

# ENGINEERING GRAPHICS

*Time allowed : 3 hours*

*Maximum Marks : 70*

**Note :**

- (i) Attempt **all** the questions.
- (ii) Use both sides of the drawing sheet, if necessary.
- (iii) All dimensions are in millimetres.
- (iv) Missing and mismatching dimensions, if any, may be suitably assumed.
- (v) Follow the SP : 46-1988 codes  
(with First Angle method of projection).
- (vi) In no view of Question 1 and in no sectioned view of question 3, are hidden edges / lines required.

## QUESTION PAPER CODE 68/1

1. (a) Construct an isometric scale, 110 mm long. 4
- (b) Construct the isometric projection, to isometric scale, of a hemisphere (diameter = 70 mm), resting on H.P. with its circular face on it. The axis is parallel to V.P.  
  
Draw the axis, marking the centre of its circular base on H.P. Give dimensions. 7
- (c) A pentagonal pyramid (base edge 30 mm and height 70 mm) is placed, centrally, on the top triangular face of a triangular prism (base side 90 mm and height 30 mm), with its pentagonal base on the prism. One base side of the pyramid, is parallel to V.P. and away from it. One side of the base of the prism, is parallel to V.P. and closer to the observer.  
  
Draw the isometric projection of the solids, placed together, to isometric scale. Draw their common vertical axis and indicate the direction of viewing. Give all dimensions. 14

2. (a) Draw to scale 1 : 1, the front view and top view of a Square Nut, for a nominal diameter  $d = 30$  mm, keeping its axis perpendicular to H.P. and two sides of the square, parallel to V.P. Give all standard dimensions. 9

**OR**

Draw to scale 1 : 1, the front view and top view of a Hook Bolt, taking nominal diameter = 26 mm and keeping its axis perpendicular to H.P. Give standard dimensions.

- (b) Sketch freehand the front view and the top view of a Stud with Collar, keeping the axis perpendicular to H.P. Take nominal diameter = 25 mm. Give standard dimensions. 6

**OR**

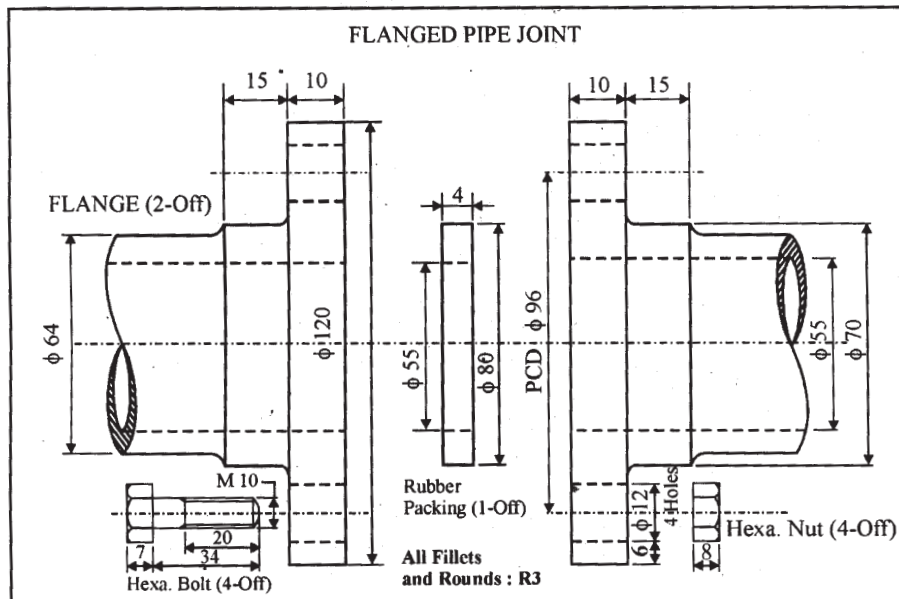
Sketch freehand the front view and the top view of a Pan Head Rivet (without tapered neck), keeping the axis vertical. Take diameter of the rivet as 25 mm. Give standard dimensions.

3. Figure 1 shows the details of the parts of a Flanged Pipe Joint. Assemble these parts, correctly, and draw, to scale 1 : 1, the following views:

- (a) Front view, lower-half in section. 15

- (b) Side view, as seen from the right. 9

Print, title and scale used. Draw the projection symbol. Give 6 important dimensions. 6



**Fig. 1**

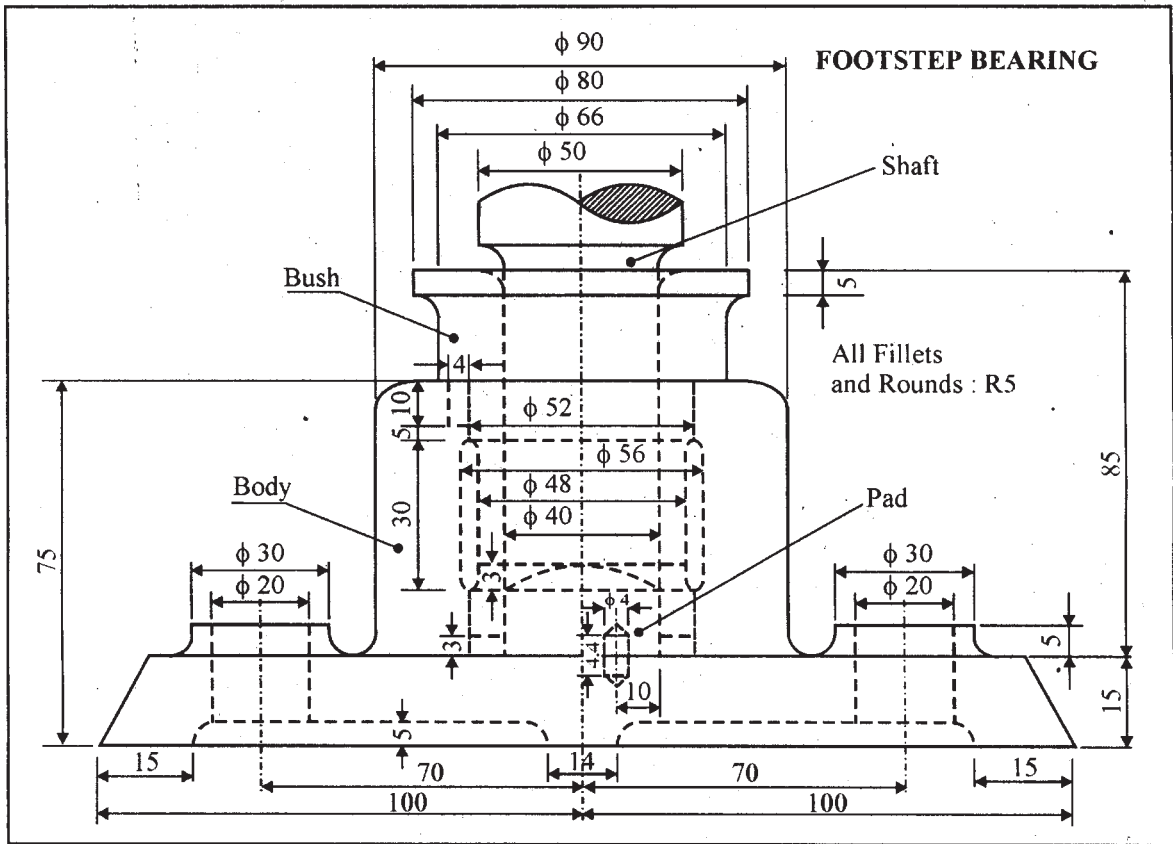
**OR**

Figure 2 shows the front view of a Footstep Bearing assembly. Dismantle the parts and draw the following views, to scale 1 : 1. Keep the same position of the parts with respect to H.P. and V.P. :

- (a) Front view of the Bush, showing the left half in section. 17
- (b) Front view of the Pad, showing right half in section. 7

Print titles of both and scale used. Draw the projection symbol. Give 6 important dimensions.

6



**Fig. 2**

**QUESTION PAPER CODE 68**

1. (a) Construct an isometric scale, 100 mm long. 4
- (b) Construct the isometric projection, to isometric scale, of a hemisphere (diameter = 80 mm), resting on H.P. with its curved surface on it and top circular face, parallel to H.P. The axis is perpendicular to H.P. Draw the axis, marking the center of its circular face and its height from H.P. Give dimensions. 7
- (c) A square prism (base edge 80 mm and height 30 mm) is resting on H.P., with its square base on it. One of the base edges of the prism, is parallel to V.P.
- A hexagonal pyramid (base edge = 30 mm and height = 70 mm) is placed, centrally, on its top square face, with its hexagonal base on it.
- One of the base edges of the pyramid, is parallel to V.P.
- Draw the isometric projection of the solids, placed together, to isometric scale. Draw the common axis and show the direction of viewing. Give all dimensions. 14
2. (a) Draw to scale 1 : 1, the full sectional front view of a single riveted lap joint. Take thickness of the plates as 16 mm. Give standard dimensions. 9

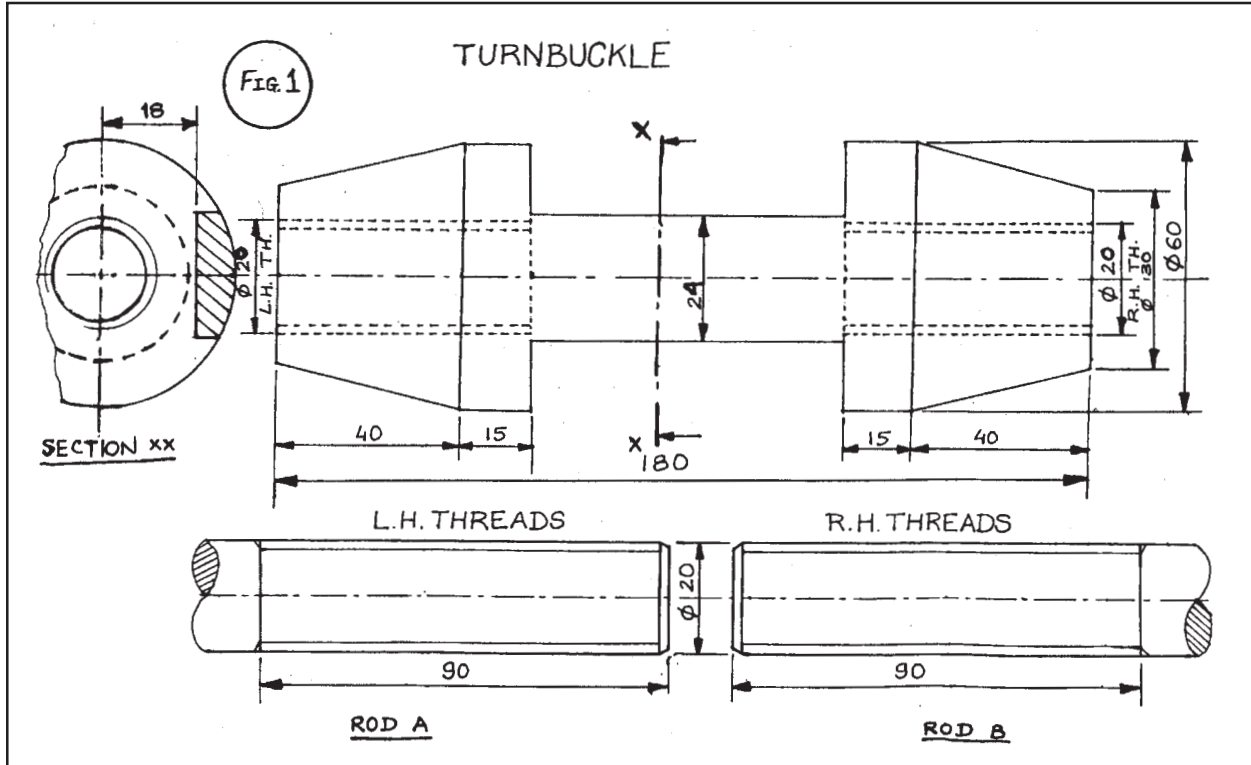
**OR**

- Draw to scale 1 : 1, the front view of a hexagonal headed bolt of size, M26 x 4 x 120 mm long, fitted with a washer of 55 mm diameter and thickness 4 mm and a square nut. Keep the common axis parallel to H.P. and V.P. Give standard dimensions;
- (b) Sketch free-hand the front view and top view of a 90° flat countersunk-head screw of size, M20. Keep the axis vertical. Give standard dimensions. 6

**OR**

- Keeping its axis vertical, sketch free-hand the front view and the top view of a flat head rivet of diameter 25 mm. Give standard dimensions.
3. Figure 1 shows the details of the parts of a Turnbuckle. Inserting 50 mm length of each one of the threaded ends of the rods A and B, assemble these parts, correctly, and draw the following views, to a scale full size :

- (a) Sectional front view, bottom half in section. 15
- (b) Side view, as viewed from the right. 9
- Print titles and scale used. Draw the projection symbol. Give 6 important dimensions. 6



OR

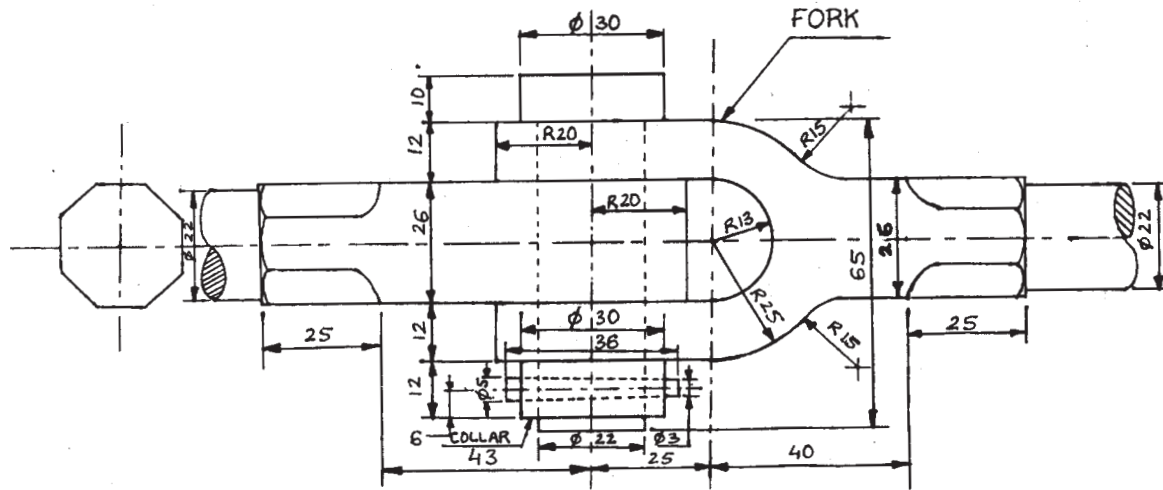
Figure 2 shows the front view of the assembly of the Knuckle Joint. Disassemble the parts and draw the following views to scale 1 : 1. Keep the same position of the parts with respect to H.P. and V.P. :

- (a) Front view of the Fork, full in section. 16
- (b) Front view of the Collar, full in section. 8

Print titles of both and scale used. Draw the projection symbol. Give 6 important dimensions. 6

Fig. 2

KNUCKLE JOINT



## Marking Scheme ó Engineering Graphics

**All Questions are to be answered correctly and accurately.**

**Notes:**

- (i) Marks are to be awarded in proportion to the work done.
- (ii) Mistakes in dimensioning up to  $\pm 1.0$  mm may be ignored.
- (iii) In dimensioning, arrow-heads of various types, as per SP : 46-1988 codes, are usable. However, where space is too small for an arrowhead, oblique stroke or a dot may be employed.
- (iv) In no view of question 1 and in no sectioned view of question 3, are hidden edges/lines required.
- (v) Other standard methods of drawing/proportions for features like nuts, heads of bolts, screws etc., employed by examinees, may also be accepted.

QUESTION PAPER CODE 68/1

### EXPECTED ANSWERS/VALUE POINTS

<b>Q 1 (a): ISOMETRIC SCALE</b>	<b>4</b>
(i) Marking of divisions of 10 mm, 1 mm on true scale and marking angles of $30^\circ$ & $45^\circ$ .	1
(ii) Projections from scale 1:1 to get points on isometric scale, Printing 'Scale 1:1' and 'Isometric Scale'.	1
(iii) Construction of isometric scale, 110 mm long, with main divisions of 10 mm each.	1
(iv) Division of the first part of isometric scale into 10 subdivisions.	1
<b>Q 1 (b): ISOMETRIC PROJECTION OF A HEMISPHERE</b>	<b>7</b>
(i) Drawing isometric ellipse on H.P. along with center lines.	3
(ii) Drawing semicircular portion of hemisphere.	2
(iii) Marking the center, vertical axis and diameter of hemisphere	2

**NOTE :**

*For incorrect position of the hemisphere, like placing the curved surface of the hemisphere on H.P. instead of its flat circular base, 1½ marks should be deducted.*

<b>Q 1 (c): ISOMETRIC PROJECTION OF PENTAGONAL PYRAMID, PLACED CENTRALLY, ON AN EQUILATERAL TRIANGULAR PRISM</b>	<b>14</b>
<u>TRIANGULAR PRISM</u>	7
(i) Drawing a helping figure of a triangle, base edge = 90 mm, with one base edge parallel to V.P. and closer to the observer.	1
(ii) Drawing isometric triangles.	3
(iii) Drawing face edges, parallel to the vertical axis / V.P.	2
(iv) Dimensioning edge of base of prism and its axis, i.e. height.	1
<u>PENTAGONAL PYRAMID</u>	7
(i) Helping figure (using either isometric scale or 1:1 scale) of a pentagon with one side parallel to V.P. and away from it.	1
(ii) Drawing isometric pentagon on the top triangular face of the triangular prism, centrally placed, with one side parallel to V.P. and away from it.	2
(iii) Drawing slant edges.	2
(iv) Marking the common vertical axis and direction of viewing.	1
(v) Printing dimensions.	1

**NOTE :**

*For incorrectly placed solids, like the common axis being drawn perpendicular to V.P. instead of drawing perpendicular to HP, as asked, 1½ marks should be deducted. Also, in the helping figures, if a side of triangle, or pentagon is not taken parallel to VP and away from it, 1 mark (1/2+1/2) should be deducted. Deductions will have to be changed proportionately, if mistakes are committed in both cases.*

<b>Q 2 (a): SQUARE NUT</b>	<b>9</b>
<u>FRONT VIEW :</u>	3
(i) Front view of square nut of nominal diameter 30 mm with six vertical lines and two horizontal lines, with a height of 0.8d to d.	2



(ii) Drawing arc with radius R. 1

TOP VIEW : 4

(i) Draw A/F = chamfer diameter of  $1.5d + 3$  mm, or  $1.5d$ . 1

(ii) Indication of outer thin and broken circle of diameter 30 mm. 1

(iii) Indication of inner thick full circle of diameter  $30 \times 0.85$  mm. 1

(iv) Square, circumscribing chamfer circle. 1

DETAILS :

Dimensioning (1) and line work (1). 2

[OR]

**HOOK BOLT** 9

FRONT VIEW : 4

(i) Threaded and unthreaded portions of cylindrical shank, square neck and center line, including curve of radius R. 3

(ii) Head of bolt. 1

TOP VIEW : 3

(i) Thick circle of diameter  $d$  and thin broken circle of  $0.85d$ . 1

(ii) Square neck and rest of the portion. 2

DETAILS :

Dimensioning (1) and line work (1). 2

**NOTE :**

*3 marks may be deducted, in all, if sketched freehand, instead of drawing to scale 1:1.*

**Q 2 (b): STUD WITH COLLAR** 6

(i) Front view with its axis perpendicular to HP. 3

(ii) Top view. 2

(iii) Dimensions. 1

[OR]

**PAN HEAD RIVET (without tapered neck) 6**

FRONT VIEW : 4

(i) Sketching the head with correct proportions. 2

(ii) Sketching cylindrical portion, broken end and hatching. 2

TOP VIEW : 1

Two circles. 1

DIMENSIONING : 1

**NOTE :**

*2 marks may be deducted, if these components are drawn with instruments, instead of being sketched freehand.*

**Q 3: FLANGED PIPE JOINT(Assembly) 30**

(a) FRONT VIEW (Lower Half in Section) : 15

(i) Drawing both flanges and pipes in top half portion (without section), including curves of R3 and hatching lines in broken end of pipe. 4

(ii) Drawing both flanges and pipes in bottom half portion, including curves of R3 and hatching lines in broken end of pipe. 4

(iii) Drawing a hole of  $\phi 12$  mm on a p.c.d. of 96 mm and hatching lines in pipes and flanges. 2

(iv) Drawing bolts and nuts of M10 correctly, (Minimum at one location). 4

(v) Indicating packing material (gasket) of outer diameter 80 mm and thickness 4 mm with a line in the upper half and with shading or cross-hatching in the bottom half. 1

(b) SIDE VIEW : 9

(i) Drawing six circles, including pitch circle for bolts. 5

(ii) Drawing hatching lines to indicate the pipe thickness. 1

(iii) Drawing chamfer circle, hexagon, M10 circle and 0.85d broken circle for four nuts, bolts and hole dia. on p.c.d. (Minimum at one location) 2

(iv) Drawing cutting plane with the direction of viewing. 1

DETAILS : 6  
Printing title (1), scale used (1), drawing projection symbol (1) and six dimensions (3).

[OR]

**FOOTSTEP BEARING (Dis-assembly) 30**

(a) FRONT VIEW OF BUSH (Left Half in Section) : 17

(i) Drawing the complete boundary of bush along with curves of proper radius. 9

(ii) 4 horizontal lines upto the vertical center line (on the right side) 4

(iii) Indicating the vertical line for hole of  $\phi 40$  mm, including fillet of proper radius. 2

(iv) Hatching lines in the thickness of bush on the left side. 2

(b) FRONT VIEW OF PAD (Right Half in Section) : 7

(i) Drawing two vertical lines of 15 mm height, one horizontal base line of pad and the center line. 2

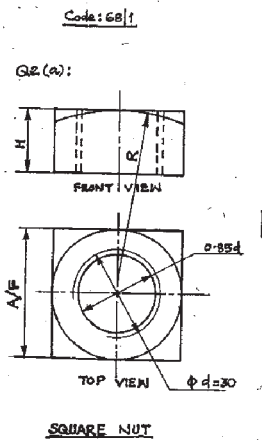
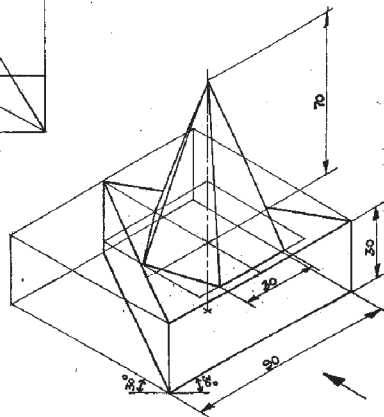
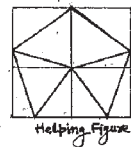
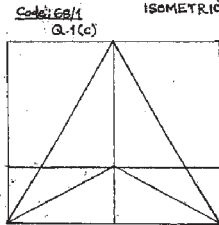
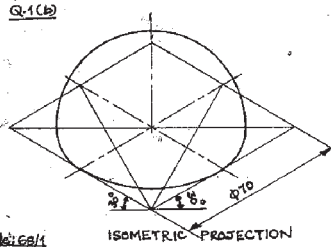
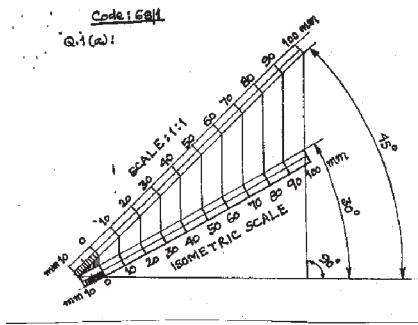
(ii) Drawing the top curve of the pad after locating its center on the center line & a horizontal line up to the center line, at a height of 15 mm. 2

(iii) Plotting the center line of the hole, hole with conical top and hatching lines. 3

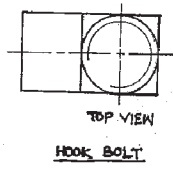
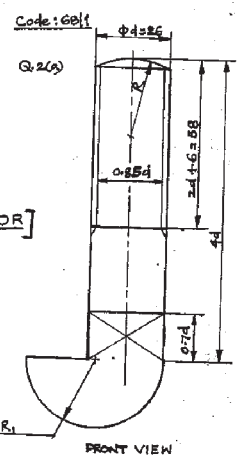
DETAILS : 6

Printing titles of both (1), scale used (1), drawing projection symbol (1) and six dimensions (3).

CODE: 68/1

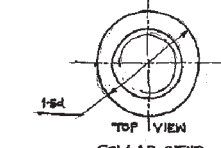
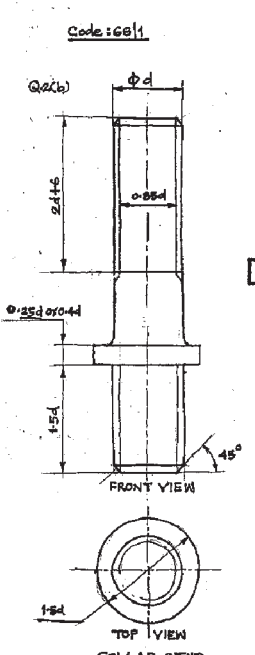


d	H	A/F	R
30	0.8d-d	1.5d to 1.8d	1.5d to 2.0d



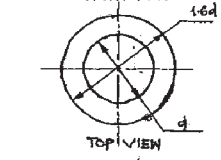
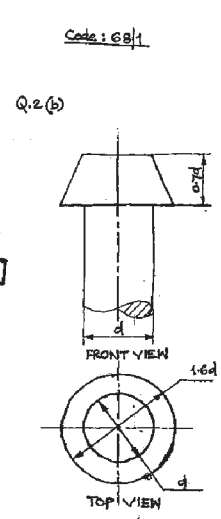
HOOK BOLT

d	R	R <sub>1</sub>	0.7d
26	26	0.7d	18.2



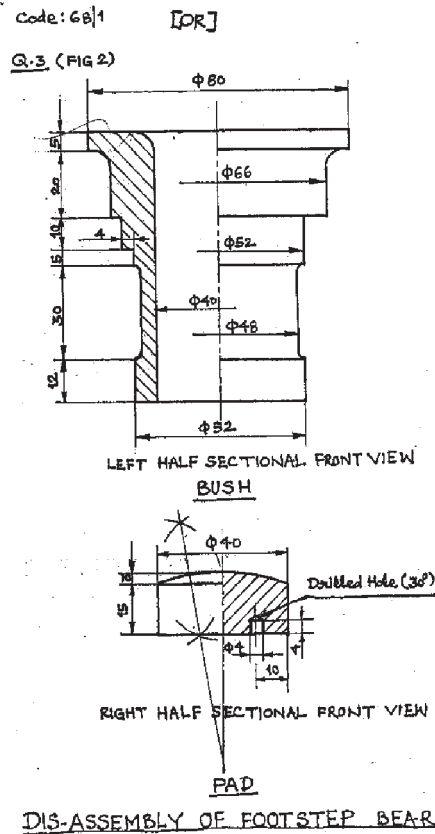
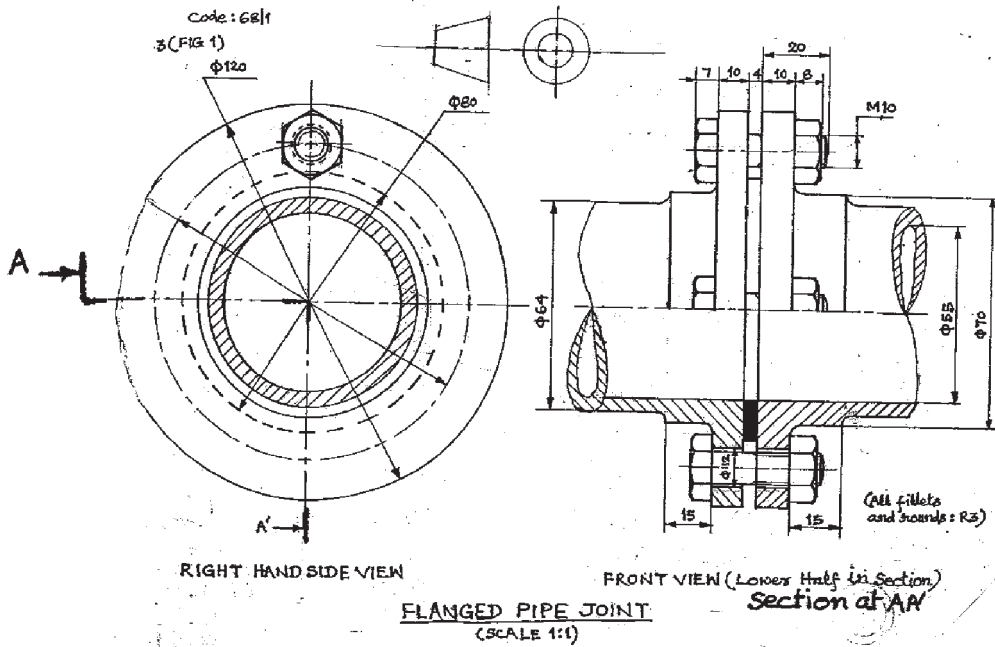
COLLAR STUD

d	2d+6	1.5d	0.85d/0.4d
25	56	37.5	6.25/4.0



PAN HEAD RIVET

d	0.7d	1.6d
25	17.5	40



**EXPECTED ANSWERS/VALUE POINTS**

<b>Q 1 (a): ISOMETRIC SCALE</b>	<b>4</b>
(i) Marking of divisions of 10 mm, 1 mm on true scale and marking angles of 30° & 45°.	1
(ii) Projections from scale 1:1 to get points on isometric scale, Printing 'Scale 1:1' and 'Isometric Scale'.	1
(iii) Construction of isometric scale, 110 mm long, with main divisions of 10 mm each.	1
(iv) Division of the first part of isometric scale into 10 subdivisions.	1
<b>Q 1 (b): ISOMETRIC PROJECTION OF A HEMISPHERE</b>	<b>7</b>
(i) Drawing isometric ellipse with center lines.	3
(ii) Drawing semicircular portion of hemisphere.	2
(iii) Marking the center, vertical axis and diameter of hemisphere	2
<b>NOTE :</b>	
<i>For incorrect position of the hemisphere, like placing the flat circular base of the hemisphere on H.P. instead of its curved surface, 1½ marks should be deducted.</i>	
<b>Q 1 (c): ISOMETRIC PROJECTION OF HEXAGONAL PYRAMID, PLACED CENTRALLY, ON A SQUARE PRISM</b>	<b>14</b>
<u>SQUARE PRISM</u>	6
(i) Drawing isometric squares, with an edge parallel to V.P.	3
(ii) Drawing face edges, parallel to the vertical axis / V.P.	2
(iii) Dimensioning edge of base of prism and its axis, i.e. height.	1
<u>HEXAGONAL PYRAMID</u>	8
(i) Helping figure (using either isometric scale or 1:1 scale) of a hexagon with one side parallel to V.P.	1
(ii) Drawing isometric hexagon on the top square face of the square prism, centrally placed, with one side parallel to V.P.	3

- |   |   |
|---|---|
| (iii) Drawing slant edges.                                      | 2 |
| (iv) Marking the common vertical axis and direction of viewing. | 1 |
| (v) Printing dimensions.  | 1 |

**NOTE :**

*For incorrectly placed solids, like the common axis being drawn perpendicular to V.P. instead of drawing perpendicular to HP, as asked, 1½ marks should be deducted. Also, in the helping figure, if a side of hexagon is not taken parallel to VP, 1 mark should be deducted. Deductions will have to be changed proportionately, if mistakes are committed in both cases.*

**Q 2 (a): SINGLE RIVETED LAP JOINT 9**

- |  |   |
|--|---|
| (i) Drawing rivet with both heads.             | 2 |
| (ii) Drawing both the plates, including taper. | 3 |
| (iii) Drawing hatching lines.                  | 1 |
| (iv) Dimensioning                              | 2 |
| (v) Line work and neatness                     | 1 |

**[OR]**

**HEX. BOLT, WASHER AND SQ. NUT 9**

- |   |   |
|---|---|
| (i) Hex. Head of the bolt with curves and chamfering.   | 2 |
| (ii) Length of the bolt, threaded length and curve of $R = d$ at the end, or the other type of end. | 2 |
| (iii) Square nut drawn correctly.   | 2 |
| (iv) Washer drawn correctly.  | 1 |
| (v) Dimensioning  | 1 |
| (vi) Neatness and Line work   | 1 |

**NOTE :**

*3 marks may be deducted, in all, if sketched freehand, instead of drawing to scale 1:1.*

<b>Q 2 (b):</b>	<b><u>90° FLAT COUNTER SUNK-HEAD SCREW</u></b>	<b>6</b>
(i)	Sketching front view with its axis perpendicular to HP.	3
(ii)	Sketching top view.	2
(iii)	Dimensioning.	1

[OR]

	<b><u>FLAT HEAD RIVET</u></b>	<b>6</b>
(i)	Sketching front view with its axis perpendicular to HP.	3
(ii)	Sketching top view.	2
(iii)	Dimensioning.	1

**NOTE :**

2 marks may be deducted if these components are drawn with instruments, instead of being sketched freehand.

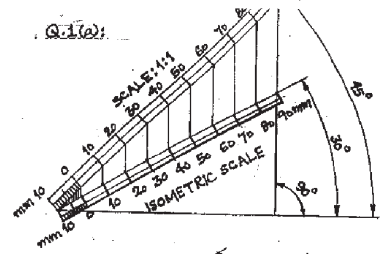
<b>Q 3 :</b>	<b><u>TURNBUCKLE (Assembly)</u></b>	<b>30</b>
(a)	<u>FRONT VIEW</u> (Lower Half in Section) :	15
(i)	Drawing upper half portion of the body.	4
(ii)	Drawing lower half portion of the body, with hatching lines.	5
(iii)	Drawing both rods with 50 mm inserted portion of each, showing threads and hatching lines at the rod ends.	6
(b)	<u>SIDE VIEW</u> (viewed from right) :	9
(i)	Drawing three circles of $\phi 20$ , $\phi 30$ and $\phi 60$ mm along with hatching lines.	5
(ii)	Drawing dotted lines to indicate hidden portion.	3
(iii)	Drawing cutting plane line with the direction of viewing.	1
	<u>DETAILS :</u>	6

Printing title (1), scale used (1), drawing projection symbol (1) Neatness and line work (1) and printing six dimensions (2).

[OR]

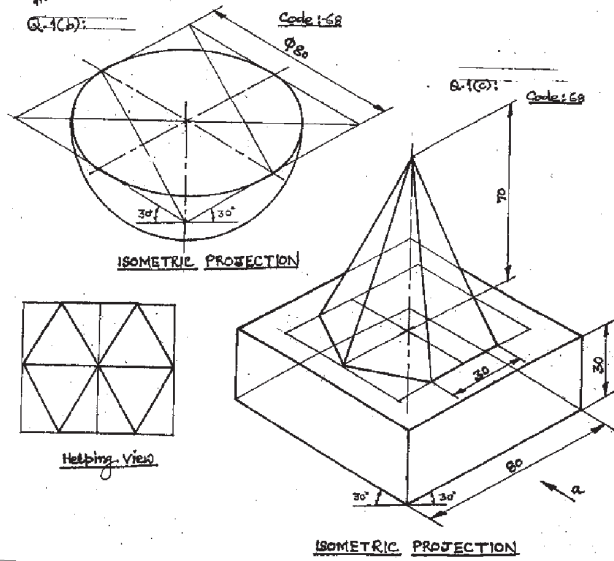


<b><u>KNUCKLE JOINT (Dis-assembly)</u></b>	<b>30</b>
(a) <b><u>FORK</u></b> (Front view full in Section) :	16
(i) 4 horizontal lines (45 mm each) and 2 vertical lines of 12 mm each.	3
(ii) Ø 22 mm holes (properly located)	1
(iii) Plotting vertical center lines at 20 mm and 45 mm from the extreme left of the fork, and the horizontal center line in the middle.	2
(iv) Semi-circle of R 13.	1
(v) Radii of R 25 mm on both sides & radii of R 15 mm on both sides.	2
(vi) Drawing horizontal lines, vertical line, fillets and rounds for the octagonal portion.	3
(vii) Rod of 22 mm diameter along with hatching lines for showing broken end.	2
(viii) Hatching lines in fork, indicating full sectional view.	2
(b) <b><u>COLLAR</u></b> (Front view full in Section) :	8
(i) Circular portion of Ø 30 and height 12 mm along with vertical center line.	4
(ii) Horizontal center line for inserting pin.	1
(iii) Showing tapered hole in collar along with hatching lines.	3
<b><u>DETAILS :</u></b>	<b>6</b>
Printing titles of both (1), scale used (1), drawing projection symbol (1) and six dimensions (3).	

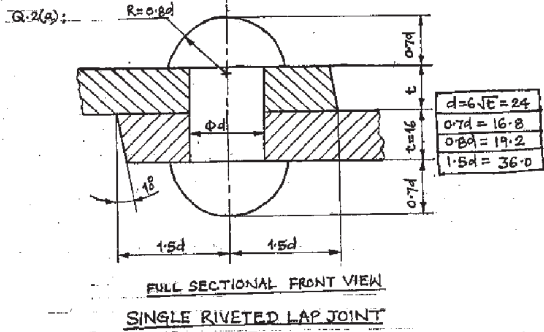


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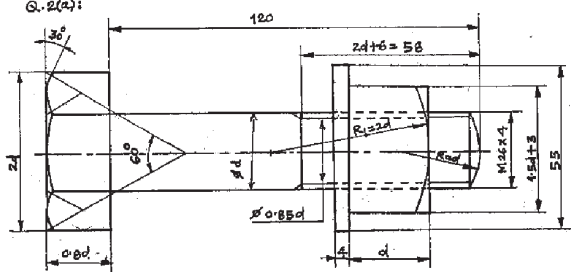
Q.1(b):



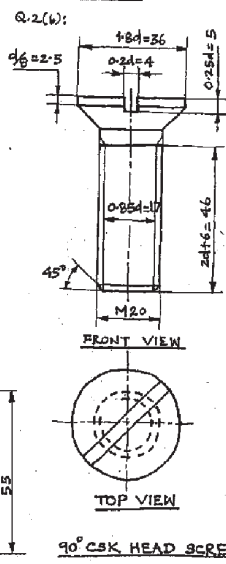
Q.2(a):



Q.2(a):

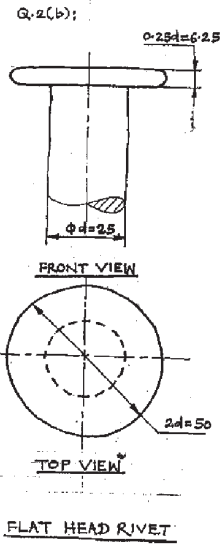


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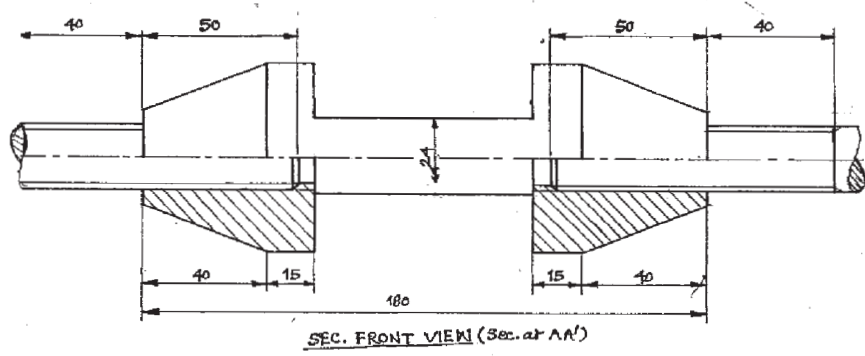
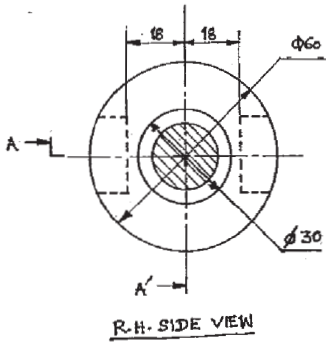


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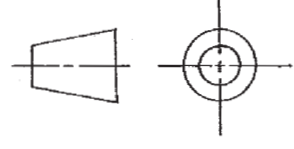
[OR]



Code: 68  
Q.3 (FIG1)

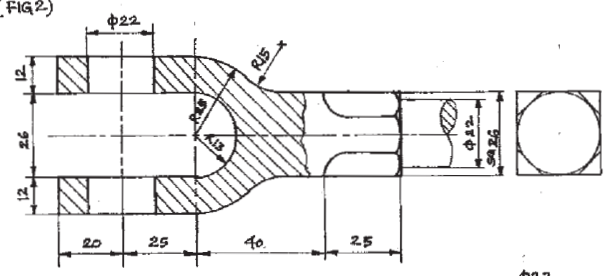


TURNBUCKLE  
(SCALE: 1:1)

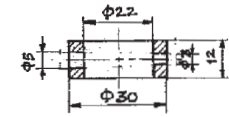
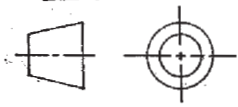


[OR]

Code: 68  
Q.3 (FIG2)



FORK



COLLAR

DIS-ASSEMBLY OF KNUCKLE JOINT  
(SCALE: 1:1)