

Duration – 3 Hours

Total Marks : 80

(1) N.B.:- Question no 1 is compulsory.

(2) Attempt any THREE questions out of remaining FIVE questions.

1)a) Evaluate  $\int_0^{\infty} \frac{dx}{(a^2 + x^2)^5}$  (4)

b) Find the particular integral of  $(D + 2)y = x^2$  (3)

c) Solve  $(\sin x \cos y + e^{2x})dx + (\cos x \sin y + \tan y)dy = 0$  (3)

Express the following integral in polar co-ordinates: (4)

d)  $I = \int_0^4 \int_y^{4+\sqrt{16-y^2}} f(x, y) dx dy$

e) Prove that  $E = 1 + \Delta$  (3)

f) Evaluate  $I = \int_0^{\pi/2} \int_0^{3(1-\cos t)} x^2 \sin t dx dt$  (3)

2 a) Solve  $\frac{dy}{dx} - xy = y^2 e^{-\left(\frac{x^2}{2}\right)} \log x$ . (6)

b) Change the order of integration and evaluate  $I = \int_0^1 \int_1^{\sqrt{2-y^2}} \frac{y dy dx}{\sqrt{(2-x^2)(1-x^2y^2)}}$  (6)

c) Evaluate  $\int_0^{\pi} \frac{dx}{a + b \cos x}$   $a > 0, |b| < a$ . Hence show that (8)

$\int_0^{\pi} \frac{dx}{(5 + 4 \cos x)^2} = \frac{-4\pi}{27}$

3 a) Evaluate  $I = \int_0^{\log 2} \int_0^x \int_0^{x+\log y} e^{x+y+z} dx dy dz$  (6)

b) Find the area between the circles  $x^2 + y^2 - 4ax = 0$  and (6)

$x^2 + y^2 - 2ax = 0$

c) Solve  $x^2 \frac{d^2 y}{dx^2} - 3x \frac{dy}{dx} + 5y = \sin \log x$  (8)

4 a) Find the total length of the curve  $x = a e^{\theta} \sin \theta$  ,  $y = a e^{\theta} \cos \theta$  from (6)

$$\theta = 0 \text{ to } \theta = \frac{\pi}{2}$$

b) Solve  $(D^2 - 3D + 2)y = \frac{1}{e^{(e-x)}} + \cos \left( \frac{1}{e^x} \right)$  (6)

c) Use Runge-Kutta method of fourth order , compute  $y(0.2)$  given (8)  
 $y' + y + xy^2 = 0, y(0) = 1$  by taking  $h = 0.1$  correct to 4 decimal point.

5 a) State duplication formula and prove that  $\int_0^{\frac{\pi}{4}} \frac{1}{4} \left( \frac{3}{4} \right) = \sqrt{2} \pi$  (6)

b) Using Taylor's series method, obtain the solution of the differential equation  $y' = y - xy$  ,  $y(0) = 1$  (6)

c) Find the volume bounded by the paraboloid  $z = 4 - x^2 - \frac{y^2}{2}$  and the plane  $z = 0$ . (8)

6 a) A chain coiled up near the edge of a smooth table starts to fall over the edge. The velocity  $v$  when a length  $x$  has fallen is given by  $x v \frac{dv}{dx} + v^2 = gx$ . Show that  $v = 8\sqrt{x/3}$  (6)

b) Find the mass of a plate I the form of a cardioid  $r = a(1 - \cos \theta)$  if the density at any point of the plate varies as its distance from the pole. (6)

c) Evaluate  $\int_{-3}^3 x^4 dx$  , using (i) Trapezoidal Rule (ii) Simpson's (1/3)rd rule. Compare it with exact solution. (8)

Time: 2 Hours

Marks: 60

- N.B.** 1) Question no 1 is compulsory.  
 2) Attempt any three questions from the remaining questions.  
 3) Assume suitable data and symbols if required.  
 4) Figures on the right indicate full marks.

**Q.1) Attempt any five**

- a) Why are Newton's rings circular & why is the centre of interference pattern dark? (3)
- b) If the number of lines on the grating surface is increased, what will happen to its resolving power? Explain with necessary formula. (3)
- c) Compare stimulated emission with spontaneous emission. (3)
- d) Proton is 1836 times heavier than that of electron. If the kinetic energy of the proton is  $8.19 \times 10^{-14}$  J find the de-Broglie wavelength associated with that of proton. (3)
- e) The critical field of niobium is  $10^5$  A/m at 8 K and  $2 \times 10^5$  A/m at 0K. Calculate critical temperature of the element. (3)
- f) How is an electron microscope different from optical microscope. (3)
- g) How will you measure of frequency of AC signal using cathode ray oscilloscope? (3)

**Q.2) a) What is antireflection coating? Derive amplitude and phase condition for it.**

The diameter of a bright ring in Newton's rings experiment was observed to decrease from 2.3 cm to 2.0 cm when air was replaced by liquid in the gap between curved surface of plano convex lens and glass plate. Determine the RI of the liquid. (8)

- b) What is index profile in optical fibre? How will you classify optical fibres based on it? The numerical aperture of an optical fibre is 0.2 when surrounded by air. Determine the RI of its core given the RI of cladding as 1.59. Also find the acceptance angle when it is in a medium of RI 1.33. (7)

**Q.3) a) Draw energy level diagram of Nd-YAG laser. Explain the working of it by**

mentioning the active centres, metastable states, type of pumping, the wavelengths emitted out in this laser. Why is the diameter of a tube made elliptical? (8)

b) Show that in wedge shape film the fringe width  $\beta = \lambda/2\mu\theta$  where  $\theta$  is the angle of wedge.

White light falls normally on a soap film of thickness  $4 \times 10^{-5}$  cm and of refractive index 1.33.

Which wavelength in the visible region will be reflected most strongly? (7)

**Q.4** a) Calculate the angular separation between the first order minima on either side of central maxima when slit is  $6 \times 10^{-4}$  cm wide and  $\lambda = 6000 \text{ \AA}$ . (5)

b) Explain single slit electron diffraction experiment to verify uncertainty principle. (5)

c) Explain the terms critical temperature, critical magnetic field and critical current in superconductivity. (5)

**Q.5** a) A diffraction grating which has 4000 lines per cm is used at normal incidence. Calculate the dispersive power of the grating in the third order spectrum in the wavelength region 5000 A.U. (5)

b) What do you mean by a particle in a box? What are its boundary conditions? Show that the energy of an electron in the box varies as the square of natural number. (5)

c) With Schematic diagram of Scanning Electron Microscope, explain its principle and working. (5)

**Q.6** a) The position and momentum of 0.5 KeV electron are simultaneously determined. If its position is located within 0.2nm, what is the percentage uncertainty in its momentum? (5)

b) Explain the working of CRO with block diagram. (5)

c) What are the nanomaterials? Explain any two methods of preparation of nanomaterials. (5)

Time : 3 Hrs

Marks: 80

Please check whether you have got the right question paper.

N.B:

1. Question No.1 is compulsory
2. Answer any three out of remaining five questions

- Q. 1 a. What is an algorithm? Explain properties of an algorithm. 04
- b. What are different data types in C? 04
- c. Compare break and continue. 04
- d. Explain any two functions from math.h 04
- e. Define pointers in C? Explain the terms: address operator and pointer variables. 04
- Q. 2 a. Write a program to find largest and smallest element in an array. 10
- b. What is Recursion? Write a program to display n terms in Fibonacci series using recursion. 10
- Q. 3 a. Write user defined function to reverse a given string. 05
- b. Write a program to print following pattern. 05
- ```

1
1 2
1 2 3
1 2 3 4
    
```
- c. Explain the concept of call by value and call by reference with example. 10
- Q. 4 a. What is use of storage classes? Explain different storage classes in C. 10
- b. Write a program to calculate sum of n terms in following series. 10
- $$1 + x/3! - x^2/5! + x^3/7! - x^4/9! + \dots$$
- Q. 5 a. Write a program to take nxn matrix as input and display addition of column elements of matrix. 10
- b. Write the output of following program segment 06
- |                                                                                         |                                                                                          |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <p>A. main()</p> <pre> { int i; int z=8; i=!z&gt;10; printf("i=%d",i); }         </pre> | <p>B. main()</p> <pre> { int x=9,y=2; float c; c=x/y; printf("\n%f",c); }         </pre> |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
- c. Explain the ternary operator in C. 04

- Q. 6 a. Compare structure and union. Write a program to create structure for storing 10 students details such as name, roll number and marks. Display the student details in ascending order of marks. 10
- b. Explain file handling in C with respect to the various modes for opening files, read and write operation. 10

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[Time: 2 Hours]

[ Marks:40]

Please check whether you have got the right question paper.

- N.B:
1. Question No. 1 is compulsory.
  2. Attempt any 3 from the remaining questions.
  3. Figures to the right indicate full marks.

- Q.1 a) "Communication is a key to success." Explain the process of communication with a labeled diagram 2
- b) Identify the sender, message, receiver, medium /channel in the following situation: 2  
A traffic police stops a biker and fines him Rs.100 for not wearing a helmet
- c) Explain: 'hearing is natural, listening requires efforts'. 2
- d) Give a diagrammatic representation of a letter in complete-block format. 2
- e) Differentiate between :warning and caution 2
- Q.2 a) Explain advantages and disadvantages of nonverbal communication. 2
- b) Explain any two means of overcoming psychological barriers in an organization. 2
- c) Your shop, Graphic Displays has received an enquiry letter from a college regarding display boards, racks, white boards and black boards. Draft the quotation letter to be sent to the Principal of the college. (Use Modified Block Format) 6
- Q.3 a) Name and explain vertical communication 3
- b) What do the following non-verbal cues communicate: 1  
i) Closed eyes ii) Pointing finger
- c) A majority of the computers and peripherals that you had ordered for your new office have been received in a damaged condition. Draft a suitable complaint cum claim letter asking for appropriate compensation from the supplier 6
- Q.4 a) Identify the barrier: 2
- i) Villagers are not able to follow the politician's speech because it is in English.
- ii) A boss commenting that all calculations are wrong because it has been done by a lady.
- b) What is Body Language? How it can be interpreted? 4
- c) Describe the process of titration. 4
- Q.5 a) Write short notes on i) Grapevine ii) You attitude 3
- b) Differentiate between skimming and scanning. 2

c) Match the following:

|    |                 |       |                  |
|----|-----------------|-------|------------------|
| a) | Full block form | (i)   | Logo/Emblem      |
| b) | FB/104/07       | (ii)  | Principle        |
| c) | Letter head     | (iii) | No indents.      |
| d) | Enclosure       | (iv)  | Dear Sir         |
| e) | Salutation      | (v)   | Reference number |
| f) | Consideration   | (vi)  | Attachment       |

d) Make sentence with the following pair of words so as to differentiate between their meanings: i)

i) except-accept

ii) cereal-serial

Q.6 a) A Read the following passage carefully and answer the questions given:

Education has always had two objects: on the one hand, to give skill; and on the other, to impart a vaguer thing which we may call wisdom. The role of skill has become very much larger than the role of wisdom. At the same time it must be admitted that wisdom in our world is useless except for those who realize the great part played by skills, for it is increase of skill that is the distinctive feature of our world.

Although scientific skill is necessary, it is by no means sufficient. A dictatorship of man of science would very soon become horrible. Skill without wisdom may prove to be surely destructive. For this reason, if for no other, it is of great importance than those who receive a scientific education should not be merely scientific, but should have some understanding of that kind of wisdom which, if it can be imparted at all, can be imparted by the cultural side of education. Science enables us to know the means to any chosen end, but it does not help us to decide upon what ends should be pursued. If you wish to exterminate the human race, it will show you how to do it. If you wish to make the human race so numerous that all are on the verge of starvation, it will show you how to do that. If you wish to secure adequate prosperity for the whole human race, science will tell you what you must do. But it will not tell you whether one of these ends is more desirable than other. Nor will it give you that instinctive understanding of human beings that is necessary if your measures are not to arouse fierce opposition which only ferocious tyranny can quell. It can't teach you patience, it can't teach you sympathy, it can't teach you a sense of human dignity. These things, insofar as they can be taught in formal education, are most likely to emerge from the learning of history and great literature.

- 1) What should, according to the writer, be the aim of education?
- 2) Why is increase of skill a distinctive feature of our world?
- 3) What danger does the writer see in the present emphasis on imparting skills?
- 4) What knowledge does science impart to us?
- 5) Why should we study history and great literature?



- b) Describe any ONE of the following objects giving definition, diagram, components & working of calculator , mobile phone 3
- c) Use one word for the following statements. 2
  - i) Words which have the same meaning
  - ii) A person with a positive approach

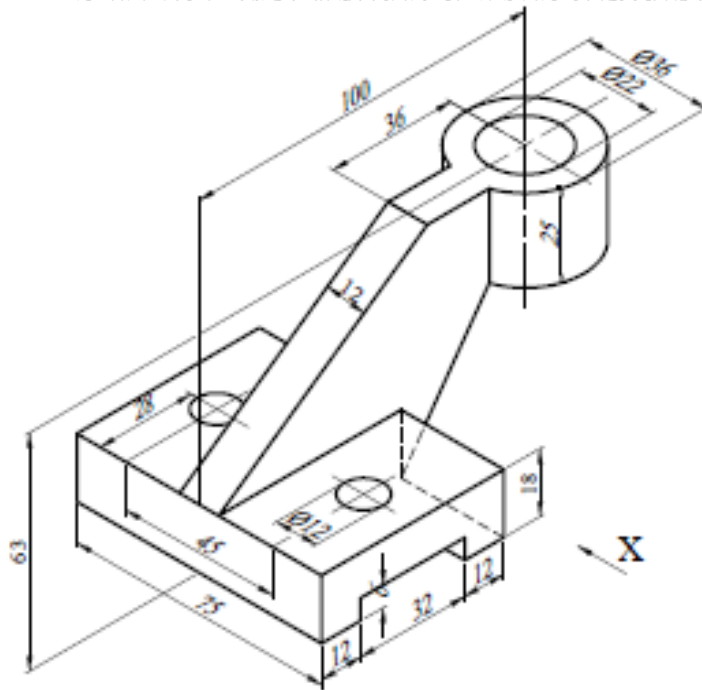
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(3 hours)

[Total Marks: 60]

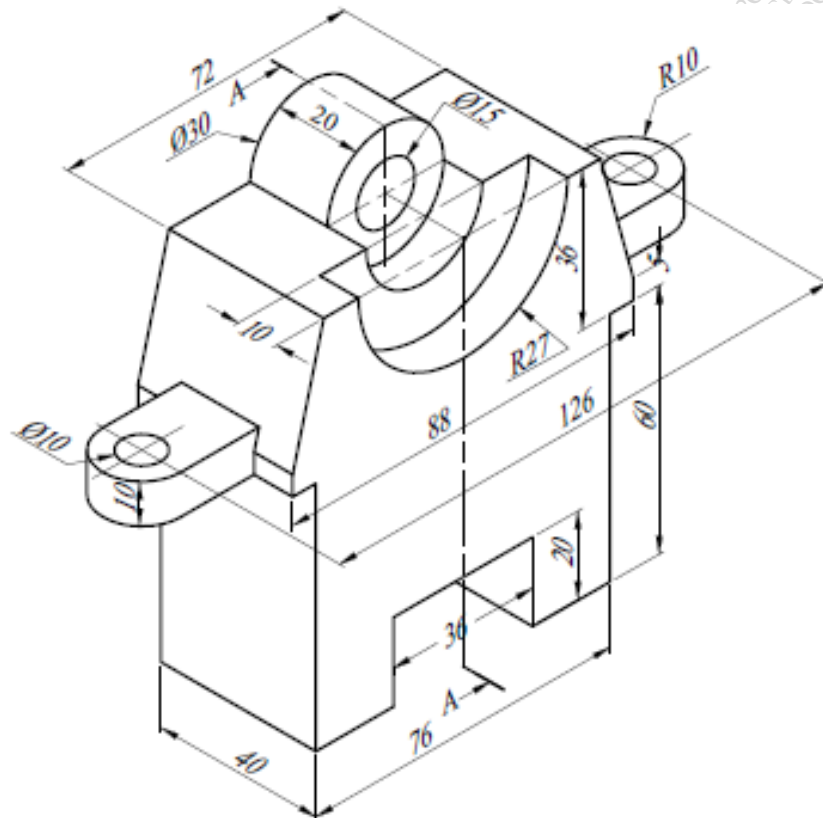
- N.B (1) Question No. 1 is compulsory. Solve any Three out of remaining five questions.  
 (2) Use your Judgment for any unspecified dimension.  
 (3) Use First Angle Method of projection only.  
 (4) Retain all construction lines.  
 (5) Figures to the right indicate full marks.

1. (a) A wheel of 50 mm diameter rolls on a straight horizontal line. Draw the locus of a point 'P' on the periphery of the wheel for one revolution of the wheel. Initial position of point 'P' on the wheel is in contact with the straight line. 6
- (b) Figure below shows a pictorial view of an object. Using first angle method of projection draw the following orthographic views:  
 a) Front View (along direction X) 4  
 b) Left Hand Side View 4  
 Insert 6 dimensions 1

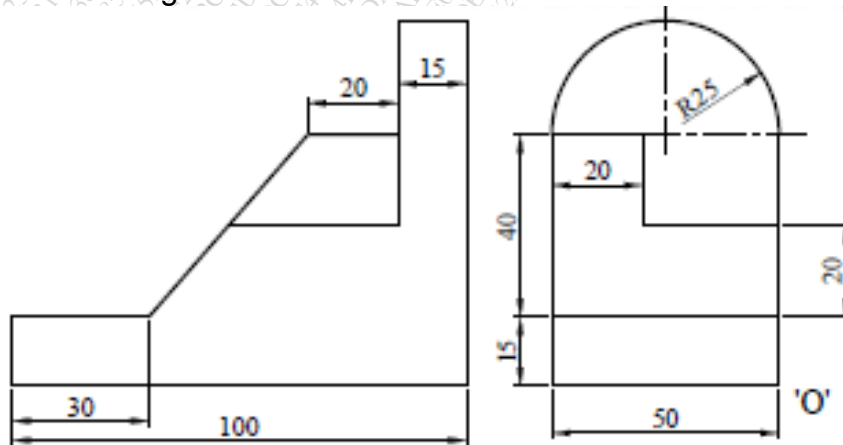


2. Figure below shows a pictorial view of an object. Using first angle method of projection draw the following orthographic views:  
 a) Elevation View 4  
 b) Sectional Side View (Along A-A) 4  
 c) Plan View 5  
 Show at least 10 major dimensions 2

TURN OVER



3. A pentagonal pyramid, side of the base 35 mm and axis 70 mm long, is lying on its base corner on H.P. One of its triangular surface is parallel to H.P. and perpendicular to V.P. The base edge containing that triangular surface is parallel to both H.P. and V.P. Draw projections of the solid, when its apex is nearer to the observer. 15
  
4. (a) A cylinder of base diameter 50 mm and height 70 mm has its axis inclined at  $60^\circ$  to VP and parallel to HP. Draw its projections when one of the point of base circular rim rests on VP. 6
  
- (b) Figure shows two views of an object. Draw the Isometric View taking 'O' as the origin. 9



TURN OVER

5. A right circular cone with base diameter 50mm and axis 65mm long, rests on its base on HP. It is cut by an AIP inclined at  $45^\circ$  to HP and bisects the axis of cone. Draw the FV, Sec. TV and TSS. Also draw development of remaining portion of the cone. **15**
6. (a) A line AB 70 mm long has its end A on HP at 25 mm in front of VP. Its top view and front view measures 60 mm and 40 mm respectively. Draw the projections of the line, if the end point B lies in first quadrant. Also determine its inclinations with HP and VP. **9**
- (b) Figure shows two views of an object. Draw its Isometric View taking 'O' as the origin. **6**

