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10MAT41

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Use Picards method to obtain the solution of $\frac{dy}{dx} = e^x - y$, $y(0) = 1$ and hence find $y(0.2)$ considering upto third approximation. **(06 Marks)**

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

c. Find $y(0.2)$ using modified Euler's method correct to four decimal places for the equation $\frac{dy}{dx} = x - y^2$, $y(0) = 1$, taking $h = 0.1$. **(07 Marks)**

2 a. Solve $\frac{dy}{dx} = 1 + zx$, $\frac{dz}{dx} = -xy$ with $y(0) = 0$, $z(0) = 1$ at $x = 0.3$ by applying Runge-Kutta method of fourth order. **(06 Marks)**

b. Obtain the solution of the equation $2y'' = 4x + y'$ with initial conditions $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.464$, $y(1.3) = 2.7514$ and $y'(1) = 2$, $y'(1.1) = 2.3178$, $y'(1.2) = 2.6725$ and $y'(1.3) = 3.0657$ by computing $y(1.4)$ applying Milne's method. **(07 Marks)**

c. Use Picard's method to obtain the second approximation to the solution of $\frac{d^2y}{dx^2} - x^3\frac{dy}{dx} - x^3y = 0$ given $y(0) = 1$, $y'(0) = \frac{1}{2}$ and hence find $y(0.1)$. **(07 Marks)**

3 a. State and prove Cauchy-Riemann equations in polar form. **(06 Marks)**

b. Find the analytic function $f(z)$ whose imaginary part is $\left(r - \frac{k^2}{r}\right)\sin\theta$, $r \neq 0$ and hence find the real part of $f(z)$. **(07 Marks)**

c. If $f(z)$ is a regular function of z, 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)**

4 a. Find the image of the triangular region bounded by the lines $x = 1$, $y = 1$, $x + y = 1$ under the transformation $W = Z^2$. **(07 Marks)**

b. If $f(z)$ is analytic within and on C (simple closed curve) and 'a' is a point within 'c' prove that $f(a) = \frac{1}{2\pi i}\int_C \frac{f(z)}{z-a}dz$. **(06 Marks)**

c. Evaluate $\int_C \frac{e^{2z}}{(z+1)^2(z-2)}$ where C is the circle $|z| = 3$. **(07 Marks)**

PART – B

5 a. Obtain the series solution of Bessel's differential equation. **(07 Marks)**

b. Derive the Rodrigues formula. **(06 Marks)**

c. If $x^3 + 2x^2 - x + 1 = aP_0(x) + bP_1(x) + cP_2(x) + dP_3(x)$ using Rodrigue's formula find the values of a, b, c, d. **(07 Marks)**

6 a. If A and B are events with $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{4}$, $P(\overline{B}) = \frac{5}{8}$ find $P(A \cap B)$, $P(\overline{A} \cap \overline{B})$, $P(\overline{A} \cup \overline{B})$ and $P(\overline{A} \cap B)$. **(06 Marks)**

b. In a college boys and girls are equal in proportion. It was found that 10 out of 100 boys and 25 out of 100 girls were referring same author text book. If a student using that was selected at random, what is the probability of being a boy? **(07 Marks)**

c. A bag contains three coins, one of which is two headed and the other two are normal and fair. A coin is chosen at random from the bag and tossed four times in Succession if head turns up each time, what is the probability that this is the two headed coin. **(07 Marks)**

7 a. Find the value of 'K' such that the following distribution represents a finite probability distribution. Hence find the mean (μ) and standard deviation (σ). Also find $P(X \leq 1)$, $P(X>1)$ and $P(-1 < X \leq 2)$. **(06 Marks)**

X	-3	-2	-1	0	1	2	3
P(X)	k	2k	3k	4k	3k	2k	k

b. If the mean and standard deviation of the number of correctly answered questions in a test given to 4096 students are 2.5 and $\sqrt{1.875}$, find an estimate of the number of candidates answering correctly (i) 8 or more questions (ii) 2 or less (iii) 5 questions. **(07 Marks)**

c. Derive the expressions for the mean and standard deviation of exponential distribution. **(07 Marks)**

8 a. Certain tubes manufactured by a company have mean life time of 800 hours and standard deviation of 60 hours. Find the probability that a random sample of 16 tubes taken from the group will have mean life time, (i) between 790 hours and 810 hours. (ii) less than 785 hours. **(06 Marks)**

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following result.

Horse A:	28	30	32	33	29	34
Horse B:	29	30	30	24	27	29

Test whether you can discriminate between the two horses. Use $t_{0.05} = 2.2$ and $t_{0.02} = 2.72$ **(07 Marks)**

c. A die is thrown 264 times and the number appearing on the face (x) follows the frequency distribution as mentioned below:

x	1	2	3	4	5	6
f	40	32	28	58	54	60

Calculate the value of χ^2. **(07 Marks)**

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10CS42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Graph Theory and Combinatorics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define the following terms and give an example for each:
i) Complete graph ii) Euler circuit iii) Path **(06 Marks)**

b. Show that in a graph G, the number of odd degree vertices is always even. **(04 Marks)**

c. Determine |V| for the following graphs:
i) G has 9 edges and all vertices have degree 3.
ii) G is registered with 15 edges.
iii) G has 10 edges with 2 vertices of degree 4 and all others of degree 3. **(06 Marks)**

d. Give pictorial and graph representation of Konigsberg bridge problem and state the problem. **(04 Marks)**

2 a. Define complete bipartite graph. Prove that Kuratowski's second graph $K_{3,3}$ is non-planar. **(06 Mark)**

b. Find the geometric dual of the graph shown in Fig.Q2(b). Write down any 4 observations of the graph and its dual.

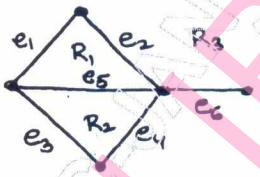

Fig.Q2(b) **(06 Marks)**

c. Find the chromatic polynomial and chromatic number for the graph shown in Fig.Q2(c).

Fig.Q2(c) **(08 Marks)**

3 a. Define a tree. In every tree T = (V, E), show that |V| = |E|+1. If a tree has 4 vertices of degree 2, 1 vertex of degree 3 and 2 vertex of degree 4 and 1 vertex of degree 5, how many pendant vertices does it have? **(06 Marks)**

b. List the vertices of the tree shown in Fig.Q3(b), when they are visited in a preorder, inorder and post order traversal.

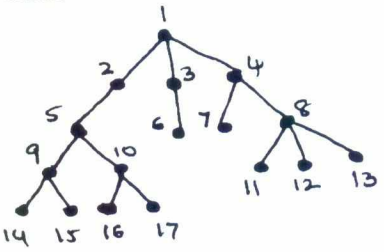

Fig.Q3(b) **(06 Marks)**

c. Obtain a prefix code to send the message "MISSION SUCCESSFUL" using labeled binary tree and hence encode the message. **(08 Marks)**

4 a. Define the following terms and give an example for each:
i) Cutset ii) Edge connectivity iii) Complete matching **(06 Marks)**

b. Table.Q4(b) summarizes the friendships between four girls g_1, g_2, g_3, g_4 and five boys b_1, b_2, b_3, b_4, b_5. Prove that each girl can marry a boy who is her friend. **(06 Marks)**

Girl	Boy friend
g_1	b_1 b_4 b_3
g_2	b_1
g_3	b_2 b_3 b_4
g_4	b_2 b_4

Table.Q4(b)

c. Bring out major steps in Prim's algorithm and find the shortest spanning tree of a weighted graph shown in Fig.Q4(c).

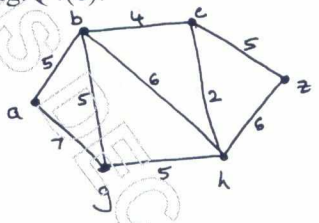

Fig.Q4(c) **(08 Marks)**

PART – B

5 a. Find the number of arrangements of the letters in TALLAHASSEE which have no adjacent A's. **(05 Marks)**

b. Find the term which contains x'' and y^4 in the expansion of $(2x^3 - 3xy^2 + z^2)^6$. **(05 Marks)**

c. How many positive integers n can be formed using the digits 3 4 4 5 5 6 7 if we want n to exceed 5,000,000? **(05 Marks)**

d. Define Catalan number. In how many ways can one arrange 3 1's and 3 −1's so that all 6 partial sums (starting with the 1st summand) are non-negative? List all the arrangements. **(05 Marks)**

6 a. Using the principle of inclusion and exclusion, determine the number of positive integers n where $1 \le n \le 100$ and n is not divisible by 2 or 3 or 5. **(06 Marks)**

b. Define derangement. There are 8 letters to 8 different people to be placed in 8 different addressed envelopes. Find the number of ways of doing this so that at least one letter gets to the right person. **(06 Marks)**

c. A girl has sarees of 5 different colors – blue, green, red, white and yellow. On Monday, she does not wear green, on Tuesday blue or red, on Wednesday blue or green, on Thursdays red or yellow, on Friday red. In how many ways can she dress without repeating a color during a week (from Monday to Friday)? **(08 Marks)**

7 a. Find the coefficient of x^{18} in the product $(x + x^2 + x^3 + x^4 + x^5)(x^2 + x^3 + x^4 + ...)^5$. **(05 Marks)**

b. Find the exponential generating function for the number of way to arrange 'n' letters, $n \ge 0$, selected from each of the following words: i) HAWAII, ii) MISSISSIPPI, iii) ISOMORPHISM. **(05 Marks)**

c. In how many ways can 12 oranges be distributed among three children A, B and C so that A gets atleast 4, B and C get atleast 2 but C gets no more than 5? **(05 Marks)**

d. Find the number of partitions of positive integer n = 6 into distinct summands as a coefficient of x^6 in the generating function of $P_d(6)$. Also list these partitions. **(05 Marks)**

8 a. Solve the recurrence relation $a_n = 6a_{n-1} - 12a_{n-2} + 8a_{n-3}$ given $a_0 = 1$, $a_1 = 4$, $a_2 = 28$. **(06 Marks)**

b. Solve the following recurrence relation using the method of generating functions:
$a_{n+2} - 5a_{n+1} + 6a_n = 2$, $n \ge 0$, $a_0 = 3$, $a_1 = 7$ **(08 Marks)**

c. The number of virus affected files in a system is 1000 (to start with) and this increases 250% every two hours. Use a recurrence relation to determine the number of virus affected files in the system after one day. **(06 Marks)**

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10CS43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. With the help of a flow chart, explain the sequence of steps in design and analysis of an algorithm. **(10 Marks)**

b. Consider the following recursive algorithm for computing the sum of the first n numbers. $S(n) = 1+ 2+ 3+ - - - -+n$.

```
Algorithm S(n)
  if (n = 1) return 1
  else return(S(n – 1) + n)
end algorithm
```

set up and solve a recurrence relation for the number of times the algorithms basic operation is executed. **(05 Marks)**

c. Write a recursive algorithm to compute the factorial of a non-negative integer n and analyze its efficiency. **(05 Marks)**

2 a. Is merge sort stable? Suggest an algorithm for merge sort and analyze its efficiency. **(10 Marks)**

b. Write the algorithm for binary search and find its best, average and worst case efficiency. **(10 Marks)**

3 a. Explain the Kruskal's algorithm to find minimum spanning tree(MST). Apply it for the following graph, Fig.3(a). **(06 Marks)**

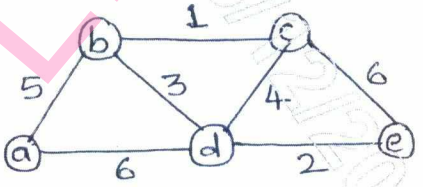

Fig.Q3(a)

b. Mention the three requirements to be specified by any greedy algorithm. For the given jobs with deadline, find the maximum profit by sequencing them. N = 5, $(P_1, P_2, P_3, P_4, P_5) = (20, 15, 10, 5, 1)$ and $(d_1, d_2, d_3, d_4, d_5) = (2, 2, 1, 3, 3)$. **(04 Marks)**

c. Write algorithm for greedy knapsack problem. Find the optimal solution for the Knapsack instance, number of objects(n) = 3, capacity of knapsack(M) = 20, Profits$(P_1, P_2, P_3) = (25, 14, 15)$ and weights $(w_1, w_2, w_3) = (18, 15, 10)$. **(10 Marks)**

4 a. Define transitive closure of a graph. Write Warshall's algorithm to compute transitive closure of a graph. Find its efficiency. **(07 Marks)**

b. Using Floyd's algorithm, find all pair shortest path for the graph of Fig.Q4(b). **(07 Marks)**

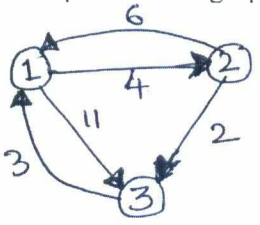

Fig.Q4(b)

c. Write Bellman and Ford algorithm to compute single source shortest path. **(06 Marks)**

PART – B

5 a. Bring out the differences between DFS and BFS. Traverse the following graph of Fig.Q5(a) by DFS and construct the corresponding DFS forest and also show its stack content. **(10 Marks)**

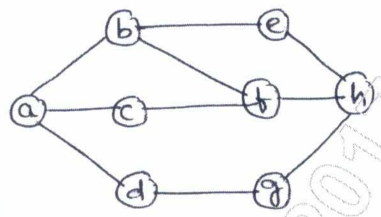

Fig.Q5(a)

b. What do you mean by space and time trade off? Explain the Horspool's string matching algorithm. **(10 Marks)**

6 a. What are decision trees? Give and explain the decision tree for 3-element selection sort. **(10 Marks)**

b. Explain the concepts of P, NP and NP – complete problems. **(10 Marks)**

7 a. Explain 4 – queen's problem using back tracking method and draw state – space tree for the same. **(05 Marks)**

b. Apply the branch –and-bound algorithm to solve the assignment problem of assigning n people to n jobs so that the total cost of the assignment is as small as possible. **(10 Marks)**

Job $\rightarrow$ 1

c =

1	2	3	4	
9	2	7	8	Person a
6	4	3	7	Person b .
5	8	1	8	Person c
7	6	9	4	Person d

c. Write the steps and apply nearest neighbor approximation algorithm on the TSP problem with starting vertex a, and calculate the accuracy ratio of approximation. **(05 Marks)**

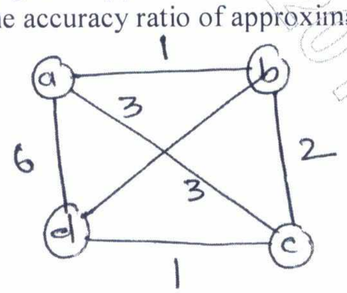

Fig.Q7(c)

8 a. Let the input to the prefix computation problem be 5, 12, 8, 6, 3, 9, 11, 12, 1, 5, 6, 7, 10, 4, 3, 5 and let $\oplus$ stand for addition. Solve the problem using work optimal algorithm. **(10 Marks)**

b. For an n $\times$ n matrix M with nonnegative integer coefficients, define $\widetilde{M}$ and give an algorithm for computing $\widetilde{M}$. Prove that $\widetilde{M}$ can be computed from a n $\times$ n matrix M in O(log n) time using n^{3+E} common CRCW PRAM processors for any fixed $\in > 0$. **(10 Marks)**

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10CS44

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
UNIX and Shell Programming

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. With a neat diagram, explain the architecture of UNIX operating system. **(08 Marks)**

b. List and explain different features of UNIX operating system. **(08 Marks)**

c. Explain briefly absolute pathname and relative pathname. **(04 Marks)**

2 a. Assuming that a file current permissions are rw_r_xr_ _, specify the chmod expression required to change them to
i) rwxrwxrwx ii) r_ _ r _ _ _ _ _ iii) _ _ _r_ _r_ _ iv) _ _ _ _ _ _ _ _ _
using both relative and absolute assigning permissions. **(08 Marks)**

b. Explain briefly the file attributes listed using ls - l command. **(06 Marks)**

c. With a neat diagram, explain different modes of Vi editor. **(06 Marks)**

3 a. Explain the mechanism of process creation in UNIX and also explain the process of shell creation. **(08 Marks)**

b. Explain the three standard files with respect to UNIX operating system. **(06 Marks)**

c. Explain Job control with suitable example. **(06 Marks)**

4 a. Differentiate between Hard link and Symbolic link. **(04 Marks)**

b. Discuss find command with all its options. **(10 Marks)**

c. Explain in detail the following command with options and example:(i) tr, (ii) cut. **(06 Marks)**

PART – B

5 a. Explain grep command with any four option with suitable example. **(06 Marks)**

b. What is sed command? With example explain the difference between line addressing and context addressing in sed. **(08 Marks)**

c. Explain with example BRE and ERE. **(06 Marks)**

6 a. List and explain any six special parameters used by shell. **(06 Marks)**

b. What is shell programming? Write a shell script to test and display the file attributes which is accepted as command line argument. **(08 Marks)**

c. Explain looping construct (for and while) in shell with example. **(06 Marks)**

7 a. List and explain built-in variables used in awk. **(06 Marks)**

b. Write an awk sequence to find DA, HRA and gross pay of an employee, where DA if 55% of basic, HRA is 25% of basic and gross pay is sum of basic, DA and HRA. Also find the average gross pay. **(08 Marks)**

c. Explain the looping construct for in awk with example. **(06 Marks)**

8 a. Explain the following string handling function in perl with example:
i) length ii) index iii) substr **(06 Marks)**

b. Write a perl program that accepts decimal number as argument and convert it to binary. **(07 Marks)**

c. Using command line arguments, write a perl script to check whether a given year is leap year or not. **(07 Marks)**

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10CS45

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Microprocessors

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What is microprocessor? Write a brief note on history of microprocessor start from 4004 µp to Pentium processors. **(05 Marks)**

b. Explain the microprocessor based computer system with block diagram. **(04 Marks)**

c. Explain the program model visible register organization of 8086 µp. **(06 Marks)**

d. Explain the concept of segment and offstes in real mode access to a memory location with default segment and offset register pairs. **(05 Marks)**

2 a. Explain the protected memory addressing with the formats of descriptors of 80286 µp and 80386 µp. **(06 Marks)**

b. What are the advantages of memory paging? Illustrate the concept of memory paging with neat diagram. **(06 Marks)**

c. Discuss the following addressing modes with examples:
i) Register ii) Register indirect
iii) Base-plus-index iv) Register relative **(08 Marks)**

3 a. Draw the format of the 16 bit instruction mode. The instruction MOV CL, [SI] stands for "Move the 8 bit contents of memory location indirectly specified by SI to the register CL". Encode the instruction into machine code using the instruction format. The opcode for MOV operation is $100010_{(2)}$. **(06 Marks)**

b. Describe the following instructions with examples:
i) PUSH ii) XLAT iii) XCHG iv) MUL **(08 Marks)**

c. What are assembler directives? Describe the following assembler directives.
i) ASSUME ii) PROC iii) ORG **(06 Marks)**

4 a. Describe how the AAM instruction converts from binary to BCD. **(04 Marks)**

b. Describe the result of executing the following sequence of instructions:

MOV AL, $01010101_{(2)}$
AND AL, $00011111_{(2)}$
OR AL, $11000000_{(2)}$
XOR AL, $00001111_{(2)}$
NOT AL **(06 Marks)**

c. Write a note on conditional jump instructions. **(04 Marks)**

d. Describe the following instruction with examples:
i) LOOP ii) WAIT iii) RET **(06 Marks)**

PART – B

5 a. Write the difference between macro and procedure and write example for each. **(06 Marks)**

b. Explain PUBLIC and EXTRN directive with program module example. **(07 Marks)**

c. Write a mixed language program that converts binary to ASCII. **(07 Marks)**

6 a. Draw the pin-out diagram of 8086 in maximum mode and minimum mode and explain the minimum mode pins. **(08 Marks)**

b. With diagram describe how the demultiplexing of address/data done in 8086 microprocessor. **(04 Marks)**

c. Using timing diagram, describe the I/O read bus cycle in 8086 μp. **(04 Marks)**

d. Write the difference between 8086 μp and 8088 μp. **(04 Marks)**

7 a. Explain with diagram how 74LS138 decodes 2764 EPROMs for a 64 × 8 section of memory in an 8088 based system. Assume starting address is $F0000_H$. **(08 Marks)**

b. Explain the 8086 memory interfacing with diagram. **(08 Marks)**

c. Differentiate between memory mapped I/O and I/O mapped I/O (Isolated I/O). **(04 Marks)**

8 a. Write a note on 82C55 programmable peripheral interface with pin-out diagram. **(06 Marks)**

b. Describe the six modes of operation of 8254 counter with diagrams. **(06 Marks)**

c. Write a note on interrupt vector table with diagram. **(04 Marks)**

d. Write a note on DMA operation. **(04 Marks)**

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10CS46

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Computer Organization

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. With a neat block diagram, explain the different functional units of a digital computer. **(06 Marks)**

b. Explain how byte addressability can be achieved using little endian and big endian memory representation. Write an example for each. **(06 Marks)**

c. Perform the following operations on the 5-bit signed numbers using 2's complement representation system. Also indicate whether overflow has occurred or not.

i) $(-10) + (-13)$
ii) $(-10) - (+4)$
iii) $(-3) + (-8)$
iv) $(-10) - (+7)$. **(08 Marks)**

2 a. Define Addressing Mode, explain the following addressing modes with an example and also show the effective address in each case :

i) Absolute
ii) Indirect
iii) Index **(10 Marks)**

b. Illustrate and explain with neat diagrams and examples, how logical shift and rotate instructions are implemented? **(10 Marks)**

3 a. What do you mean by interrupt? Explain polling and vectored interrupts. **(06 Marks)**

b. Define bus arbitration. Explain the centralized arbitration with a neat diagram. **(06 Marks)**

c. What is DMA? Explain how the DMA controllers are used in a computer system. **(08 Marks)**

4 a. Explain the following with respect to USB :

i) Characteristics
ii) Architecture
iii) Addressing. **(10 Marks)**

b. Discuss the main phases involved in the operation of SCSI bus. **(08 Marks)**

c. Differentiate between serial port and parallel port. **(02 Marks)**

PART – B

5 a. With the help of a neat block diagram, explain the working of a 1K × 1 memory cell organization. **(10 Marks)**

b. Explain the memory hierarchy with respect to speed, size and cost with a neat diagram. **(05 Marks)**

c. With a block diagram, explain the working principle of direct mapping cache memory. **(05 Marks)**

6 a. Discuss with a neat diagram, the design of a 4-bit carry-look ahead adder. **(10 Marks)**

b. Perform multiplication for +13 and −6 using Booth's Algorithm. **(05 Marks)**

c. With a neat figure, explain the circuit arrangement for binary division. **(05 Marks)**

7 a. List out the actions needed to execute the instruction Add (R_3), R_1. Write and explain sequence of control steps for execution of the same. **(10 Marks)**

b. With a neat block diagram, explain hardwired control unit. Show the generation Z_{in} and End control signals. **(10 Marks)**

8 a. With a neat diagram, explain the organization of a shared memory multi processor. **(08 Marks)**

b. What is hardware multithreading? Explain the two approaches to hardware multithreading. **(08 Marks)**

c. Discuss: i) SISD ii) SIMD iii) MIMD iv) MISD. **(04 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions selecting atleast TWO questions from each part.***

PART – A

1 a. Find the direction cosines ℓ, m, n of the line :
$x + y + z + 1 = 0$
$4x + y - 2z + 2 = 0$. **(06 Marks)**

b. Show that the lines $\frac{x+4}{3} = \frac{y+6}{5} = \frac{z-1}{-2}$ and $3x - 2y + z + 5 = 0 = 2x + 3y + 4z - 4$ are coplanar. **(07 Marks)**

c. Find the angle between the line $\frac{x+4}{4} + \frac{y-3}{-3} = \frac{z+2}{1}$ and the plane $2x + 2y - z + 15 = 0$. **(07 Marks)**

2 a. Find the equation of the plane which passes through the points A(0, 1, 1), B(1, 1, 2), C(–1, 2, –2). **(06 Marks)**

b. Find the equation of the plane which passes through the point(3, –3, 1) and normal to the line joining the points (3, 2, –1) and (2, –1, 5). **(07 Marks)**

c. Find the equations to the two planes which bisects the angle between the planes :
$3x - 4y + 5z = 3$
$5x + 3y - 4z = 9$. **(07 Marks)**

3 a. Find the sides and the angle A of the triangle whose vertices are $\overline{OA} = I - 2J + 2K$, $\overline{OB} = 2I + J - K$, $\overline{OC} = 3I - J + 2K$. **(06 Marks)**

b. Show that the points $-6I + 3J + 2K$, $3I - 2J + 4K$, $5I + 7J + 3K$ and $-13I + 17J - k$ are coplanar. **(07 Marks)**

c. Prove that : $\left[\bar{B} \times \bar{C}, \bar{C} \times \bar{A}, \bar{A} \times \bar{B}\right] = \left[\bar{A}\,\bar{B}\,\bar{C}\right]^2$. **(07 Marks)**

4 a. A particle moves along the curve $x = t^2 + 1$, $y = t^2$, $z = 2t + 3 + \sin(\pi t)$ where t is the time. Find the velocity and acceleration at t = 1. **(06 Marks)**

b. If $\bar{A} = (\cos t)I + (\sin t)J + (4t)K$ and $\bar{B} = (t^3 + 1)I + J + (8t^2 - 3t^3)K$ then find :
i) $\frac{d}{dt}(\bar{A} + \bar{B})$ ii) $\frac{d}{dt}(\bar{A} \cdot \bar{B})$. **(07 Marks)**

c. If $\phi = 3x^2y - y^3z^2$, find grad ϕ at (1, –2, 1). Also find a unit normal vector to the surface $3x^2y - y^3z^2 = 6$ at (1, –2, 1). **(07 Marks)**

PART – B

5 a. If $\bar{A} = xyz\,I + 3x^2y\,J + (xz^2 - y^2z)K$ then find curl $\bar{A}$ at (1, 2, 3). **(06 Marks)**

b. Find the directional derivative of the scalar function $f(x, y, z) = x^2 + xy + z^2$ at the point A(1, –1, –1) in the direction of $2\hat{i} + 3\hat{j} + 2\hat{k}$. **(07 Marks)**

c. If $u = x^2 + y^2 + z^2$ and $\bar{r} = xI + yJ + zK$ then find div $(u\bar{r})$ in terms of u. if $\vec{f} = \nabla(x^3 + y^3 + 2^3 - 3xyz)$ find $\nabla \cdot \vec{f}$ and $\nabla \times \vec{f}$. **(07 Marks)**

6 a. Find the Laplace transform of f(t) defined as :

$$f(t) = \begin{cases} \frac{t}{6}, & \text{when } 0 < t < 6 \\ 1, & \text{when } t < 6 \end{cases}.$$ **(05 Marks)**

b. Find : i) $L(\cos t^2 t)$ ii) $L(t \sin h\, at)$ iii) $L\left(\frac{1}{t}\sin 2t\right)$. **(15 Marks)**

7 a. Find : $L(e^{2t} \cos 3t)$. **(06 Marks)**

b. Find : $L^{-1}\left(\frac{2h-5}{9s^2-25}\right)$. **(07 Marks)**

c. Find : $L^{-1}\left(\frac{s^2+4}{x^2+9}\right)$. **(07 Marks)**

8 a. Using Laplace transforms, find the solution of the initial value problem $y''-4y'+4y=64 \sin 2t$, $y(0) = 0, y'(0) = 1$. **(10 Marks)**

b. Using Laplace transforms, solve $y'' + 9y = \cos 2t$, $y(0) = 1$, $y'(0) = \frac{12}{5}$. **(10 Marks)**

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