

N.B 1) Question No. 1 is **Compulsory**.

2) **Answer** any **three** questions from remaining questions.

3) Figures to the right indicate full marks.

Q.1 a) Evaluate $\int_0^{\infty} x e^{-x^4} dx$. 3

b) Find the length of the arc of the curve $r = a \sin^2\left(\frac{\theta}{2}\right)$ 3
from $\theta = 0$ to any point $P(\theta)$.

c) Solve $(D^4 - 2D^2 + 1)y = 0$. 3

d) Solve $(x - 2e^y)dy + (y + x \sin x)dx = 0$. 3

e) Evaluate $\int_0^1 \int_0^x x^2 y^2 (x + y) dy dx$. 4

f) Solve $\frac{dy}{dx} = x^3 + y$ with initial condition $x_0 = 1, y_0 = 1$ 4
by Taylors method. Find the approximate value of y for $x=0.1$.

Q.2 a) Solve $\frac{d^2y}{dx^2} - 4y = x^2 e^{3x} + e^{3x} - \sin 2x$. 6

b) Show that $\int_0^{\infty} \frac{\log(1+ax^2)}{x^2} dx = \pi\sqrt{a}, (a > 0)$ 6

c) Change the order of integration and evaluate 8
 $\int_0^5 \int_{2-x}^{x+2} dy dx$.

Q.3 a) Evaluate $\iiint z dx dy dz$ over the volume of tetrahedron 6
bounded by the planes $x = 0, y = 0, z = 0$ and
 $\frac{x}{3} + \frac{y}{4} + \frac{z}{5} = 1$.

b) Find the mass of the lamina bounded by the curves 6
 $y^2 = 4x$ and $x^2 = 4y$ if the density of the lamina at any
point varies as the square of its distance from the origin.

c) Solve $x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + 6y = -x^4 \sin x$. 8

Q.4 a) Find by the double integration the area between the curves $y^2 = 4x$ and $2x - 3y + 4 = 0$. 6

b) Solve $(1 + \sin y) \frac{dx}{dy} = 2y \cos y - x(\sec y + \tan y)$. 6

c) Solve $\frac{dy}{dx} = x^2 + y^2$ with initial conditions $y_0 = 1$, $x_0 = 0$ at $x=0.2$ in steps of $h=0.1$ by Runge Kutta method of fourth order. 8

Q.5 a) Evaluate $\int_0^1 \frac{x^2}{\sqrt{1-x^4}} dx \cdot \int_0^1 \frac{dx}{\sqrt{1-x^4}}$. 6

b) The distance x descended by a parachute satisfies the differential equation $\left(\frac{dx}{dt}\right)^2 = k^2(1 - e^{-2gx/k^2})$ where k and g are constants. If $x=0$ when $t=0$, show that $x = \frac{k^2}{g} \log \cosh \left(\frac{gt}{k}\right)$. 6

c) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using i) Trapezoidal ii) Simpsons (1/3)rd and iii) Simpsons (3/8)th rule. 8

Q.6 a) Find the volume in the first octant bounded by the cylinder $x^2 + y^2 = 2$ and the planes $z = x + y$, $y = x$, $z = 0$ and $x = 0$. 6

b) Change to polar coordinates and evaluate $\iint_R \frac{dx dy}{(1+x^2+y^2)^2}$ over one loop of the lemniscates $(x^2 + y^2)^2 = x^2 - y^2$. 6

c) Solve by method of variation of parameters $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$. 8

(2 Hours)

[Total Marks : 60]

- 1) Question no.1 is compulsory
- 2) Attempt any three questions from Q.2. TO Q. 6
- 3) Use suitable data wherever required.
- 4) Figures to the right indicate full marks.

1. Attempt any five of the following

- a) Why does an excessively thin film appear to be perfectly dark when illuminated by white light. 15
- b) In a plane transmission grating the angle of diffraction for the first order principal maximum is 20° for a wavelength of 6500 \AA . Calculate the number of lines in one cm of the grating surface.
- c) Explain the term V-number of an optical fibre.
- d) Differentiate between Spontaneous Emission & Stimulated Emission
- e) Show that divergence of the curl of a vector is zero.
- f) An electron is accelerated through a potential difference of 18-Kv in a colour Cathode ray tube. Calculate the kinetic energy & the speed of the electron.
- g) What will happen when a liquid is introduced between the plano convex lens and glass plate in Newton's rings experiment.

2. (a) What do you mean by thin film? Obtain the conditions for the maxima and minima of the light reflected from a thin transparent film of uniform thickness 8

(b) Explain Step index and Graded index fibres. A Step Index fibre has a core diameter of $2.9 \times 10^{-6} \text{ m}$, the refractive indices of core & claddings are 1.52 & 1.5189 resply. If the light of wavelength 1.3 \mu m is transmitted through the fibre determine the normalized frequency & number of modes supported by the fibre. 7

3. (a) With neat energy level diagram describe the construction and working of Nd-Yag laser 8

(b) What is grating element. The visible spectrum ranges from 4000 \AA to 5000 \AA . Find the angular breadth of the first order visible spectrum produced by a plane grating having 6000 lines/cm when light is incident normally on the grating 7

4. (a) Explain with neat diagram, construction and working of SEM. 5
- (b) Explain spherical co-ordinate system? State the transformation relation between Cartesian and Spherical coordinates 5
- (c) What is Holography? Distinguish between holography and ordinary photography? 5
5. (a) Show that diameter of Newton's dark ring is directly proportional to square root of natural number? 5
- (b) What are the different techniques to synthesise nanomaterial & explain one of them in detail. 5
- (c) In a Newton's rings experiment the diameter of n^{th} and $(n+12)^{\text{th}}$ rings are 4.3mm and 6.8mm respectively. Radius of curvature of plano-convex lens is 1m. Find the wavelength of light. 5
6. (a) Explain the physical significance of divergence and curl of a vector field? 5
- (b) State Bethe's law and explain electrostatic focusing of electron beam? 5
- (c) Two glass plates enclose a wedge-shaped air film touching at one edge are separated by wire of 0.03mm diameter at distance 15 cm from the edge. Monochromatic light of Wavelength $\lambda=6000\text{\AA}$ from a broad source falls normally on the film. Calculate the fringe width. 5

Duration: 2 Hours

Total Marks: 60

- N.B.:** (1) Question no. I is compulsory.
(2) Attempt any three questions from Q. 2 to Q. 6.
(3) All questions carry equal marks.
(4) Figures to the right indicate full marks.
(5) Atomic weights: H= 1, C =12, O =16, S =32, N =14, Cl = 35.5, Ba =137.3.

1. Answer any five of the following:

- What is passivity? With an example explain how it affects the rate of corrosion? (15)
- Name a green solvent and explain its properties.
- Give the detailed classification of composites with examples.
- A coal sample was found to contain the following constituents:
C= 81%, H= 6%, S =1%, N= 2%, ash = 4% and rest is oxygen.
Calculate the minimum weight of air required at STP for complete combustion of 1 kg of the coal sample.
- State and explain the Pilling Bedsworth rule.
- Give the classification and composition of plain carbon steels.
- Draw the diagram of the alkaline fuel cell and write the reactions taking place at the anode and cathode.

2. (a) Explain the impressed current cathodic protection method with the help of following points:-

- Principle and diagram
- Explanation of process.
- Applications.

(6)

(b) i) 1.5gm of a coal sample was kjeldahlised and the ammonia evolved was absorbed in 49 ml N/10 H_2SO_4 . After absorption the excess H_2SO_4 required 32.5ml of 0.1N NaOH for neutralization. 0.5gm of the same coal sample was burnt in a bomb calorimeter and on treatment with $BaCl_2$ produced 0.08gm of $BaSO_4$. Calculate the percentage of nitrogen and Sulphur in the given coal samples. (3)

ii) Give an example to explain why it is beneficial to prevent waste formation in chemical processes rather than treat waste? (2)

(c) Classify structural composites and explain their properties and uses along with diagram. (4)

3. (a) Explain fixed bed catalytic cracking with the help of the following points:-

- Principle ii) Labelled Diagram iii) Flow chart of process.

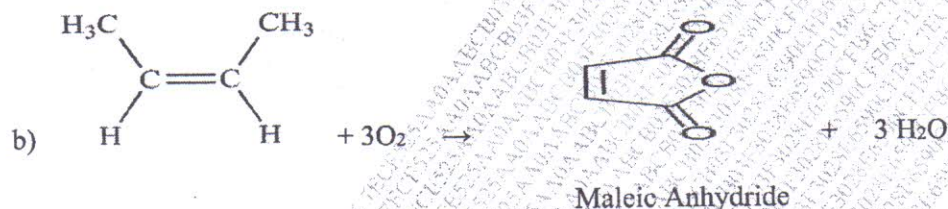
(6)

(b) i) What are special steels? Explain the properties and applications of any one type of special steel. (3)

ii) Name the type of microscopic corrosion affecting Alpha brass and explain the conditions under which it occurs. (2)

Paper / Subject Code: 29703 / Applied Chemistry- II.

- (c) Calculate the percentage atom economy of the following reactions with respect to the target product Maleic Anhydride and state which is the greener reaction.



4. (a) How do the following factors affect the rate of corrosion:
 i) Conductance of corroding medium ii) Relative area of anode and cathode
 iii) Temperature
- (b) i) Give the traditional and green synthesis of adipic acid and compare the starting materials used.
- ii) What are the properties of composites which make them popular engineering materials?
- (c) Give the composition and properties of any two:
 i) German Silver ii) Magnalium iii) Wood's Metal
5. (a) A gas has following composition by volume: $\text{H}_2=10\%$, $\text{C}_2\text{H}_6=25\%$, $\text{CO}=16\%$, $\text{H}_2\text{O}=20\%$, $\text{C}_2\text{H}_2=15\%$, $\text{CH}_4=4\%$, $\text{O}_2=4\%$ and the rest is CO_2 . Calculate the volume of air supplied per 2m^3 of the gas at STP. Also calculate the weight of air to be supplied at STP per 2m^3 of the gas. (Average molar mass of air at STP = 28.94gm).
- (b) i) Part of an iron nail corrodes inside a piece of wood. Identify the type of corrosion and explain the mechanism with a labelled diagram and reactions.
- ii) What is shape memory effect?
- (c) The Bhopal Gas Tragedy was one of the worst industrial disasters. With reactions explain the synthesis of the intermediate which caused the tragedy and the final product. Also give the alternative route of synthesis of the final product explaining the green chemistry principle being adhered to.
6. (a) What are the steps involved in powder metallurgy? Name the different moulding techniques used. Explain any one method of moulding with detailed diagram.
- b) (i) How are particle reinforced composites different from fibre reinforced composites?
 (ii) Distinguish between galvanizing and tinning.
- (c) What is knocking? Explain the role of antiknocking agents.

(3 Hours)

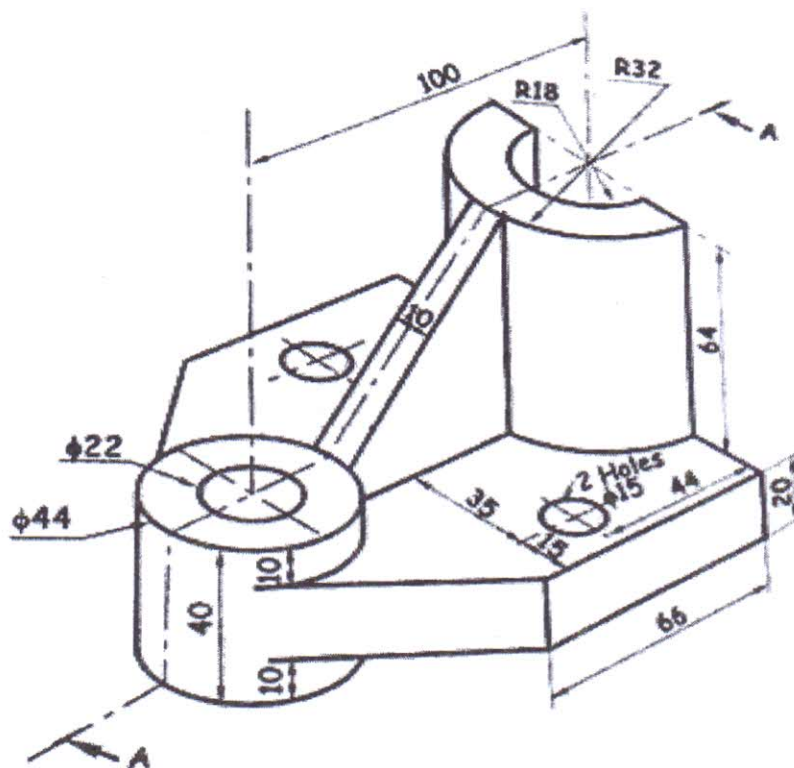
[Max Marks: 60]

- Solve any **FOUR** questions.
- All dimensions are in mm.
- Use first angle method of projection.
- Assume suitable dimension if it is necessary.
- Retain all construction lines.

Q.1

Following figure shows the pictorial view of an object, draw

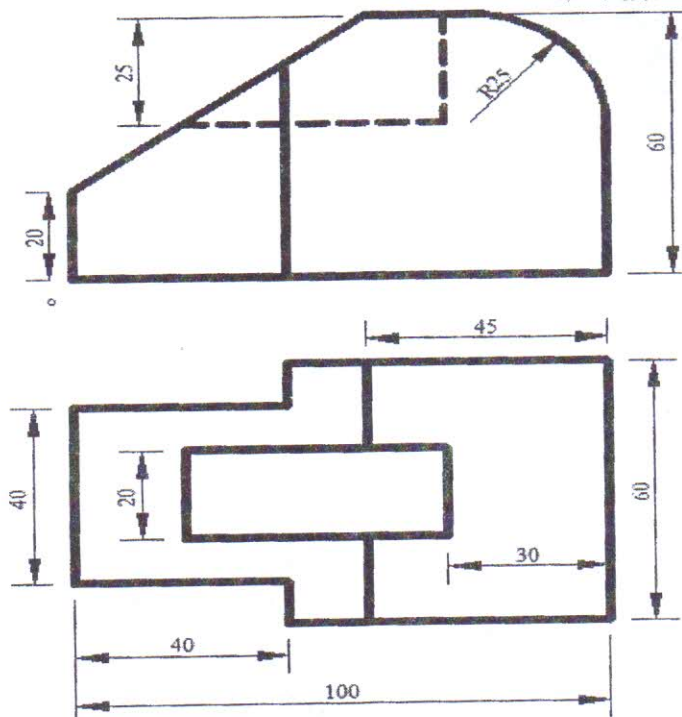
- Sectional front view along section A-A [5]
- Top view. [4]
- Left Hand Side view [4]
- Insert 10 major dimensions. [2]



- Q.2 A right circular cone of base 60mm diameter and axis 75mm long is lying on VP on one of its end generator. Draw projections of the cone when FV of the axis inclined 45° with HP and base nearer to observer. [15]

Paper / Subject Code: 29706 / Engineering Drawing.

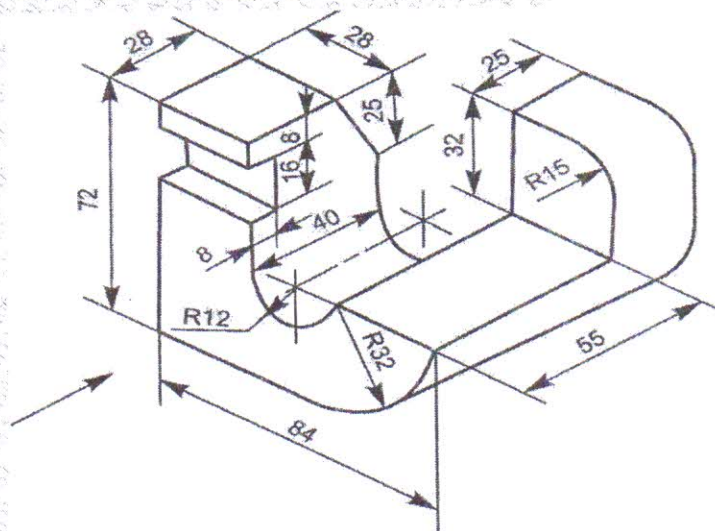
Q.3 (a) Front view and top view of an object is shown in figure, draw an Isometric View. [9]



(b) A square prism edge of base 35mm and axis 70mm has one of its base edges in the HP with its axis inclined at 40 degrees to the HP and Parallel to VP. Draw its projections. [6]

Q.4 (a) The pictorial view of a machine part is shown in following figure. Draw

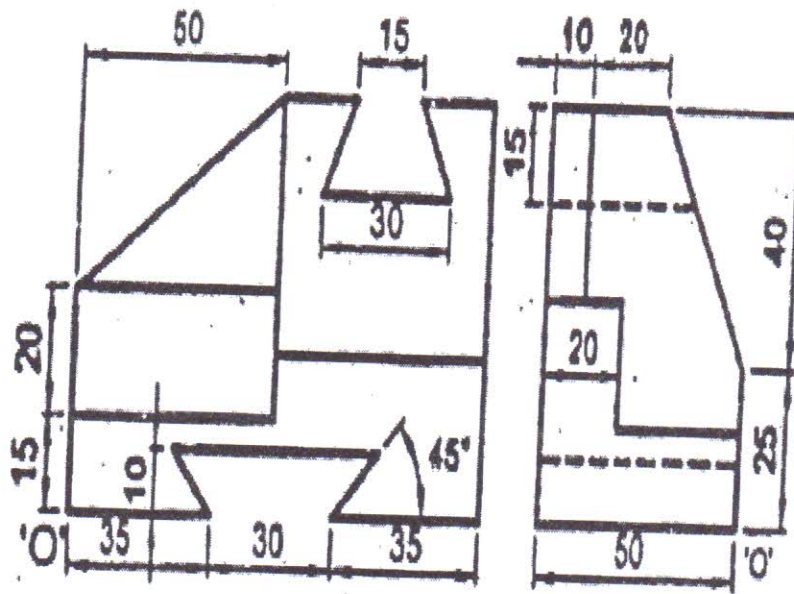
- Front view along arrow direction
- Top view
- Insert at least 6 Dimensions.



(b) Draw a helix of pitch 80mm on a cylinder of 60mm diameter. [6]

A hexagonal pyramid of 30mm edge of base, 60mm axis length rests on its base on HP with an edge of base perpendicular to VP. It is cut by a section plane normal to VP and 60° inclined to HP bisects the axis of the pyramid. Draw sectional FV, sectional TV, True shape of section and Development of Lateral surface of the pyramid after removing apex. [15]

- (a) The TV of 75mm long line AB measures 60mm. Point A is 15mm below HP and 50mm in front of VP. Point B is 15mm in front of VP and above HP. Draw projections of line and determine its inclination with HP and VP. [8]
- (b) Front view and side view of an object are shown in figure, draw an isometric view. [7]



Sem-II
Choice based

Time: 3 hours

Marks: 80

N.B

- (1) Question no. 1 is compulsory.
- (2) Attempt any 3 from the remaining questions.
- (3) Assume suitable data if necessary.
- (4) Figures to right indicate full marks.

Q.1 a. Attempt the Multiple Choice Questions

6

i) The format identifier '%i' is also used for _____ data type?
(a) char (b) int (c) double (d) float

ii) Which keyword can be used for coming out of recursion?
(a) break (b) exit (c) return (d) all of above

iii) What will happen if in a C program you assign a value to an array element whose subscript exceeds the size of array?
(a) The element will be set to 0
(b) The compiler would report an error
(c) The program may crash if some important data gets overwritten
(d) The array size would appropriately grow.

iv) A pointer is
(a) A keyword used to create variable
(b) A variable that stores address of an instruction
(c) A variable that stores address of other variable
(d) All of the above

v) In which order do the following gets evaluated
1. Relational
2. Arithmetic
3. Logical
4. Assignment
(a) 2134 (b) 1234 (c) 4321 (d) 3214

vi) Which of the following cannot be a structure member?
(a) Another structure (b) Function (c) Array
(d) None of the mentioned

b) Find the output of following

4

```
i) ) #include<stdio.h>
void main()
{
    int c;
    for(c=1;c<=5;)
    printf("%d",++c);
}
```

```
ii) How many 'x' are printed by the following code?
#include<stdio.h>
void main()
{
    int i=5;
    while(i-- > 0)
    printf("x");
    printf("x");
}
```


- c) Draw a flowchart for printing the sum of even terms contained within the numbers 0-20. 4
- d) Solve the following 6
- i) Convert 238 decimal to octal
- ii) Convert A3D Hexadecimal to decimal
- Q.2 a) Distinguish between 6
- i) While and do-while loop
- ii) break and continue
- b) Write a c program that will convert a decimal number into any base. 6
- c) Write a program to calculate the sum of following series without pow() library function 8
- $S = 1 - x + x^2/2! - x^3/3! + \dots N$ terms
- Q.3 a) What is an array? What does an array name signify? Can array index be negative? Write a c program to arrange the number stored in an array in such a way that the array will have the odd numbers followed by even numbers. 10
- b) Write a program that accepts a word from the user and prints it in the following way. 10
- For ex. If the word is "STUDY" the program will print it as
- S
- ST
- STU
- STUD
- STUDY
- Q.4 a) What is string? Explain the use of gets()? Write a c program that will read a word and rewrite it in alphabetical order. For ex. If the word is "matrix" the program should print "aimrtx". 10
- b) Explain recursion and its advantages? Write a recursive c program to find the factorial of a given number. 10
- Q.5 a) Explain the storage classes with example. 10
- b) Declare a structure to store the information of 10 cricketers. 10
- i. Cricketer name
- ii. Matches Played
- iii. Runs Scored
- iv. Strike rate
- Use a function to display the cricketer information having the maximum strike rate.
- Q.6 a) How do pointers differ from variables in c? Write a c program to add two pointers. 10
- b) What is file? Write a c program that include the menu that must have the following capabilities 10
- i) Enter the several lines of text and store them in a data file.
- ii) Retrieve and display the particular line.
- iii) Delete n lines

(2 HOURS)

[Total Marks:40]

- N.B.** 1. Question no. 1 is compulsory
2. Attempt any three out of the remaining five questions
3. Figures to the right indicate full marks
4. Answers to all the sub questions should be grouped together.

Q1.a. Answer any two of the following:

(05)

- Describe the process of communication with a suitable diagram. Would the communication cycle be considered incomplete if the feedback is in a different medium and not the same as the original message? Justify your answer.
- What is the importance of feedback? Give instances where feedback is not immediate or altogether missing.
- A sales letter best captures the AIDA Principle---Comment.
- Explain "Complete block form" of writing a business letter with a diagrammatic representation.

b. Identify the Sender, Receiver, Medium, Message, Feedback in the following communication situations:

(05)

- The Managing Director calls an urgent business meeting to discuss about the falling market prices and its repercussions on the company. Executives attend the meeting in full strength.
- The Sales officer proposes some strategies to increase the sales target of a newly launched product in a seminar. The sales manager appreciates his proposal.

Q2 a. Write short notes on: (any two)

(05)

- Information Overload, a barrier to communication
- Proxemics and its impact on communication at the workplace
- SQ3R Technique of Reading
- Upward Communication and its limitations.

b. Identify and explain the barriers in the following situations :

(05)

- Shekhar is feeling disturbed and is unable to concentrate on his work, as he is constantly thinking about the argument that he had with his boss, this morning.
- Norman was struggling to explain his peril to the French Police officer who was not very conversant in English, but to no avail.

Q3 a. As the Senior Sales Manager of "Kings Electronics Pvt Ltd." Mumbai, draft a sales letter addressed to the Principals of Degree Colleges in your city, to promote the sale of the new interactive smart boards, that your company has recently manufactured. Point out its salient features and utility. Invent the necessary details and write the letter in complete block form.

(05)

- b. Do as directed: (05)
- The captive fell down on his knees. The captive pleaded for mercy. (Join the pair of sentences with suitable conjunctions)
 - Give the synonym for the word "Ruckus"
 - Didn't you hear that they're arriving today? (Punctuate the given sentence)
 - I appreciated his work with me in resolve the conflict. (Correct the error and rewrite)
 - "SPECULATE" (Expand this verb into a suitable noun by adding a suffix)

Q.4. a. You are the Branch Manager of "Quantum group of companies Pvt Ltd." Noida. You want to set up a new branch office in Baruch. Write a letter inviting quotations for office furniture from "Woodwork Destination Pvt Ltd", Mumbai. Write the letter in modified block form. (05)

- b. Write short notes on: (05)
- Grapevine and its effects on organizational communication.
 - Choose a useful computer program and write five instructions on how to use it.

Q.5. a. You are going to make a project presentation for your department. What aspects of non-verbal communication will you take care of, to make an impactful presentation? (03)

b. Construct precise definitions for the following: (03)

- i. Telescope ii. Power bank iii. Hard disk

c. Write short notes on: (04)

- Language as a tool of communication.
- The importance of "Clarity, Conciseness, Correctness and Courtesy" in business correspondence.

Q.6.a. Read the following passage and answer the questions given below: (06)

When I go into a stranger's library I wander round the bookshelves to learn what sort of person the stranger is, and when he comes in I feel that I know the key to his mind and the range of his interests. A house without books is a characterless house, no matter how rich the Persian rugs. These only tell you whether he has a lot of money, but the books tell you whether he has got a mind as well. It is not a question of money but we do not buy books. I repeat that the books are the cheapest as well as the best part of the equipment of a few dollars. Nearly all the best literature in the world is at your command at two dollars a volume. For 100 dollars you can get a library of fifty books. Even if you do not read them yourself, they are priceless investment for your children. What delight is there like the revelation of books-the sudden impact of a master-spirit, the sense of a window flung wide open to the universe? It is the adventures of the mind, the joy of which does not pass away, that give the adventure of life itself beauty and fragrance.

Questions

- Why does the adventure of mind not pass away?
- Why does the writer wander round the bookshelves when he goes to a stranger's house?
- What delight does a good book provide?

4. What can books tell you about a stranger?
 - a. That he is a rich man
 - b. That he believes in priceless investment
 - c. That he has good mental faculties
5. When one reads a good book, one is delighted because
 - a. One finds the windows of the library opened
 - b. One feels the influence of a great writer
 - c. One knows much about the universe
6. The word 'master-spirit' in the passage mean
 - a. a prominent writer
 - b. the spiritual effect of a master
 - c. one who has a control over the spirit of man

- Q6. b. i. Compare the salient features of oral and written communication. (02)
- ii. Differentiate between caution, warning, note and instructions, with a suitable example for each of them. (02)
