

## Second Semester Bachelor of Engineering Examination

## ENGINEERING MATHEMATICS - II

Time : 3 Hours ]

[ Max. Marks : 60

## Instructions to Candidates :—

- (1) All questions carry marks as indicated against them..
- (2) Use of non - programmable calculator is permitted.

## 1. Solve any two :—

- (a) Evaluate

$$\int_0^{2a} x \sqrt{2ax - x^2} dx$$

5

- (b) Using differentiation under the integral sign evaluate

$$\int_0^1 \frac{x^a - x^b}{\log x} dx \quad a > 0, b > 0$$

5

- (c) Find R M S value of one complete period of the function
- $f(t) = \frac{1}{2} + \cos t$
- , hence show that the peak value = peak value =
- $\sqrt{3}$
- (RMS value).

5

## 2. Solve any two :—

- (a) Find the area of the loop of the curve
- $x(x^2 + y^2) = a(x^2 - y^2)$
- . 5

- (b) Find the volume of the spindle formed by the revolution of a parabolic arc about the line joining the vertex to one extremity of the latus rectum. 5

- (c) Find the surface of the solid of revolution formed by the revolution of
- $r = a(1 + \cos \theta)$
- about the initial line. 5

3. Solve any two :—

(a) Evaluate

$$\int_0^a \int_0^{\sqrt{a^2-x^2}} \frac{\sqrt{a^2-x^2}}{\sqrt{a^2-x^2-y^2}} dy dx, \text{ by changing to polar coordinates.} \quad 5$$

(b) Find the mass of the plate, which is inside the circle  $r=2a \cos \theta$  and  $r=a$ , if the density varies as the distance from the pole. 5

(c) Evaluate

$$\iiint_V xyz \, dx \, dy \, dz \text{ where } v \text{ is bounded by } x=0, y=0, z=0 \text{ and } x+y+z=1. \quad 5$$

4. Solve any two :—

(a) Find the direction derivative of  $v^2$ , where  $\vec{v} = xy^2\hat{i} + zy^2\hat{j} + xz^2\hat{k}$  at the point  $(2, 0, 3)$  in the direction of the outward normal to the sphere  $x^2 + y^2 + z^2 = 14$  at the point  $(3, 2, 1)$ . 5

(b) Check whether  $\vec{F} = (y^2 - z^2 + 3yz)\hat{i} + (3xz + 2xy)\hat{j} + (3xy - 2xz + 2z)\hat{k}$  is both solenoidal and irrotational. 5

(c) If  $\vec{F} = (2xyz)\hat{i} + (x^2y)\hat{j} + (x^2y)\hat{k}$ , then show that  $\vec{F}$  is irrotational field and its scalar potential  $\phi$  such that  $\vec{F} = \nabla\phi$ . Also find the work done in moving a particle in this field from  $(0, 1, 1)$  to  $(1, 2, 0)$ . 5

5. Solve any two :—

(a) Using Gauss divergence theorem, evaluate

$$\iiint_V \vec{F} \cdot \hat{n} \, ds, \text{ for } \vec{F} = (xy\hat{i} - y^2\hat{j} + 2y)\hat{j} + 4xz^2\hat{k} \text{ over the region bounded by the cylinder } x^2 + y^2 = 9 \text{ and the plane } y=2, \text{ in the first octant.} \quad 5$$

(b) Evaluate

$$\iiint_V (\nabla \times \vec{F}) \cdot \hat{n} \, ds, \text{ where } \vec{F} = (x^2 + y - 4)\hat{i} + 3xy\hat{j} + (2xz + z^2)\hat{k}$$

Over the surface of the sphere  $x^2 + y^2 + z^2 = 16$  above  $xy$  plane. 5

- (c) Evaluate  $\oint [(x^2 + 2y) dx + (4x + y^2) dy]$  by Green's theorem, where C is the boundary of the region bounded by  $x=0$ ,  $y=2x$  and  $x+y=3$ . 5

6. Solve any two :—

- (a) Fit a curve of the type  $y = ae^{bx}$  to the following data :

x	1	2	3	4	5	6
y	1.6	4.5	13.8	40.2	125	300

5

- (b) Find the coefficient of correlation and the lines of regressions to the following data. :

x	5	7	8	10	11	13	16
y	33	30	28	20	18	16	9

5

- (c) For the following set of data

y	10	17	18	26	35	8
X <sub>1</sub>	8	21	14	17	36	9
X <sub>2</sub>	4	9	11	20	13	28

Find the equation of the multiple regression plane

$y = a + bx_1 + cx_2$  and predict y for  $x_1 = 20$  and  $x_2 = 10$ .

5



Third Semester B. E. (Computer Science and Engineering) Examination

**DATA STRUCTURE AND PROGRAM DESIGN**

Time : 3 Hours ]

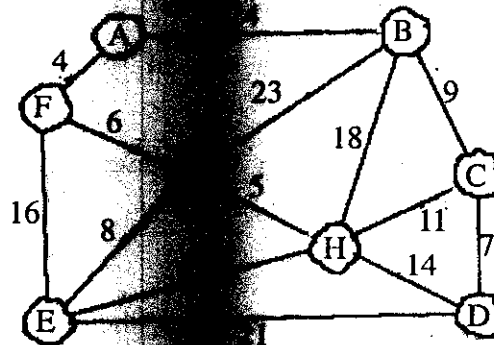
[ Max. Marks : 60

**Instructions to Candidates :—**

- (1) All question carry equal marks.
- (2) Solve any Two sub-questions from each question.
- (3) Mention comments properly before writing the algorithms.

1.
  - (a) Write an algorithm for finding transpose of a sparse matrix. Sparse matrix is given as an input in 3-tuple form. 5
  - (b) How can you implement multiple queues in an array ? Write generalized functions for insertion and deletion. 5
  - (c) Convert the following infix expression to its equivalent postfix expression using stack. Write an algorithm for the same.  
$$(A + (B * (C - D) / E)) ^ K$$
 5
2.
  - (a) Write a function for the implementation of stack using linked list. State the advantages of linked stack over array implementation of stack. 5
  - (b) Write a function for deletion off all occurrences of x in a singly linked list. 5
  - (c) Write a function for merging two sorted circular linked lists into a single sorted circular linked list. 5
3.
  - (a) Write a recursive algorithm to count the number of nodes having both the children in a binary tree. 5
  - (b) Write a function in C to find the second largest element in the already constructed Binary search tree. 5

- (c) Explain the necessity for a self balanced tree ? Construct AVL tree step by step for the following numbers :  
35, 78, 86, 81, 17, 15, 11, 10 5
4. (a) Given  $X = \{4371, 1323, 4199, 4344, 9679, 1989\}$  and  $H(x) = x \bmod 10$ . Show the resulting hash table using (1) Separate Chaining, (2) Open addressing with linear probing. 5
- (b) Explain the following terms in the context of hashing :  
(1) Primary clustering  
(2) Secondary clustering  
(3) Random Clustering 5
- (c) Explain the following collision resolution techniques in brief :  
(1) Linear Probing.  
(2) Quadratic Probing.  
(3) Rehashing. 5
5. (a) Write Prim's Algorithm for finding the minimum cost spanning tree. Apply the algorithm for the following connected graph. 5



- (b) Write a C function that uses breadth first traversal to determine if a directed graph is cyclic. 5

- (c) Write a C function to compute the in-degree and out-degree of a vertex of a directed graph when graph is represented by Adjacency List. 5
6. (a) Write a function for quick sort. Comment on the worst case of the algorithm. 5
- (b) Give an algorithm for bubble sort. What sort of modification can be done when the input data is in sorted order for improving the performance ? Apply the algorithm on the following data :  
32, 45, 15, 12, 36, 78 5
- (c) Write an algorithm or function for creation of a heap from a given list. Comment on the time complexity of the algorithm. 5





**Third Semester B. E. (Computer Science and Engineering)  
Examination**

**DIGITAL CIRCUITS AND FUNDAMENTALS OF MICROPROCESSOR**

Time : 3 Hours]

[Max. Marks : 60

**Instructions to Candidates :—**

- (1) All questions carry marks as indicated against them.
- (2) Due credit will be given to neatness and adequate dimensions.
- (3) Assume suitable data and illustrate answers with neat sketches wherever necessary.

1. (a) Convert the following numbers from the given base to the other three bases listed in the table :

Decimal	Binary	Octal	Hexadecimal	
369-3125	?	?	?	
?	101111-101	?	?	
?	?	326-5	?	
?	?	?	F3C7-A	8

**OR**

- (b) Find the Minterms and Maxterms of the following Boolean expression and Simplify it with the help of K-map :

$$Y = B'D' + ABD + A'BC \quad 8$$

- (c) Represent the decimal numbers 694 and 835 in BCD. 2

2. (a) A Combinational circuit is defined by the following three Boolean functions :

$$F1 = (X + Y)' + XYZ'$$

$$F2 = XYZ + (X + Y)' \text{ and}$$

$$F3 = (X + Y)' + X'YZ$$

Design the circuit with a decoder and external OR gates. 8

- (b) Design the Boolean equation for a 16:1 and 8:1 MUX. 8
- (c) Subtract using 2's complement method (44 - 22). 2
3. (a) A sequential circuit with two D flip-flops A and B, two inputs X and Y and one output Z is defined by the following input equations :
- $$D_A = X'Y + XA$$
- $$D_B = X'B + XA \text{ and}$$
- $$Z = XB$$
- (a) Draw the logic diagram of the circuit.
- (b) Derive state table.
- (c) Derive state diagram. 10
4. (a) Convert J-K Flip-flop to a Delay Flip-flop. 5
- (b) How a Latch can be converted into a Flip-flop ? Give any one example along with a truth table. 5
5. (a) Design a Synchronous up counter MOD5 counter using J-K Flip-flop.
- $S_0 \rightarrow S_2 \rightarrow S_4 \rightarrow S_6 \rightarrow 7$
- (b) Design a 3 bit twisted ring counter using a T-ff and also give the sequence of states of the counter. 7
- (c) State the different types of registers and give the design of any one. 3

6. (a) Design a Full Subtractor circuit with three inputs and two outputs with the help of ROM. Specify the size of ROM required for the implementation. 7

OR

- (b) (i) How many 32k x 8 RAM chips are needed to provide a memory capacity of 1 M bytes ?
- (ii) How many lines of the address must be used to access 1 M bytes ?
- (iii) How many of these lines are connected to the address inputs of all chips ?
- (iv) How many lines must be decoded for the chip select inputs ? Specify the size of the decoder. Also draw the logic diagram for this. 7
- (c) Write a note on Flash memories. 3
7. (a) Specify the addressing mode and the operation performed by the following instructions :
- (a) LHLD C200H.
- (b) STAX Rp.
- (c) ADD M.
- (d) PUSH Rp.
- (e) RAR. 10

OR

8. (a) Write a program using 8085 instruction which will count the no. of one's and zero's in a 8 bit hexadecimal number which is stored at memory location C200H. Store no. of 1's at C2001H and 0's at C202H. 5
- (b) Explain with example the action of XTHL and POP instructions in 8085 microprocessor on Stack pointer and Program counter. 5



**Third Semester B. E. (Computer Science and Engineering)  
Examination**

**BUSINESS DATA PROCESSING**

Time : 3 Hours ]

[ Max. Marks : 60

**Instructions to Candidates :—**

- (1) Attempt all questions.
- (2) All questions carry marks as indicated against them.
- (3) Due credit will be given to neatness and adequate dimensions.
- (4) Assume suitable data and illustrate answers with syntax (s) wherever necessary.
- (5) **Mobile phones and/or electronic gadgets are prohibited in the examination hall.**
- (6) Use of non - programmable calculator is permitted.

**1. Attempt any two of the following :—**

- (a) Explain significance of column-07 of COBOL coding sheet. How is non-numeric literal continued in next line ? Explain. 5
- (b) Write a COBOL program to determine whether a number entered at the console is a palindrome. You must ensure that the user input is a 6-digit number. The program should also display sum-of-digits of the inputted number. 5
- (c) Explain with syntax the following :—
  - (i) SYNCHRONIZED clause
  - (ii) USAGE clause. 5

**2. Attempt any two of the following :—**

- (a) Elaborate on the following :—
  - (i) PERFORM ... UNTIL
  - (ii) PERFORM ... TIMES. 5

- (b) Write a COBOL program that will read coefficients of a quadratic equation and compute its roots. Consider all possible cases. All roots including imaginary roots must also be computed and shown in appropriate manner. 5
- (c) What is a module? Elaborate on the structured programming forms of program structure. 5
3. Attempt any two of the following
- (a) What is file organization? Elaborate on the principle considerations in selecting a file organization. 5
- (b) A file PARKING-FL contains records composed as -Car Number (4 digits). Time Parked (HH : MM). For the first one hour of parking duration a minimum of 30 units are charged. Thereafter the charge is 25 units per hour. The fractional duration up to 15 minutes is charged 15 units otherwise. Write a COBOL program that will print for each record in PARKING-FL, the Car Number followed by Parking Fee. 5
- (c) Academic data for students of a class are to be stored on a file - ACAD-DATA. Each record is comprised as -Roll Number (3 digits), Name (20 characters). Marks in Subjects each not exceeding 100. Write a COBOL program to create line sequential file as described above. You must use OCCURS clause in organizing the input record data. 5
4. Attempt any one of the following
- (a) What do you understand by shuffling or randomization? State its significance to relative files. Write a COBOL program to create a relative file - STUDENT-REL-FL. In a class size of 30 students, each student record is composed as - Roll Number (4 digits between 1001 and 1099). Department Code (2 char with allowable values - CS, ME, EN). Name of Student (first name, last name). The Roll Number should serve for randomization of records. 10

- (b) The stock information for a departmental store is available as a deck of cards. Each card is organized as –Product –ID (5 digits). Description (40 characters). Unit Price (99999v99). Recorder Quantity (3 digits). The cards are unique but not in any defined order.  
Write a program to create an indexed file using above deck of cards. You must ensure that the indexed file contains as many records as the number of cards. 5

5. Attempt any two of the following :—

- (a) Elaborate on the significance of work file in sorting, Differentiate between RETURN and RELEASE statements. 5
- (b) Discuss general format of a report elaborating on different groups. 5
- (c) Student information for a class is stored on two sequential files.  
A file – 1 record contains –Roll Number, Name and Gender.  
File – 2 record contains –Roll Number, Branch and CGPA.  
Write a COBOL program to merge these files to create a file, containing student records with CGPA > 8.0. The record should contain –Roll Number, Name, Gender, Branch and CGPA.  
The inputs files are in ascending order of roll numbers, and that roll numbers are identical on both files. 5

6. Attempt any two of the following :—

- (a) Explain INSPECT statement with syntax. Give suitable example demonstrating options available with this statement. 5
- (b) A file contains in its records with other information, an elementary field called NAME (25 char) which stores the name as "First Name ; Last Name ; Middle Initial". For example, "Natalia ; Garcia Molina ; K"  
Write a COBOL program to order the file by last name and first name. 5
- (c) State the advantages of using subroutine programs. Write a COBOL program that will compute area and circumference of a circle using a subroutine "CircleAV". The output values must be displayed in the main routine. 5





**Third Semester B. E. (Computer Science and Engineering)  
Examination**

**COMPUTER ARCHITECTURE AND ORGANIZATION**

Time : 3 Hours ]

[ Max. Marks : 60

**Instructions to Candidates :—**

- (1) All questions carry marks as indicated against them.
- (2) Question 3 (a) , 3 (b) , 6 (a) , 6 (b) and 7 are compulsory.
- (3) Assume suitable data and illustrate answers with neat sketches wherever necessary.

1. (a) Assume 16-bit instruction length. Explain Expanding op-codes for the following types of instructions. Also write the encoding and decoding scheme.
  - (1) 14 instructions with 12 bit – address
  - (2) 7 instructions with 10 bit – address
  - (3) 8 instructions with 7 bit – address. 4

- (b) Consider the possibility for saving the return address of a subroutine. Can a processor register be used if subroutine nesting has to be supported ? Justify the answer and provide the solution for implementing subroutine nesting. 4

- (c) Write a program that can evaluate the expression  
$$(A \times B + C \times D) / E$$

In a single – accumulator processor, assume that processor has Load, Store, Multiply, and Add instructions, and that all the values fit in the accumulator. 2

**OR**

2. (a) Briefly describe :—
  - (i) Control signals generated for unconditional and conditional branch instruction.
  - (ii) MAR and MDR. 4

- (b) Consider a computer that has byte-addressable memory organized in 32-bit words according to little-endian scheme. A program reads ASCII characters (in HEX form) entered at the keyboard and stores them in successive byte locations, starting at address 1000. Show the contents of memory words : 1000, 1004 and 1008 after the word "Encyclopedia" has been entered. 3
- (c) Write an assembly language program to add five numbers stored in successive memory locations. 3
3. (a) Why is bus tie G needed in bus architecture ? Explain with example. 2
- (b) Explain Micro-programmed Control Unit. Also explain the need for grouping of signals and how it is done for micro-routine. 4
- (c) Explain three bus organizations with diagram. Write the control sequence for the execution of following instructions : Add R1, (R2), R3. 4
- (d) Explain two bus organizations with diagram. Write the control sequence for the execution of following instructions : MUL R1, (R2). 4
4. (a) Explain the single and double precision format. Also represent  $-1/32$  in IEEE single and double precision format. 5
- (b) Multiply the following numbers using Booth's algorithm :  $-13 \times 6$ . State what are good and worst multipliers. 5
5. (a) Show the addition of 0001 and 0001 using fast adder logic. Show the values of all G, P, and C sum for all adders. Also explain overflow condition and how it is detected in carry look-ahead adder ? 5
- (b) Consider floating point numbers are represented in 12 bit format : 1 bit for sign, 5 bits for 15 exponent and 6 bits for mantissa. Represent the following numbers in the above format :  $-1.7, 1/32$ . 5

6. (a) (i) How many 128 x 8 RAM chips are needed to provide a memory capacity of 4096 bytes ?
- (ii) How many address lines are needed for 4096 bytes of memory ? How many lines will be common to all chips.
- (iii) How many lines must be decoded for chip select ? Specify size of decoder.
- And show the design of memory. 5

(b) Define and explain the following terms related to Hard disk.

(i) Magnetic surface

(ii) Cylinder

(iii) Seek time

(iv) Access time. 2

- (c) Show the organization of 16-megabit Dynamic-RAM chip, configured as  $2M \times 8$ . The cells must be organized using  $4K \times 4K$  array. 3

OR

- (d) For the memory capacity of 256 KB, how many 32 k x 1 RAM will be needed ? Draw and explain. 3

7. (a) Differentiate between I/O Mapped I/O and Memory Mapped I/O. 3

(b) Briefly describe (any three) :—

(i) Interrupt Service Routine

(ii) Subroutine

(iii) Polling

(iv) Priority interrupt handling scheme. 3

- (c) Explain the Centralized and distributed Bus arbitration. 4

8. (a) Consider a machine with byte addressable main memory of 216 bytes and block size of 8 bytes. Assume that a direct mapped cache consisting of 32 lines is used in this machine.

(A) How is 16-bit memory address divided into tag, line and byte number ?

(B) Into what lines and bytes with each of the following addresses be stored ?

0001 0001 1011

0011 0011 0100

0000 0001 1101

0010 1010 1010

(C) Suppose the byte with the address 0001 1010 0001 1010 is stored in the cache. What are addresses of the other bytes stored along with it ?

(D) How many bytes of memory can be stored in the cache ?

(E) Why is the byte also stored in the cache ?

5

(b) Describe briefly about five) :—

(i) Temporal locality reference

(ii) Spatial Locality reference

(iii) Write through

(iv) Dirty bit

(v) Memory hierarchy

(vi) Replacement algorithm.

5

OR

9. (a) Consider the following address trace and find the number of hits for cache containing 3 blocks.

2 3 2 1 5 2 5 3 2 5 2

Use FIFO, LRU and optimal replacement algorithm.

6

(b) Explain block set associative memory mapping technique.

4

**Third Semester B. E. (Computer Science and Engineering)  
Examination**

**TECHNICAL COMMUNICATION**

Time : 3 Hours ]

[ Max. Marks : 60

**Instructions to Candidates :—**

- (1) Mobile are not allowed in the examination hall.
- (2) All questions carry marks as indicated against them.
- (3) Due credit will be given to neatness and adequate dimensions.
- (4) Assume suitable data and illustrate answers with neat sketches wherever necessary.

1. (a) Explain any One 21st Century Business Management Philosophy. 5
- (b) State the importance of teamwork in technical communication. 5

**OR**

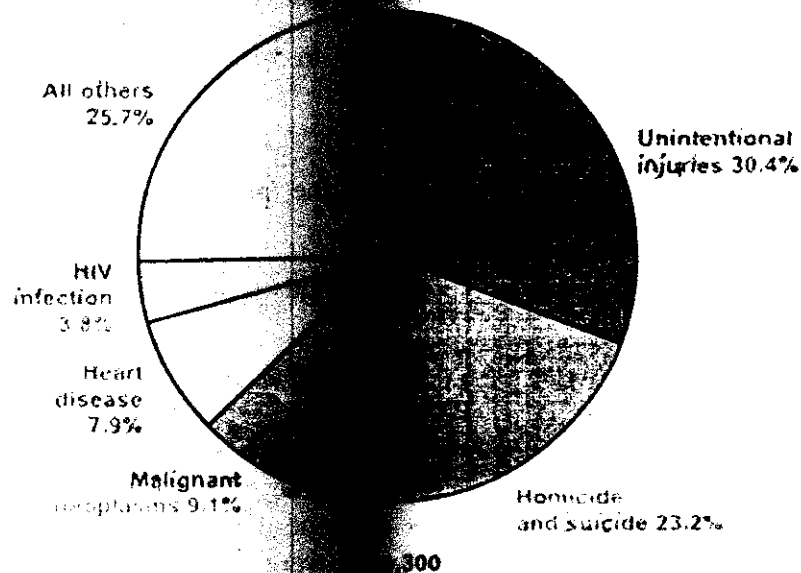
2. (a) Explain the technique of writing in the 'pre-writing-writing-rewriting' process. 5
- (b) How do e-mails, memos, letters and reports differ from each other ? 5

3. (a) The content of the following paragraph is unclear. Edit it.  
Our latest attempt at moulding perform protectors has led to some positive results. We spent several hours in Dept. 15 trying different machines settings and techniques. Several good parts were moulded using two different sheet thickness. Here's a summary of the findings.  
First, we tried the thick sheet material. At 204 degree Fahrenheit, this thickness worked well. We tested many samples of this material.  
Next, we tried the thinner sheet material. The thinner material is less forgiving, but after a few adjustments we were making good parts. Still, the thin material caused the most handling problems. 6

(b) Cite the following in any (MLA or APA or IEEE) reference styles:

- Paperback: 674 pages
- Publisher: Macmillan Education; 3rd EDN edition (2015)
- Language: English
- ISBN-10: 9350597292
- ISBN-13: 978-9350597292
- Author(s) : Carol A. T. , Jamie Potter, A K Jason
- Name of the book: Principles and Practices of Banking
- Place of Publication: San Francisco, California State (CA) 2x2=4

4. Analyze the following data on 'Number of Deaths by Cause Among 25-34 Year Olds - United States, 2003' and prepare a report based on it.



5. Draft a resume stating relevant information about you. Don't mention your name. Assume your name as Annie Hayden/Ramona Nav. 10

You are Jan Pascal, Director, Safe Hospital, Civil Road, Nashik. Draft a letter inquiring to Joshon Lifts, Lokhandwala complex, Mumbai about different kinds of lifts like stair lifts, wheelchair lifts, bath and escalators meant to be fitted as outpatient care equipment. 5

6. (a) Draft a flyer/pamphlet on 'Office Mate Stationary Products' to be circulated with newspapers. 10

OR

Write a user manual on Kodak Wall Mounted CCTV camera.



10

- (b) Do as directed :
- (i) I love to write I would write on everyday if I had the time.  
(Correct the run-on sentence)
  - (ii) Shows no improvement in any of the vital signs.  
(Correct the sentence fragment)
  - (iii) My uncle likes to eat in restaurants and visiting museums.  
(Edit the sentence to have parallel structure)
  - (iv) His Supervisor undoubtedly think that all the employees wants incentives.  
(Correct the sentence)
  - (v) Overtime is favoured by hourly workers. (Change the voice).

5

7. Write short notes on any two of the following :—

- (i) Fog Index
- (ii) 'Order' in effective document design
- (iii) Multicultural Communication
- (iv) 'Access' in effective document design
- (v) Answering reporter's questions as one of the steps while gathering data in the pre-writing process.

10





**Third Semester B. E. (Computer Science and Engineering/Information Technology) Examination****ENGINEERING MATHEMATICS - III**

Time : 3 Hours ]

[ Max. Marks : 60

**Instructions to Candidates :—**

- (1) Mobile phones are prohibited in examination hall.
- (2) All questions carry equal marks.
- (3) Use of non programmable calculator is permitted.
- (4) Use of normal distribution table is permitted.

**1. Solve any two :—**

- (a) Test the consistency of the following system of equations and, if consistent, solve them

$$x + 2y - z = 3, \quad 3x - y + 2z = 1, \quad 2x - 2y + 3z = 2, \quad x - y + z = -1. \quad 5$$

- (b) Find the eigen values and corresponding eigen vectors of the following matrix:

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$$

5

- (c) Use Sylvester's Theorem to find  $A^{-1}$  where

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

5

**2. Solve any two :—**

- (a) Find the real root of the equation  $x \log_{10} x - 1.2 = 0$  by the method of false position correct to four decimal places. 5

- (b) Use the fourth order Runge-Kutta method to find  $u(0.2)$ , of the initial value problem  $\frac{du}{dt} = -u$ ,  $u(0) = 1$ , using  $h = 0.1$ . 5

- (c) Use Crout's method to solve the equations

$$3x + 2y + 7z = 3, \quad 2x + 3y + 4z = 5, \quad 3x + 4y + z = 7. \quad 5$$

3. Solve any **two** :—

- (a) Prove that, if  $Z\{f_n\} = F(z)$  then  $Z\left\{\frac{f_n}{n+k}\right\} = z^k \int_z^\infty \frac{F(z)}{z^{k+1}} dz$ .

Hence find  $Z\left\{\frac{(-4)^n}{n+1}\right\}$ .

5

- (b) State and prove Convolution theorem for Z-transform.

Hence find  $Z^{-1}\left\{\frac{1}{(1-2z^{-1})(1-3z^{-1})}\right\}$ .

5

- (c) Solve following difference equation by using Z-transform :

$$y_{n+2} - 2\cos \alpha y_{n+1} + y_n = 1, \quad y_0 = 1, \quad y_1 = \cos \alpha. \quad 5$$

4. Solve any **two** :—

- (a) The probability function of discrete random variable X is

$$f(x) = \begin{cases} \frac{x}{15}, & x = 1, 2, 3, 4, 5 \\ 0, & \text{otherwise} \end{cases}$$

Find (i)  $P(X = 1)$  or (ii)  $P(0.5 < X < 2.5 \mid X > 1)$  5

- (b) Define distribution function of continuous random variable. Find the values of constants 'a' and 'b' such that

$$F(x) = \begin{cases} 1 - ae^{-x/b}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

is a valid distribution function.

5

- (c) Find the conditional density of (i) X given Y and (ii) Y given X for the distribution

$$f(x, y) = \begin{cases} \frac{3(x^2 + y^2)}{2}, & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

5

5. Solve any two :—

- (a) Let X and Y be two independent random variables such that

$$X = \begin{cases} 1, & \text{prob. } 1/3 \\ 0, & \text{prob. } 2/3 \end{cases}, \quad Y = \begin{cases} 2, & \text{prob. } 3/4 \\ -3, & \text{prob. } 1/4 \end{cases}$$

Find (i)  $E(3X + 2Y)$  (ii)  $E(2X^2 - Y^2)$  (iii)  $E(XY)$  (iv)  $E(X^2Y)$

5

- (b) Find the moment generating function if the density function is

$$f(x) = \begin{cases} x e^{-x}, & x > 0 \\ 0, & \text{otherwise} \end{cases}$$

Also find first three moments about origin.

5

- (c) Let  $f(x) = \begin{cases} c(1 - x^2), & -1 < x < 1 \\ 0, & \text{otherwise} \end{cases}$

Find (i) c (ii) coefficient of skewness and (iii) coefficient of kurtosis.

5

6. (a) An underground mine has 5 pumps installed for pumping out storm water, the probability of any one of the pumps failing during the storm is  $1/8$ . What is the probability that (i) at least 2 pumps will be working; (ii) all the pumps will be working during a particular storm ? 4
- (b) Find moment generating function of Poisson distribution. 3
- (c) In a male population of 1000, the mean height is 68.16 inches and standard deviation is 3.2 inches. Use normal distribution to find the number of men whose height is more than 6 feet (72 inches). 3

