Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

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S.E. (E & TC/Comp/I.T. (For Sem.-II)/Elect./Elect. SW/Instru. (For Sem.-I)) EXAMINATION, 2008

ENGINEERING MATHEMATICS—III

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) In Section I, attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**.

In Section II, attempt Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12**.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of non-programmable electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Solve the following (any *three*) :

(*i*) $\left(D^2 + 9\right) y = \sec 3x$

(*ii*) $\left(D^5 - D\right) y = 4e^x + 2^{-x}$

(*iii*) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$ [By variation of parameters]

(*iv*) $\left(x^3 D^3 + x^2 D^2 - 2\right) y = x + \frac{1}{x^2}$. [12]

P.T.O.

(*b*) Solve :

$$\frac{dx}{x(2y^4 - z^4)} = \frac{dy}{y(z^4 - 2x^4)} = \frac{dz}{z(x^4 - y^4)}.$$ [5]

Or

2. (*a*) Solve the following (any *three*) :

(*i*) $(D^2 + 5D + 6)\, y = e^{-2x} \sec^2 x\, (1 + 2 \tan x)$

(*ii*) $(D^5 - D^4 + 2D^3 - 2D^2 + D - 1)\, y = \sin x$

(*iii*) $x^3 \frac{d^2y}{dx^2} + 3x^2 \frac{dy}{dx} + xy = \cos(\log x)$

(*iv*) $(D^2 - 1)\, y = (1 + e^{-x})^{-2}$ [By variation of parameters]. [12]

(*b*) An e.m.f. E sin *pt* is applied at $t = 0$ to a circuit containing a condenser C and inductance L in series :

$$i = -\frac{dq}{dt}$$

and initially the current i and the charge q are zero. If

$$p^2 = \frac{1}{LC},$$

find the current in the circuit at time t. [5]

3. (*a*) If $f(z)$ is analytic, show that :

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) |f(z)|^n = n^2\, |f(z)|^{n-2}\, |f'(z)|^2.$$ [5]

(*b*) If

$$f(z_0) = \oint_C \frac{3z^3 + 5z + 2}{z - z_0} dz$$

where 'C' is the ellipse :

$$\frac{x^2}{4} + \frac{y^2}{9} = 1,$$

find :

(*i*) $f(1)$,

(*ii*) $f''(1 - i)$. [6]

(*c*) Find the image of the triangular region bounded by $x = 0$, $y = 0$, $x + y = 1$ under the transformation $w = z^2$. [5]

Or

4. (*a*) Find the analytic function $f(z) = u + iv$ where :

$$u = \left(r + \frac{1}{r}\right) \cos \theta, \quad r \neq 0.$$ [5]

(*b*) Evaluate :

$$\oint_C \frac{e^z}{(z+1)^3 (z-1)^2} dz$$

where 'C' is the contour $|z + 1| = \frac{1}{2}$. [6]

(*c*) Show that the transformation :

$$w = z + \frac{1}{z} - 2i$$

maps the circle $|z| = 2$ into an ellipse. Find the centre of the ellipse and its semi major and minor axes. [5]

5. (*a*) Find *z*-transforms of the following :

(*i*) $Ka^{K-1}\ U(K-1),\ K \geq 0$

(*ii*) $\cos(7K+2),\ K \geq 0.$ [6]

(*b*) Solve the difference equation :

$$f(K+1)+\frac{1}{2}f(K)=\left(\frac{1}{2}\right)^{K},\ K \geq 0,\ f(0)=0.$$ [5]

(*c*) Find the Fourier transform of :

$$f(x)=\begin{cases}1-x^2 & ,\ |x| \leq 1\\ 0 & ,\ |x|>1\end{cases}$$

and hence evaluate :

$$\int_0^{\infty}\left(\frac{x\cos x-\sin x}{x^3}\right)\cos\frac{x}{2}\,dx.$$ [6]

Or

6. (*a*) Show that Fourier transform of :

$$f(x)=e^{-x^2/2}$$

is it self. [6]

(*b*) Find the inverse sine transform of :

$$F_s(\lambda)=\frac{1}{\lambda}e^{-a\lambda}.$$ [5]

(*c*) Find inverse *z*-transform of :

(*i*) $\dfrac{z^2}{z^2+1}$ (using inversion integral method)

(*ii*) $\dfrac{3z^2+2z}{z^2-3z+2},\ 1<|z|<2.$ [6]

SECTION II

7. (*a*) Find Laplace transform of (any *two*) :

(*i*) $\int_0^t te^{-4t} \sin 3t \, dt$

(*ii*) $t^2 v(t-1) - te^{-2t} \, \delta(t-2)$

(*iii*) $\frac{d}{dt}\left(\frac{\sin t}{t}\right)$. [8]

(*b*) Find inverse Laplace transform of $\frac{s}{(s^2 + a^2)^2}$. [4]

(*c*) Solve by Laplace transform method :

$$\frac{dy}{dt} + 3y(t) + 2\int_0^t y(t)\, dt = t, \text{ given } y(0) = 0.$$ [4]

Or

8. (*a*) Find inverse Laplace transform of (any *two*) :

(*i*) $\frac{e^{-3s}}{s^2 + 8s + 25}$

(*ii*) $\frac{s+1}{(s^2 + 2s + 2)^2}$

(*iii*) $\log\left(1 + \frac{a^2}{s^2}\right)$. [8]

(*b*) Find Laplace transform of :

$$f(t) = \begin{cases} t & , \quad 0 < t < \pi \\ \pi - t & , \quad \pi < t < 2\pi \end{cases} \text{ and } f(t + 2\pi) = f(t). \qquad [4]$$

(*c*) Express the following function in terms of Heavisides unit step function and hence find the Laplace transform :

$$f(t) = \begin{cases} \cos t & , \quad 0 < t < \pi \\ \sin t & , \quad t > \pi \end{cases}. \qquad [4]$$

9. (*a*) Prove the following (any *two*) :

(*i*) $\nabla \cdot \left[r \nabla \left(\frac{1}{r^3} \right) \right] = \frac{3}{r^4}$

(*ii*) $\bar{a} \cdot \nabla \left[\bar{b} \cdot \nabla \left(\frac{1}{r} \right) \right] = \frac{3(\bar{a} \cdot \bar{r})(\bar{b} \cdot \bar{r})}{r^5} - \frac{(\bar{a} \cdot \bar{b})}{r^3}$

(*iii*) $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$. [8]

(*b*) Find the constants m, n such that the surface $mx^2 - 2nyz = (m + 4)x$ will be orthogonal to the surface $4x^2y + z^3 = 4$ at the point $(1, -1, 2)$. [5]

(*c*) Find the function $f(r)$ so that $f(r)\,\bar{r}$ is solenoidal. [4]

Or

10. (*a*) Show that :

$$\bar{F} = \left(ye^{xy} \cos z\right) \bar{i} + \left(xe^{xy} \cos z\right) \bar{j} - e^{xy} \sin z\, \bar{k}$$

is irrotational. Find ϕ if $\bar{F} = \nabla\phi$. [6]

(*b*) Find the directional derivative of :

$$\phi = 4xz^3 - 3x^2y^2z$$

at (2, –1, 2) along a line equally inclined with co-ordinate axes. [6]

(*c*) If $\rho\overline{E} = \nabla\phi$, prove that $\overline{E} \cdot \text{curl}\,\overline{E} = 0$. [5]

11. (*a*) Find the work done in moving the particle once round the ellipse :

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1,\ z = 0,$$

if field of force is :

$$\overline{F} = \left(2xy + 3z^2\right)\bar{i} + \left(x^3 + 4yz\right)\bar{j} + \left(2y^2 + 6xz\right)\bar{k}\,.$$ [6]

(*b*) Evaluate :

$$\iint_S \left(x^3\bar{i} + y^3\bar{j} + z^3\bar{k}\right) . d\overline{S}$$

where S is the surface of the sphere $x^2 + y^2 + z^2 = 16$. [5]

(*c*) Evaluate :

$$\iint \left(\nabla \times \overline{F}\right) . d\overline{S},$$

where :

$$\overline{F} = \left(x^3 - y^3\right)\bar{i} - xyz\,\bar{j} + y^3\,\bar{k}$$

and S is the surface $x^2 + 4y^2 + z^2 - 2x = 4$ above the plane $x = 0$. [6]

Or

12. (*a*) Evaluate :

$$\int_C \overline{F} \cdot d\overline{r} \quad \text{for} \quad \overline{F} = 3x^2\,\overline{i} + (2xz - y)\,\overline{j} + z\,\overline{k}$$

along the straight line joining (0, 0, 0) to (1, 2, 3). [6]

(*b*) Prove that :

$$\iint_S \frac{\overline{r}}{r^3} \cdot \hat{n}\, dS = 0. \qquad [5]$$

(*c*) Maxwell's equations are given by :

$$\nabla \cdot \overline{E} = 0,\ \nabla \cdot \overline{H} = 0,\ \nabla \times \overline{E} = -\frac{\partial \overline{H}}{\partial t},\ \nabla \times \overline{H} = \frac{\partial \overline{E}}{\partial t},$$

show that $\overline{E}$ and $\overline{H}$ satisfy :

$$\nabla^2 u = \frac{\partial^2 u}{\partial t^2}. \qquad [6]$$

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S.E. (Computer) EXAMINATION, 2008

MICROPROCESSORS AND INTERFACING TECHNIQUES

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Draw and discuss block schematic diagram and operation of 8284 clock generator and 8286 transceiver. [8]

(*b*) Explain I/O mapped I/O and memory mapped I/O with the help of neat diagrams. [8]

Or

2. (*a*) How 8086 accesses a byte from memory banks ? Discuss both odd and even accesses with the help of neat diagram and examples. [8]

(*b*) List and explain 8086 bus cycles required to fetch and execute the instruction IN AX,3CH. [8]

P.T.O.

3. (*a*) Write a program in 8086 Assembly Language to convert hex to bcd. Display proper string to prompt the user while accepting the input and displaying the results. [8]

(*b*) What is use of addressing mode ? Recognize addressing modes of the following instructions and explain each :

(*i*) MOV AH, 50H

(*ii*) MOV AH,[BP+2]

(*iii*) MOV AH, [BP+SI]

(*iv*) MOV AH, TEMP[BX]

where TEMP defines a memory location. [10]

Or

4. (*a*) What is the difference between a rotate and a shift instruction ? Explain with an appropriate diagram. [6]

(*b*) Determine the Register contents of AL, BL, and the six status flag register after the following instructions are executed :

```
STC
MOV AL, 4CH
SBB AL, 3EH
XOR BL, BL
MOV [SI], BL
```

[8]

(*c*) Explain with example 8086 instructions :

(*i*) LOOPZ

(*ii*) LODSB. [4]

5. (*a*) Draw and explain command/control words of 8259 PIC. What is master-slave configuration ? How many maximum number of slaves can be connected to a master ? [10]

(*b*) Explain operation of 8253/54 in modes 0 and 3 with the help of timing diagram. [6]

Or

6. (*a*) Draw and explain block diagram of 8254. How does 8254 differ from 8253 ? [8]

(*b*) What are type 0, 1, 2, 3 interrupts for 8086 processor ? [8]

SECTION II

7. (*a*) Explain mode 0 and BSR mode of 8255 with appropriate control word formats. [8]

(*b*) Draw and explain block diagram of 8259 PIC. [8]

Or

8. (*a*) Write the 8086 instruction sequence to program 8251 for asynchronous transmission with seven data bits, 1 stop bit and no parity with 6400 baud rate. [8]

(*b*) Explain different modes of operation for DMA. [8]

9. (*a*) Draw and explain a simple photodiode circuit to measure light intensity. [8]

(*b*) Write notes on : [10]

(*i*) Data Acquisition System

(*ii*) LVDT.

Or

10. (*a*) Show a typical 8-bit ADC interface with 8086. Explain functionality of each signal used. [10]

(*b*) Why are the strain gauges usually connected in a bridge configuration ? How to amplify the signal from a strain gauge bridge ? [8]

11. (*a*) What is the role of EXEC function ? [8]

(*b*) Where is the BIOS located ? Explain what routines are the part of BIOS. [8]

Or

12. (*a*) What are assembler directives ? List and explain at least *four* of them. [8]

(*b*) Differentiate between ·COM and ·EXE files. [8]

Total No. of Questions—12] [Total No. of Printed Pages—4

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S.E. (Computer) EXAMINATION, 2008

DATA STRUCTURES

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer *three* questions from each Section.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain generalized linked list (GLL) with node structure in C-language format. What is the significance of use of GLL ? Explain any *one* of the example which shows the advantage of GLL over other data structure. [10]

(*b*) Write pseudo C code to implement stack using singly linked list and then use the same algorithm for reversing the string and finding out the length of the string. [6]

Or

2. (*a*) Write pseudo C code for deletion and insertion of node in the doubly circular linked list. [10]

(*b*) How do we represent and manipulate the polynomial using arrays and linked list ? Which do you find more suitable for the representation and manipulation of polynomial ? Why ? Give suitable example. [6]

P.T.O.

3. (*a*) "Is it worthwhile to use threaded trees to avoid recursive post-order or pre-order traversal ?" Justify your answer. [6]

(*b*) Write a pseudo code for deletion of a node from a binary search tree. Simulate your algorithm with BST of 10 nodes and show the deletion process. Your simulation should show deletion of interior node and not just for leaf node. [12]

Or

4. (*a*) Explain the difference between binary tree and binary search tree. Why do we have binary search tree ? Write an algorithm for conversion of binary tree to binary search tree. [6]

(*b*) Write recursive and non-recursive algorithm for post-order traversal of the binary tree. What is the complexity of both of the algorithm ? Which do you prefer to implement ? Why and when ? [12]

5. (*a*) What are the different ways to represent the graph ? Give the suitable example. [4]

(*b*) Write an algorithm for binary search tree using Kruskal's algorithm and calculate its time complexity. Compare it with time complexity of Prim's algorithm and suggest which is better under what condition. [12]

Or

6. (*a*) Write an algorithm for Depth First Search algorithm in Graph using suitable data structure. What is the complexity of the algorithm ? If we have not use this data structure can still we implement the same algorithm, if yes what is its complexity ? [12]

(*b*) Explain the minimal spanning tree and their any *two* applications. [4]

SECTION II

7. (*a*) Give the input {4371, 1323, 6173, 4199, 4344, 9679, 1989} and hash function h(X) = X (mod 10), show the results for the following :

(*i*) open addressing hash table using linear probing

(*ii*) open addressing hash table using quadratic probing

(*iii*) open addressing hash table with second hash function h2(X) = 7 –(X mod 7) [12]

(*b*) What is optimal binary search tree and what is its use ? [4]

Or

8. (*a*) What are static and dynamic trees ? Distinguish between binary tree, Binary search tree, Optimal binary search tree and AVL tree. [8]

(*b*) Write a non-recursive function for insertion and deletion of elements in AVL tree. [8]

9. (*a*) What do you mean by max-heap and min-heap ? Explain with a suitable example. [8]

(*b*) Explain B trees, B+ trees and tries indexing for indexing of the data. [6]

(*c*) How priority heap is implemented using binary heap ? [4]

Or

10. (*a*) What is splay tree ? What are its applications ? Explain all the rotation in splay tree with pictorial representation. [6]

(*b*) Show the result of inserting 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13 and 2, one at a time, into initially empty binary heap.

After creating such heap delete the element 8 from heap, how do you repair the heap ?

Then insert the element in the heap and show the final result (insertion should be at other than lead node) [12]

11. (*a*) Explain how records are logically deleted from a file ? [4]

(*b*) Compare index sequential file with Sequential files. Write C-primitives for both organization and compare when out of these organization is used. [12]

Or

12. (*a*) What are index sequential files ? Why the records are being sorted as an indexed sequential file ? Is it necessary to reorganize the index of an indexed sequential file ? If so, Why ? When will the index be reorganized ? How is deletion of records handled in an indexed sequential file ? [12]

(*b*) What is multi-indexed file ? Give the suitable example for operations on such file. [4]

Total No. of Questions—**6**] [Total No. of Printed Pages—**3**

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S.E. (Computer Engineering) EXAMINATION, 2008

FINANCIAL AND INDUSTRIAL MANAGEMENT

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :—(*i*) Answer any *three* questions from each Section.

(*ii*) Answer *three* questions from Section I and *three* questions from Section II.

(*iii*) Answers to the two Sections should be written in separate answer-books.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Figures to the right indicate full marks.

SECTION I

1. (*a*) Explain the concept Management by Objectives (MBO). [7]

(*b*) Explain the following principles of management : [9]

(*i*) Division of labour

(*ii*) Unity of Direction

(*iii*) Remuneration.

Or

(*a*) Define Management. What are the characteristics and objectives of management ? Explain. [8]

(*b*) Explain the following in brief : [8]

(*i*) Authority and responsibility

(*ii*) Administration.

P.T.O.

2. (*a*) Scarcity of means and multiplicity of human wants gives rise to economic problem. Comment. [8]

(*b*) Explain the Law of Demand along with exceptions. [8]

Or

(*a*) Explain the role of Chambers of Commerce and Industries in India. [6]

(*b*) Explain the following : [10]

(*i*) E-Commerce

(*ii*) SEBI

3. Write short notes on : [18]

(*i*) Private Limited Companies

(*ii*) Functional Structure

(*iii*) Individual Ownership

Or

(*a*) Define organization and explain the significance of organization. [8]

(*b*) Explain the state ownerships as form of business. [10]

SECTION II

4. (*a*) What is Communication ? What is the importance of effective communication in modern business ? Explain. [8]

(*b*) Discuss the various factors affecting Man power planning. [8]

Or

(*a*) Discuss the salient features of Maslow's Theory of Motivation. [8]

(*b*) Explain the need and different methods of training. [8]

5. (*a*) Differentiate between (any *two*) : [12]

(1) Shares *Vs* Debentures

(2) Money Market *Vs* Capital Market

(3) Fixed Capital *Vs* Working Capital.

(*b*) What are overhead costs ? Explain the different overhead costs. [6]

Or

(*a*) Define cost and explain the elements of cost. [8]

(*b*) What is Budget ? What is importance and significance of Budgetary control ? Explain. [10]

6. (*a*) Explain the following Ratios : [8]

(1) Current Ratio

(2) Inventory turnover ratio.

(*b*) What is credit rating ? Explain the credit rating process for software companies. [8]

Or

(*a*) What is break-even analysis ? Explain in brief. [8]

(*b*) Explain the following : [8]

(*i*) Depreciation

(*ii*) Payback method.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

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S.E. (Computer) EXAMINATION, 2008

COMPUTER GRAPHICS

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) In Section I, attempt Q. No. **1** *or* Q. No. **2**; Q. No. **3** *or* Q. No. **4**; Q. No. **5** *or* Q. No. **6**; and in Section II attempt Q. No. **7** *or* Q. No. **8**; Q. No. **9** *or* Q. No. **10**; Q. No. **11** *or* Q. No. **12**.

(*ii*) Answers to the two Sections should be written in separate answer books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain the following character generation methods : [8]

(*i*) Stroke method

(*ii*) Starburst method

(*iii*) Bitmap method.

(*b*) Consider the line from (4, 9) to (7, 7). Draw a line using Bresenham's line drawing algorithm. [8]

P.T.O.

Or

2. (*a*) What is aliasing ? Discuss situation in which these artifacts matter, and those in which they do not.

Discuss various ways to minimize the effects of jaggies and explain what the 'costs' of these remedies might be. [8]

(*b*) Explain the features of the following graphics primitives : [8]

(*i*) Tablets

(*ii*) Touch panels

(*iii*) Scanners

(*iv*) Light pen.

3. (*a*) Explain seed fill algorithm for polygon filling. [8]

(*b*) Write short notes on : [10]

(*i*) Inverse transformation method

(*ii*) 2D shearing transforms.

Or

4. (*a*) Show that two dimensional scaling and rotation do not commute in general. [8]

(*b*) Explain scan line algorithm for polygon filling and explain how it can be extended for hidden line removal. [10]

5. (*a*) Explain why the Sutherland-Hodgman polygon clipping algorithm works for only convex clipping regions. [8]

(*b*) What is segment ? How is segmentation used in animation ? Explain creation and deletion of segment. [8]

Or

6. (*a*) Explain Cohen-Sutherland outcode algorithm. [8]

(*b*) Write a short note on Image transformation with example. [8]

SECTION II

7. (*a*) Explain :

(*i*) Translation

(*ii*) Scaling and

(*iii*) Rotation for 3D. [8]

(*b*) Explain the 3D viewing process with various 3D viewing parameters. [8]

Or

8. (*a*) What is the necessity of 3D clipping ? Explain parallel projection. [8]

(*b*) Explain :

(*i*) 3D coordinate system

(*ii*) 3D primitives. [8]

9. (*a*) Explain the necessity of hidden surface algorithms. How does back face removal algorithm determine which surface to be remove ? [8]

(*b*) Write short notes on :

(*i*) Ray tracing

(*ii*) Transparency. [10]

Or

10. (*a*) Compare RGB and CYM colour models. [6]

(*b*) What is shading ? What steps are required to shade an object using Gauard's shading algorithm ? [6]

(*c*) Explain binary space partition. [6]

11. (*a*) What is interpolation ? Explain Lagrangian interpolation method. [8]

(*b*) Define fractal and give any *two* examples of fractals. [8]

Or

12. (*a*) Compare Bezier and B-spline curves. [8]

(*b*) What is fractal dimension ? Explain Triadic Koch curve in detail, giving the fractal dimension. [8]

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S.E. (Computer) EXAMINATION, 2008

COMPUTER ORGANIZATION

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Perform the following division using restoring and non-restoring division algorithm :

Dividend = 1100

Divisor = 0011. [10]

(*b*) Represent the following numbers in single precision floating point format :

(*i*) 100.125

(*ii*) 42.625. [6]

Or

2. (*a*) Solve the following multiplication using Booth's algorithm and also by bit-pair recording technique :

Multiplicand = 11011

Multiplier = 00111. [10]

P.T.O.

(*b*) Draw the IEEE standard formats for floating point number representation. [6]

3. (*a*) Explain with suitable examples how the size of the control words can be reduced in order to obtain small control store. [8]

(*b*) Draw and explain the microprogrammed control unit. [8]

Or

4. (*a*) What are the different design methods for Hardwired control unit ? Explain any *one*. [8]

(*b*) Write the control sequence for the following instruction considering single bus organization of the CPU :

SUB (R_3), R_2

where, R_3 is source Register and R_2 is Destination Register. [8]

5. (*a*) Explain different hazards in instruction pipelining. [8]

(*b*) Explain the following addressing modes with *one* example each :

(*i*) Autoincrement

(*ii*) Autodecrement

(*iii*) Immediate

(*iv*) Register

(*v*) Direct addressing. [10]

Or

6. (*a*) Discuss in detail register organization of any INTEL/MOTOROLA processor. [10]

(*b*) Explain briefly :

(*i*) Instruction Format

(*ii*) Instruction Pipelining. [8]

SECTION II

7. (*a*) What is Virtual memory concept ? Explain the role of TLB in virtual memory organization. [8]

(*b*) Explain briefly different Replacement algorithms. [8]

Or

8. (*a*) Explain with neat diagram address translation mechanism for converting virtual address into physical address. [8]

(*b*) Explain the following terms :

(*i*) Cache updation policies

(*ii*) Cache Hit and cache miss. [8]

9. (*a*) Discuss the following terms :

(*i*) Programmed I/O

(*ii*) Interrupt Driven I/O. [8]

(*b*) Explain briefly the following bus standards :

(*i*) PCI

(*ii*) SCSI. [8]

Or

10. (*a*) What are the types of printers ? Explain the printing mechanism of Dot matrix printer. [8]

(*b*) Explain with suitable diagrams types of I/O channels. [8]

11. (*a*) Draw and explain briefly loosely coupled configuration. [8]

(*b*) Explain interprocessor communication between main processor and co-processor. [6]

(*c*) List out the advantages of loosely coupled system over closely coupled system. [4]

Or

12. (*a*) Explain daisy chaining method of resolving bus priority in multiprocessor configuration. [6]

(*b*) Explain how I/O processor communicates with the main processor. [6]

(*c*) Compare : RISC *Vs.* CISC. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+4+2**

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S.E. (Comp.) EXAMINATION, 2008

DISCRETE STRUCTURES

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) In Sections I and II, attempt Q. No. **1** *or* Q. No. **2**; Q. No. **3** *or* Q. No. **4**; Q. No. **5** *or* Q. No. **6**; Q. No. **7** *or* Q. No. **8**; Q. No. **9** *or* Q. No. **10**; Q. No. **11** *or* Q. No. **12**.

(*ii*) Answers to the two Sections should be written in separate answer books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Prove by mathematical induction that for $n \geq 1$:

$1.1\,! + 2.2\,! + 3.3\,! + \ldots\ldots + n.n\,! = (n+1)! - 1.$ [6]

(*b*) Let p denote the statement 'The material is interesting', q denote the statement 'The exercises are challenging' and r denote the statement 'The course is enjoyable'. Write the following statements is symbolic form :

(*i*) The material is interesting and exercises are challenging.

P.T.O.

(*ii*) The material is interesting means the exercises are challenging and conversely.

(*iii*) Either the material is interesting or the exercises are not challenging but not both.

(*iv*) If the material is not interesting and exercises are not challenging, then the course is not enjoyable.

(*v*) The material is uninteresting, the exercises are not challenging and the course is not enjoyable. [5]

(*c*) It was found that in first year of computer engineering out of 80 students 50 know 'C' language, 55 know 'Basic' and 25 know 'C++', while 8 did not know any language.

Find :

(*i*) How many know all the three languages.

(*ii*) How many know exactly two languages. [4]

(*d*) Show that :

$$A \cup (B \cap C) = (A \cup \overline{B}) \cap (A \cup C)$$

using Venn diagrams. [3]

Or

2. (*a*) Out of the integers 1 to 1000 :

(*i*) How many are not divisible by 3, nor by 5, nor by 7 ?

(*ii*) How many are not divisible by 5 and 7 but divisible by 3 ? [6]

(*b*) A survey of 500 television watches produced the following information. 285 watch football, 195 watch hockey, 115 watch basketball, 45 watch football and basketball, 70 watch football and hockey, 50 watch hockey and basketball and 50 do not watch any of the three games.

(*i*) How many people in the survey watch all three games ?

(*ii*) How many people watch exactly one game ? [6]

(*c*) If

$$|P \cup Q \cup R| = |P| + |Q| + |R|$$

then which of the following is *true* ?

(*i*) $(P \cap Q) = \phi$

(*ii*) $(R \cap Q) \cup (P \cap R) = \phi$

(*iii*) $(P \cap Q \cap R) = \phi$. [3]

(*d*) Prove the following using Venn diagram :

$$A \cap B \oplus C = (A \cap B) \oplus (A \cap C).$$ [3]

(*a*) Five fair coins are tossed and the results are recorded :

(*i*) How many different sequences of heads and tails are possible ?

(*ii*) How many of the sequences in part (*i*) have exactly one head recorded ?

(*iii*) How many of the sequences in part (*i*) have exactly three heads recorded ? [6]

(*b*) How many different ways can n people be seated around a circular table ? [4]

(*c*) If thirteen people are assembled in a room, show that at least two of them must have their birthday in the same month. [4]

(*d*) State pigeon-hole principle. [2]

Or

4. (*a*) Suppose that three balls are selected at random from an urn containing seven red balls and five black balls. Compute probability that :

(*i*) All three balls are red.

(*ii*) At least two balls are black.

(*iii*) At most two balls are black.

(*iv*) At least one ball is red. [4]

(*b*) (*i*) How many distinguishable permutations of the letters in the word 'BANANA' are there ?

(*ii*) Compute number of permutations of the set given :

$$\{1, 2, 3, 4, 5\}.$$

(*iii*) Find the number of permutations of A taken r at a time :

$$A = \{a, b, c, d, e, f\}, \; r = 2.$$

(*iv*) In how many ways can six men and six women be seated in a row if any person may sit next to any other ? [4]

(c) A bit is either 0 or 1 : *a* byte is a sequence of 8 bits. Find :

(*i*) The number of bytes that can be formed from 8 bits.

(*ii*) The number of bytes that begin with 11 and end with 11.

(*iii*) The number of bytes that begin with 11 and do not end with 11.

(*iv*) The number of bytes that begin with 11 or end with 11. [4]

(*d*) In how many ways can a cricket team of eleven be chosen out of batch of 15 players ? How many of them will :

(*i*) Include a particular player ?

(*ii*) Exclude a particular player ?

(*iii*) If two players of team are fix ? [4]

5. (*a*) Determine the properties of the relations given by the graphs below : [4]

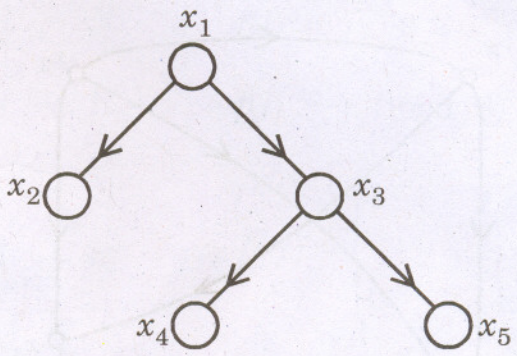


Fig. (*a*)

Fig. (*b*)

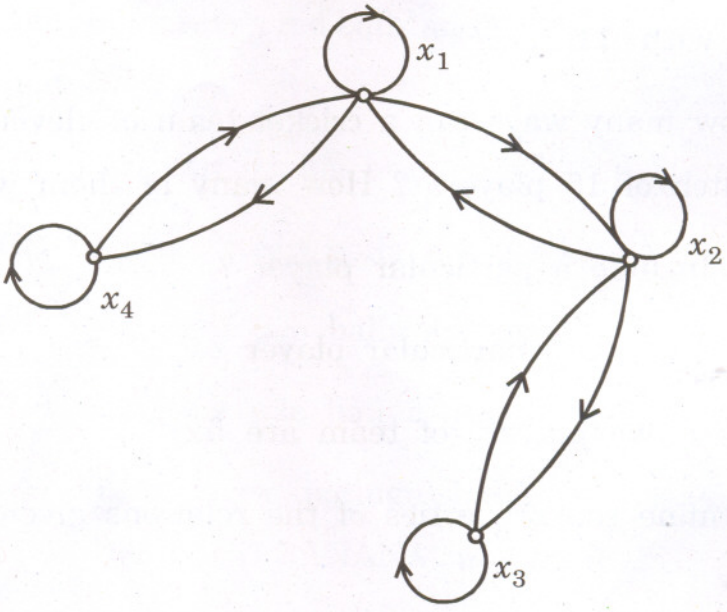


Fig. (*c*)

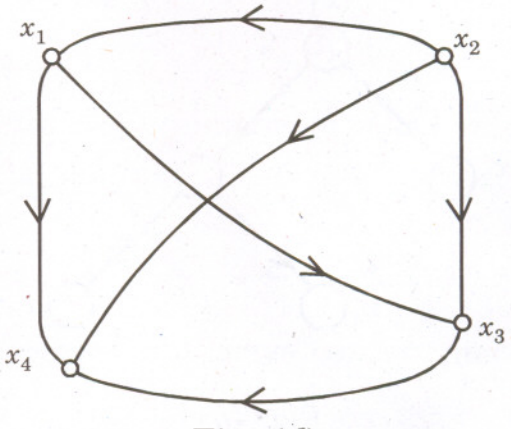


Fig. (*d*)

(*b*) Let R denote a relation on the set of ordered pairs of positive integers such that $<x, y>$ R $<u, v>$ iff $xv = yu$. Show that R is an equivalence relation. [4]

(*c*) Let $f(x) = x + 2$, $g(x) = x - 2$ and $h(x) = 3x$ for $x \in$ R, where R is the set of real numbers. Find :

(*i*) g o f

(*ii*) f o g

(*iii*) f o f

(*iv*) h o g. [4]

(*d*) Define functions. Define 'onto', 'one-to-one', 'one-to-one onto' functions. [4]

Or

6. (*a*) Let N be the set of natural numbers including zero. Determine which of the following functions are one-to-one, onto and which are one-to-one onto :

(1) $f : N \to N$ $\quad f(j) = j^2 + 2$

(2) $f : N \to N$ $\quad f(j) = j \pmod 3$

(3) $f : N \to N$ $\quad f(j) = \begin{cases} 1 & j \text{ is odd} \\ 0 & j \text{ is even} \end{cases}$

(4) $f : N \to \{0, 1\}$ $\quad f(j) = \begin{cases} 0 & j \text{ is odd} \\ 1 & j \text{ is even} \end{cases}$ [4]

(*b*) Solve the recurrence relation : [6]

(1) $d_n = 2d_{n-1} - d_{n-2}$ with initial conditions $d_1 = 1.5$ and $d_2 = 3$.

(2) $b_n = -3\,b_{n-1} - 2b_{n-2}$ with initial conditions $b_1 = -2$, $b_2 = 4$.

(*c*) Let n be a positive integer and S_n be the set of all divisors of n. Let D denote the relation of 'division'. Draw the diagrams of lattices for :

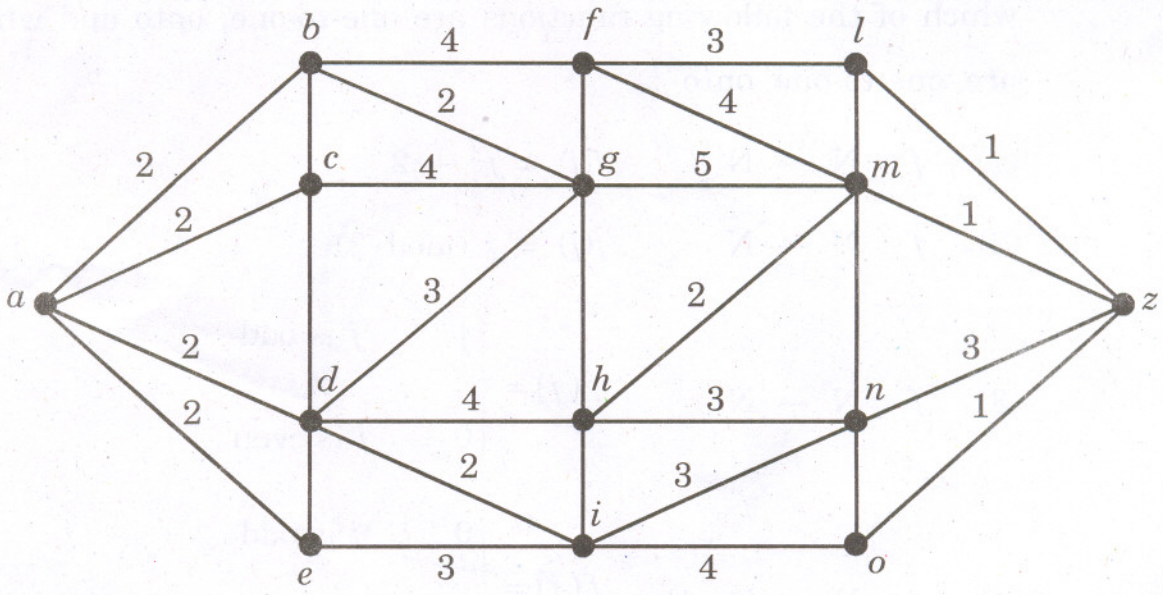
(1) $n = 24$

(2) $n = 30$

(3) $n = 6$. [6]

SECTION II

7. (*a*) State the Dijkstra's algorithm to obtain the shortest path between two vertices in the given graph and apply the same to obtain the shortest path between a and z in the following graph : [10]



(*b*) Determine which of the graphs below represent Eulerian circuit, Eulerian path, Hamiltonian circuit, Hamiltonian path. Justify your answer. [4]

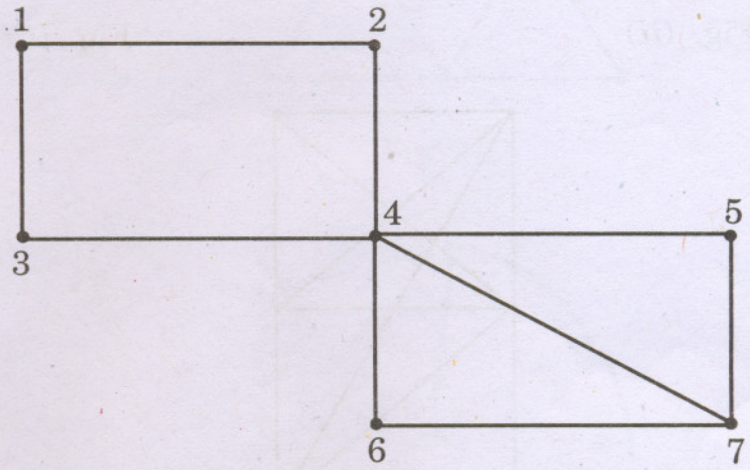


Fig. (*a*)

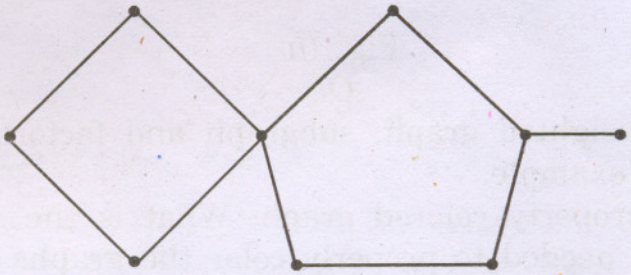


Fig. (*b*)

(*c*) Identify whether the graphs given are planar or not : [4]

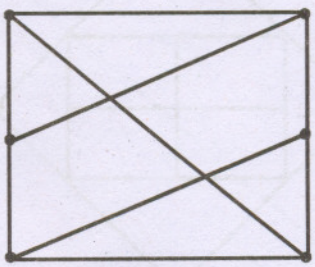


Fig. (*i*)

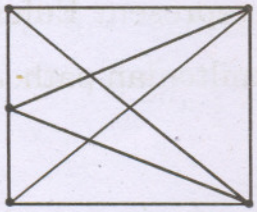


Fig. (*ii*)

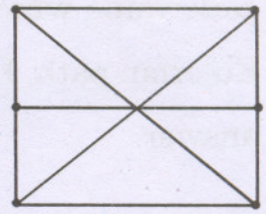


Fig. (*iii*)

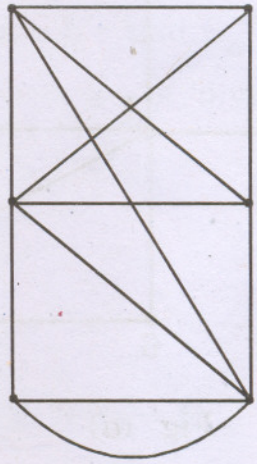


Fig. (*iv*)

Or

8. (*a*) Define weighted graph, subgraph and factors of graph with a suitable example. [6]

(*b*) Define property colored graph. What is the minimum number of colors needed to properly color the graphs shown in Fig. (*i*), (*ii*) and (*iii*). [6]

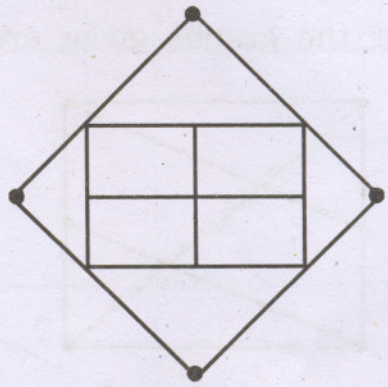


Fig. (*i*)

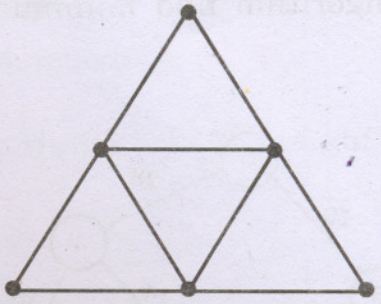


Fig. (*ii*)

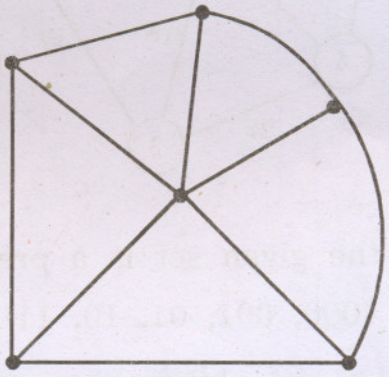
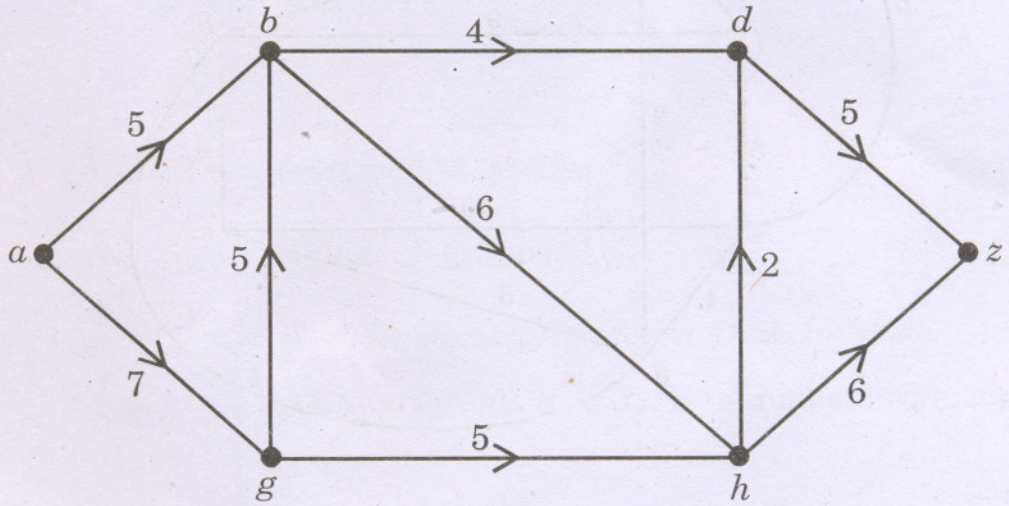


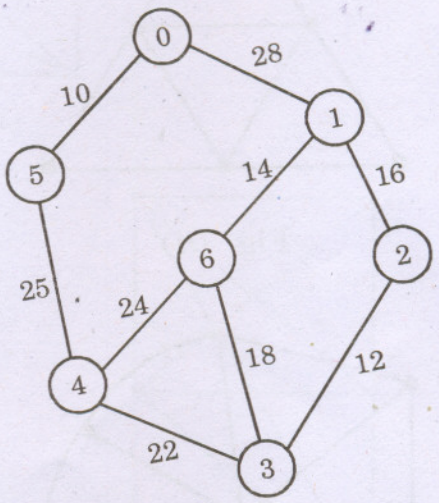
Fig. (*iii*)

(*c*) Describe edge and vertex connectivity with examples. [6]

9. (*a*) Find maximum flow in the transport network using labelling procedure. Determine the corresponding minimum cut. [8]



(*b*) Using Prim's algorithm find minimum spanning tree for graph below : [6]

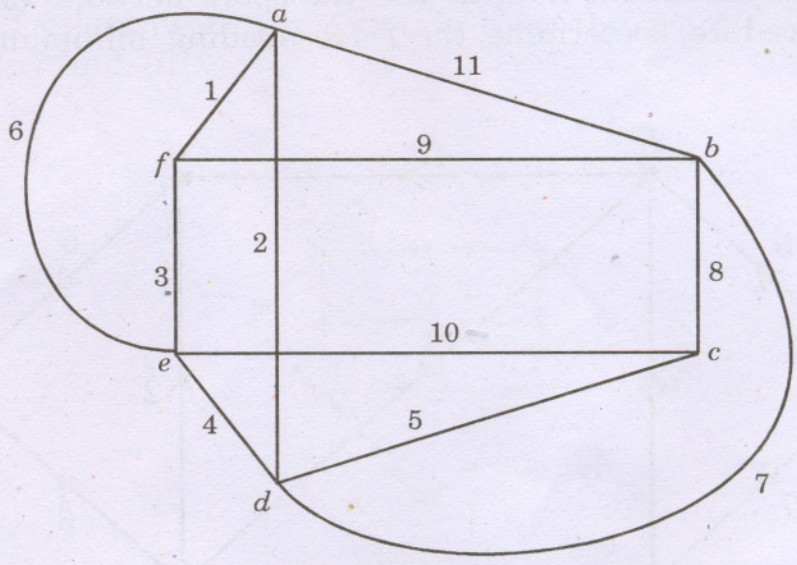


(*c*) State whether the given set is a prefix code. Justify.

{000, 001, 01, 10, 11}. [2]

Or

10. (*a*) Determine minimum spanning tree for the graph of Fig. 1 using Kruskal's algorithm. [6]



(*b*) Suppose data items A, B, C, D, E, F, G occur with the following probabilities of distribution :

Data Items	Probability
A	10
B	30
C	05
D	15
E	20
F	15
G	05

Construct a Huffman code for the data. What is the minimum path length ? [6]

(*c*) Explain fundamental circuits and fundamental cut sets. [4]

11. (*a*) Define :

(*i*) Subgroups

(*ii*) Quotient groups

(*iii*) Homomorphism of groups

(*iv*) Isomorphism of groups. [4]

(*b*) Let G a group with identity e. Show that function $f : G \to G$ defined by $f(a) = e$ for all $a \in G$ is a homomorphism. [6]

(c) Let G = {EVEN, ODD} and binary operation $\oplus$ is defined as :

$\oplus$	EVEN	ODD
EVEN	EVEN	ODD
ODD	ODD	EVEN

Show that (G, $\oplus$) is a group. [6]

Or

12. (a) Define rings. Show that the algebraic system (A, +, •) is a ring; where A is the set of integers and + and • are two binary operations giving addition and multiplication of two integers respectively. [6]

(b) Define congruence classes with respect to groups. [4]

(c) Define Abelian group. Show that $<Z_6, +>$ is Abelian group. [4]

(d) Define ring homomorphism. [2]