks)**

c. Show that the vector field $\vec{F} = (4xy - z^3)i + (2x^2)j - (3xz^2)k$ is irrotational. **(07 Marks)**

OR

6 a. Find $\text{div}\,\vec{F}$ and $\text{curl}\,\vec{F}$ where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$. **(07 Marks)**

b. If $\vec{F} = (3x^2y - z)i + (xz^3 + y^4)j - 2x^3z^2k$, find $\text{grad}(\text{div}\,\vec{F})$ at $(2, -1, 0)$. **(07 Marks)**

c. Find the value 'a' such that the vector field $\vec{F} = (x + 3y)i + (y - 2z)j + (x + az)k$ is Solenoidal. **(06 Marks)**

Module-4

7 a. Obtain the reduction formula for $\int_0^{\pi/2} \cos^n x\,dx$, $n > 0$. **(07 Marks)**

b. Evaluate $\int_0^1 \frac{x^9}{\sqrt{1-x^2}}\,dx$ **(06 Marks)**

c. Evaluate $\iint_C xy(x + y)dxdy$ over the area between $y = x^2$ and $y = x$. **(07 Marks)**

OR

8 a. Obtain the reduction formula for

$$\int_0^{\pi/2} \sin^n x\,dx, \quad n > 0$$ **(07 Marks)**

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

c. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dxdydz}{\sqrt{1-x^2-y^2-z^2}}$ **(07 Marks)**

Module-5

9 a. Solve $(4xy + 3y^2 - x)\,dx + x(x + 2y)\,dy = 0$ **(07 Marks)**

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

c. Obtain the solution of the differential equation

$$(1 + e^{x/y})dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0$$ **(07 Marks)**

OR

10 a. Solve : $\tan y\,dy = (\cos y \cos^2 x - \tan x)dx$ **(07 Marks)**

b. Solve : $\left[y\left(1 + \frac{1}{x}\right) + \cos y\right]dx + (x + \log x - x\sin y)dy = 0$ **(07 Marks)**

c. Solve : $(1 + y^2)dx = (\tan^{-1}y - x)\,dy$ **(06 Marks)**

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CBCS SCHEME

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Third Semester B.E. Degree Examination, June/July 2024

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 of
i) $e^{-t}\cos^2 3t$ ii) $t\cos t$ **(06 Marks)**

b. A periodic function of period $\frac{2\pi}{\omega}$ is defined by

$$f(t)=\begin{cases} E\sin\omega t, & 0\le t\le \frac{\pi}{\omega} \\ 0, & \frac{\pi}{\omega}\le t\le \frac{2\pi}{\omega} \end{cases}$$ where E and ω are constants.

Show that $L\{f(t)\}=\dfrac{E\omega}{(s^2+\omega^2)(1-e^{-\pi s/\omega})}$ **(07 Marks)**

c. Find the Inverse Laplace transform of
i) $\dfrac{2s-1}{s^2+2s+17}$ ii) $\log\left(\dfrac{s^2+1}{s(s+1)}\right)$ **(07 Marks)**

OR

2 a. Express the function f(t) in terms of unit step function and find its Laplace transform, where

$$f(t)=\begin{cases} \cos t, & 0<t\le\pi \\ 1, & \pi<t\le 2\pi \\ \sin t, & t>2\pi \end{cases}$$ **(06 Marks)**

b. Using the convolution theorem, obtain inverse Laplace transform of $\dfrac{s}{(s+1)(s^2+1)}$ **(07 Marks)**

c. Solve the equation $y'' + 5y' + 6y = e^t$ under the condition $y(0)=0$, $y'(0)=0$ **(07 Marks)**

Module-2

3 a. Find the Fourier series of the function $f(x)=x^2$ in $(-\pi, \pi)$. **(08 Marks)**

b. Define half range sine and cosine series in the interval $(0, l)$. **(04 Marks)**

c. Find the constant term and the first two harmonics in the fourier series for f(x) given by the following table.

x	0	π/3	2π/3	π	4π/3	5π/3	2π
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0

(08 Marks)

OR

4 a. Obtain the fourier series of the saw-tooth function

$f(x) = \frac{Ex}{T}$ for $0 < x < T$ given that $f(x + T) = f(x)$ for all $x > 0$. **(06 Marks)**

b. Obtain the Fourier series expansion of

$$f(x) = \begin{cases} \pi x & \text{in } 0 \le x \le 1 \\ \pi(2-x) & \text{in } 1 \le x \le 2 \end{cases}$$ over the interval (0, 2)

Deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots$ **(07 Marks)**

c. Expand $f(x) = \sin x$ in half range cosine series over the interval $(0, \pi)$. **(07 Marks)**

Module-3

5 a. Prove that fourier transform of

$$f(x) = \begin{cases} 1 + \frac{x}{a}, & -a < x < 0 \\ 1 - \frac{x}{a}, & 0 < x < a \\ 0, & \text{otherwise} \end{cases}$$ is $\frac{4\sin^2 \frac{au}{2}}{au^2}$, if Fourier transform of $f(x)$ is $F(u)$. **(06 Marks)**

b. Find the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx$, $m > 0$. **(07 Marks)**

c. Find z-transform of $5n^2 + 4\sin\left(\frac{n\pi}{2} + \frac{\pi}{4}\right)$ **(07 Marks)**

OR

6 a. Find the fourier cosine transform of

$$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2 - x & \text{for } 1 < x < 2 \\ 0 & \text{for } x > 2 \end{cases}$$ **(07 Marks)**

b. Obtain the inverse z-transform of $\frac{4z^2 - 2z}{(z-1)(z-2)^2}$ **(07 Marks)**

c. Solve the difference equation

$u_{n+2} + 3u_{n+1} + 2u_n = 3^n$, given $u_0 = 0$, $u_1 = 1$, using z-transform. **(06 Marks)**

Module-4

7 a. Use Taylor's series method to find the value of y at x = 0.1, given that $dy/dx = x^2 + y^2$, $y(0) = 1$. Consider upto 4th degree term. **(06 Marks)**

b. By using modified Euler's method, solve the initial value problem $\frac{dy}{dx} = \log(x + y)$, $y(1) = 2$ at the point $x = 1.2$. Take $h = 0.2$ and carryout two modifications. **(07 Marks)**

c. Given $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$, $y(0.1) = 1.1169$, $y(0.2) = 1.2773$, $y(0.3) = 1.5049$. Find $y(0.4)$ correct to three decimal places using Milne's predictor – corrector method. Apply corrector formula once. **(07 Marks)**

OR

8 a. Using modified Euler's method compute y(1.1) correct to five decimal places taking h = 0.1, given that $\frac{dy}{dx}+\frac{y}{x}=\frac{1}{x^2}$ and y = 1 at x = 1. **(06 Marks)**

b. Use fourth order Runge-Kutta method to find y at x = 0.1, given that $\frac{dy}{dx}=3e^x+2y$, y(0) = 0 and h = 0.1. **(07 Marks)**

c. Apply Adam's – 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 corrector formula once. **(07 Marks)**

Module-5

9 a. By Runge-Kutta method solve $y'' = xy'^2 - y^2$ for x = 0.2 correct to four decimal places, using initial conditions y = 1 and y′ = 0 when x = 0. Take step length h = 0.2. **(06 Marks)**

b. Derive the Euler's equation in the form $\frac{\partial f}{\partial y}-\frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right)=0$. **(07 Marks)**

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

OR

10 a. Using Runge-Kutta method solve the differential equation at x = 0.1 under the given conditions:

$\frac{d^2y}{dx^2}=x^3\left(y+\frac{dy}{dx}\right)$, y(0) = 1, y′(0) = 0.5. Take step length h = 0.1. **(06 Marks)**

b. 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.

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

Apply corrector formula once. **(07 Marks)**

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

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IV Sem. EC

CBCS SCHEME

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21EC42

Fourth Semester B.E. Degree Examination, June/July 2024
Digital Signal Processing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Prove that the sampling of Fourier transform of a sequence x(n) results in N point DFT. Using which both the sequence and the transform can be reconstructed. **(10 Marks)**

b. Compute the 8 point DFT of the sequence x(n) = {1, 1, 1, 1, 0, 0, 0, 0}. Also write a Matlab code to compute N point DFT of a sequence. **(10 Marks)**

OR

2 a. Compute the circular convolution of the given sequences using DFT and IDFT method $x_1(n) = \{2, \ 3, \ 1, \ 1\}$ and $x_2(n) = \{1, \ 3, \ 5, \ 3\}$. **(10 Marks)**

b. Compute the N point DFT of $x(n) = \begin{cases} \frac{1}{3}; & 0 \le n \le 2 \\ 0; & \text{otherwise} \end{cases}$ **(06 Marks)**

c. If $x(n) = \{1, \ 2, \ 0, \ 3, \ -2, \ 4, \ 7, \ 5\}$. Evaluate i) X(0) ii) X(4) iii) $\sum_{K=0}^{7} X(K)$. **(04 Marks)**

Module-2

3 a. Determine the response of a LTI system with $h(n) = \{1, -1, 2\}$ for an input. $x(n) = \{1, 0, 1, -2, 1, 2, 3, -1, 0, 2\}$ using overlap add method. Use 6 point circular convolution in your approach. **(10 Marks)**

b. Develop the 8 point DIF_FFT algorithm. Mention the property of phase factor exploited. **(10 Marks)**

OR

4 a. Determine 8 point DFT of $x(n) = \{1, 0, -1, 2, 1, 1, 0, 2\}$ using of radix-2 DIT-FFT algorithm. Clearly show all intermediate results. **(10 Marks)**

b. State and prove circular time shift property. Also write the matlab code for the same. **(10 Marks)**

Module-3

5 a. Design a filter with

$$H_d(e^{-jw}) = \begin{cases} e^{-j3w}; & \frac{-\pi}{4} \le w \le \frac{\pi}{4} \\ 0; & \frac{\pi}{4} \le |w| \le \pi \end{cases}$$

Use Hamming window with M = 7. Obtain the system transfer function equation. **(10 Marks)**

b. Consider a FIR filter with system function: $H(z) = 1 + 2.82z^{-1} + 3.4048z^{-2} + 1.74z^{-3}$. Sketch the direct form-I and lattice realization of the filter. **(10 Marks)**

OR

6 a. Write a Matlab code to design a high pass FIR filter, using hanning window. The expected output with necessary calculations to be shown. **(10 Marks)**

b. Mention the two desirable characteristics of window function. Compare Rectangular, Hamming, Hanning and Bartlett window functions. **(06 Marks)**

c. Given $H(z)=(1+0.6z^{-1})^3$. Realize as a cascade of 1st and 2nd order section. **(04 Marks)**

Module-4

7 a. Compare analog and digital filters. **(04 Marks)**

b. Given $H(z)=\dfrac{8z^3-4z^2+11z-2}{\left(z-\frac{1}{4}\right)\left(z^2-z+\frac{1}{2}\right)}$. Realize in DF-I and DF-II. **(06 Marks)**

c. Obtain the expression for order and cut-off frequency of Low Pass Butterworth filter. **(10 Marks)**

OR

8 a. Design a digital low pass filter using BLT method to satisfy the following characteristics:
i) Monotonic stopband and pass band
ii) -3db cut off frequency of 0.5π rad
iii) Magnitude down atleast 15dB at 0.75π rad. **(10 Marks)**

b. Mention two conditions of transforming the filter from s plane to z plane. Explain how is it achieved in bilinear transformation with mapping diagram. **(06 Marks)**

c. Write a matlab code to design an analog LP Butterworth filter. **(04 Marks)**

Module-5

9 a. Explain :
i) General Microprocessor based on Von Neumann architecture
ii) Digital signal processors based on Harvard architecture. **(12 Marks)**

b. Convert the following:
i) Q15 signed number 0.100011110110010 to decimal number.
ii) Decimal number -0.160123 to signed Q-15 representation. **(08 Marks)**

OR

10 a. Explain IEEE floating point formats. **(10 Marks)**

b. Explain the basic architecture of TMS320C54X processor. **(10 Marks)**

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CBCS SCHEME

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21EC44

Fourth Semester B.E. Degree Examination, June/July 2024
Communication Theory

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive the expression in time domain and frequency domain for an AM wave. Outline the waveform and spectrum. **(08 Marks)**

b. With neat diagram, explain costas receiver. **(06 Marks)**

c. With relevant block diagram, explain the working of FDM transmitter and receiver. **(06 Marks)**

OR

2 a. With relevant equations and diagrams, explain the generation of AM waves using switching modulator. **(08 Marks)**

b. Explain in detail quadrature carrier multiplexing and demultiplexing system. **(06 Marks)**

c. An audio frequency signal 5 sin 2π (1000)t is used to amplitude modulate a carrier of 100sin 2π (10^6)t. Assume modulation index is 0.4. Find:

i) Sideband frequencies
ii) Amplitude of each sideband
iii) Bandwidth required
iv) Total power delivered to a load of 100Ω. **(06 Marks)**

Module-2

3 a. Define modulation index, frequency deviation and derive the time domain and frequency domain representation wideband FM with diagram. **(08 Marks)**

b. With neat diagram, explain the FM demodulation using balanced slope detector/balanced frequency discriminator. **(08 Marks)**

c. An FM signal has sinusoidal modulation with W = 15kHz and modulation index β = 2. Using Carson's rule determine the transmission bandwidth and deviation ratio. Assume Δf = 75kHz. **(04 Marks)**

OR

4 a. With relevant diagram, explain direct method generation of FM using Hartley oscillator and how frequency stability is achieved. **(08 Marks)**

b. With block diagram, explain the linear model of PLL. **(06 Marks)**

c. With the aid of neat diagram, explain FM stereo multiplexing. **(06 Marks)**

Module-3

5 a. Explain shot noise and thermal noise with relevant diagrams and expressions. **(06 Marks)**

b. Derive the equation for the figure of merit of an AM receiver and show figure of merit = 1/3 when operating on a single tone AM. **(08 Marks)**

c. Explain about FM threshold effect and its reduction method. **(06 Marks)**

OR

6 a. With relevant diagrams and expressions explain noise equivalent bandwidth. **(04 Marks)**

b. Derive the equation for the figure-of-merit for DSB-SC receiver is one. **(08 Marks)**

c. Explain the pre-emphasis and de-emphasis with respect to FM system. **(08 Marks)**

Module-4

7 a. List the two operations involved in the generation of PAM and explain with neat waveform and derive the equations for flat-top sampled PAM. **(10 Marks)**

b. Explain the working principle and operation of Time Division Multiplexing (TDM) with neat diagram. **(10 Marks)**

OR

8 a. State sampling theorem for a strictly band limited signal and explain how the effects of aliasing is overcome. **(06 Marks)**

b. With neat diagram and equations explain the generation of PPM waves. **(08 Marks)**

c. What are the advantages of transmission of digital information over analog information? **(06 Marks)**

Module-5

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

b. What is delta modulation? With neat block diagram, explain the construction of delta modulation. **(06 Marks)**

c. Explain μ-law and A-law of compression. **(06 Marks)**

OR

10 a. Define quantization. Explain how the quantization process takes place. Illustrate the input output characteristics of a quantizer interms of mid-tread and mid-rise. **(08 Marks)**

b. With neat block diagram, explain the generation and reconstruction of PCM signals. **(08 Marks)**

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

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CBCS SCHEME

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21MATME41

Fourth Semester B.E. Degree Examination, June/July 2024
Complex Analysis, Probability and Linear Programming

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Show that $w = f(z) = \log z$ $(z \neq 0)$ is analytic, using Cauchy – Riemann equation and find $\frac{dw}{dz}$ **(06 Marks)**

b. Derive Cauchy – Riemann equation in Cartesian form. **(07 Marks)**

c. Find the analytic function f(z) whose imaginary part is $e^x(x \sin y + y \cos y)$ **(07 Marks)**

OR

2 a. Show that $f(z) = \cosh z$ is analytic and hence find $f'(z)$. **(06 Marks)**

b. If f(z) is analytic function 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)**

c. Find the analytic functions whose real part is $\frac{x^4 - y^4 - 2x}{x^2 + y^2}$. Hence determine V. **(07 Marks)**

Module-2

3 a. Discuss the transformation $w = e^z$. **(06 Marks)**

b. State and prove Cauchy's integral formula. **(07 Marks)**

c. Find the bilinear transformation which maps the points $z = 1, i, -1$ in to $w = 2, i, -2$. **(07 Marks)**

OR

4 a. Find the bilinear transformation which maps the points $z = \infty, i, 0$ into $w = -1, -i, 1$. **(06 Marks)**

b. Discuss the transformation $w = z + \frac{1}{z}$ **(07 Marks)**

c. Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z+1)^2(z-2)} dz$, where C is the circle (i) $|z| = 3$, (ii) $|z| = \frac{1}{2}$ **(07 Marks)**

Module-3

5 a. The probability density function of a variate X is given by the following table.

x	0	1	2	3	4	5	6
P(x)	K	3K	5K	7K	9K	11K	13K

Find K. Also find $P(x \geq 5)$ and $P(3 < x \leq 6)$ **(06 Marks)**

b. Find the Mean and Variance of a Poisson distribution. **(07 Marks)**

c. The number of telephone lines busy at an instant of time is binomial variate with probability 0.1 that a line is busy if 10 lines are choosen at random, what is the probability that (i) no line is busy (ii) all lines are busy (iii) atleast one line is busy (iv) atmost 2 lines are busy. **(07 Marks)**

OR

6 a. The probability density function of a random variable X is

$$f(x) = \begin{cases} Kx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$$

Find (i) the value of K, (ii) $P(1 < x < 2)$, (iii) $P(x \leq 1)$ **(06 Marks)**

b. Find the mean and variance of binomial distribution. **(07 Marks)**

c. The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviations. Find the number of students whose marks will be
(i) Less than 65, (ii) More than 75 (iii) Between 65 and 75. **(07 Marks)**

Module-4

7 a. Using the Simplex method to solve the L.P.P.
Maximize $Z = 5x_1 + 7x_2$
Subject to constraint $x_1 + x_2 \leq 4$
$3x_1 - 8x_2 \leq 24$
$10x_1 + 7x_2 \leq 35$
and $x_1, x_2 \geq 0$ **(10 Marks)**

b. Use Big-M method to solve the L.P.P.
Maximize $Z = -2x_1 - x_2$
Subject to constraint $3x_1 + x_2 = 3$
$4x_1 + 3x_2 \geq 3$
$x_1 + 2x_2 \leq 4$
and $x_1, x_2 \geq 0$ **(10 Marks)**

OR

8 a. Define the following terms :
i) A linear Programming problems
ii) Basic solution
iii) Basic feasible solution
iv) Optional solution
v) Artificial variables of an LPP. **(10 Marks)**

b. Use Big-M method to solve the LPP.
Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$
Subject to constraints $x_1 + 2x_2 + 3x_3 = 15$
$2x_1 + x_2 + 5x_3 = 20$
$x_1 + 2x_2 + x_3 + x_4 = 10$
$x_1, x_2, x_3, x_4 \geq 0$ **(10 Marks)**

Module-5

9 a. Find the feasible solution to the following transportation problem using North West corner method.

	D_1	D_2	D_3	D_4	
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
	6	10	15	4	

(10 Marks)

b. The processing time in hours for the Jobs when allocated to the different machines are indicated below. Assign the machines for the Jobs so that the total processing time is minimum.

		Machines				
		M_1	M_2	M_3	M_4	M_5
Jobs	J_1	9	22	58	11	19
	J_2	43	78	72	50	63
	J_3	41	28	91	37	45
	J_4	74	42	27	49	39
	J_5	36	11	57	22	25

(10 Marks)

OR

10 a. Solve the following transportation problem by least cost method.

5	4	3	6
4	7	6	8
2	5	8	12
8	6	7	4
8	10	12	

(10 Marks)

b. Four jobs are to be done on four different machines. The cost (in rupees) of producing i^{th} Job on the J^{th} machine is given below.

		Machines			
	J\ M	M_1	M_2	M_3	M_4
Jobs	J_1	15	11	13	15
	J_2	17	12	12	13
	J_3	14	15	10	14
	J_4	16	13	11	17

Assign the Jobs to different machines so as to minimize the total cost. **(10 Marks)**

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21MATCS41

Fourth Semester B.E. Degree Examination, June/July 2024
Mathematical Foundations for Computing, Probability and Statistics

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Provide data table book.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define tautology. Show that the compound proposition $[p \rightarrow (q \rightarrow r)] \rightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$ is a tautology for any propositions p, q, r. **(06 Marks)**

b. Prove that (i) $p \vee [p \wedge (p \vee q)] \equiv p$ (ii) $[(\neg p \vee \neg q) \rightarrow (p \wedge q \wedge r)] \equiv p \wedge q$ using the laws of logic. **(07 Marks)**

c. Prove that for all integers k and ℓ is k and ℓ are both odd, then $k + \ell$ is even and $k\ell$ is odd. **(07 Marks)**

OR

2 a. Define: (i) Universal quantifiers (ii) Existential quantifiers, with an example. **(06 Marks)**

b. Test the validity of the following argument.
I will become famous or I will not become a musician.
I will become a musician.
Therefore I will become famous. **(07 Marks)**

c. Suppose the universe consist of integers. Consider the following open statements:
$p(x) : x \leq 3$, $q(x) : x + 1$ is odd $r(x) : x > 0$
Write down the truth values of:
(i) p(2) (ii) $\vee$q (4) (iii) $p(-1) \wedge q(1)$ (iv) $\sim p(3) \vee r(0)$
(v) $p(0) \rightarrow q(0)$ (vi) $p(1) \leftrightarrow \sim q(2)$ (vii) $p(4) \vee (q(1) \wedge r(2))$ **(07 Marks)**

Module-2

3 a. Let A and B be finite sets with |A| = m and |B| = n. Find how many one to one functions are possible from A to B. If there are 60 1 – 1 functions from A to B and |A| = 3, what is |B|? **(06 Marks)**

b. Let A = {1, 2, 3, 4, 6, 12} and R be a relation on A defined by aRb if "a is a multiple of b". Write down the relation R, relation matrix M(R) and draw its digraph. **(07 Marks)**

c. Define: (i) Null graph (ii) Bipartite graph (iii) Euler circuit. Give an example for each. **(07 Marks)**

OR

4 a. Draw the Hasse diagram representing the positive divisors of 48. **(06 Marks)**

b. Consider the functions f and g defined by $f(x) = x^3$ and $g(x) = x^2 + 1 \ \forall \ x \in R$. Find gof, fog, f^2. **(07 Marks)**

c. Define isomorphism of graphs. Prove that 2 graphs below are isomorphic.

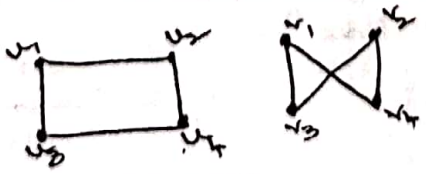

Fig.Q.4(c) **(07 Marks)**

Module-3

5 a. Find the correlation coefficient between the speed and the stopping distance and the equations of regression lines.

Speed, x	16	24	32	40	48	56
Stopping distance, y	0.39	0.75	1.23	1.91	2.77	3.81

(06 Marks)

b. Fit a best curve of the form $y = ax^b$ for the following data:

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

(07 Marks)

c. Fit a straight line by the method of least squares.

x	1	2	3	4	5
y	14	13	9	5	2

(07 Marks)

OR

6 a. The following are the percentage of marks in 2 subjects of 9 students. Find the rank correlation coefficient.

x	38	50	42	61	43	55	67	46	72
y	41	64	70	75	44	55	62	56	60

(06 Marks)

b. Fit a 2nd degree parabola $y = a + bx + cx^2$ for the data:

x	0	1	2	3	4	5
y	1	3	7	13	21	31

(07 Marks)

c. Given that $8x - 10y + 66 = 0$ and $40x - 18y = 214$ are the regression equations. Find the means of x and y and correlation coefficient. Find σ_y if $\sigma_x = 3$. **(07 Marks)**

Module-4

7 a. A random variable X has the following probability function:

x	–2	–1	0	1	2	3
P(x)	0.1	K	0.2	2K	0.3	K

Find: (i) K (ii) $P(X < 1)$ (iii) $P(X > -1)$ **(06 Marks)**

b. Find the mean and standard deviation of Poisson distribution. **(07 Marks)**

c. The mean weight of 500 students in a school is 50 kgs and the standard deviation is 6 kgs. Assuming that the weights are normally distributed, find the expected number of students weighing (i) between 40 and 50 kg (ii) more than 60 kg. Given that A(1.67) = 0.4525. **(07 Marks)**

OR

8 a. Find the constant K such that

$$f(x) = \begin{cases} Kx^2, & 0 \le x \le 3 \\ 0, & \text{elsewhere} \end{cases}$$

is a probability density function. Find the mean. **(06 Marks)**

b. When an honest coin is tossed 4 times, find the probability of getting:
(i) exactly one head (ii) atmost 3 heads (iii) at least 2 heads **(07 Marks)**

c. The probability that an individual suffers a bad reaction from a certain injection is 0.001. Using Poisson distribution, find the probability that out of 2000 individuals:
(i) exactly 3 (ii) more than 2 will suffer a bad reaction. **(07 Marks)**

Module-5

9 a. X and Y are independent random variables such that X takes 1, 5 with probabilities $\frac{1}{2}, \frac{1}{2}$ respectively. Y takes –4, 2, 7 with probabilities $\frac{3}{8}, \frac{3}{8}$ and $\frac{1}{4}$ respectively. Find the joint probability distribution of X and Y. Find Cov (X, Y). **(06 Marks)**

b. Find the 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. **(07 Marks)**

c. The following are the I.Q's of a randomly chosen sample of 10 boys: 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Does this data support the hypothesis that the population mean of I.Q's is 100 at 5% level of significance? **(07 Marks)**

OR

10 a. Explain the terms:
(i) Null hypothesis
(ii) Alternate hypothesis
(iii) Levels of significance
(iv) Type 1 and Type 2 errors **(06 Marks)**

b. A die is thrown 60 times and the frequency distribution for the number appearing on the face x is given by the following table:

x	1	2	3	4	5	6
Frequency	15	6	4	7	11	17

Test the hypothesis that the die is unbiased. Use Chisquare test at 5% level of significantly. **(07 Marks)**

c. The nine items of a sample have the following values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from the assumed mean of 47.5 ($t_{0.05} = 2.31$). **(07 Marks)**

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18 V Sem. EC

CBCS SCHEME

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18EC52

Fifth Semester B.E. Degree Examination, June/July 2024
Digital Signal Processing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Determine the 6-DFT of the data sequence $x(n) = \{1, 1, 2, 2, 3, 3\}$ and Compute the corresponding amplitude and phase spectrum. **(10 Marks)**

b. State and prove the following properties of DFT's :
(i) Linearity property
(ii) Periodicity property **(10 Marks)**

OR

2 a. Find the N-point DFT of $x(n) = \cos\left(\frac{2\pi}{N} K_0 n\right)$; $0 \le n \le N-1$. **(05 Marks)**

b. Find the 4-point DFT of the sequence $x(n) = \{1, 2, 0, 1\}$ using matrix method. **(05 Marks)**

c. Find the circular convolution of given data sequence $x_1(n) = \{1, 3, 5, 7\}$ and $x_2(n) = \{2, 4, 6, 8\}$, using DFT-IDFT method. **(10 Marks)**

Module-2

3 a. Determine the output sequence of a FIR filter whose jmpulse response in $h(n) = \{1, 1, 1\}$ and input sequence $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$ using overlap-add method. Assume length of block is 6. **(10 Marks)**

b. Determine 8-point DFT Sequence for given input signal $x(n) = n + 1$ using DIF-FFT algorithm. **(10 Marks)**

OR

4 a. Find the response of LTI system (Linear convolution) of input sequence $x(n) = \{1, 1, 1\}$ and impulse response $h(n) = \{-1, -1\}$ using DIT-FFT algorithm. **(12 Marks)**

b. What is total number of complex additions and multiplications required to compute N = 1024 point DFT using direct and FFT method and also calculate the percentage savings in multiplications and additions. **(08 Marks)**

Module-3

5 a. With necessary mathematical analysis, explain the frequency sampling technique of FIR filter design. **(10 Marks)**

b. The desired frequency response of a low pass filter is given by,

$$H_d(w) = \begin{cases} e^{-j3w}; & |w| \le \frac{3\pi}{4} \\ 0 & ; \frac{3\pi}{4} < |w| < \pi \end{cases}$$

Determine the frequency response of the FIR filter if Hamming window is used. **(10 Marks)**

OR

6 a. List the steps in the design of a FIR filter using window functions. **(05 Marks)**

b. Realize the Linear FIR filter having the following transfer function,
$H(z) = 1 + 0.25z^{-1} - 0.125z^{-2} + 0.25z^{-3} + z^{-4}$ **(05 Marks)**

c. Sketch the lattice realization for given FIR filter with the following difference equation,
$y(n) = x(n) + 3.1x(n-1) + 5.5x(n-2) + 4.2x(n-3) + 2.3x(n-4)$ **(10 Marks)**

Module-4

7 a. Derive an expression for order and cut off frequency of a low pass Butterworth filter. **(08 Marks)**

b. Design a butterworth digital low pass filter with maximum pass band attenuation of 3 db at 500 Hz, minimum attenuation of 15 db at stopband edge frequency of 750 Hz and sampling frequency $F_3 = 2$ KHz. Use bilinear transformation method. (Assume T= 1 sec) **(12 Marks)**

OR

8 a. Derive mapping function used in transforming analog filter to digital filter by bilinear transformation. **(08 Marks)**

b. Distinguish between FIR and IIR filters. **(04 Marks)**

c. Obtain the direct form I and direct form II realization for the following system :
$y(n) + 0.1y(n-1) - 0.2y(n-2) + 3x(n) + 3.6x(n-2) + 0.6x(n-2)$ **(08 Marks)**

Module-5

9 a. With neat diagrams, explain hardware units used in DSP processors. **(10 Marks)**

b. Find the signed Q-15 representation for the decimal number -0.160123. **(06 Marks)**

c. Convert the Q-15 signed number 0.1000111101110010 to the decimal number. **(04 Marks)**

OR

10 a. With a neat diagram, explain the fixed point basic architecture of TMS 320C54X processor. **(10 Marks)**

b. Explain the IEEE double precision floating point format used in DSP processor. **(05 Marks)**

c. Describe fixed point representation of numbers used in DSP processor. **(05 Marks)**

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18EC53

Fifth Semester B.E. Degree Examination, June/July 2024
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. Derive the expression of AM in both time domain and frequency domain representation with necessary waveforms. **(08 Marks)**

b. With a neat block diagram, explain demodulation of DSB-SC wave using costas receiver. **(06 Marks)**

c. With a neat block diagrams of a transmitter and receiver explain the operation of FDM system. **(06 Marks)**

OR

2 a. With a neat circuit diagram, waveforms and necessary equations, explain how the ring modulator can be used to generate DSB-SC wave. **(10 Marks)**

b. An audio frequency signal $m(t) = 5\sin [2\pi \times 500t]$ is used to amplitude modulate the carrier of signal $c(t) = 10 \sin [2\pi \times 10^6 t]$ find i) The modulation index μ ii) Side-band frequencies iii) Amplitude of each side band iv) Band width required v) Total power delivered to a load of 100Ω. **(05 Marks)**

c. With a neat block diagrams of transmitter and receiver explain quadrature carrier multiplexing system. **(05 Marks)**

Module-2

3 a. Define and describe the time domain representation of frequency modulation and phase modulation with waveforms. **(06 Marks)**

b. Explain the generation of narrow band FM with phasor diagram. **(06 Marks)**

c. With relevant block diagrams, explain FM stereo multiplexing and demultiplexing. **(08 Marks)**

OR

4 a. Derive an expression for single-tone sinusoidal FM wave. **(05 Marks)**

b. Explain with relevant block diagram, and mathematical expression, the demodulation of FM signal using non linear and linear model of the PLL. **(10 Marks)**

c. The equation for a FM wave is $s(t) = 10\sin [5.7 \times 10^8 t + 5 \sin 12 \times 10^3 t]$. Find:

i) Carrier frequency
ii) Modulating frequency
iii) Modulation index
iv) Frequency deviation
v) Power dissipated in 100Ω. **(05 Marks)**

Module-3

5 a. With a neat block diagram of receiver model show that the figure of merit of for DSB-SC system is unity. **(10 Marks)**

b. Discuss capture and threshold effect in FM receiving systems. **(05 Marks)**

c. Show that the figure of merit of noisy AM receiver for single tone modulation is $\frac{\mu^2}{1+\mu^2}$. **(05 Marks)**

OR

6 a. With a neat block diagram of receiver model using discriminator derive the expression for figure of merit of an FM receiver. **(10 Marks)**

b. Explain the working of pre-emphasis and de-emphasis in frequency modulation. **(06 Marks)**

c. Explain briefly the following: i) Shot noise ii) Thermal noise. **(04 Marks)**

Module-4

7 a. Mention the advantages of digital communication system. **(04 Marks)**

b. Show that the signal g(t) can be reconstructed using the interpolation formula shown below.

$$g(t) = \sum_{n=-\infty}^{\infty} g\left(\frac{n}{2w}\right) \text{Sinc}(2wt - n).$$ **(10 Marks)**

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

OR

8 a. Define the pulse amplitude modulation with relevant equations, waveforms, diagram, explain the generation and reconstruction of flat top sampling. **(10 Marks)**

b. With a neat block diagram and wave forms, explain the generation of pulse position modulation waves. **(10 Marks)**

Module-5

9 a. With a neat block diagram, explain the concept of the PCM. **(10 Marks)**

b. What is quantization process? Derive the expression for signal to quantization noise ratio for PCM signal where the input is sinusoidal signal. **(10 Marks)**

OR

10 a. With a neat encoder and decoder block diagram, necessary equations explain the delta modulation technique. **(08 Marks)**

b. Represent the binary data: 10011101
i) Polar NRZ ii) Bipolar RZ iii) Unipolar NRZ iv) Split phase formatting. **(04 Marks)**

c. Write a short note on:
i) Slope overload distortion
ii) Granular noise. **(08 Marks)**

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18EC54

Fifth Semester B.E. Degree Examination, June/July 2024
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. With relevant equations and units define
   i) Self information
   ii) Entropy of source
   iii) Information rate. **(06 Marks)**

b. For the Markov source shown in Fig.Q.1(b). Find:
   i) State entropies
   ii) Source entropy
   iii) G_1 and G_2. Also show that $G_1 \geq G_2 \geq H(S)$ **(10 Marks)**

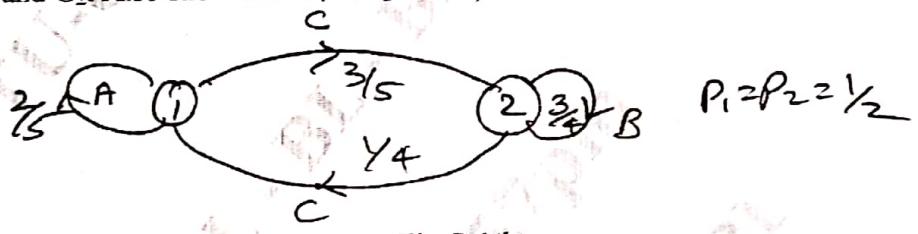

Fig.Q.1(b)

c. List any 4 properties of entropy with relevant equations. **(04 Marks)**

OR

2 a. Consider a discrete memoryless source with source alphabet S = {S_0, S_1, S_2, S_3} with source statics $\left\{\frac{7}{16}, \frac{5}{16}, \frac{1}{8}, \frac{1}{8}\right\}$
   i) Calculate source entropy
   ii) Find all the symbols and probabilities of 2nd extension. Also find its entropy.
   iii) Show that $H(S^2) = 2H(S)$. **(08 Marks)**

b. The international Morse code uses a sequence of dots and dashes to transmit letters of English alphabet. The dash is represented by a current pulse of duration 3 times as long as dot and has half the probability of a occurrence of dot. Consider 0.2 sec duration of gap is given in between the symbols, which is same as dot duration. Calculate self-information of a dot and dash, average information content of a dot dash code and average information rate of transmission. **(08 Marks)**

c. Show that the source entropy is $\log_2 M$, when M symbols emitted from source are equiprobable. **(04 Marks)**

Module-2

3 a. State and prove the source encoding theorem. (10 M

b. Differentiate between fixed length and variable length source coding. (04 Ma

c. Define the following codes with example:
   i) Prefix codes
   ii) Uniquely decodable codes
   iii) Instantaneous codes. (06 Marks)

OR

4 a. Apply Shannon encoding algorithm to the following set of messages and obtain code efficiency and redundancy.

$$S = \{S_1, S_2, S_3, S_4, S_5\} = \left\{\frac{1}{8}, \frac{1}{16}, \frac{3}{16}, \frac{1}{4}, \frac{3}{8}\right\}.$$ (10 Marks)

b. The five symbols of the alphabet of a discrete memory less source are given as $S = \{S_1, S_2, S_3, S_4, S_5\} = \{0.4, 0.2, 0.2, 0.1, 0.1\}$. Find the Huffman code by
   i) Moving combined symbol as high as possible.
   ii) Moving combined symbol as low as possible.
   Also find variance in both the cases and inference the results. (10 Marks)

Module-3

5 a. For joint probability matrix shown below find H(x, y), H(x), H(y), H(x/y), H(y/z) and I(x, y).

$$P(x,y) = \begin{bmatrix} 0.2 & 0 & 0.2 & 0 \\ 0.1 & 0.01 & 0.01 & 0.01 \\ 0 & 0.02 & 0.02 & 0 \\ 0.04 & 0.04 & 0.01 & 0.06 \\ 0 & 0.06 & 0.02 & 0.2 \end{bmatrix}$$ (10 Marks)

b. Prove the following equations:
   i) $I(x, y) = I(y, x)$
   ii) $I(x, y) = H(x) - H(x/y)$
   iii) $I(x, y) = H(y) - H(y/x)$ (10 Marks)

OR

6 a. For a given channel matrix. Find the channel capacity by using Muroga method. If it were a symmetric channel recomputed the channel capacity.

$$P(y/x) = \begin{bmatrix} 0.8 & 0.1 & 0.1 \\ 0.2 & 0.6 & 0.2 \\ 0.2 & 0.2 & 0.6 \end{bmatrix}$$ (10 Marks)

b. What is Binary Erasure Channel (BEC)? Derive the equation for channel capacity of a BEC. (10 Marks)

Module-4

7 a. For a (6, 3) linear block code the check bits are related to the message bits as per the equations below

$c_4 = d_1 \oplus d_3$

$c_5 = d_1 \oplus d_2$

$c_6 = d_2 \oplus d_3$

   i) Find the generator matrix G and H.
   ii) Find all code words and weights of the code
   iii) Find error correcting and detecting capabilities of the code. (10 Marks)

b. The generator polynomials 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 polynomial $V(x) = D(x)\, g(x)$ where $D(x)$ is the message polynomial. **(10 Marks)**

OR

8 a. For a given generator matrix below for (6, 3) linear block code

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

i) Draw the encoder circuit diagram.
ii) Draw the syndrome circuit diagram. **(10 Marks)**

b. In a (15, 5) cyclic code the generator polynomial is given by $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$.
i) Draw the encoder and syndrome calculator.
ii) Find whether $r(x) = 1 + x^4 + x^6 + x^8 + x^{14}$ a valid code word or not. **(10 Marks)**

Module-5

9 a. For the convolutional encoder shown in Fig.Q.9(a) find the encoder output for the message sequence m = {1, 1, 0, 1} by

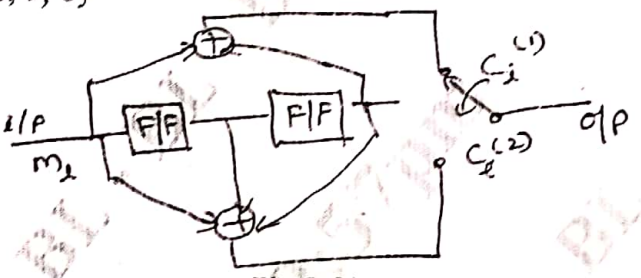

Fig.Q.9(a)

Using Time-domain and transfer domain approach. **(10 Marks)**

b. For encoder in Fig.Q.9(a) construct state diagram and code tree. **(10 Marks)**

OR

10 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 (11101) using generator matrix and transform domain approach. **(10 Marks)**

b. Write a note on:
i) Trellis diagram
ii) Viterbi decoding algorithm. **(10 Marks)**

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18EC55

Fifth Semester B.E. Degree Examination, June/July 2024
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. State and derive Coulomb's law. **(06 Marks)**

b. Find the force on charge Q_1 located at (4, -2, 1) m due to charge Q_2 located at (3, -1, -2) m. $Q_1 = 200\ \mu C$, $Q_2 = 300\ \mu C$. **(07 Marks)**

c. Calculate the electric field intensity E at (-1, 3, -2) m due to infinite line charges with $\rho_l = 25\ nC/m$ lying along x-axis and $\rho_l = 50\ nC/m$ lying along y-axis. **(07 Marks)**

OR

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

b. Two point charges $Q_1 = 5\ \mu C$ and $Q_2 = -3\ \mu C$ are located in free space at (1, 0, -2) m and (-2, 1, 3) m respectively. Find electric field intensity E at P(-3, 2, -1) m. **(07 Marks)**

c. Calculate the electric field intensity E at (-2, 1, -3) m due to infinite sheet charges :

$\rho_S = \frac{1}{6\pi} nC/m^2$ located at y = 3 m and

$\rho_S = \frac{1}{3\pi} nC/m^2$ located at z = -5 m **(07 Marks)**

Module-2

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

b. Given $D = \frac{5r^3}{y} a_r C/m^2$ in cylindrical co-ordinates. Prove divergence theorem for the volume enclosed by r = 2m, r = 3 m, z = 0 and z = 5 m. **(07 Marks)**

c. Find the total charge in a volume defined by six planes for which, $2 \le x \le 3$, $3 \le y \le 4$, $4 \le z \le 5$, if $D = 5x^2 a_x + 4y^2 a_y + 3z a_z\ C/m^2$. **(07 Marks)**

OR

4 a. Using Gauss's law, derive the expressions for $\overline{D}$ and $\overline{E}$ due to co-axial cylindrical conductors. **(06 Marks)**

b. Calculate the total electric flux density due to two uniform line charges of 30 μC/m lying along x-axis and 50 μC/m lying along z-axis, at (2, 3, 4)m. **(07 Marks)**

c. In an electric field, potential field is $V = 5x^2 + 3y^3 + 8z$ volts. Find

(i) $\overline{E}$ (ii) $|E|$ (iii) $\overline{D}$ at (-3, 2, 4) m **(07 Marks)**

Module-3

5 a. Using Laplace's equation, derive the expression for potential (V) and electric field strength E due to two concentric cylinders of infinite length. **(06 Marks)**

b. In spherical co-ordinates V = 750 volts at r = 25 cm and E = 825 a_r V/m at r = 75 cm. Determine the location of voltage reference if potential depends only on r. **(07 Marks)**

c. State and prove Ampere's circuital law. **(07 Marks)**

OR

6 a. Using Biot-Savart's law, derive the expression for magnetic field intensity "H" due to infinite long conductor. **(06 Marks)**

b. In spherical co-ordinates, V = 0 for r = 0.2 m and V = 200 volts for r = 3 m. Assuming free space between concentric spheres (Shells) find electric field intensity E and flux density D. **(07 Marks)**

c. Find magnetic field intensity H at the center of a square loop of sides equal to 10 m and carrying a current of 5 amp. **(07 Marks)**

Module-4

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

b. Calculate the force on a straight conductor of length 0.5 m carrying a current of 10 amp in the z-direction, where $\overline{B} = 5\times10^{-3}a_x$ Tesla and $B = 6\times10^{-3}a_y$ Tesla. **(07 Marks)**

c. A solenoid with air core has 2000 turns and a length of 700 mm. Core radius is 50 mm. Find self inductance. **(07 Marks)**

OR

8 a. Derive the equation for force between two parallel current carrying conductors. **(06 Marks)**

b. Derive tangential and normal boundary conditions (magnetic) between two media of permeabilities μ_1 and μ_2. **(07 Marks)**

c. Find the inductance per unit length of a co-axial conductor with an inner radius of a = 4 mm and outer radius of b = 10 mm. Assume $\mu_r = 1$. **(07 Marks)**

Module-5

9 a. State the inconsistency of Ampere's law, for time varying fields. Derive Maxwell's equation to correct it. **(06 Marks)**

b. Derive general plane wave equation in terms of E, taking help of the Maxwell's equation (for free space). **(07 Marks)**

c. A plane wave travelling in positive z-direction in a lossless unbounded medium has permeability 5 times that of free space and a dielectric constant 3 times that of free space.

(i) Find phase velocity of the wave

(ii) If E has only x-component with amplitude 25 V/m, find amplitude and direction of H. **(07 Marks)**

OR

10 a. Prove that conduction current and displacement current are equal. **(06 Marks)**

b. State and explain Poynting theorem. **(05 Marks)**

c. Determine following parameters for a medium with $\epsilon_r = 4$, $\mu_r = 1$, $\sigma = 20\times10^{-2}$ S/m, f = 1 mHz.

(i) Attenuation constant

(ii) Phase shift constant

(iii) Propagation constant

(iv) Wavelength

(v) Phase velocity

(vi) Intrinsic impedance

(vii) Skin depth (δ) **(09 Marks)**

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18EC56

Fifth Semester B.E. Degree Examination, June/July 2024
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. List the importance of HDL. **(04 Marks)**

b. Explain design flow for designing VLSI IC circuits with a neat flow chart. **(10 Marks)**

c. Discuss the different levels of abstraction used in verilog modelling and write example in each case. **(06 Marks)**

OR

2 a. Describe the top down design approach with 4-bit ripple counter example. **(12 Marks)**

b. What is the need of stimulus block in simulation? Discuss different techniques of applying stimulus. **(08 Marks)**

Module-2

3 a. List all the data types of verilog HDL. Explain any 4 with example. **(10 Marks)**

b. Write a verilog description of SR latch and write a stimulus code, use $monitor to display the simulation time, inputs and outputs. **(06 Marks)**

c. Describe different methods of connecting ports to external signals. **(04 Marks)**

OR

4 a. Write verilog statements to declare the following variables.

i) Declare a 16-bit vector called addr

ii) Declare a memory RAM with 1K bytes

iii) Declare a constant port_id = 5

iv) Declare time variable T_1. **(04 Marks)**

b. Discuss any 4 system tasks with example. **(08 Marks)**

c. Bring out differences between :

i) $display ii) $monitor iii) Sized and unsized data. **(08 Marks)**

Module-3

5 a. Design a 4-bit ripple carry adder using 1-bit full adder. **(08 Marks)**

b. What is the output of the following expressions, given :

a = 4' b1010 b = 4' b1011 c = 4' b110x

i) a = = = 6

ii) y = ∧ b

iii) y = a && b

iv) y = b >>>1

v) y = {2a[1], b, 11, c[3]}

vi) y = a¦ b. **(06 Marks)**

c. Write a verilog program to implement 4 × 1 MUX using :

i) Conditional operator

ii) Data flow Boolean expressions. **(06 Marks)**

OR

6 a. Derive Boolean expressions for 4-bit carry look ahead adder and also write the design module. **(10 Marks)**

b. Design a 2 × 1 MUX by writing logic circuit using bufifo and bufifi for the following delay specification.

	Min	typ	Max
Rise	3	4	5
Fall	6	7	9
Turn off	5	6	7

(04 Marks)

c. Write verilog module, test bench and waveform for the circuit shown in Fig.Q6(c). Assume
t = 0, a = 0, b = 0, c = 0, d = 0
t = 5, a = 1, b = 1, c = 1, d = 1
t = 15, a = 0, c = 0.

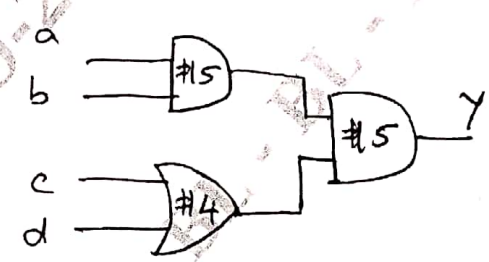

Fig.Q6(c) **(06 Marks)**

Module-4

7 a. Differentiate always initial blocking and on blocking statement. **(08 Marks)**

b. Write a verilog program to call a function called calc – parity which computes the parity of a 32 – bit data [31 : 0] Data and display the parity. **(06 Marks)**

c. Explain the following control statements :
i) case ii) for loop. **(06 Marks)**

OR

8 a. Bring out differences between tasks and functions of verilog. **(06 Marks)**

b. Write a verilog program for 1 × 4 demux considering 0, 1, x, z values for select inputs. **(08 Marks)**

c. Explain the different event – based timing control with example. **(06 Marks)**

Module-5

9 a. Define the term logic synthesis. With a neat block diagram. Explain computer aided logic synthesis process. **(08 Marks)**

b. Discuss conditional execution with an example. **(08 Marks)**

c. Bring out difference between $strobe and $display. **(04 Marks)**

OR

10 a. What will the following statements translate to when run on a logic synthesis tool?
i) assign y = (a & b) ¦ (c & d) where a, b, c, d are 2–bit vectors
ii) if(s) out = i1 ;
else out = i0 ; **(06 Marks)**

b. Explain force and release procedural assignments with example. **(08 Marks)**

c. Discuss any 4 system tasks related to files. **(06 Marks)**

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