

Seat Number

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Data Communication (174111 / 224111)

P. Pages : 2

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.

UNIT – I

1. a) Define data communication. Explain it's characteristics and components? 8
- b) Explain the different design issues of layers? 8
- c) Explain periodic analog signal in details? 8

UNIT – II

2. a) What is line coding? Explain characteristics of line coding? 8
- b) i) Explain Pulse Code Modulation (PCM)? 4
- ii) Explain Parallel Transmission mode with its advantages and disadvantages? 4
- c) For an 8 – PSK system operating at an information bit rate of 24 kbps determine band, minimum bandwidth and bandwidth efficiency? 8

UNIT – III

3. a) i) What is Multiplexing? State its types? 4
- ii) PCM / TDM system consists of 20 channels with an 8 KHz sample rate, 10 bits per symbol and one framing bits per frame, determine the line speed. 4

- b) What is Transmission media? Classify transmission media and explain selection criteria for Transmission media. 8
- c) i) Differentiate Unshielded Twisted Pair (UTP) cable with shielded twisted pair (STP) cable using following parameter. 4
- Data rate
 - Cable length
 - Electrical Interference
 - Installation
 - Cost.
- ii) Explain characteristics, advantages and disadvantages of Fiber Optic Cable (FOC). 4

UNIT – IV

- 4 a) Explain datagram network routing approach of packet switching in details? 8
- b) i) Calculate the throughput S for a pure ALOHA network if the offered traffic G is 0.75? 4
- ii) Differentiate between packet switching and message switching. 4
- c) Explain Code Division Multiple Access (CDMA) with advantages & disadvantages applications. 8

UNIT – V

5. a) What are the types of errors and why error detection and correction is essential. 8
- b) i) Find the hamming distance for each coding scheme given below? 4
- ii) What is Cyclic Redundancy Check (CRC). Enlist the standard polynomials where CRC is widely used in local area network (LAN) with advantages of cyclic code. 4
- c) What is checksum? Explain how sender calculate checksum and which steps are used by receiver for error detection. 8

Seat Number

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Microprocessor & Microcontroller Interfacing
(174112 / 224112)

P. Pages : 2

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **two** sub questions form each question in such a way that one question will get attempted for maximum of **16 marks**.
5. Assume suitable data it necessary.
6. Figure to the right indicate full marks.

1. a) Draw and explain block diagram of 8255 PPI 8
- b) What is device driver? Explain the structure of device driver in detail. 8
- c) Draw the control word format of 8255. Also write a program in assembly language to initialize 8255 in the configuration given below. 8
 - i) Port A simple input
 - ii) Port B simple output
 - iii) Port C lower output
 - iv) Port C upper input

Assume adders of control word register of 8255 is 83H.

2. a) Draw and explain format of control word of 8254 programmable interval timer. 8
- b) Draw and explain internal architecture of 8251 USART. 8
- c) What do you mean by TSR? Write a TSR routine to change the default interrupt service routine for divide by zero interrupt. 8
3. a) Explain any two motherboard logic's in short 8
- b) Write short note on following. 8
- i) VGA ii) EGA
- c) Explain with neat sketch interfacing keyboard with microprocessor. 8
4. a) Draw and explain organisation of hard disk controller. 8
- b) Write short note on following. 8
- i) FM and MFM disk recording techniques.
- ii) Explain any four HDC command.
- c) Draw and explain architecture of 8272 floppy disk controller. 8
5. a) Explain stepper motor interfacing with neat sketch. 8
- b) Explain static and multiplexed display approach of interfacing 7 segment display. 8
- c) Explain with neat sketch interfacing ADC with microprocessor. 8

Seat Number

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Data Structures (174113 / 224113)

P. Pages : 2

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub question from each unit.
5. Figures to right indicate full marks.
6. Assume suitable data wherever necessary.

UNIT – I

1. a) What is data structure ? Differentiate primitive & non – primitive data structure ? Explain different operation to be perform on data structure ? 8
- b) Describe in brief, the various data structure ? 8
- c) Explain use of Molloc () function ? Distinguish between static and dynamic memory allocation ? 8

UNIT – II

2. a) Consider following infix expression X 8
 $x : ((P+Q)*S) \wedge (T-U)$.
 Using algorithm using Stack translate X into its equivalent post fix expression P ?
- b) Write algorithm to perform PUSH, POP and Display operation of STACK ? 8
- c) Write algorithm to perform insertion deletion and display algorithm of input restricted double ended queue ? 8

UNIT – III

3. a) Write a algorithm to insert a number in the linked list at the following position ? 8
 i) In the beginning at the list.
 ii) After the specified position.
 iii) At the end of list.
- b) What is generalise list ? Give some example ? What are the application of linked list ? 8
- c) Explain algorithm for deleting the first node last node and a node at specified position of doubly linked list with diagram ? 8

UNIT – IV

4. a) Suppose the following letters is inserted in order into an empty binary search tree. 8
 S, T, P, Q, M, N, O, R, K, V, A, B
 i) Find the final tree T.
 ii) Find the inorder, preorder, postorder traversal of T.
- b) What is AVL tree ? Write LL, LR, RR, RL rotation algorithm ? 8
- c) Write short note. 8
 i) Threaded binary tree.
 ii) Strictly binary tree.

UNIT – V

5. a) Explain different hash function with example ? 8
- b) Explain algorithm of bubble sort with example ? 8
- c) Sort the following number in ascending using Heap sort. 8
 46, 25, 35, 49, 10, 92, 83, 32.

Seat Number

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Computer Organisation (174114 / 224114)

P. Pages : 2

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Answer **any two** sub questions from each unit.
5. Figures to right indicate full marks.
6. Assume suitable data, if necessary.

UNIT – I

1. a) Processor P1, P2 and P3 are one address, two address and three address processor respectively. Write program for all processor to compute $Y=(A-B)/(C+D*E)$ 8
- b) Write short note on : 8
 - i) Expanding opcodes.
 - ii) Basic functional unit of a computer.
- c) What is bus structure ? Explain single, two and multiple bus structure with an appropriate diagram. 8

UNIT – II

2. a) Multiply following pair of numbers using Bit pairing method. 8
 - i) $13*-6$
 - ii) $-9*-6$
- b) Perform division for $10/3$ by using Restoring method. 8
- c) Explain non – restoring division algorithm with an appropriate example. 8

UNIT – III

3. a) Explain Hard wired control unit design. 8
- b) Write down complete control sequences to execute conditional and unconditional branch instructions. 8
- c) Explain Wilkes design. 8

UNIT – IV

4. a) Enlist mapping techniques. Explain direct mapping in detail. 8
- b) Explain concept of memory interleaving in detail. 8
- c) Explain ROM, PROM and EPROM, each in brief. 8

UNIT – V

5. a) Make comparison of RISC Vs CISC in brief. 8
- b) Explain PCI bus in detail. 8
- c) What is bus ? Explain USB key objectives and USB tree structure. 8

Seat Number

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Discrete Structure and Graph Theory

(173103 / 223103)

P. Pages : 3

Time: Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** sub questions out of 3 sub questions for each unit.
5. Assume suitable data whenever necessary.
6. Draw neat diagrams whenever necessary.

UNIT - I

1. a) i) Explain proposition and proposition connectives. 4
- ii) Prove by mathematical induction 4
 $8^n - 3^n$ is multiple of 5 for $n \geq 1$
- b) Among the integers between 1 to 60 4
 - i) Find how many of them are not divisible by 2, nor by 3 and nor by 5. 4
 - ii) Also Find, how many are divisible by 2 but not by 5. 4
- c) A bag contains 4 white, 6 black and 5 red balls. 8
 2 balls are selected by a person. Find probability that –
 - 1) Both are white.
 - 2) Both are of same colour.
 - 3) One is black and other is white.
 - 4) Both are not black.

UNIT – II

2. a) i) Define and explain function with suitable example. 4
 ii) Explain properties of binary relation. 4
- b) i) Let $A = \{a, b, c, d, e\}$ and $F: A \rightarrow A$ such that 4
- ```

 graph LR
 a1[a] --> c[c]
 b1[b] --> a2[a]
 c1[c] --> b2[b]
 d1[d] --> e2[e]
 e1[e] --> d2[d]

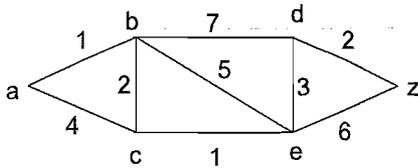
```
- Find – 1)  $f \circ f$   
 2)  $f \circ [f \circ f]$
- ii) Let  $A = \{1, 2, 3, 4, 5, 6\}$   $R$  is equivalence relation such that,  $R = \{(1,1)(1,5)(2,2)(2,3)(2,6)(3,2)(3,3)(3,6)(4,4)(5,1)(5,5)(6,2)(6,3)(6,6)\}$  4  
 Find equivalence classes of  $R$ . Also Find rank.
- c) i) Let  $A = \{1, 2, 3, 4\}$  and relation  $R = \{(1,2)(2,3)(3,4)\}$  on set  $A$  4  
 Find Transitive closure and draw its diagram.
- ii) Find minimum number of students in a class to be sure that 3 of them are born in same month. 4

**UNIT – III**

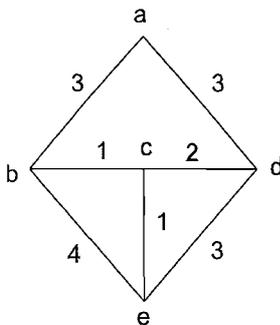
3. a) i) Define and explain recurrence relation with example. 4  
 ii) Explain bubble sort algorithm with example. 4
- b) Explain time complexity of an algorithm. Write an algorithm to find largest number between  $n$  given numbers, Also Justify its time complexity with an example. 8
- c) Find total solution with suitable example. 8  
 Find out Homogeneous solution for Fibonacci sequence of number. Also Find particular solution for –  
 $a_r + 5a_{r-1} + 6a_{r-2} = 3r^2 - 2r + 1$

**UNIT – IV**

4. a) Determine shortest path from vertex a to z using Dijkstra's algorithm in the given graph. 8



- b) i) Explain Huffman's algorithm for optimal binary tree with an example. 4  
 ii) Determine number of edges in a graph with 6 nodes, 2 of degree is 4 and 4 of degree is 2. Draw Resultant graph. 4
- c) i) Find minimum spanning tree using prim's algorithm. 4



- ii) Explain multiple graph and bipartite graph. 4

**UNIT – V**

5. a) i) Explain binary operation with its properties. 4  
 ii) Explain distributed and complemented lattice. 4
- b) i) Explain group with suitable example. 4  
 ii) Explain Boolean expression with its, type. 4
- c) i) Perform following conversions- 4  
 1)  $(753)_8 = ( )_{10}$                       2)  $(11001)_2 = ( )_{10}$   
 ii) Explain ring with its properties. 4

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ENGINEERING, DHULE-200004-20/12/14 12:08:00 PM SSVPS'S COLLEGE OF ENGINEERING, DHULE-200004-20/12/14

Seat Number

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## Object Oriented Technology

### (173105 / 223105)

P. Pages : 2

Time : Three Hours

Max. Marks : 80

#### Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.
5. Write syntax of sample code wherever necessary.
6. Answers to the questions must be precise and to the point.

#### UNIT - I

1. a) i) What is data hiding ? Explain with suitable example. 4
- ii) Explain in brief the 'Encapsulation' in an object oriented programming paradigm. 4
- b) Explain operators and operator precedence in C++. Write a program in C++ to demonstrate operator in C++. 8
- c) i) Give difference between procedural programming and object oriented programming. 4
- ii) What are the advantages of object oriented programming. 4

#### UNIT - II

2. a) Write a program for addition of two matrices using the concept of friend function. 8
- b) i) Explain the concept of static data member and static member function. 4
- ii) What is member function ? Give general syntax for the definition of member function inside and outside of class definition. 4
- c) Write a program for addition and subtraction of two complex numbers by overloading '+' and '-' operators respectively. 8

## UNIT – III

3. a) Write a program for keeping employee record using the concept of array of object. 8
- b) Design a class "math" that contains the data member int arr [10]. Write a program for addition of elements of array arr [ ] using the concept of pointer to object. 8
- c) i) Explain how dynamic memory can be allocated using new and delete operators. 4  
ii) Explain the concept of void pointer. 4

## UNIT – IV

4. a) What is polymorphism ? How is polymorphism achieved at compile time and run time ? 8
- b) Write a program for reading and displaying roll number, subject 1 and subject 2 marks and their total using the concept of multilevel inheritance. 8
- c) Write a program for calculating average of marks of three subjects of student using the concept of virtual base class. 8

## UNIT – V

5. a) Write a function template for finding the maximum and minimum value stored in an array. 8
- b) Write a program for keeping student information such as name, roll number, class in a file. Write a function to read and write the data from file. 8
- c) i) What are the file opening modes ? Explain each mode in detail. 4  
ii) Explain how to open the file using constructor and open ( ) function. 4

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## Engineering Mathematics - III

### (173101 / 223101)

P. Pages : 4

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory.
5. Figures to the right indicate full marks.
6. Use of statistical table is allowed.
7. Use of non-programmable calculator is allowed.

1. Attempt any two.

a) i) Find Laplace transform of  $e^{-4t} \int_0^t t \sin 4t dt$  4

ii) Evaluate  $\int_0^{\infty} \frac{(\cos 6t - \cos 4t)}{t} dt$  4

b) i) Find the Laplace transform of – 4  
 $f(t) = t^2 U(t-4) + \sin(t-\pi) U(t-\pi)$

ii) Find  $L^{-1} \left\{ \frac{S}{(S^2+4)^2} \right\}$ , using convolution theorem. 4

c) Using the Laplace transform, solve the following differential 8  
equation,  $\frac{dy}{dt} + 3y(t) + 2 \int_0^t y(t) dt = t$  given  $y(0) = 0$ .

2. Attempt any two.

a) i) Find the  $z \left\{ \left( \frac{1}{4} \right)^{|k|} \right\}$  for all k. 4

ii) Find the Fourier cosine transform of the function 4  
 $f(x) = \begin{cases} \cos x & , 0 < x < a \\ 0 & , x > a \end{cases}$

b) i) By considering Fourier sine integral of  $e^{-mx}$  ( $m > 0$ ) 4  
 prove that  $\int_0^{\infty} \frac{\lambda \sin \lambda x}{\lambda^2 + m^2} d\lambda = \frac{\pi}{2} e^{-mx}$

ii) Find  $z^{-1} \left\{ \frac{z^2}{\left( z - \frac{1}{2} \right) \left( z - \frac{1}{3} \right)} \right\}$  if  $\frac{1}{3} < |z| < \frac{1}{2}$  4

c) Find the Fourier transform of 8  
 $f(x) = \begin{cases} 1 - x^2 & , |x| \leq 1 \\ 0 & , |x| > 1 \end{cases}$

and hence evaluate  $\int_0^{\infty} \frac{(x \cos x - \sin x)}{x^3} \cos \frac{x}{2} dx$

3. Attempt any two.

a) i) The first four moments about the working mean 30.2 of a distribution are 0.255, 6.222, 30.211 and 400.25. Calculate the first four moments about the mean. 4

ii) The first four central moments of distribution are 0, 2.5, 0.7 and 18.75. Comment on the skewness and kurtosis of the distribution. 4

b) Obtain regression lines for the following data : 8

|   |   |   |   |    |    |    |    |    |
|---|---|---|---|----|----|----|----|----|
| X | 2 | 3 | 5 | 7  | 9  | 10 | 12 | 15 |
| Y | 2 | 5 | 8 | 10 | 12 | 14 | 15 | 16 |

and estimate y for x = 6 and x when y = 20.

- c) i) on an average a box containing 10 articles is likely to have 2 defectives. if we consider a consignment of 100 boxes, how many of them are expected to have three or less defectives ? 4
- ii) In a Poisson distribution if  $p(r=1) = 2p(r=2)$ , find  $p(r=3)$ . 4

4. Attempt any two.

- a) i) A sample of 400 electric bulbs from company A gave an average life 1225 hours with a standard deviation 42 hours, where as sample of 200 bulbs from company B gave an average life 1265 hours with a standard deviation 60 hours. Can we say that the two companies are producing bulbs of same average life ? 4
- ii) A certain factory, runs in two shifts. A sample of 1000 items selected from production of day shift, gave 52 defective articles. However a sample of 700 items selected from production of night shift revealed 45 items defective. Can we conclude that proportion of defective items in the first shift is less than that of second shift ? 4
- b) i) Define the terms : 4
- 1) Critical region.
  - 2) Null Hypothesis
  - 3) Alternative Hypothesis
  - 4) Level of significance.
- ii) To determine whether the mean breaking strength of synthetic fiber produced by a certain company is 8 kg or not, a random sample of 50 fibers were tested yielding a mean breaking strength of 7.8 kg. If standard deviation is 0.5 kg, test at 1% level of significance. 4
- c) Fit a Poisson distribution to the following data and test the goodness of fit. 8

|   |     |    |    |   |   |   |   |
|---|-----|----|----|---|---|---|---|
| x | 0   | 1  | 2  | 3 | 4 | 5 | 6 |
| f | 275 | 72 | 30 | 7 | 5 | 2 | 1 |

[Given  $\chi^2_{2,0.05} = 5.991$ ]

5. Attempt **any two**.

Notation : For all the problems below the following notation will be used.

Let  $X$  be a universal set. A fuzzy subset  $\tilde{A}$  of  $X$  is understood by its membership function  $\mu_{\tilde{A}}(x): X \rightarrow [0, 1]$ .

- a) i) Universal set  $x = \{1, 2, 3, 4, 5\}$ . Consider the fuzzy subsets  $\tilde{A}, \tilde{B}, \tilde{C}$  given by. 4

$$\mu_{\tilde{A}}(1)=0.3, \mu_{\tilde{A}}(2)=0.5, \mu_{\tilde{A}}(3)=0.6, \mu_{\tilde{A}}(4)=0.8, \mu_{\tilde{A}}(5)=0.7$$

$$\mu_{\tilde{B}}(1)=0.1, \mu_{\tilde{B}}(2)=0.5, \mu_{\tilde{B}}(3)=0.7, \mu_{\tilde{B}}(4)=0.5, \mu_{\tilde{B}}(5)=0.2$$

$$\mu_{\tilde{C}}(1)=0.2, \mu_{\tilde{C}}(2)=0.8, \mu_{\tilde{C}}(3)=0.1, \mu_{\tilde{C}}(4)=0.4, \mu_{\tilde{C}}(5)=0.2$$

Evaluate  $\tilde{A}^C \cap \tilde{B}^C \cap \tilde{C}$ .

- ii) For the fuzzy subset defined in problem a(i) verify 4  
DeMorgan's law  $(\tilde{A} \cup \tilde{B})^C = \tilde{A}^C \cap \tilde{B}^C$ .

- b) By extension principle fuzzy multiplication is defined by 8  
$$\mu_{\tilde{A} \times \tilde{B}}(z) = \max_{x \times y = z} \min(\mu_{\tilde{A}}(x), \mu_{\tilde{B}}(y))$$

for the following fuzzy subsets  $\tilde{A}, \tilde{B}$ , find  $\tilde{A} \times \tilde{B}$ , where

$$\mu_{\tilde{A}}(1)=0.1, \mu_{\tilde{A}}(2)=0.4, \mu_{\tilde{A}}(3)=0.6, \mu_{\tilde{A}}(4)=0.8$$

$$\text{and } \mu_{\tilde{B}}(1)=0.2, \mu_{\tilde{B}}(2)=0.3, \mu_{\tilde{B}}(3)=0.5, \mu_{\tilde{B}}(4)=0.6$$

- c) By extension principle fuzzy addition is defined by 8  
$$\mu_{\tilde{A} - \tilde{B}}(z) = \max_{x - y = z} \min(\mu_{\tilde{A}}(x), \mu_{\tilde{B}}(y))$$

for the following fuzzy subsets  $\tilde{A}, \tilde{B}$  find  $\tilde{A} - \tilde{B}$

$$\mu_{\tilde{A}}(1)=0.2, \mu_{\tilde{A}}(2)=0.3, \mu_{\tilde{A}}(3)=0.8, \mu_{\tilde{A}}(4)=0.4$$

$$\text{and } \mu_{\tilde{B}}(1)=0.1, \mu_{\tilde{B}}(2)=0.5, \mu_{\tilde{B}}(3)=0.3, \mu_{\tilde{B}}(4)=0.2$$

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## Computer Graphics (174115)

P. Pages : 2

Time: Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** sub questions from each unit.
5. Draw neat diagram wherever necessary.
6. Figures to the right hand side indicates full marks.

### UNIT – I

1.
  - a) Explain DDA Line Drawing algorithm along with its Drawbacks. 8
  - b) Plot a Circle at origin (0,0) and radius = 8 using Bresenham's circle drawing algorithm. 8
  - c) Differentiate Raster scan display and vector scan display. 8

### UNIT – II

2.
  - a) Explain implementation of real time scan conversion. 8
  - b) Describe Inside- Outside Test. 8
  - c) Describe "Seed fill" Polygon filling algorithm. 8

### UNIT- III

3.
  - a) Derive transformation matrix for 2D-viewing transformation. 8

- b) Perform counter clockwise rotation of triangle  
A(2, 3) B(5,5) C(4, 3) about(1, 1) 8
- c) What is reflection and shearing, how to perform reflection and  
shearing about x-axis and  $Y = -X$  Line 8

## UNIT – IV

4. a) Explain Mid-Point subdivision algorithm for 2D clipping. 8
- b) Explain how generalized polygon clipping achieved with  
Sutherland Hodgeman polygon clipping 8
- c) Explain Back Face removal algorithm 8

## UNIT – V

5. a) Describe in detail RGB color model 8
- b) Explain Any four Graphics standard 8
- c) List and explain computer Graphics applications. 8

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## Microprocessor & Micro Controller (173104)

P. Pages : 2

Time : Three Hours

Max. Marks : 80

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.
5. Assume suitable data if necessary.
6. Figure to the right indicates full marks.

### UNIT – I

1. a) Explain memory segmentation of 8086 with suitable diagram. 8
- b) Explain macro & procedure in detail. 8
- c) Explain following instructions of 8086. 8
  - i) DAA.
  - ii) MUL.

### UNIT – II

2. a) Explain 8086 minimum mode block diagram only. 8
- b) Explain cascading mode and Automatic Rotation mode of 8259A. 8
- c) Explain DMA technique and DMA modes with suitable diagram. 8

## UNIT - III

3. a) What is address decoder ? Enlist address decoding techniques. Explain Full Address Decoding with suitable example. 8
- b) What is troubleshooting of memory module ? Explain checker board algorithm. 8
- c) Interface 32k ROM and 64k RAM with 8086 such that RAM begins at an address 00000H and ROM ends with FFFFFH. Draw memory map, decoder table and decoder design. 8

## UNIT - IV

4. a) Explain bus arbitration methods. 8
- b) Draw & explain 8087 stack Register & Control Register. 8
- c) Write an ALP to find area of circle using 8087. 8

## UNIT - V

5. a) Explain following. 8  
 i) Differentiate Microprocessor & Microcontroller.  
 ii) 8051 hardware features.
- b) Write a note on 8051 interrupts. 8
- c) Draw & explain TCON & TMOD register. 8

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**Digital System Design  
(1100)**

P. Pages : 3

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

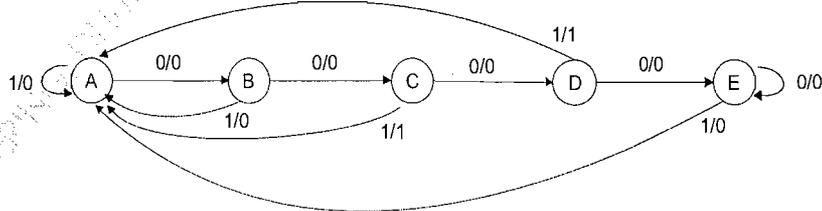
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided
4. Attempt **any two** questions from each unit.
5. Draw neat diagram whenever necessary.
6. Assume suitable data whenever necessary.

**UNIT I**

1. a) Design a combinational circuit whose output is high when input is greater than 9. 10
- b) Design BCD to Excess - 3 converter using basic gates. 10
- c) Implement Full adder circuit using 8:1 MUX. 10

**UNIT II**

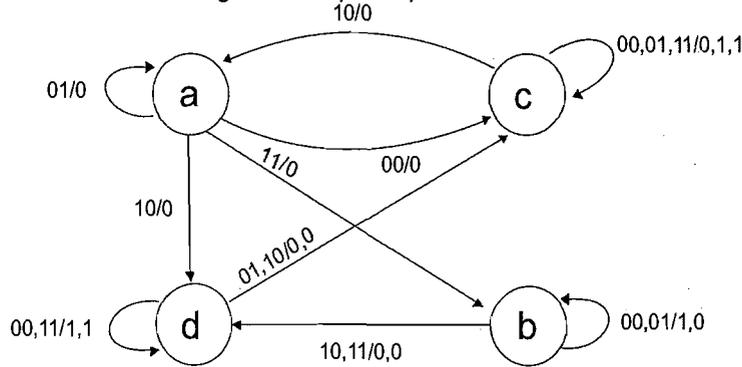
2. a) Implement following functions using PLA. 10  
 $F_1 = A\bar{B} + \bar{A}B\bar{C}$   
 $F_2 = \bar{A}B\bar{C} + \bar{B}C$   
 $F_3 = \bar{A}B\bar{C} + A\bar{C}$
- b) Implement the following state diagram using PAL. 10



- c) Design a combinational circuit having 3-bit binary input and output is square of input Implement circuit using ROM. 10

**UNIT III**

3. a) For given state diagram obtain state table, transition table and implement circuit using S-R Flip Flop. 10



- b) A Sequential circuit has 2-Flip Flop A & B, two inputs x & y and one output z. The Flip Flop input function and circuit output Function are given as below. 10

$$J_A = xB + \bar{y}\bar{B} \quad , \quad K_A = x\bar{y}\bar{B}$$

$$J_B = x\bar{A} \quad , \quad K_B = x\bar{y} + A$$

$$z = xyA + \bar{x}\bar{y}B$$

Obtain transition table, state table & State diagram.

- c) Design a Synchronous sequential circuit using J-K Flip Flop. The circuit is having single input and single output. Output is to be zero unless an input sequence of 3 consecutive one's occur. 10

**UNIT IV**

4. a) Reduce the following state table and implement using J-K Flip Flop. 10

| Present State | Next State |     | Output |     |
|---------------|------------|-----|--------|-----|
|               | x=0        | x=1 | x=0    | x=1 |
| a             | a          | b   | 0      | 0   |
| b             | c          | d   | 0      | 0   |
| c             | a          | d   | 0      | 0   |
| d             | e          | f   | 0      | 1   |
| e             | a          | f   | 0      | 1   |
| f             | g          | f   | 0      | 1   |
| g             | a          | f   | 0      | 1   |

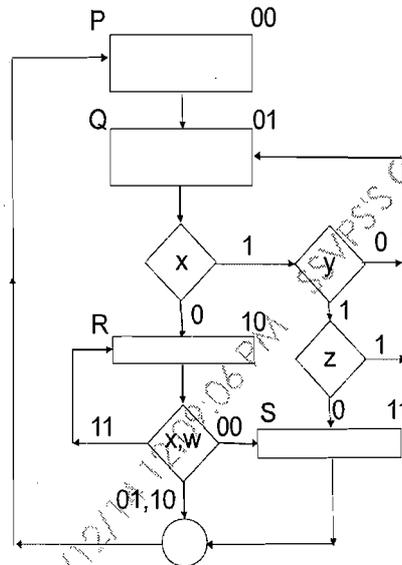
- b) Consider following state table minimize it upto 3 state by method of partition and implement the same using D-Flip Flop. 10

| Present state | Next state / output |     |
|---------------|---------------------|-----|
|               | x=0                 | x=1 |
| P             | R/0                 | P/0 |
| Q             | R/0                 | S/0 |
| R             | Q/0                 | S/1 |
| S             | R/0                 | P/0 |
| T             | P/0                 | S/0 |
| U             | P/0                 | S/1 |

- c) Design a 3-bit counter using J-K Flip Flop.

**UNIT V**

5. a) Implement following ASM chart using.  
 i) one-hot controller method.  
 ii) ROM controller method. 10



- b) Develop an ASM chart for circuit having input line x and output line z is to be zero unless input has been one for four consecutive clock cycles or 0(zero) for four consecutive cycles. The output must be one at the end of 4 consecutive identical input such that at any time input is same as it was during last 3 clock cycles. 10
- c) Explain ASM chart in detail. 10

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## Microprocessor - I (1070)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any two** questions from each unit.
5. Assume suitable data if necessary.

### UNIT - I

1. a) Explain following 8086 instructions with suitable examples. 10
  - i) LEA ii) CMPS
  - iii) SAHF iv) XOR 10
- b) Explain difference between 8086 & 8088. 10
- c) Explain following terms related to 8086.
  - i) Flag Register ii) IP & SP

### UNIT - II

2. a) Explain difference between macro & procedure. Also write syntax for NEAR & FAR procedure. 10
- b) Explain following MASM directives. 10
  - i) ASSUME ii) MACRO & ENDM
  - iii) PROC & ENDP iv) NEAR & FAR 10
- c) Write an ALP to find Factorial of given number.

## UNIT – III

3. a) Draw & explain formats for ICW1 & ICW2 of 8259A. 10
- b) Explain following signals related to 8086 operating modes. 10
- i)  $\overline{MN}|MX$  ii)  $DT|\overline{R}$
- iii) ALE iv) RESET 10
- v)  $S_0-S_2$
- c) Explain following.
- i) Comparison of 8086 minimum mode & maximum mode
- ii) 8089 IOP programming model.

## UNIT – IV

4. a) A memory module of 32 k RAM & 16 kB ROM is to be interfaced with 8086 such that RAM begins at an address 00000H. ROM address must be continue. Draw memory map. Decoder table & decoder design. 10
- b) What is address decoder? Enlist address decoding techniques and explain block address decoding technique with suitable example. 10
- c) Draw & explain block diagram of 8237 DMAC is short. 10

## UNIT – V

5. a) Write an ALP to find area of triangle using 8087. 10
- b) Draw short Real & long Real formats Convert following number into short real formats. 10
- i)  $(10.0)_{10}$
- c) Explain tightly coupled system & loosely coupled system with suitable diagram. 10

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## Data Structures & Files (1080)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub question from each unit.
5. Draw neat diagrams wherever necessary.
6. Assume suitable data if necessary

### UNIT – I

1. a) Explain algorithms for all operations associated with structure STACK, with examples ? 10
- b) Write notes on following. 10
  - i) Polish notations.
  - ii) Queue.
- c) Write and explain circular queue with algorithms & examples ? 10

### UNIT – II

2. a) Write algorithms to add and delete element from single linked list with example ? 10
- b) Write notes on following. 10
  - i) Storage pool.
  - ii) Data structure for DLL.
- c) Write algorithm for insertion and deletion of node in circular double linked list with example ? 10

## UNIT – III

3. a) Write an algorithm to implement following operations on binary tree. **10**  
 i) Insertion of node to Binary search tree.  
 ii) Search of node from Binary search tree.
- b) Explain height balance tree ? and explain all rotations algorithms to make tree height balanced ? **10**
- c) Write notes on following. **10**  
 i) Threaded binary tree  
 ii) Binary search tree.

## UNIT – IV

4. a) Explain heap sort ? Arrange following number in Ascending order. **10**  
 44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, 66
- b) Write notes on following. **10**  
 i) Merge sort  
 ii) Selection sort.
- c) What is Hash table ? When overflow occur into the hash table ? Explain one of the method of overflow handling. **10**

## UNIT – V

5. a) Write a note on : **10**  
 i) Sequential file.  
 ii) Relative file.
- b) Explain the operation of addition of record deletion of record in indexed sequential files ? **10**
- c) Explain description and organization of inverted files and multilist files ? **10**

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Seat Number

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## Computer Organization (1090)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

### Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.
5. Assume suitable data if necessary.
6. Figures to the right indicate full marks.

### UNIT – I

1. a) Explain basic functional units of a computer. 10
- b) Explain single bus structure and two bus structure. 10
- c) Explain the following addressing modes. 10
  - i) Register mode.
  - ii) Auto-increment mode.
  - iii) Index mode.
  - iv) Immediate mode.
  - v) Auto-decrement mode.

### UNIT – II

2. a) Perform the following division using non-restoring division method 10  
 $12 \div 5$ .
- b) Explain IEEE standard floating point formats for representation of 10  
a floating point numbers.
- c) Explain booth's algorithm to multiply the following pair. 10  
A = 110011 Multiplicand.  
B = 101100 Multiplier.

## UNIT – III

3. a) For a single bus CPU, write the control sequence to execute the instruction. **10**  
 "Jump to again labelled location if zero flag is set".
- b) Explain delay element method for designing Hardwired control unit. **10**
- c) Explain Wilkes design. **10**

## UNIT – IV

4. a) A block set associative cache of 2 kB has 4 sets with 2 blocks per set and CPU refers the main memory in the address range 00000 H – FFFFFH. Find number of bits in TAG, SET & WORD field if CPU happens to refer main memory at the following address, clearly indicate where these will be mapped in cache. **10**  
 i) 3 ABCD H  
 ii) 37904 H.
- b) Differentiate between SRAM and DRAM. **10**
- c) What is meant by virtual memory ? Explain with the help of neat diagram the virtual memory address translation. **10**

## UNIT –V

5. a) Write a note on : **10**  
 i) UNIBUS.  
 ii) IO channels.
- b) Explain the function of IEEE 488 with diagram. **10**
- c) Write a note on RISC with its advantages. **10**

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## Data Communications (1110)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** questions from each unit.
5. Figures to the right indicate full marks.
6. Assume suitable data if necessary.

### UNIT – I

- |    |                                                                                                                                                                                          |        |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| 1. | Explain layers in OSI model                                                                                                                                                              | 10     |
| 2. | a) A periodic signal has bandwidth of 20 Hz. The highest frequency is 60 Hz. What is the lowest frequency? Draw the spectrum if the signal contains all frequency of the same amplitude. | 5<br>5 |
|    | b) A signal travels through an amplifier and its power is increased 10 times this means $p_2 = 10 p_1$ , then calculate amplification (Gain of power)?                                   |        |
| 3. | Define data communication? explain the five components of data communication                                                                                                             | 10     |

### UNIT – II

- |    |                                                                     |    |
|----|---------------------------------------------------------------------|----|
| 1. | Explain and list three different techniques in serial transmission. | 10 |
| 2. | Explain the four techniques used in digital to analog conversion.   | 10 |
| 3. | Explain uploading and downloading in 56 K modem.                    | 10 |

## UNIT – III

- |    |                                                                                                                                                                                                                                      |    |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1. | Explain the role of routing in datagram network also explain destination address, efficiency, and delay in detail.                                                                                                                   | 10 |
| 2. | Explain fiber optic cable with advantages and disadvantages.                                                                                                                                                                         | 10 |
| 3. | a) Four channel are multiplexed using TDM and if each sends 100 bytes/sec and we multiplex 1 byte per channel. Show the frame travelling on the link. The size of the frame, duration of a frame rate, bit rate for the link in TDM. | 5  |
|    | b) Explain techniques of data rate management                                                                                                                                                                                        | 5  |

## UNIT – IV

- |    |                                                                                           |    |
|----|-------------------------------------------------------------------------------------------|----|
| 1. | Explain the steps calculated at sender and Receiver side to calculate checksum.           | 10 |
| 2. | Explain sender side algorithm and receiver side algorithm for stop and wait ARQ protocol. | 10 |
| 3. | Explain the concept of division in CRC encoder and CRC decoder.                           | 10 |

## UNIT – V

- |    |                                                               |    |
|----|---------------------------------------------------------------|----|
| 1. | Draw and explain IEEE 802.3 MAC frame format with its fields. | 10 |
| 2. | Explain procedure for pure ALOHA protocol                     | 10 |
| 3. | Explain network connecting devices in detail.                 | 10 |

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Seat Number

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## Engineering Mathematics - III (1050)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All the questions are compulsory.
5. Neat diagram must be drawn wherever necessary.
6. Figures to the right indicate full marks.
7. Use of non programmable calculator and statistical tables are allowed.
8. All the subquestions of a particular question (or unit) must be written at one place only.

1. Solve any four.

20

a)  $(D^2 - 2D + 1)y = x e^x \sin x$

b)  $(D^2 - 4D + 3)y = (x e^x)^2 + \sin(\log 2)$

c)  $(D^2 + 1)y = \log(\cos x)$  by method of variation of parameter.

d)  $4x^2 \frac{d^2 y}{dx^2} + y = 9 \cos(\log x) + 4 \sin(\log \sqrt{x})$

e)  $\frac{dx}{dt} + 5x - 2y = t, \frac{dy}{dt} + 2x + y = 0$

- f) A circuit consist of an inductance of 2 henrys, a resistance of 4 ohms and capacitance of 0.05 farads. If  $i = 0 = q$  at  $t = 0$ , Find  $q(t)$  for constant e.m.f. of 100 volts. Also find  $i(t)$  under steady state condition.

2. a) Solve **any two**.

8

a) Find  $Z\left\{\sin^2\left(k\frac{\pi}{4}\right)\right\}, k \geq 0$

b) Find  $Z\left\{5^k\delta(t-2)+k^2\right\}, k \geq 0$

c) Find Fourier sine transform of

$$f(x) = \begin{cases} 1, & 0 \leq x \leq 1 \\ 0, & x > 1 \end{cases} \quad \text{hence evaluate } \int_0^{\infty} \frac{\sin^3 \lambda}{\lambda} d\lambda$$

b) Solve **any two**.

12

p) Using Fourier integral representation show that

$$e^{-3x} \sinh x = \frac{12}{\pi} \int_0^{\infty} \frac{\lambda \sin \lambda x}{(\lambda^2 + 4)(\lambda^2 + 16)} d\lambda$$

q) Find  $Z^{-1}\left[\frac{z^3}{(z-1)\left(z-\frac{1}{2}\right)^2}\right], |z| > 1$  by using residue theorem.

r) Solve the different equation.

$$y_{k+2} + 6y_{k+1} + 9y_k = 2^k \quad \text{Given } y_0 = 0 = y_1.$$

3. Attempt **any four**.

20

a) Find  $L\left[e^{-2t} \frac{d}{dt}\left(\frac{\sin t}{t}\right) + 2^{2t}\right]$

b) Find  $L\left[t^2 H(t-2) - \cos ht(e^{-t})\delta(t-2)\right]$

c) Evaluate  $\int_0^{\infty} e^{-\sqrt{2}t} \cdot \frac{\sin t \cdot \sin ht}{t} dt$  by Laplace Transform.

d) Find :  $L^{-1} \left[ \log \frac{(S^2+1)}{S(S+1)} \right]$

e) Find :  $L^{-1} \left[ \frac{S^2}{(S^2+4)(S^2+9)} \right]$

f) Solve  $\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 2y = t\delta(t-1)$ , Given  $y(0) = 0 = y'(0)$

4. a) Attempt **any two**.

10

a) Find the coefficient of variance for the following data :

| Marks          | 0 - 10 | 10 - 20 | 20 - 30 | 30 - 40 | 40 - 50 | 50 - 60 | 60 - 70 |
|----------------|--------|---------|---------|---------|---------|---------|---------|
| No.of students | 10     | 15      | 25      | 30      | 10      | 5       | 5       |

b) For a distribution the mean is 10, variance is 16,  $r_1 = \sqrt{\beta_1} = 1$  &  $\beta_2 = 4$ . Find the first four moments about origin comment on nature of distribution.

c) Find the coefficient of correlation for the following data.

|            |     |     |     |     |     |     |     |     |     |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Price (X)  | 80  | 82  | 86  | 91  | 83  | 85  | 89  | 96  | 93  |
| Demand (Y) | 145 | 140 | 130 | 121 | 133 | 127 | 120 | 110 | 116 |

b) Attempt **any two**.

10

p) Can the following regression line are valid? why?

$$2x + 3y = 4, \quad x - y = 5$$

q) If X be a binomially distributed random variable with  $E(x) = 2$  &  $\text{Var}(x) = 4/3$  find the distribution of X.

r) On an average 20 red blood cells are found in a fixed volume of blood for a normal person. Determine the probability that the blood sample of a normal person will contain less than 5 red cell.

5) a) Attempt **any two**.

12

- a) Mice with an average life span of 32 months will live upto 40 months when fed by a certain nutritious food. If 64 Mice fed on this diet have an average life span of 38 months & S.D. of 5.8 months, is there any reason to believe that average lifespan is less than 40 months.  
[  $|Z_{\alpha}| = 2.33$  at 1% LOS ]

- b) A random sample of 220 students in second year Civil Engg; Mechanical Engg. & Computer Engg. were asked to give their opinion in terms of Yes or No about the winning of Congress Party in the election to be held on 13<sup>th</sup> Oct. 2009. The following data was collected. Test by using Chi-square test whether there is association between opinion and branch.

|     | SE (Civil) | SE (Comp) | SE (Mech) |
|-----|------------|-----------|-----------|
| Yes | 43         | 20        | 37        |
| No  | 23         | 57        | 40        |

[ Given  $\chi_{0.05,2}^2 = 5.99$  ]

- c) A company claim that alloying reduces resistance to electric wire by more than 0.050 ohms. To test this claim sample of standard wire and alloyed wire are tested yielding following result.

| Types of wire | Sample Size | mean resistance (ohms) | S.d. (ohms) |
|---------------|-------------|------------------------|-------------|
| Standard      | 32          | 0.136                  | 0.004       |
| alloyed       | 32          | 0.083                  | 0.005       |

can the claim be substantiated (i.e. acceptable) at 0.05 LOS.

[ Given  $|Z_{\alpha}| = 1.64$  at 5% LOS ]

b) Attempt **any two**.

8

- p) Define Gamma function and write any four properties of it.
- q) Define level of significance (LOS) in testing of hypothesis with proper example.
- r) Explain the test for goodness of fit by using Chi – square test.

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## Digital Systems & Microprocessor (1030)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

### Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub-questions from each unit.
5. Draw neat diagram wherever necessary.
6. Figure to right indicates full marks.
7. Assume suitable data wherever necessary.

### UNIT – I

1. a) Implement exclusive gates using universal gate only. 10
- b) Simplify following expressions using boolean laws. 10
  - i)  $BC + A\bar{C} + AB + BCD$
  - ii)  $WX + X\bar{Y} + YZ + X\bar{Z}$
- c) Explain DTL logic family with suitable diagram. 10

### UNIT – II

2. a) Solve following using kmap and implement it by using NAND only 10
  - i)  $Y = ABC \cdot \bar{D} + \bar{B} \cdot C + \bar{B} \cdot D + ABC \cdot \bar{D} + \bar{B} \cdot C$
  - ii)  $F = \bar{A}BD + \bar{A}CD + \bar{A}BC \cdot d = \bar{A}BCD + ACD + \bar{A}B \cdot \bar{D}$
- b) Explain full subtractor. Also construct it using two half subtractor and one OR gate. 10
- c) Solve and implement using kmap.
  - i)  $F = \sum m(0, 2, 5, 7, 8, 10, 13, 15, 16, 18, 21, 23, 24, 26, 29, 31)$  6
  - ii)  $F = \pi M(1, 3, 4, 6, 9, 11, 12, 14) \cdot d(0, 2, 8, 10)$ . 4

## UNIT – III

3. a) Implement 32:1 Mux using 4:1 Mux and 2:1 Mux. 10
- b) Design a combinational logic circuit whose input is 4 bit binary number and output is 2's complement of a given input number. 10
- c) Explain JK Flip Flop. How to avoid RACE condition in JK Flip-Flop. 10

## UNIT – IV

4. a) Explain 8085 addressing modes with suitable example. 10
- b) Explain following terms of 8085. 10
- |           |                |
|-----------|----------------|
| i) READY  | ii) CALL & RET |
| iii) HOLD | iv) DAA        |
- c) Draw & explain 8085 memory READ timing diagram. 10

## UNIT – V

5. a) Write an ALP for BCD to HEX conversion. 10
- b) Write an ALP for & bit addition result is 16 bit. 10
- c) i) Explain role of assembler. 10
- ii) Difference between Assembly language and High level language. 10

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Seat Number

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## Industrial Management & Economics (1040)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All question are compulsory
5. Figures to right indicate full marks.
6. Assume suitable data if necessary.

### UNIT – I

1. Solve **any two** question.

- |    |                                                                                                                            |    |
|----|----------------------------------------------------------------------------------------------------------------------------|----|
| a) | Define management. Why management has gained more importance in today's scenario. Correlate management and administration. | 10 |
| b) | Explain modern memory of management.<br>i) System approach.<br>ii) Quantitative approach.                                  | 10 |
| c) | Define motivation. Why motivation is important briefly explain Maslow's Hierarchy theory.                                  | 10 |

### UNIT – II

2. Solve **any two** questions.

- |    |                                                                                                                    |    |
|----|--------------------------------------------------------------------------------------------------------------------|----|
| a) | What are various types of organisation structures? Explain advantages of line and staff organisation with example. | 10 |
| b) | What are various forms of ownership. Explain public limited Joint stock company with advantages and disadvantages. | 10 |

- c) Explain public sector. In spite of its disadvantages why public sector organisations are important in developing countries as ours? Explain? **10**

**UNIT – III**

3. Solve **any two** questions.

- a) Define utility. Explain law of Diminishing Marginal utility with example of Bread. **10**
- b) Explain relation between Demand and supply and selling price of goods. What are the factors to be considered to fix up selling price? **10**
- c) Explain various sources of finance. Explain the role of nationalized Banks in the development of India. **10**

**UNIT – IV**

4. Solve **any two** questions.

- a) What is manpower planning? "Manpower planning affects efficiency of an organisation". Explain. **10**
- b) "Training Affects efficiency of worker" Explain. Explain vestibule school in detail. **10**
- c) Define Advertising. What are different media of Advertising? Which media will you choose for Advertising lathe machines manufactured by you? Explain in detail. **10**

**UNIT – V**

5. Solve **any two**.

- a) Define quality. Explain various factors that affect quality. What is the relation between quality of product and its manufacturing cost? **10**
- b) Define and Explain **10**  
 1) Patent  
 2) Copyright.
- c) Explain management Information system. State the role of management Information system in increasing efficiency of an organisation. **10**

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Seat Number

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## Discrete Structure & Graph Theory (1020)

P. Pages : 2

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with black ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Assume suitable data if necessary.
5. Draw neat diagram wherever is required.
6. Attempt **any two** sub-questions from each unit.

### UNIT - I

1. a) Prove by induction that sum of the cubes of 3 consecutive integers is divisible by 9. Also Define a explain principle of strong mathematical Induction. 10
- b) A husband and wife appear in an interview for two vacancies in the same post. The probability of husband's selection is  $1/3$  and that of wife's selection is  $1/2$ . What is the probability that. 10
  - i) both of them will be selected?
  - ii) only one of them will be selected?
  - iii) none of them will be selected?
- c) Among 130 students, 60 study Mathematics, 51 study Physics and 30 study both Mathematics and Physics. Out of 54 students studying Chemistry, 26 study Mathematics, 21 study Physics and 12 study both Mathematics and Physics. All the students studying neither mathematics nor physics are studying biology 10  
Find
  - 1) How many are studying biology?
  - 2) How many not studying chemistry are studying mathematics but not physics?
  - 3) How many students are studying neither mathematics nor physics nor Chemistry?

## UNIT - II

- 2 a) i) What is chain and antichain? 5  
 ii) Show that if seven numbers from 1 to 12 are chosen then two of them will add upto 13. 5
- b) Explain Equivalence and partial order relations with examples. 10
- c) What is difference between relation and function? Explain Surjection, Injection and Bijection. 10

## UNIT - III

3. a) Explain Hamiltonian path and Hamiltonian circuit, Eulerian path and Eulerian circuit with examples. 10
- b) Define the following graphs and give an example of each. 10  
 i) Spanning Subgraph ii) Complement of graph  
 iii) Factors of a graph iv) Planar graph
- c) i) What is shortest path algorithm? Explain it with example. 5  
 ii) Explain with an example Prim's algorithm. 5

## UNIT - IV

4. a) Explain following terms with examples. 10  
 i) Homomorphism ii) Isomorphism  
 iii) Auto morphism iv) Group
- b)  $G = \{1, 2, 3, 4, 5, 6\}$ . Find whether  $G$  is group under multiplication modulo 7. Also find whether it is an abelian group. Justify your answer. 10
- c) What is Time complexity of algorithm? Explain it with shortest path algo and Bubble sort Algo. 10

## UNIT - V

5. a) Prove that in a distributive lattice, if an element has a complement, then this complement is unique. 10
- b) Write DNF and CNF equation for function  $\Sigma_m(0, 1, 3, 6, 9, 13, 14)$  10
- c) Explain properties of algebraic systems Defined by lattice. 10

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