Time: 3 hours   Marks: 80

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 $\int_0^\infty \frac{e^{-x^3}}{\sqrt{x}}\, dx$.   3

b) Find the length of the curve $x = \frac{y^3}{3} + \frac{1}{4y}$ from $y = 1$ to $y = 2$.   3

c) Solve $(D^2 + D)y = e^{4x}$.   3

d) Evaluate $\int_0^1 \int_{x^2}^x xy(x + y)\,dy\,dx$.   3

e) *Solve*   4
$$(4x + 3y - 4)dx + (3x - 7y - 3)dy = 0.$$

f) Solve $\frac{dy}{dx} = 1 + xy$ with initial condition   4
$x_0 = 0, y_0 = 0.2$ by Taylors series method. Find the
approximate value of y for x=0.4 (step size 0.4).

Q.2 a) Solve $\frac{d^2y}{dx^2} - 16y = x^2 e^{3x} + e^{2x} - cos3x + 2^x$.   6

b) Show that $\int_0^\pi \frac{\log(1+a\cos x)}{\cos x}\,dx = \pi \sin^{-1}a \; 0 \le a \le 1$.   6

c) Change the order of integration and evaluate $\int_0^2 \int_{2-\sqrt{4-y^2}}^{2+\sqrt{4-y^2}} dx\,dy$.   8

Q.3 a) Evaluate $\iiint (x + y + z)\, dx\,dy\,dz$ over the tetrahedron bounded by   6
the planes $x = 0, y = 0, z = 0$ $and\; x + y + z = 1$.

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b) Find the mass of the lamina bounded by the curves $y = x^2 - 3x$ and $y = 2x$ if the density of the lamina at any point is given by $\frac{24}{25}xy$.

6

c) Solve $x^2 \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} + 3y = \frac{logx \cdot cos(logx)}{x}$.

8

Q.4 a) Find by double integration the area bounded by the parabola $y^2 = 4x$ and the line $y = 2x - 4$.

6

b) Solve $\frac{dy}{dx} + xsin2y = x^3cos^2y$.

6

c) Solve $\frac{dy}{dx} = x^3 + y$ with initial conditions $y(0) = 2$ at x=0.2 in steps of h=0.1 by Runge Kutta method of fourth order.

8

Q.5 a) Evaluate $\int_0^1 x^5 sin^{-1}x \, dx$ and find the value of $\beta\left(\frac{9}{2}, \frac{1}{2}\right)$.

6

b) In a circuit containing inductance L, resistance R, and voltage E, the current i is given by $L\frac{di}{dt} + Ri = E$. Find the current i at time t if at t=0,i=0 and L,R, E are constants.

6

c) Evaluate $\int_0^6 \frac{dx}{1+3x}$ by using i) Trapezoidal
ii) Simpsons (1/3)rd and iii) Simpsons (3/8)th rule.

8

Q.6 a) Find the volume bounded by the paraboloid $x^2 + y^2 = az$ and the cylinder $x^2 + y^2 = a^2$.

6

b) Change to polar coordinates and evaluate $\int_0^1 \int_0^x (x + y)dydx$.

6

c) Solve by method of variation of parameters $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{e^x}$.

8

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Time: 2 Hours　　　　　　　　　　　　　　Marks: 60

N.B.
1. Question **No.1** is Compulsory.
2. Attempt **any three** questions from the remaining questions Nos. 2 to 6
3. Assume suitable data wherever required.
4. Figures to the right indicate marks.

Q.1.　　Attempt **any Five**

a) Find the divergence of vector function $\vec{A}= x^2\hat{i} + x^2y^2\hat{j}+ 24x^2y^2z^3\hat{k}$　　03

b) What is antireflection coating? What should be the refractive index and minimum thickness of the coating?　　03

c) A glass material A with which an optical fibre is made has a refractive Index of 1.55.This material is clad with another material whose refractive index is 1.51. The light in the fibre is launched from air. Calculate the numerical aperture of the fibre.　　03

d) What is the difference between Bottom up approach and Top down approach with respect to nanotechnology?　　03

e) Write the difference between LED and Laser Diode.　　03

f) How is Lissajous figures used to measure unknown frequency?　　03

g) A parallel beam of light of wavelength 5890 Å is incident on a glass plate having refractive index μ =1.5 such that the angle of refraction in the plate is 60^0.Calculate the smallest thickness of the glass plate which will appear dark by reflected light.　　03

Q.2　a) With the help of a proper diagram and necessary expression, explain how Newton's ring experiment is useful to determine the radius of curvature of a plano convex lens. In a Newton ring's experiment the diameter of 5th dark ring is 0.336 cm and the diameter of 15th dark ring is 0.590cm.Find the radius of curvature of a plano convex lens, if the wavelength of light used is 5890Å .　　08

b) What is monomode and multimode fibre? Explain the term V-number. Calculate the number of modes a step index optical fibre of diameter 40μm will transmit as its core and cladding refractive indices are 1.5 and 1.46 respectively. Wavelength of light used is 1.5 μm.　　07

Q.3　a) With a neat energy level diagram describe the construction and working of He-Ne laser. What are its merits and demerits?　　08

b) What is diffraction grating and grating element? Explain the experimental method to determine the wavelength of the spectral line using diffraction grating?　　07

Q.4　a) With a neat diagram explain the construction and working of scanning electron microscope　　05

b) Derive the Bethe law for electron refraction.　　05

c) Derive the condition for absent spectra in grating.　　05

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Q.5 a) Draw the block diagram of an optical fibre communication system and explain the function of each block. 05

b) Derive Maxwell's third equation. 05

c) An electron enters a uniform magnetic field B=0.23 X 10^{-2} Wb/m^2 at 45^0 angle to B. Determine radius and the pitch of helical path. Assume electron speed to be 3 x 10^7m/s 05

Q.6 a) If $\vec{A} = x^2 z \hat{\imath} - 2y^2 z^2 \hat{\jmath} + xy^2 z \hat{k}$. Find $\nabla \cdot \vec{A}$ at point (1,-1,1). 05

b) A Newton's rings set up is used with a source emitting two wavelengths λ_1 = 6000Å and λ_2 = 4500Å. It is found that n^{th} dark ring due to 6000Å coincides with $(n+2)^{th}$ dark ring due to 4500Å. If the radius of curvature of the lens is 90 cm, find the diameter of nth dark ring for 6000Å 05

c) Differentiate between stimulated and spontaneous emission. 05

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(Time: 2 Hours) [Marks:60]

N.B. 1) Question **No1** is **compulsory**.

  2) Attempt **any three** questions from remaining **five** questions.

  3) **Figures** to the **right** indicate full **marks**.

  4) Atomic wt: Al=27,Ca=40,S=32,Cl=35.5,Fe=56,K=39,C=12,N=14,O=16,Na=23,Mg=24

Q1) Attempt **any five** of the following 15

  (a) Define Fuel.Why a good fuel must have low ash content?

  (b) Name the different methods of applications of metallic coatings. Explain metal cladding.

  (c) A sample of coal contains C=66%,O=28%,H=4%,S=1.5%,N=0.8% and
    ash=0.2%.Calculate the G.C.V and N.C.V of the coal.

  (d) Give the composition, properties and uses of Gun metal .

  (e) Explain ' Design for Energy Efficiency' principle of Green Chemistry.

  (f) Give the functions of matrix phase.

  (g) State the characteristics of a good paint.

Q2) (a) With a suitable diagram explain electrochemical mechanism of rusting of iron in neutral
    aqueous medium. 06

  (b) (i) 0.5gm of coal sample was burnt in Bomb Calorimeter experiment produced 03
      0.06gm of $BaSO_4$ .Calculate percentage of Sulphur.

  (ii) What are Green solvents? Give two industrial applications of Green solvents. 02

  (c) Write a short note on 'Sandwich Panel' .Mention their applications. 04

Q3) (a) What is Cracking. With the help of diagram explain Fixed Bed Catalytic cracking. 06

  (b) (i) Differentiate between Brass and Bronze. 03

    (ii) Define Stress corrosion with an example. 02

  (c) Calculate the % atom economy of the following reaction w.r.t the product Allyl 04
    Chloride.

$$CH_3- CH= CH_2 + Cl_2 \rightarrow Cl-CH_2- CH= CH_2 + HCl$$

Allyl Chloride

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Q4) (a) How do the following factors affect the rate of corrosion: 06

    (i) Passive character of metal

    (ii) pH of medium

    (iii) Purity of metal

  (b) (i) What is Green Chemistry .Give its significance. 03

    (ii) Define the following: a) Matrix Phase b) Dispersed Phase 02

  (c) Write a short note on Shape memory alloy. 04

Q5) (a) Calculate weight and volume of air required for complete combustion of $1m^3$ of gaseous fuel which possess by volume ; CH_4= 35%,C_2H_4= 5% , CO=15%, H_2= 40%,N_2=1%, 06 watervapour = 4%. (Molecular weight of air = 28.949)

  (b) (i) Explain Galvanic corrosion with a neat labeled diagram. 03

    (ii) What is meant by cracking of petroleum. 02

  (c) Explain conventional and Green route of manufacturing of Carbaryl. By this reaction which principle of Green Chemistry is shown. 04

Q6)   (a) What is Powder metallurgy? Explain Injection moulding method of compaction 06

  (b) (i) Explain characteristics of composite materials. 03

    (ii) Define Paint? Give any 2 functions of Thinners. 02

  (c) Explain the determination percentage of Moisture content in the coal sample. Give its significance. 04

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(3 Hours) [Total Marks : 80]

N.B. (1) Question No.1 is **compulsory**.
(2) Attempt any **three** questions from remaining.
(3) Figures to **right** indicate **full marks**.
(4) Assume suitable **data** wherever **necessary**.

1. (a) What is recursion? Write a program to find x^y using recursion 4
   (b) State any two library functions string.h along with its syntax, use an example 4
   (c) What is a pointer? Explain how the pointer variable declared and initialized. 4
   (d) Write the output for following code 4

```
#include<stdio.h>
int main()
{
        int val=1;

        do{
                val++;
                ++val;
        }while(val++>25);

        printf("%d\n",val);

        return 0;
}
```

   (e) Write a program to validate whether accepted string is palindrome or not. . 4
2. (a) Write a program to multiply two matrices after checking compatibility. 10
   (b) What is file? What are the different functions available to read data from file? Specify the different modes in which files can be opened along with syntax. 10
3. (a) Write a program to find transpose of matrix without making use of another matrix. 10
   (b) Define a structure consisting of following elements 10
       1. student roll_no
       2. student name
       3. student percentage
   Write a program to read records of 5 students and display same.
4. (a) Write a program to calculate summation of series. 10

$$\frac{1}{1!}+\frac{2}{2!}+\frac{3}{3!}+...+\frac{n}{n!}$$

   (b) Draw the flowchart for finding the roots of quadratic equation. Write the program for same. 10
5. (a) Write a program to implement calculator with following operations using switch case 10
       1. add two numbers
       2. Subtract two numbers

      3. Multiply two numbers
      4. Divide two numbers

(b) What do you mean by FILE? What are the different functions available to read data   10
       from file? Specify the different modes in which file can be opened along with syntax.

6. (a) Write a program to generate following patterns.   10

      1. 1
           1 2
           1 2 3
           1 2 3 4
           1 2 3 4 5

      2. 1
           2 3
           3 4 5
           6 7 8 9

(b) Explain call by value and call by reference with example.   10

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[Time: 2 Hours]   **[Marks:40]**

Please check whether you have got the right question paper.

N.B:
   i)   Question No.1 is compulsory
   ii)   Attempt any four from the remaining five questions.
   iii)   Figures to the right indicate marks.
   iv)   Answers to all sub questions should be attempted and grouped together.

Q.1 A) Define communication. Illustrate it with examples from one existing communication patterns   **3**
in your college/institute.

B) Identify the barriers in the following communication situations: **2**
   i)   The presenter uses only technical terms in a seminar and could not impress the audience.
   ii)   The DJ music was so loud that the students could hardly study.
   iii)   Inability of the rural audience to understand the speech of the President of America on TV
   iv)   A soft drink company launched its new range of soft drinks in the month of December and
       got very poor sales.

C) Any three differences between General and Technical communication.   **3**

D) Match the following: **2**

A		B	
i)	Avoid an injury	a.	Reference No
ii)	Marketing goods	b.	Warning
iii)	ACD/38/2771/98	c.	Complete block
iv)	Left aligned	d.	Sales letter

Q.2 A) Write two lines on any two objectives of communication.   **2**

B) Any two non-verbal methods of communication during a presentation.   **3**

C) As the Purchase Manager of your company you had ordered two dozen personal computers.   **5**
When the consignment arrived, you found some pieces in damaged condition. Write a
complaint letter to the Sales Manager of the company asking for replacement or
compensation. (Complete block)

Q.3 A) Write short notes on any four: **8**
   i)   Signature Block in official letters
   ii)   Clarity and Correctness
   iii)   Vertical communication
   iv)   Advantages of written communication
   v)   Feedback

B) Choose the correct option: **2**
Lower in value: _____ (Deprecate/Depreciate)
Feeling regret: _____ (Regrettable/Regretful)
Head of an Institute: _____ (Principle/Principal)
Tranquility: _____ (Piece/Peace)

Q.4 A) Define the process of communication with the help of diagram and an example. **3**

B) Write the disadvantages of oral communication. **3**

C) Define the following: **4**

i) Lap top ii) Transformer iii) Electric Bulb iv) Mobile phone

Q.5 A) Explain 7Cs of communication. **6**

B) i) State the difference between warning and danger. **1**

ii) What is the difference between a tool and an instrument? **1**

iii) What is the difference between description and instruction? **2**

Q.6 A) Identify the sender, message, medium, channel, receiver and feedback. **3**

i) The Manager gives instructions to the computer operator over telephone about launching their product and how to market it through advertisement.

B) Read the following passage and answer the questions below:

It is time we looked at the latent causes. Where does the strength of India lie? Not in numbers, not necessarily in our moral stands on international issues. In modern times, the strength of a nation lies in its achievement in science and technology. This is not to say that the other fields do not count.

In the 5 decades after independence, we have yet to demonstrate our originality in applied science and technology. Though Japan also started like us, by cultivating the technology of the west, the Japanese adapted, improved and displayed originality in, several areas of science and technology. The generation which was at the helm of affairs in science and technology in our country after independence mostly consisted of self- seekers. By and large the science and technology managers in India concentrated on gaining power and influence. They loved publicity. Most of them stopped doing science while they managed science. Things would have been better, had they been humble enough to acknowledge the difference between doing and managing science. Instead, they claimed that they were the foremost in science and technology, simply because they were at the helm of affairs. As a result they ceased to inspire the younger lot. India continues to be the borrower of science and technology, even though its potential for originality is substantial.

Our achievement in nuclear science and technology may be dazzling to our people. But, in worth and originality they are ordinary and routine. While our own people remain ignorant, the people of other countries know all about the pretensions to knowledge of our nuclear science and technology managers. The veil of secrecy over nuclear deals does not allow any investigations into misdeeds of the people who sabotage good and sincere efforts. The ones at the helm of affairs do make every endeavor to sabotage any genuine efforts, lest they might not get the continued funding if the actual objective is accomplished. International bodies came in as handy tools in this subtle process. The talk of national security comes as an easy weapon to prevent any probe into mismanagement. On nuclear matters the media in our country, by and large, avoid the investigative approach. As a result, the mismatch between promise and performance in the nuclear field does not get exposed as much as that in other fields.\

1.   What, according to the passage, is the criterion to decide the strength of the country? **1**

2.   What is common between the scientists of Japan and India?   **1**

3.   What does the author mean by doing science?   **1**

4.   Pick out the words that is nearest in meaning as the words underlined in the passage.   **2**
     a) Pretensions
     i) shortcomings ii) claims iii) apathy iv) access v) permissiveness
     b) Managed
     i) conducted ii) organized iii) trained iv) performed v) maneuvered

5.   Pick out the word which is furthest in meaning to the words underlined: **2**
     a) Dazzling
     i) lustrous ii) glaring iii) unnoticeable iv) unexposable v) unscrupulous
     b) Substantial
   i) insignificance ii) extensive iii) independent iv) noteworthy y) uncompromising.

_____

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(3 Hours) [Total Marks: 60]

N. B. – 1. **Attempt any four questions.**

    2. Use first angle method of projection, unless mentioned otherwise.

    3. Write all answers on drawing sheets only & use both sides of the sheets.

    4. Use your own judgment for any unspecified dimension.

    5. Retain construction lines.

    6. All dimensions are in mm.

Q.1 (a) A stick is 130 mm long is initially tangent to semicircle of 80 mm *(06)* diameter at its left side corner. This stick now rolls over the circumference of semi circle without slipping. Draw the locus of the end point of the stick, which is away from the semicircle and name the curve.

(b) For the object shown in figure draw the following views -
    (i) Front view in the direction of arrow. *(05)*
   (ii) Top view. *(04)*

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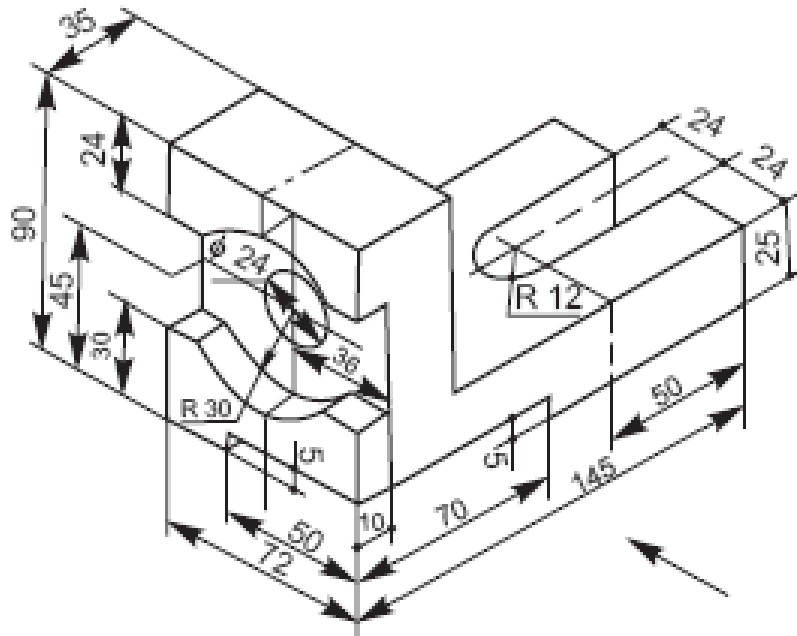
Q. 2   For the object shown in figure draw the following views –
- i. Sectional front view from X direction section along A-A.   *(04)*
- ii. Side view from Right   *(04)*
- iii. Top view   *(05)*
- iv. Insert the major dimensions   *(02)*
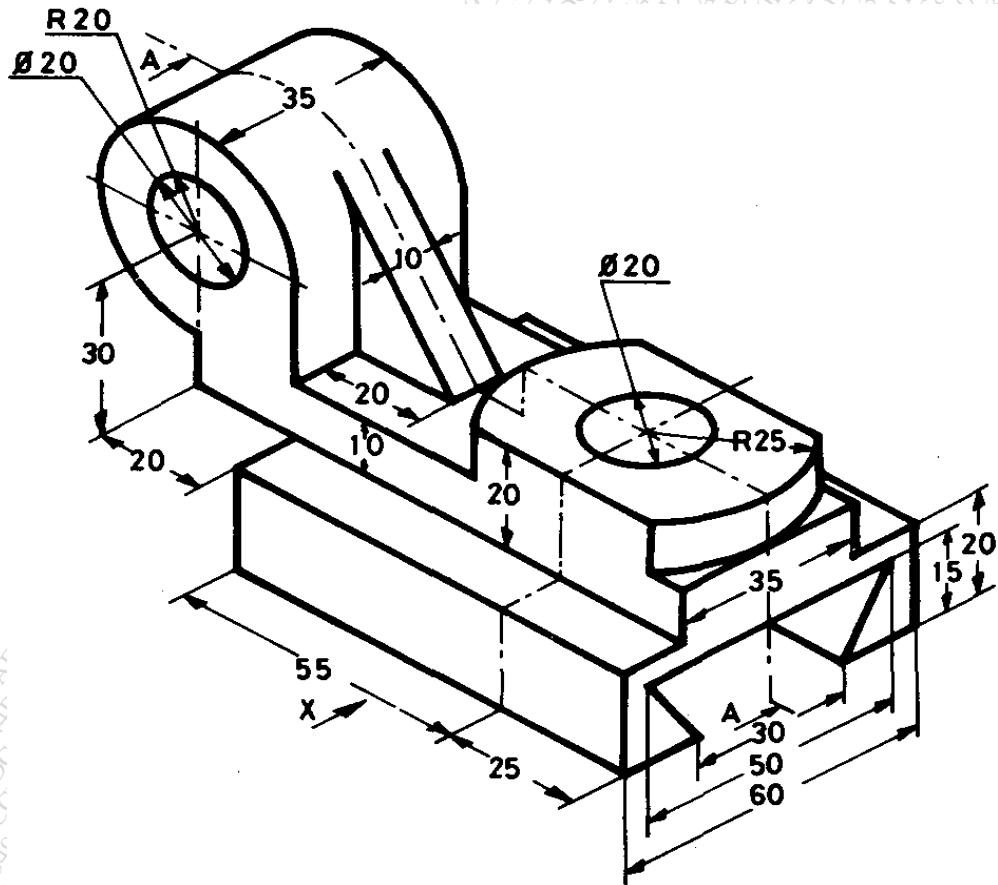
Q. 3   A pentagonal pyramid, side of base 35 mm and axis 70 mm long, is *(15)* lying on one of its corner on the HP such that the triangular surface opposite to the corner is parallel to HP and perpendicular to VP, and base edge containing that triangular surface is parallel to both the HP and VP. Draw the projections of the solid when the apex of the pyramid is nearer to the observer.

Q. 4 (a) A cylinder of 50 mm diameter of base and 70 mm length of an axis has **(06)** resting on one point of the circumference in VP. Draw its projections if one of the generators is inclined at 30⁰ to VP and parallel to HP.

Q. 4 (b) Figure shows three views of an object. Draw its isometric view with 'O' **(09)** as origin.

F.V.

T.V.
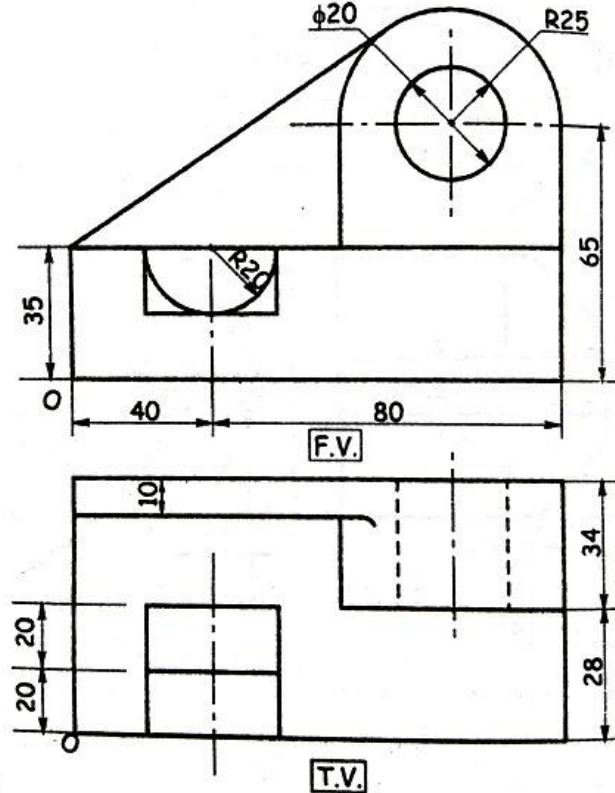
Q. 5 A pentagonal pyramid side of base 40 mm and height 80 mm is resting **(15)** on HP on its base with one of the edge of base parallel to VP and away from VP. It is cut by an AIP bisecting the axis, the distance of the section plane from the apex being 13 mm, if the apex portion is removes, draw the elevation and sectional plan of the pyramid and show the true shape of the section. Also draw the development of the lateral surface of the remaining part of the pyramid

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Q. 6 (a) The F.V. of 85 mm long straight line AB measures 60 mm while its T.V. **(09)** measures 70 mm. Draw the projection of AB if its end A is 10 mm above HP and 20 mm behind VP. while its end B is in first quadrant. Draw the projections of line and determine the inclination of line AB with the reference planes.

(b) Figure shows two views of an object. Draw its isometric view with 'O' **(06)** as origin.

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