Total No. of Questions : 5] **[Total No. of Pages : 2**

P384

[3634]-34
M.C.A. - II (Under Science Faculty)
COMPUTER SCIENCE
CS - 305 : System Analysis and Design
(Sem. - III)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***All questions carry equal marks.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) Solve the following CASE : **[16]**

The railway reservation system functions as-The passenger is required to fill in a reservation form which contains his journey details. After ensuring about availability of seats, the reservation entries are made in a reservation register, amount is calculated, tickets are prepared and cash is accepted by a booking clerk. A booking statement is prepared with 3 copies. One copy is kept with booking office, second is given to train conductor and third is pasted on the compartment. Cash statement is prepared at the end of each shift.

a) Identify the specified entities with their attributes in a given CASE.
b) Draw an E-R diagram for the given CASE.
c) Draw a context diagram.
d) Draw first level DFD.

Q2) Attempt any four : **[4 × 4 = 16]**

a) Explain the process of normalization.
b) Discuss the benefits and weaknesses of CASE tools.
c) Explain the spiral model of SDLC.
   CASE : The discount policy declared by computer manufacturer producing products as -
   i) Desktop Computers
   ii) Laptops
   And having 3 types of customers as
   (D) - Dealers, (R) - Retailers, (I) Institutions
   Policy -
   1) If the order is from retailer for the amount upto Rs. 2,00,000/, 5% discount is given.
   2) If the order is from dealer for the amount upto Rs .2,00,000/-, 7.5% discount is given.

P.T.O.

3) On retail order exceeding Rs.2,00,000/- 7.5% discount is given.
4) If the order is from dealer for an amount exceeding Rs. 2,00,000/-, 10% discount is given.
5) In all the above cases, a flat discount of 7.5% is given to institutions regardless of amount.
6) In the case of Laptops, a flat discount of 5% is given regardless of customer and amount.

d) Draw a Decision Table for the above CASE.
e) Draw a Decision Tree for the above CASE.

Q3) Attempt any four : **[4 × 4 = 16]**

a) Explain the advantages and disadvantages of top-down incremental approach.
b) Explain black-box and white-box testing.
c) Define feedback. Explain feedback control mechanism used by a system.
d) Explain preliminary investigation in detail.
e) What is an interview? Explain it with structured and unstructured interviews.

Q4) Attempt any four : **[4 × 4 = 16]**

a) What is a flow-chart? Discuss any two types of flow-charts.
b) What is Data Dictionary? Explain how Data Dictionary describes a process with an example.
c) What do you mean by "Configuring a System". Explain what types of system statistics can be collected during configuring a system.
d) Define system analyst. Explain the role of system analyst.
e) Write a short note on feasibility study.

Q5) Attempt any eight : **[8 × 2 = 16]**

a) Define probablistic and deterministic system.
b) What is system prototyping method?
c) What do you mean by Requirements Anticipation?
d) State all fact finding techniques.
e) What is a tool? State any two tools used for documenting procedures.
f) Describe System Design in short.
g) What is meant by E-R analysis.
h) What do you mean by "Constructing the System".
i) State stages in software testing.
j) What is Turbo Analyst?

Total No. of Questions : 5] **[Total No. of Pages : 2**

P387

[3634] - 201
M.C.A. - I (Under Science Faculty)
CS - 201 : DATA & FILE STRUCTURES USING C
(Sem. - II) (2008 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***All questions carry equal marks.***

Q1) Answer the following (any four) : **[4 × 4 = 16]**

a) Show how stack is used in recursive function for calculating factorial.

b) Write a function to delete an element from circular linked list.

c) Sort the following sequence of numbers using heap sort method.
12 30 10 8 15 100 2 33 67 5

d) Write an algorithm to count leaf nodes in a tree.

e) Define circular queue? Explain why we need circular queue.

Q2) Attempt any four : **[4 × 4 = 16]**

a) Explain BFS & DFS algorithm with e.g.

b) Construct the AVL tree for the following data
Mon, Sun, Thir, Fri, Sat, Wed, Tue

c) Which are the methods for overflow handling?

d) What is dynamic memory allocation? Write an algorithm for best-fit method.

e) Sort the following numbers using insertion sort method
30, 40, 10, 50, 25, 35, 15

Q3) Attempt any four of the following : **[4 × 4 = 16]**

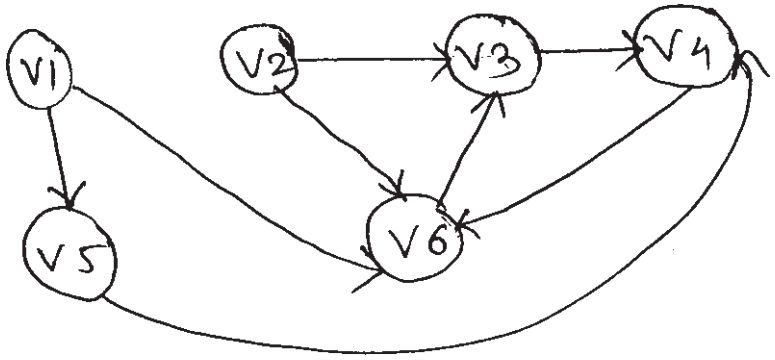
a) Write a function for search an element using binary search method.

b) Evaluate the following expression using stack A + B ∗ C – D with A = 4, B = 3, C = 5 and D = 1

c) Compare sequential file organization and index sequential file organization.

P.T.O.

d) Consider the following graph :
   i) Create an adjacency matrix.
   ii) Find out the indegree and outdegree of all vertices in graph.



e) What are the characteristics of good hash function? Explain various hash function with suitable example.

Q4) Attempt any four of the following : **[4 × 4 = 16]**

a) Draw an expression tree for the following
   i) (A + B + C) ∗ D/(F + G)
   ii) (D ∗ E) ∧ F + G + M ∗ N.
b) Write a 'C' language function to implement binary search algorithm.
c) Differentiate between arrays and linked list.
d) Define the following :
   i) Bucket.
   ii) Complete Binary tree.
   iii) Complete graph.
   iv) Acyclic graph.
e) Write a program to implement stack using linked list.

Q5) Answer the following (any four) : **[4 × 4 = 16]**

a) Explain B+ tree deletion algorithm.
b) What is merge sort explain algorithm for merge sort.
c) When it is preferable to use dense verses sparse index. Explain with suitable example.
d) Write a function to check whether two singly linked lists are equal or not.
e) What are the different applications of queue?

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Total No. of Questions : 5] **[Total No. of Pages : 4**

P390

[3634]-204
M.C.A. - I (Science Faculty)
COMPUTER SCIENCE
CS - 205 : Database Management Systems
(Sem. - II) (2008 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Assume suitable data, if necessary.***
3) ***Figures to the right indicate full marks.***

Q1) a) Attempt the following : **[10]**

Consider a video library system, that issues video cassettes and CD's to its members. Members can borrow any number of cassettes/CD's at a time. Issued item must be returned within 2 days, else a fine is charged 50/- for videocassette and 80/- for CD. Members can also put their claim on cassettes/CD's if they are not available on the racks.

i) Draw an E-R diagram that captures this information.
ii) Identify the primary key for each entity and represent in diagram.
iii) Convert E-R, diagram into relational database.

b) Attempt <u>any one</u> of the following : **[6]**

i) Explain multivalued dependency with example.
ii) Write a note on timestamp ordering protocol. How is Thomas write rule different from timestamp based concurrency control protocol.

Q2) Attempt <u>any four</u> : **[16]**

a) Write short note on generalization.
b) Define following term
   i) Integrity with example.
   ii) Primary key, candidate key.
c) Explain the three levels of data abstraction.
d) Explain lossless join decomposition with example.
e) "The Validation based protocol guards against casceding rollbacks". Comment.

P.T.O.

Q3) Attempt <u>any four</u> of the following : **[16]**

a) Compute the closure of the following set of functional dependencies for relation schema.

R = (A, B, C, D, E)

F = {A $\rightarrow$ BC, CD $\rightarrow$ E, B $\rightarrow$ D, E $\rightarrow$ A}

List the candidate keys for R.

b) State different components used to construct E-R diagram with its meaning.

c) What is canonical cover? How to compute canonical cover of set of functional dependencies.

d) Write a short note on Refential Integrity in SQL.

e) Write a short note on view serializability.

Q4) Attempt <u>any four</u> of the following : **[16]**

a) Consider the following relational database

employee (ename, street, city)
works (ename, company, name, salary)
company (company-name, city)
manages (ename, manager-name)

Write a following queries in SQL

i) Give all employees of 'City Bank' a 10% salary raise.

ii) Find those companies whose employees earn a higher salary on average than the average salary at 'HDFC Bank'.

b) Describe ACID properties of transaction.

c) What are the actions to be taken to recover from deadlock.

d) What are the main disadvantages of file processing system.

e) Explain 1 NF, 2 NF, 3 NF with example.

Q5) Attempt <u>any four</u> of the following : **[16]**

a) Consider the following transactions :

T_1	T_2
read (A)	read (A)
A : = A - 50	temp : = A $*$ 0.1;
write (A)	A = A - Temp
read (B)	write (A)
B : = B + 50	read (B)
write (B)	B : = B + Temp
	write (B)

b) Consider the log at time of system crash with four transactions. Specify which transactions are rolled back. Which operations are redone and which are undone.

[Start, T_1]
[Write, T_1, D, 20]
[Commit, T_1]
[Check point]
[Start, T_4]
[Write, T_4, B, 15]
[Write, T_4, A, 20]
[Commit, T_4]
[Start, T_2]
[Write, T_2, B, 25]
[Start, T_3]
[Write, T_3, A, 30]
[Write, T_2, D, 20]
System crash →

c) Consider the following log entries :

LSN	LOG
00	update : T_1 write p_3
10	update : T_2 write p_2
20	T_1 commit
30	begin-check point
40	end-check point
50	update : T_3 write p_1
60	update : T_2 write p_3
70	T_2 commit

crash →
on restart after crash specify.

i) What is done during analysis phase? Describe the contents of tables created during this phase.
ii) What is done during redo phase?
iii) What is done during undo phase?

d) Consider the following set of transactions :

T_1	T_2	T_3
read (p)	read (q)	read (r)
read (r)	q = q + 10	read (p)
p = p + r	write (q)	r = r + q
write (p)	read (r)	write (r)
	r = r – 10	
	write (r)	

Execution of these instruction is interleaved that one instruction from each transaction is executed at a time. Give the execution trace of non serial schedule assuming 2 phase locking protocol. Does this lead to deadlock? Justify.

e) Consider the following database :
student (studno, studname)
teacher (tno, tname)
Subject (subno, subname)
Relationship between student-teacher and teacher-subject are many to many. Normalize the database and write following queries in SQL.

i) List name of all student taught by “Prof. Deshpande”.
ii) List the number of subject taught by “Prof. Jecob”.

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P391

[3634]-401
M.C.A. - II (Science Faculty)
COMPUTER SCIENCE
CS - 401 : Graphics
(Sem.- IV)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***All questions are compulsory.***

Q1) Attempt any two of the following : **[2 × 5 = 10]**

a) Compare plasma display and raster scan CRT.
b) Explain Bitmap method for character generation.
c) For a pentagon A(10,20), B(10,40), C(30,55), D(50,40), E(50,20) obtain reflection through the line $x = \frac{1}{3}(y + 2)$.

Q2) Attempt any four of the following : **[4 × 5 = 20]**

a) Explain the boundary fill algorithm.
b) Explain Liang Barskey line clipping algorithm.
c) Apply each of the following transformation on the point P[2,3]
   i) Reflection through the line y = –x.
   ii) Shearing about x-axis is 2 units.
d) What is projection? Explain its type.
e) Explain the steps in DDA circle drawing algorithm.

Q3) Attempt any four of the following : **[4 × 5 = 20]**

a) Show the transformation matrix for reflection about a line y = x is equivalent to reflection of x-axis followed by y-counterclockwise rotation of 90^o.
b) Explain image transformation.
c) What are the different antialiased ray tracing techniques? Explain any one technique in detail.
d) Explain the three dimension viewing process.
e) Describe the back-face removal algorithm.

P.T.O.

Q4) Attempt any four of the following : **[4 × 5 = 20]**

a) Explain z-buffer for hidden surface removal.
b) Distinguish between Gouraud and Phong's method of shading.
c) Use Cohen-Sutherland outcode algorithm to clip a line with points P1(70,20) and P2(100,10) against window A(50,40), B(80,10), C(80,40), D(50,40).
d) Write a short note on Bezier Curve.
e) Distinguish between vector scan and raster scan.

Q5) Attempt any five terms : **[5 × 2 = 10]**

a) Refresh rate.
b) Homogeneous co-ordinates.
c) Half toning.
d) Windowing.
e) Aspect ratio.
f) Coefficient of reflection.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P392

[3634]-402
M.C.A. (Under Science Faculty)
COMPUTER SCIENCE
CS - 402 : Artificial Intelligence
(Sem. - IV)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***All questions carry equal marks.***
4) ***Assume suitable data, if necessary.***
5) ***All questions are compulsory.***

Q1) Attempt any four of the following : **[4 × 4 = 16]**

a) Define A.I. Explain various task domains of A.I.
b) Explain two requirements of control strategy.
c) Explain simple hill climbing algorithm.
d) Explain knowledge acquisition in detail.
e) Write four less desirable properties of knowledge.

Q2) Attempt any four of the following : **[4 × 4 = 16]**

a) Explain cut predicate of prolog in detail.
b) Describe COND in detail.
c) Define a recursive function in LISP to return factorial of a given number passed as an argument.
d) Write a PROLOG program to illustrate the use of fail predicate.
e) Write a PROLOG program to illustrate the use of recursion.

Q3) Attempt any four of the following : **[4 × 4 = 16]**

a) Explain resolution in propositional logic.
b) Construct and describe semantic net representing the sentence, “John gave the book to Mary”.
c) What are the main differences between scripts and frames?
d) Write four desirable properties of heuristic search algorithm.
e) Explain list constructor and list selector functions.

P.T.O.

Q4) Attempt any two of the following : **[2 × 8 = 16]**

a) Discuss problem characteristics in detail.

b) Write restaurant script.

c) Express the following concepts as an associative network.
Company ABC is a s/w development company. Three departments within the company are sales, admin, and programming. Joe is the manager of programming. Bill and Sue are programmers. Sue is married to Sam. Sam is an editor for prentice hall. They have three children, and they live on Elm street. Sue wears glasses and is 5' 4" tall.

Q5) Attempt any two of the following : **[2 × 8 = 16]**

a) Explain all steps needed to convert a wff to clause form.

b) Explain unification algorithm with the help of suitable example.

c) Explain best-first search algorithm with the help of suitable example.

Total No. of Questions : 5] **[Total No. of Pages : 4**

P393

[3634]-403
M.C.A. (Under Science Faculty)
COMPUTER SCIENCE
CS - 403 : Advanced Database Management System
(Sem.- IV)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) Case Study : **[20]**

Consider the following BCNF relational schema for a portion of bank database.
Bank (bankid, bname, assets, bankmgrid)
customer (actno, cname, addr, age, balance, bankid).

The following queries are the five most common : roughly equivalent in frequency and importance in workload.

1. List actno, name and address of those customer who have an account in 'Bank of India'.
2. List details of customer whose balance is >5,000Rs.
3. List the maximum balance for the customer of each age.
4. List the cname and bname of customer in user specified age range.
5. List the overall average balance of the customer.

    a) Design a physical schema for the given database that will give good performance for expected workload in particular, decide which attribute should be indexed and whether each index should be clustered or unclustered index.

    b) Redesign the physical schema assuming that the set of important queries is changed to the following :

        i. List the average balance for customer by banks.

        ii. List the actno and address of customer with user specified cname.

        iii. List the sum of balances of all the banks.

        iv. List the overall maximum balance for customers.

P.T.O.

Q2) Qualify whether the following statements are True or False. Justify your answer (any five) : **[10]**

a) Three phase commit (3pc) protocol avoids blocking even if the coordinator site fails during recovery.

b) Two deep equal objects are always shallow equal but two shallow equal objects may not be deep equal.

c) A B+ tree index is usually preferable to ISAM index for range selection.

d) Distributed query processing can not be done using semijoin operation.

e) Range queries can benefit from clustered indexing.

f) During redo phase of ARIES algorithm, all the updates starting from smallest LSN upto the end of the log are redone.

g) Fragmentation in distributed database increase availability.

Q3) Answer any five in brief : **[10]**

a) State the basic difference between collaborating server systems and middle ware systems.

b) What is a transaction? Define its durability property?

c) Define the terms-scale up, speed up.

d) Explain the time stamp based concurrency control mechanism.

e) What is meant by client-server system.

f) Describe steal and no-force policies.

g) What are multidatabase system? How the communication between different sites is handled in these systems?

Q4) Attempt any four of the following : **[20]**

a) Consider the following sequence of actions listed in the order in which they are submitted to RDBMS.

T_1 : R(X), T_2 : W(Y), T_3 : R(X), T_2 : R(X), T_1 : W(X), T_3 : R(Y), T_2 : R(X),

T_1 : commit, T_2 : commit, T_3 : commit.

For each of the following concurrency control mechanism, describe how the concurrency control mechanism handles the sequence.

For lock based concurrency control mechanism, add lock and unlock requests as per the protocol.

Assume time-stamp of transaction Ti is i.

i) Strict 2PL with dead lock detection.

ii) Time stamp concurrency control with Thomas write rule.

b) Consider the following log entries :

LSN	LOG
00	Begin-checkpoint
01	End-checkpoint
02	Update : T_3 writes P_2
03	Update : T_2 writes P_1
04	T_2 commits
05	Update : T_1 writes P_2
06	T_2 ends
07	Update : T_4, writes P_4
08	T_3 aborts
09	T_1 commits
10	Update : T_4 writes P_1

CRASH

i) What is done during analysis phase? Describe the contents of tables constructed during this phase.

ii) What is done during redo phase?

iii) What is done during undo phase?

c) For the following queries find out one reason why on optimizer might not find good plan. Rewrite the query so that good plan might be found out

i) Select item-name
from item
where item-rate = 150 or
item-rate = 200
Hash index available on rate attribute.

ii) Select sid
from sailor, reservers
where sailor. sid = Reservers . sid.
Sid in reserves is foreign key that refers to sid in sailor.

d) Consider the following transactions :

T_1 : read (X)	T_2 : read (X)
X : = X – N	X : = X + M
Write (X)	Write (X)
Read (Y)	
Y : = Y + N	
Write (Y)	

will serial execution involving these transactions preserve the consistency of the database? Give non-serial schedule which is serializable.

e) Consider the following classes of schedule-serializable, recoverable and conflict serializable. For the following two schedules, state which of the above classes it belongs to. If you can not decide whether aschedule belongs to a particular class based on the listed action, explain briefly.

i) T_1 : R(X), T_2 : R(X), T_1 : W(X), T_2 : W(X).

ii) T_1 : W(X), T_2 : R(Y), T_1 : R(Y), T_2 : R(X).

Q5) Attempt any four of the following : **[20]**

a) Explain timestamp based concurrency control.

b) Discuss how various operations can be implemented in shared nothing architecture.

c) What is the role of metadata repository in a data warehouse? How does it differ from a catalog in a relational DBMS?

d) What are different types of replicas which are maintained in DDBMS? Explain primary site technique?

e) Explain the concept of fact tables and dimension tables, used in building a data warehouse with an example.

Total No. of Questions : 5] **[Total No. of Pages :4**

P594

[3634] - 1
M.C.A. (Under Science Faculty)
COMPUTER SCIENCE
CS - 101 : Introduction to programming
(Sem. - I) (Old Pattern)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) a) i) Trace the output (any two) **[8]**

```
void main ( )
{
char nm [ ] = {'A', 'N', 'S', 'I', 'b', o, 'c', '\0'};
int x = 0;
clrscr ( ) ;
while (nm [x] ! = '\0')
printf ("%c", nm [x + +]) ;
getch ( );
}
```

ii)
```
# define MAX (a,b) ((a) > (b)? (a) : (b))
main ( )
{
int m, x = 5, y = 6 ;
m = MAX (x + y, 10) ;
printf ("%d", m) ;
m = MAX ( x, y) * 100 ;
printf ("\n%d", m) ;
}
```

iii)
```
main ( )
{
int b [ ] = { 5, 10, 15, 20, 25}
int i, * ptr ;
ptr = & b [4] – 3;
for (i = 0; i < 4; i + +)
```

P.T.O.

```
{
printf (" %d", * ptr);
ptr + +;
}
}
```

b) Find out errors & rewrite (any two) : **[8]**

i)
```
# include < stdio.h >
main ( )
{
int k = 10 ;
int fun (char) ;
k = fun ( k = fun (k = fun (k))) ;
printf (" k = %d", k) ;
}
int fun (int. n)
{
n++ ;
return n ;
}
```

ii)
```
main ( )
{
int i, *j, *k ;
i = 2 ;
j = & i ;
k = j * 2 :
printf ("%u \n", j) ;
}
```

iii)
```
# include < stdio.h >
main  ( )
{
struct employee
{
char name [25] ;
 int age ;
float salary ;
```

```
}
struct employee e ;
strcpy (e.name, "Sachine") ;
age = 25 ;
e.salary = 10000.00
printf ("\n %d", e.name, e.age, e.salary) ;
}
```

Q2) Attempt any four : **[16]**

a) Explain Increment & Decrement operators in C.

b) Give the difference between break & continue statement with example.

c) Explain the concept of recursion with example.

d) Write a note on storage classes.

e) What is meant by array of pointers? Explain with suitable examples.

Q3) Attempt any four : **[16]**

a) Write a program to convert a given number to words.
for example : 653
output is six five three

b) Write a program to determines & print the sum of the series for the given value of

$$\frac{1}{(x+1)^1} + \frac{2}{(x+1)^2} + \frac{3}{(x+1)^3} + \ldots\ldots\ldots + \frac{n}{(x+1)^n} .$$

c) Write a program to sort n numbers by using bubble sort.

d) Write a program to convert upper case to lower case by using FILE.

e) Accept the following details for N books:
Book title, Authors, Price, Year of Publication Print the list of all books whose Price is not higher than Rs. 500.50/ & published before 2002. By using structure.

Q4) Attempt any four : **[16]**

a) Write a program using pointers to read in an array of integers & print it's elements in reverse order.

b) Write a program to read file & print no. of words, lines & characters in it.

c) Write a program for multiplication of two matrix.

d) Write a program to convert decimal number into it's equivalent binary format.

e) Write a to check whether the given number is palindrome or not.

Q5) Attempt any four : **[16]**

a) Explain different file opening modes.

b) Explain the concept of preprocessor.

c) Explain Greedy Method with suitable example.

d) Write the algorithm for DFS (Depth First Search) with example.

e) Explain Linked List with it's operation.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P595

[3634]-2

M.C.A. (Under Science Faculty)

CS - 102 : LOGICAL ORGANIZATION OF COMPUTERS

(2005 Pattern) (Old Course) (Semester - I)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Draw neat diagrams wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of scientific calculator is not allowed.***

Q1) Answer any four of the following : **[4 × 4 = 16]**

a) Solve the following :

i) $(101101.10101)_2 = (?)_{10}$

ii) $(247.6875)_{10} = (?)_8$

iii) $(3456.57)_8 = (?)_{16}$

iv) $(BCD)_{16} = (?)_2$

b) State the commutative, associative and distributive laws of Boolean algebra.

c) Draw the logic diagram and explain the working of 4 : 1 multiplexer.

d) Explain the operation of JK flip flop with logic diagram and truth table.

e) What is meant by the following terms - edge triggering, synchronous counter, modulus of counter, sequential circuit.

Q2) Answer any four of the following : **[4 × 4 = 16]**

a) Perform the following calculations on binary numbers.

i) 101101 + 100111

ii) 10001 – 1010

b) Using the rules of Boolean algebra show that

$$\overline{\overline{A} + (\overline{A + B})\,(\overline{B} + \overline{B + C})} = A$$

c) State duality theorem. Give two examples of dual Boolean expressions.

P.T.O.

d) Draw the logic diagram, truth table and timing diagram for 3 bit asynchronous up counter.

e) Explain the working of the fastest shift register with neat logic diagram.

Q3) Answer any two of the following : **[2 × 8 = 16]**

a) Using K map method, reduce the expression

$$Y = \overline{A}\,\overline{B}\overline{C}D + \overline{A}\,\overline{B}CD + \overline{A}B\overline{C}D + \overline{A}BCD + A\overline{B}\overline{C}D$$
$$+ A\overline{B}CD + AB\overline{C}\,\overline{D} + AB\overline{C}D + ABC\overline{D} + ABCD$$

Draw the simplified logic circuit.

b) Explain the different microprocessor initiated and peripheral initiated operations in a computer system.

c) Write the control word format of 8255 in I/O mode and BSR mode. How are the ports of 8255 used in different I/O modes?

Q4) Answer any four of the following : **[4 × 4 = 16]**

a) Give the classification of instructions based on type of operation. Give one example of each type.

b) With block diagram, explain a microcomputer system.

c) Explain the different control and status signals of 8085.

d) What are the basic interfacing concepts for connecting an output display?

e) What is the function of assembler, cross-assembler, compiler and interpreter?

Q5) Answer any four of the following : **[4 × 4 = 16]**

a) What is the purpose of stack? Explain the operations performed on stack.

b) Explain the logic devices used for interfacing I/O devices to microprocessor.

c) How can a 1KB memory be interfaced to 8085? Find the address range of this memory.

d) Using basic interfacing concepts, explain how can a matrix keyboard be interfaced to a microprocessor.

e) Differentiate between I/O mapped I/O and memory mapped I/O.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P596

[3634]-3
M.C.A. (Under Science Faculty)
CS - 103 : MATHEMATICAL FOUNDATION
(2005 Pattern) (Old Course) (Semester - I)

Time : 3 Hours] ***([Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Use of non programmable calculator is allowed.***
3) ***Figures to the right indicate full marks.***

Q1) Attempt any four of the following : **[16]**

a) Verify whether the following statements are tautology,

i) $(p \wedge q) \wedge \sim p$

ii) $(p \vee q) \wedge (p \vee r)$.

b) Test validity of the following :

$$p \rightarrow q, q \rightarrow r, q \rightarrow s, p \vee q \vdash\!\!\!- \; svr$$

c) Prove that $\sqrt{5}$ is irrational.

d) Let A = {1, 2, 3, 4, 5}. Determine truth value of the following statements,

i) $\forall\, x \in \text{A}\ (x + 3 < 10)$

ii) $\exists\, x \in \text{A}\ (x + 3 < 5)$

e) Let n is integer value. Prove that if n^2 is odd then n is odd.

f) Explain 'validity of argument'. Discuss indirect method to test validity of argument.

Q2) Attempt any four of the following : **[16]**

a) State De? Morgan's Laws with proper example verify it.

b) If $\text{A} = \{x / x \text{ is multiple of } 5 \text{ and } x \leq 25\}$

$\text{B} = \{x / x \text{ is odd and } x \leq 25\}$

then find :

i) $\text{A} \cup \text{B}$

ii) $\text{A} \cap \text{B}$

P.T.O.

c) Let A and B are two sets. Is $A \times B = B \times A$? Justify.

d) Prove that $A - B = A \cap B^c$.

e) If cardinality of set A is *n*. Then find cardinality of power set of A.

f) Prove that by mathematical induction "$5x + 6y$ is divisible by 11" for some $x, y \in N$.

Q3) Attempt any four of the following : **[16]**

a) Find remainder of $4^{37}+82$ when divided by 7.

b) Find g.c.d. of 3587 and 1819 and express it in the form $3587m + 1819n = 1$.

c) Define the terms :
   i) Cartesian product.
   ii) Pair of relatively prime elements.

d) Let A = {1, 2, 3, 4} and relation $R : A \to A$ is defined as ${}^aR_b$ if and only if $a \leq b$ draw Digraph and Hasse diagram of R.

e) If $c \mid ab$ and $(b, c) = 1$, then prove that $c \mid a$.

f) For any integer *x* show that $(a, b) = (a, b + ax)$.

Q4) Attempt any four of the following : **[16]**

a) Prove that any two equivalence classes are either identical or disjoint.

b) With proper example prove that $ho\ (gof) = (hog)of$.

c) If $f : R \to R$ such that $f(x) = \frac{3x-5}{7}$. Prove that $f^{-1}(x)$ is exist and find it.

d) Find real and imaginary part of $z = \frac{1-i^{11}}{(1+i)^2}$

e) Find (r, θ) form of $z = 3 - 4i$

f) If $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 2 & 1 & 4 & 7 & 6 & 3 & 5 \end{pmatrix}$ state whether σ is even or odd permutation. Find order of σ.

Q5) Attempt any two of the following : **[16]**

a) State and prove De' Moivre's theorem.

b) If A = { 1, 2, 3, 4, 5} and relation R = {(1 1) (2 3) (2 5) (3 4) (5 5)} find transitive closure of R.

c) Define symmetric group. Find alternating subgroup of S_3.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P597

[3634]-4
M.C.A. (Under Science Faculty)
CS - 105 : NUMERICAL METHODS
(2005 Pattern) (Old Course) (Semester - I)

Time : 3 Hours] ***([Max. Marks : 80***

Instructions to the candidates:

1) ***Attempt all questions.***
2) ***Use of non programmable calculator is allowed.***
3) ***Figures to the right indicate full marks.***

Q1) Attempt any four of the following : **[16]**

a) Derive Newton Raphson formula for finding roots of nonlinear equation $f(x) = 0$.

b) If $u_0 + u_8 = 1.9233$, $u_1 + u_7 = 1.9600$,
$u_2 + u_6 = 1.9833$, $u_3 + u_5 = 1.9946$.
Then find u_4.

c) Evaluate $\int_0^1 \frac{1}{1+x} dx$ with $h = \frac{1}{6}$ by Simpsons 1/3 rule.

d) Find first and second derivative of the function tabulated below at the point $x = 1.1$.

x	1	1.2	1.4	1.6	1.8	2.0
$f(x)$	0	0.128	0.544	1.296	2.432	4.0

e) From the following data find number of students who obtained less than 45 marks.

Marks :	30-40	40-50	50-60	60-70	70-80
No. of students	31	42	51	35	31

f) With usual notation prove that $(1+\Delta)(1-\nabla) = 1$

Q2) Attempt any four of the following : **[16]**

a) Find the missing figures in the following data.

x	1	2	3	4	5	6	7	8
$f(x)$	1	8	□	64	□	216	343	512

P.T.O.

b) Derive Lagrange's interpolation formula.

c) Evaluate $\int_4^{5.2} \log e^x dx$ by Simpsons 3/8 rule.

d) Given $\frac{dy}{dx} = 1 + xy,\ y(0) = 1$, obtain the Taylor's series for $y(x)$ and compute $y(0.1)$ corrected to four decimal places.

e) Write an algorithm to find solution of system of linear equation by Gauss Jorden elimination method.

f) Find cube root of 10 by bisection method corrected up to 2 decimal places.

Q3) Attempt any four of the following : **[16]**

a) Solve following system of linear equation by Inversion method.

$x + 2y + 3z = 6$
$2x - y - z = 0$
$2x - 3y + 2z = 1$

b) Explain iterative method to solve system of linear equation.

c) Using Lagranges formula prove that
$y_1 = y_3 = 0.3\ (y_5 - y_{-3}) + 0.2\ (y_{-3} - y_{-5})$.

d) The velocity of a car running on a straight road at intervals of 2 minutes are given below.

Time (in min)	0	2	4	6	8	10	12
Velocity (km/hr)	0	22	30	27	18	7	0

Find distance covered by the car in 12 minutes.

e) Write all necessary formulae required in Runge-Kutta fourth order method for solution of ordinary differential equation.

f) Given that $xy = \frac{dy}{dx},\ y(0) = 1$, estimate $y(0.4)$ by Euler's method (use $h = 0.1$).

Q4) Attempt any two of the following : **[16]**

a) Find Eigen values and Eigen vectors of the matrix corresponding to largest eigen value. $A = \begin{bmatrix} 5 & 6 & 2 \\ 0 & -1 & -8 \\ 1 & 0 & -2 \end{bmatrix}$

b) If exist find matrix P that diagonalize matrix

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

c) Estimate the truncation error in Trapezoidal rule.

Q5) Attempt any two of the following : **[16]**

a) Find LU Factorization of $A=\begin{bmatrix}1 & 3 & -4\\ 2 & 5 & -9\\ 3 & -2 & 3\end{bmatrix}$ and then use to solve the system of linear equation.

$x + 2y - 4z = -4$
$2x + 5y - 9z = -10$
$3x - 2y + 3z = 11.$

b) Find the conditions on a, b, c so that the following system of linear equations is consistent.

$x - y + 3z = a$
$-2x + 2y - 6z = b$
$3x - 3y + 9z = c$

c) Discuss following terms :

i) Interpolation.
ii) Crammers rule with it's limitations.

Total No. of Questions : 5] **[Total No. of Pages :3**

P598

[3634] - 21
M.C.A. - I (Under Science Faculty)
CS - 201 : Data and File Structures
(Sem. - II) (Old) (2005 Pattern)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Figures to the right indicate full marks.***

Q1) Attempt any four of the following : **[4 × 4 = 16]**

a) Write a function to invert singly linked list.

b) What are primitive operations performed on Indexed sequential file?

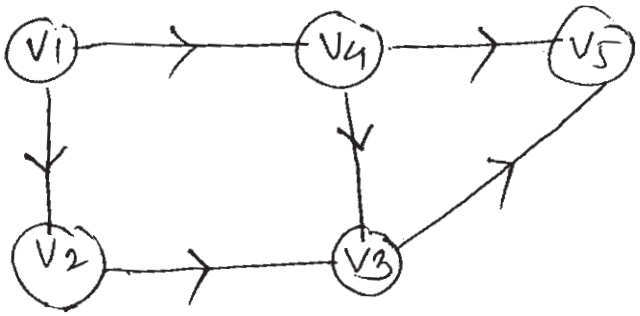
c) Write a note on doubly ended queue.

d) Write a function for insertion and deletion of an element at any position in doubly linked list.

e) Write a function for merging two linear linked list of integers.

Q2) Attempt any four of the following : **[4 × 4 = 16]**

a) Find out the indegree and out degree of all vertices in the graph.

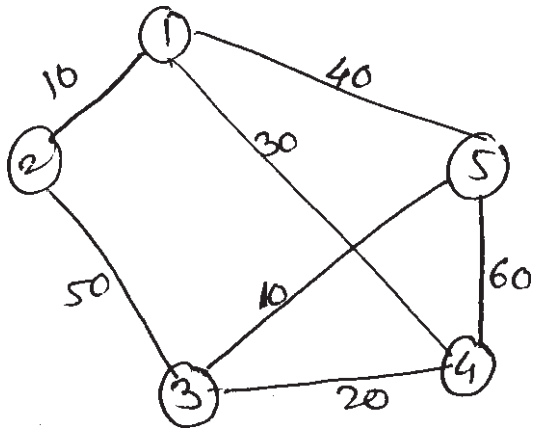


create an adjancency matrix.

b) What is binary search tree? Write a function to search value 'X' in BST.

P.T.O.

c) Find the shortest path from vertex 1 to each vertex in the following.



d) Show all the steps of sorting the following elements using Bubble sort.
67 8 43 20 10 98 35

e) Convert the following postfix expressions to infix

i) AB + C –

ii) AB – C + DEF – + $

Q3) Attempt any <u>four</u> of the following : **[4 × 4 = 16]**

a) With the help of a diagram, show how a stack can be used to convert the infix expression to postfix.
((A + B * C) / D)

b) Construct the AVL true for the following. CAP, BALL, MACHINE, SAD, TAN, FAN, ADD.

c) Compare chaining with replacement and chaining without replacement in hashing with an e.g.

d) Write a recursive function to find factorial of n = 5 illustrating the use of stack in recursion.

e) Define the following terms.

i) Priority queue.

ii) Graph.

iii) Abstract Data type.

iv) Almost complete Binary tree.

Q4) Attempt any four of the following : **[4 × 4 = 16]**

a) Write a function to delete a circular linked list pointed at by P.

b) What are the applications of Queue? Explain FCFS.

c) Differentiate between an array and linked list.

d) What are different search techniques used to read record from file? Explain any two.

e) What is overflow? What are methods for handling overflow? Explain any one indetail.

Q5) Attempt any <u>four</u> of the following : **[4 × 4 = 16]**

a) Prove that a complete binary tree with n levels contains 2n-1 nodes.

b) What do you mean by traversal? What are the different types of traversals.

c) Compare the sorting algorithms with respect to time complexity.

d) What are the different ways of representing two dimensional arrays in memory? Give the formulae for address calculation for representation.

e) Explain the concept of dense and sparse index with example.

Total No. of Questions : 6] **[Total No. of Pages : 3**

P600

[3634]-23
M.C.A. - I (Under Science Faculty)
COMPUTER SCIENCE
CS - 203 : SDK & MFC Event Driven Programming
(Old) (Semester - II)

Time : 3 Hours] ***([Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Neat diagrams must be drawn wherever necessary.***

SECTION - I

Q1) Case Study : **[1 × 8 = 8]**

Develop a billing module for a telephone company using win 32API. Your module should handle the following.

a) Accept phone number & usage recorded (in number of calls).

b) Display Bill

Bill is calculated as follows :

first 50 calls are free
51 to 150 calls are charged 80 paise per call
> 150 calls are charged 1.20 Rs

A 2% service charge is added to the bill amount.
Note : Do not use ODBC, Win Main not required.

Q2) Write windows procedure for the following Any four : **[4 × 4 = 16]**

a) Display continuously how many times Left mouse button has be clicked in a window.

b) Display "HelloWorld" after every 10 seconds at a new position in the window.

c) Draw the following diagram in a window.

P.T.O.

d) Display the result of the series $\frac{1}{1!}+\frac{2}{2!}+\frac{3}{3!}+.....+\frac{n}{n!}$ where '*n*' is accepted from the user.

e) Accept text in edit box and allow the user to copy text from this edit box to another edit box. Text can be multi-line text.

Q3) Attempt any eight of the following : **[8 × 2 = 16]**

a) What is subclassing?

b) Explain a memory Device context.

c) Explain the message loop in WinMain( ).

d) What is a cursor?

e) Describe in brief a Device independent bitmap.

f) What is a dialog box? Differentiate between the types of dialog boxes.

g) Describe the use of semaphores.

h) Comment :

The WM_TIMER message may not be received by your application when it is due.

i) What happens when additional areas of window are invalidated after windows sets the WM_PAINT message pending flag before the WM_PAINT message is retrieved?

j) Explain in brief the MM_ISOTROPIC mapping mode.

SECTION - II

Q4) Attempt any two of the following : **[2 × 5 = 10]**

a) Accept user name and password from the user and validate it. Write an MFC application that does this and displays proper "login successful" or "Invalid username/password" error messages.

b) Write an MFC application that displays a circle every 10 seconds with increasing radius at a new centre every time.

c) Write an MFC application that accepts 2 numbers in text boxes, multiplies the 2 numbers & displays the result in a static control.

Q5) Attempt any four of the following : **[4 × 4 = 16]**

a) Explain the document/view architecture with an example.

b) Write a short note on dynamic array sizing in MFC with the help of example.

c) How are status bars created and initialized in MFC.

d) How is a predefined bitmap image added to your application?

e) Explain the class wizard.

Q6) Attempt any seven of the following : **[7 × 2 = 14]**

a) Describe any 2 functions used with Radio buttons.

b) State the special Indicator ID's MFC defines for status bar panes.

c) How is property sheet built using VC++?

d) Explain owner-draw menus in brief.

e) List any 2 key CDocument operations.

f) Explain ActiveX Control in short.

g) Implement the MFC message map to handle WM-PAINT message.

h) State the different GDI objects.

Total No. of Questions : 5] **[Total No. of Pages :2**

P601

[3634] - 24

MCA - I (Under Science Faculty)

CS - 205 : Operating System Concepts

(Sem. - II) (Old) (2005 Pattern)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Figures to the right indicates full marks.***

Q1) Attempt the following: **[4 × 4 = 16]**

a) State different system calls related with file management and device management.

b) Define the following terms.
   i) Context switch.
   ii) Buffer.
   iii) Page fault.
   iv) Swapping.

c) What is Process control Block? Explain its structure.

d) Explain preemptive and non-preemptive scheduling.

Q2) Attempt the following (Any Four): **[4 × 4 = 16]**

a) Explain the characteristics for selecting CPU scheduling algorithms.

b) Five jobs arrive at time 0, in the order given

Job	Burst time
1	10
2	29
3	3
4	7
5	12

Considering SJF and RR (quantum = 10) scheduling algorithm for this set of jobs, which algorithm give minimum average waiting time.

c) What is operating system? What are the different services provided by operating system?

P.T.O.

d) Explain three types of scheduler with the help of a diagram.

e) Explain Multilevel queue scheduling.

Q3) Attempt the following (Any Four) : **[4 × 4 = 16]**

a) Explain compaction in detail.

b) What are different page replacement algorithms? Explain optimal page replacement algorithm.

c) What are different disk scheduling algorithms? Explain Look algorithm.

d) Explain indexed file allocation method in detail.

e) Explain Round Robin scheduling algorithm.

Q4) Attempt the following (Any Four) : **[4 × 4 = 16]**

a) Consider the following page reference string 1, 2, 3, 4, 2, 1, 6, 5, 1, 2, 1, 3, 7, 6, 3, 2, 1, 2, 3, 6 how many page fault would occur for LRU page replacement algorithm assuming 5 and 6 frames.

b) What is internal and external fragmentation? State whether each of the following memory management technique results in internal or external fragmentation.

i) MVT ii) MFT iii) Paging iv) Segmentation

c) What is Deadlock? Explain necessary conditions for deadlock to occur.

d) Write short note on Race condition.

e) Explain Resident Monitor and Buffering.

Q5) Attempt the following (Any Four) : **[4 × 4 = 16]**

a) What is segmentation? Give advantages and disadvantages?

b) Suppose head of a moving disk with 200 tracks numbered from 0 to 199 is currently at 80. It has served the previous request at 70. Consider the queue of request as follows:

100, 40, 25, 60, 120, 90, 110

Compute total head movement using SSTF and Look algorithm.

c) Explain sequential and Direct access methods of file system.

d) Explain Multiprogramming with fixed partition (MFT).

e) Explain Demand Paging.

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Total No. of Questions : 5] **[Total No. of Pages :2**

P603

[3634] - 102

M.C.A. (Under Science Faculty)

CS - 102 : COMPUTER ARCHITECTURE

(Sem. - I) (New) (2008 Pattern)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Draw neat diagrams wherever necessary.***
3) ***Figures to the right indicate full marks.***

Q1) Answer any four of the following : **[4 × 4 = 16]**

a) Draw the symbol and give truth table for AND, OR, NOT and Ex-OR gates.

b) What is addressing mode? With suitable example explain any three addressing modes used in a microprocessor.

c) What is a full form of EISA and PCI bus? Compare EISA and PCI bus used in computer system.

d) Explain 4-bit R/2R Digital to Analog converter with neat circuit diagram.

e) Explain 'Address Unit' of Intel 80286 microprocessor architecture.

Q2) Answer any two of the following : **[2 × 8 = 16]**

a) Explain the working of edge triggered SR flip-flop with logic diagram and truth table. What is its limitation?

b) Explain with neat block diagram register section of 80486 microprocessor.

c) Explain 8255 - Programmable Peripheral Interface (PPI) with neat block diagram.

Q3) Answer any four of the following : **[4 × 4 = 16]**

a) Draw and explain 1:4 De-multiplexer with active low strobe input.

b) Explain the concept of Pipelining with suitable example.

c) Explain the working of a full adder with neat logic diagram.

d) State the features of VESA bus.

e) Explain the working of 2-bit Flash Analog to Digital converter.

P.T.O.

Q4) Answer any four of the following : **[4 × 4 = 16]**

a) What are interrupts? Explain the terms
   i) Hardware interrupt ii) Software interrupt

b) Which are the main components of a microprocessor? Give the function of these components.

c) Explain serial communication interfaces with diagram.

d) Which are the parallel computer structures? Explain any one structure.

e) Explain Successive Approximation method of Analog to Digital conversion with neat diagram.

Q5) Answer any two of the following : **[2 × 8 = 16]**

a) Explain internal structure of 80X87 arithmetic coprocessor.

b) Explain the operation of DMA controller with neat block diagram.

c) Explain any four parallel processing mechanisms in uniprocessor computers.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P604

[3634]-103
M.C.A. - I (Under Science Faculty)
CS - 103 : MATHEMATICAL FOUNDATIONS
(2008 Pattern) (New) (Semester - I)

Time : 3 Hours] ***([Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt any <u>four</u> of the following : **[16]**

a) If A = {1, 2}, B = {1, 2, 3} then find (A × B) ∩ (B ×A).

b) Using Mathematical induction prove that $8 \mid 5^{2n} + 7$.

c) If c | *ab* and (*b*, *c*) = 1 then prove that *c* | *a*.

d) Find remainder of $4^{37} + 82$ when divided by 7.

e) For any two sets A and B prove that $A - B = A \cap B^C$

f) Test whether the function $f : Q \to Q$ defined by $f(x) = 2x + 3$ for $x \in Q$ (set of rationals) is one-one, onto.

Q2) Attempt any <u>four</u> of the following : **[16]**

a) Let A = {0, 1, 2, 3} and R = {(0, 0), (1, 1), (2, 2), (3, 3), (1, 2), (2, 1), (3, 2), (2, 3), (3, 1), (1, 3)} test whether R is an equivalence relation, if so find equivalence class of I∈ A.

b) Find g.c.d of 3997 and 2947 also find integers *m* and *n* such that (3997)*m* + (2947)*n* = gcd (3997, 2947).

c) If $f : R \to R$ is defined by $f(x) = x^2 + 2x + 3$, for $x \in R$ and $g : R \to R$ is defined by $g(x) = 2x + 3$ then find

i) *fog*
ii) *gof*
iii) *fof*
iv) *gog*.

d) Find roots of the polynomial

$$2x^4 + 4x^3 - 3x^2 - 3x = 0$$

P.T.O.

e) Generate composition table of $(Z_6, +_6)$.

f) Let X = {1, 2, 3, 4} A = {1, 3}, B = {1, 4}
Verify Demorgan's laws for A and B.

Q3) Attempt any <u>four</u> of the following : **[16]**

a) Give an example of a relation which is symmetric but neither reflexive nor transitive.

b) If $(G, *)$ is a group and e is identity element in G then prove that 'e' is unique.

c) Find gcd of $x^3 - 5x^2 + 3x - 15$ and $x^2 + 3$.

d) If $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 1 & 4 & 5 & 6 & 2 \end{pmatrix}$ and $\tau = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 4 & 1 & 3 & 6 & 5 \end{pmatrix}$ then find

i) $(\sigma\tau)^{-1}$

ii) $\sigma^{-1}\tau^{-1}$

e) Solve the following system of equations.

$x + 2y + 3z = 14$
$2x - y + 5z = 15$
$3x - 2y - 4z = -13$

f) Prove that, if $a \equiv b \pmod{n}$ and $m \mid n$ then $a \equiv b \pmod{m}$

Q4) Attempt any <u>four</u> of the following : **[16]**

a) Find inverse of matrix A by adjoint method.

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

b) Let R be a relation on Z defined by ${}^{x}R_{y}$ iff $x^2 = y^2$. Show that R is an equivalence relation.

c) Express the permutation $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 2 & 5 & 4 & 3 & 6 & 1 & 7 & 9 & 8 \end{pmatrix}$ as product of disjoint cycles. Determine whether σ is even or odd. Find σ^{-1}.

d) Prepare composition table of $G = \{\overline{2}, \overline{4}, \overline{6}, \overline{8}\}$ w.r.t multiplication modulo 10. Find identity element.

e) Let G be a group such that $x^2 = e \quad \forall x \in G$. Prove that G is abelian.

f) Give an example for each of the following.

i) A semigroup G which is not monoid.

ii) A Monoid G which is not group.

Q5) Attempt any <u>four</u> of the following : **[16]**

a) By using truth table show that $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$

b) Show that $p \vee \sim p$ is a tautology.

c) Let p be "He is tall" and q be "He is handsome". Write each of the following statements in symbolic form using p and q.

i) He is tall and handsome.

ii) He is tall but not handsome.

d) Test validity of

$r \rightarrow c,\ s \rightarrow \sim w,\ r \vee s,\ w \vdash\!\!\!\!- c$

e) Determine the truth value of each of the following statements, if the universe U = R.

i) $\exists x,\ x^2 - 5x + 6 = 0$

ii) $\exists x, |x| = 0$

iii) $\exists x,\ x^2 - 4 = 0$

iv) $\exists x, x^2 - 3x + 2 = 0$

f) The contrapositive of a statement is given as

"If $x < 2$, then $x + 4 < 6$"

Write the converse and inverse.