SUMMER – 2022 EXAMINATION

Subject Name: Chemical Engineering Drawing **Model Answer** **Subject Code:** 22608

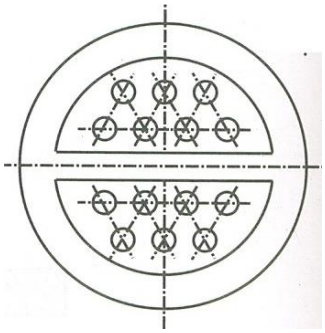
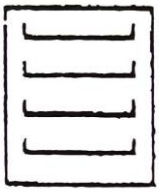
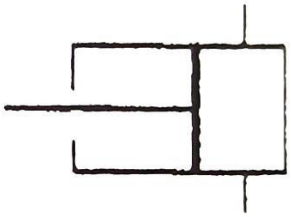
Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	a	**Applications of Computer Aided Drafting (CAD) software:** 1. In Process Flow Diagram 2. Process plant layout drawing 3. Piping drawing.	1 mark for each point (any 2)
1	b	**Drawing command used in CAD with their use :** 1. Line Command – to make Line 2. Polygon Command – to make Polygon 3. Rectangle Command – to make Rectangle 4. Polygon (Hexagon) Command – to make Hexagon 5. Arc Command – to make Arc 6. Ellipse Command – to make Ellipse 7. Polyline Command – to make Polyline	1 mark for each point (any 2)
1	c	**Necessity of diaphragm valve in chemical industry** 1. To isolate working parts of valve while handling corrosive liquids diaphragm valve is necessary. 2. To prevent leakage of volatile and toxic liquid diaphragm valve is necessary.	1 mark for each point

SUMMER – 2022 EXAMINATION

Subject Name: Chemical Engineering Drawing **Model Answer** **Subject Code:** 22608

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	d	**Vessel supports for vertical vessels :** 1. Bracket Support 2. Leg Support 3. Straight Skirt Support 4. Angular Skirt Support	1 mark for each point (any 2)
1	e	**Jackets used in batch reactor :** 1. Plain Jacket 2. Half Coil Jacket 3. Channel Jacket 4. Tube Jacket	1 mark for each point (any 2)
1	f	**Triangular pitch** 	2 marks
1	g	**IS 3232 Symbol :** 1. Tray Dryer –  2. Reciprocating Pump – 	1 mark for each

SUMMER – 2022 EXAMINATION

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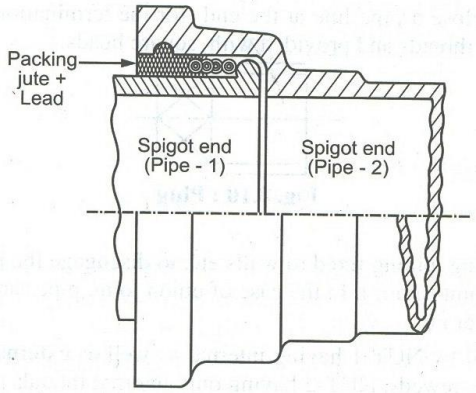
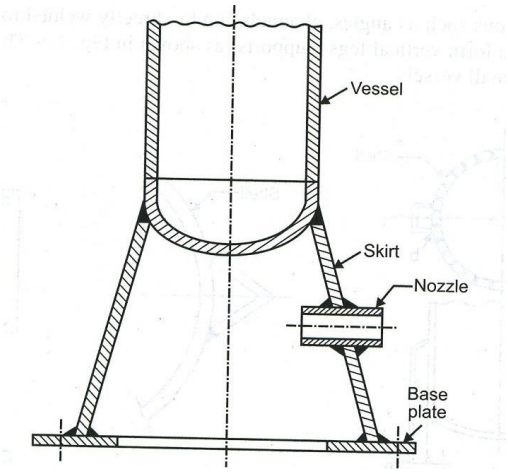
Q. No.	Sub Q. N.	Answer	Marking Scheme
2	a	**Uses of CAD initial setting commands :** 1. Snap : to restrict the movement of crosshairs cursor to an interval defined by user. 2. Grid : it is useful in aligning object and visualizing distance between them. 3. Ortho : to restrict the cursor movement to horizontal and vertical direction only. 4. Osnap : to specify snap onto a particular point location (on an object) when picking a point.	1 mark for each point
2	b	**Procedure for modify command used in CAD :** 1. Move Command – - Enter Move or M in the command window (type command : MOVE or M and enter) **or** Click MOVE icon or tool from modify tool bar (select the move command) - Select the object. - Right click. - Left click on the object. - Move it in any direction. - D enter. - Type distance. - Enter 2. Erase Command – - Enter ERASE or E in the command window (type command : ERASE or E and enter) **or** Click ERASE icon or tool from modify tool bar (select the ERASE command) - Select the object. - Right click. - OK 3. Offset Command – - Enter OFFSET or O in the command window (type command : OFFSET or O and enter) **or** Click OFFSET icon or tool from modify tool bar (select the OFFSET command) - Enter the distance. - Type distance. - Enter. - Select the object (e.g. vertical line) to offset. - Move the mouse in the direction in which (i.e. on the side on which) you want to offset. - Left click. - -	1 mark for each point

SUMMER – 2022 EXAMINATION

Subject Name: Chemical Engineering Drawing **Model Answer** **Subject Code:** 22608

Q. No.	Sub Q. N.	Answer	Marking Scheme
		4 Copy Command – Enter COPY or O in the command window (type command : COPY or CO and - enter) **or** Click COPY icon or tool from modify tool bar (select the COPY command) - Select object to copy. - Right click. - Specify base point. - Move it any direction. - Make multiple copies. - Enter. **(Any Four Modify Command form Mirror Command, Trim Command, Extend Command, Stretch Command, Rotate Command, Scale Command, Fillet Command, Explode Command, Hatch Command with process may be considered)**	
2	c	**Socket and Spigot joint** 	4 marks
2	d	**Angular Skirt Support** 	4 marks

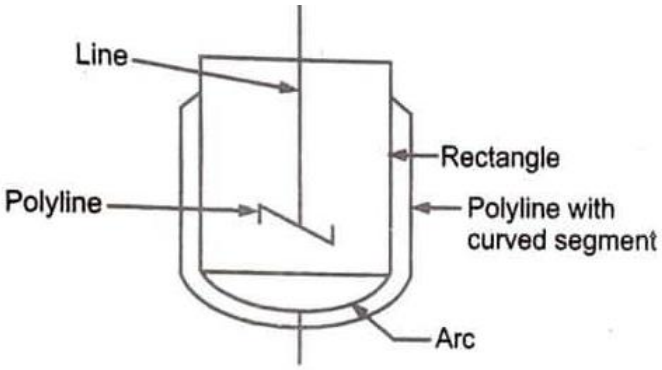
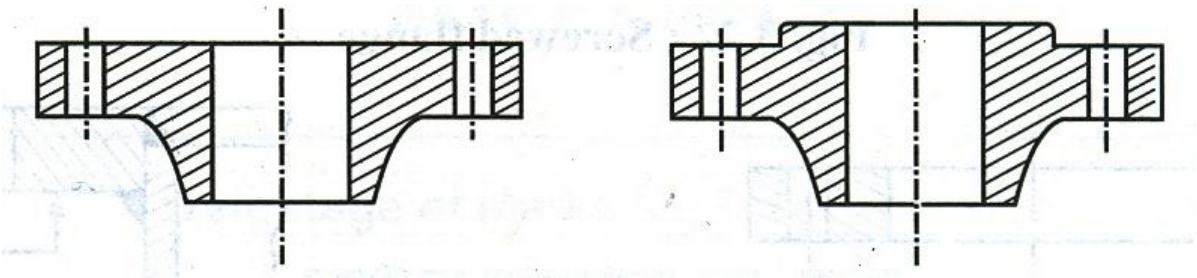
SUMMER – 2022 EXAMINATION

Subject Name: Chemical Engineering Drawing **Model Answer** **Subject Code:** 22608

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	a	**Computer Aided Drafting in Chemical Engineering** CAD, or computer-aided design and drafting (CADD), is technology for design and technical documentation, which replaces manual drafting with an automated process. Computer-aided drafting is the 2-dimensional representation of designs. The introduction of computer-aided drafting, commonly referred to as "CAD", replaced years of using pen and paper to make handmade designs. CAD immensely improved productivity by converting design ideas into 2D images that can be technically sound. Before introduction of CAD various drawings in Chemical Engineering are prepared by hand or manually. This process is time consuming. After introduction of CAD various drawings like PFD, PID, ULD, sectional views of equipment are prepared by software. It is less time consuming; we can do duplication of drawing or part in few seconds. Computer-aided drafting involves the use of computer systems to produce accurate representations of 2D objects. Using this method, designers of any sort can quickly and easily visualize accurate and precise representations. Another great perk is the flexibility to adjust and iterate designs. CAD presents a multitude of advantages to several industries, including engineering, architecture, and manufacturing. Digitalized designs take up virtually no space and can be easily shared and reused. Indeed, many programs take advantage of the modularity offered by digital storage, allowing users to effectively insert designs into designs. Editing in the drawing becomes easy by CAD. In chemical processing arrangement of equipment is major work which is called as plant layout. All the equipments necessary for process must be accommodated in optimal space. These equipments are connected with pipelines. Using CAD we can get clear view in 2D or 3D of the plant.	4 marks

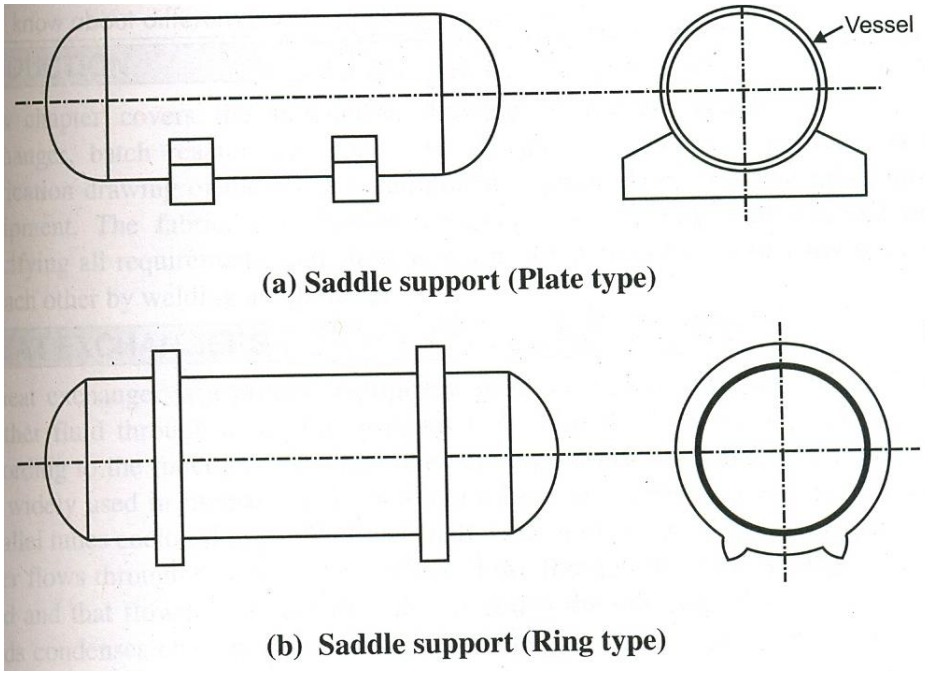
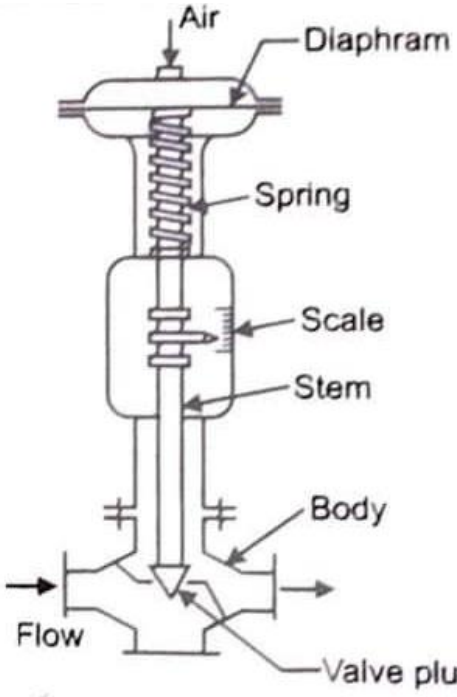
SUMMER – 2022 EXAMINATION

Subject Name: Chemical Engineering Drawing **Model Answer** **Subject Code:** 22608

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	b	**Batch reactor using CAD**  As shown in above diagram reactor drawing need various shapes which include rectangle, line, polyline, arc etc. by using command prompt we can draw above shapes using respective command. For the proper placement of shapes coordinates can be defined after each command. 1. Type RECTANGLE in command window. Specify first corner point – Point1. Specify other corner point – Point2. 2. Type LINE in command window. Specify first start point – Point1. Specify other point as end point – Point2. Specify end points of other segments. 3. Type ARC in command window. Specify start , center and end points. 4. Click Home tab Draw panel Polyline. Find Specify the start point of the polyline segment. Specify the endpoint of the polyline segment. Switch to Arc mode by entering a (Arc) at the Command prompt. Return to Line mode by entering L (Line). Specify additional polyline segments as needed. Press Enter to end, or enter c to close the polyline.	4 marks
3	c	**Welded neck flange** 	4 mark for any one

SUMMER – 2022 EXAMINATION

Subject Name: Chemical Engineering Drawing **Model Answer** **Subject Code:** 22608

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	d	**Saddle support**  (a) Saddle support (Plate type) (b) Saddle support (Ring type)	4 marks for any one
4	a	**Control Valve** 	4 marks

SUMMER – 2022 EXAMINATION

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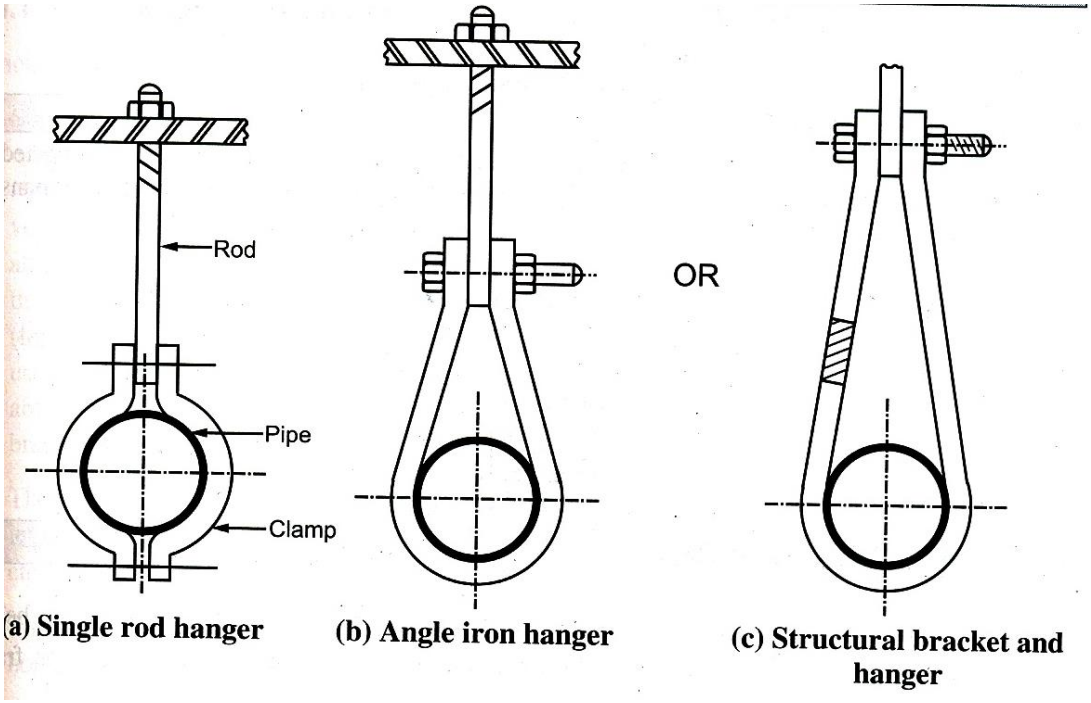
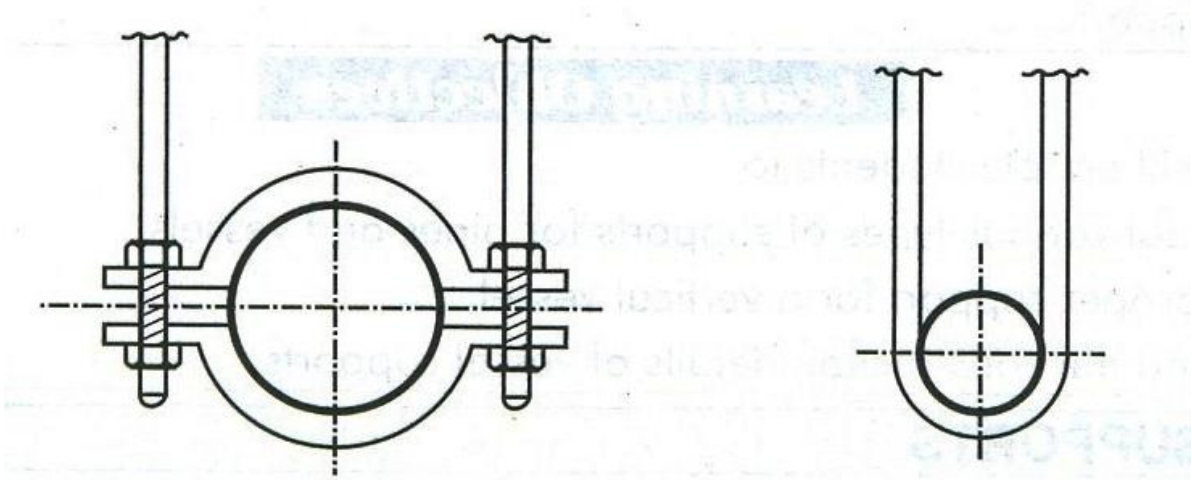
Q. No.	Sub Q. N.	Answer	Marking Scheme
4	b	**Hanger support**  **(a) Single rod hanger** **(b) Angle iron hanger** **(c) Structural bracket and hanger** **Double rod hanger support and Double U-bolt hanger** 	2 marks each for any two hanger

SUMMER – 2022 EXAMINATION

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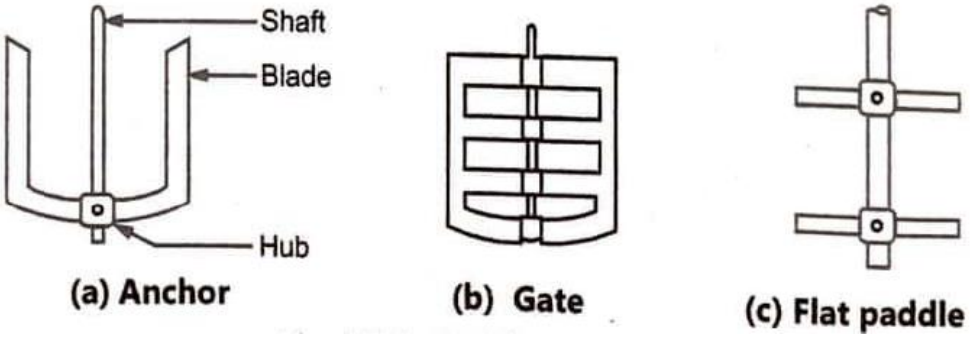
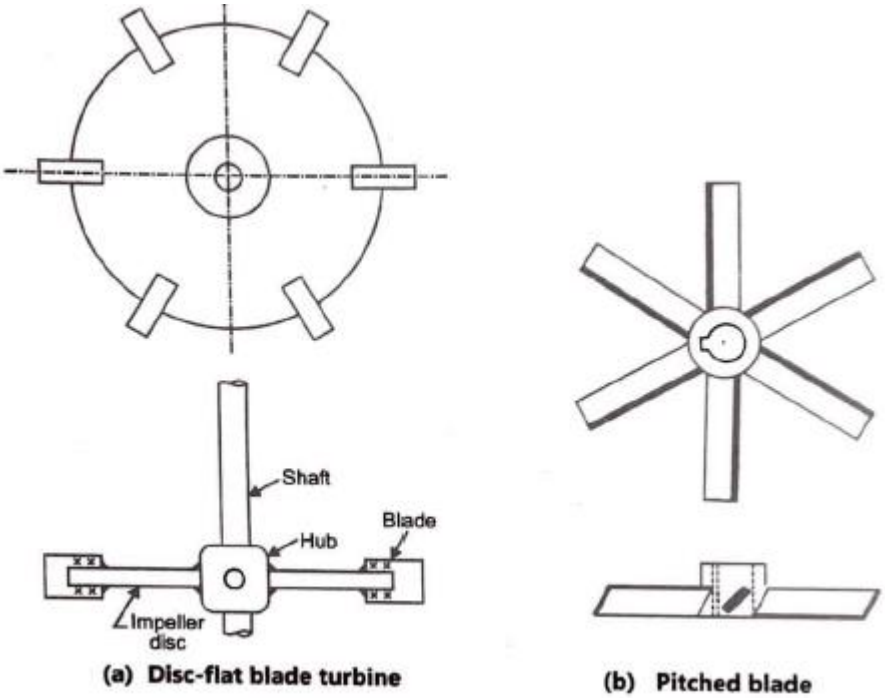
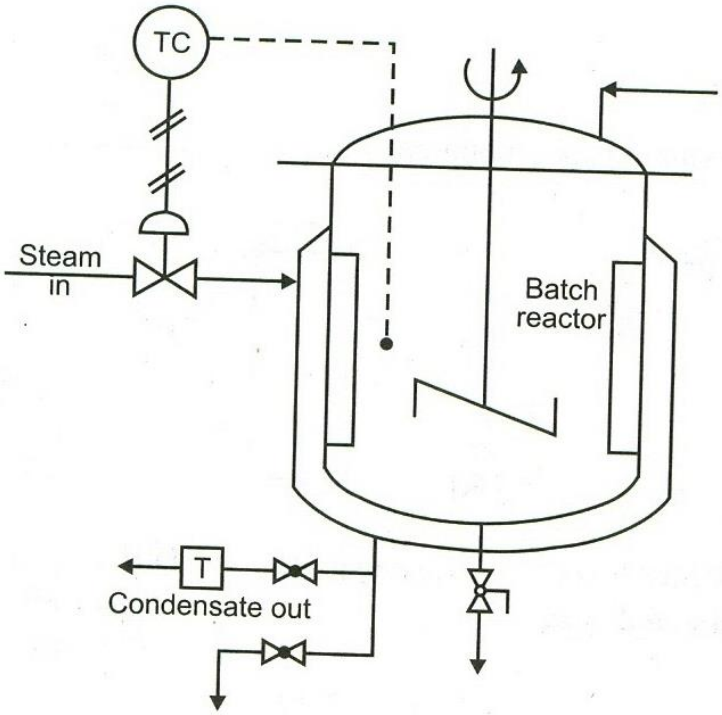
Q. No.	Sub Q. N.	Answer	Marking Scheme
4	c	**Agitators**  	2 marks each for any two agitators

SUMMER – 2022 EXAMINATION

Subject Name: Chemical Engineering Drawing **Model Answer** **Subject Code:** 22608

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	d	**Temperature control for batch reactor** 	4 marks

SUMMER – 2022 EXAMINATION

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Q. No.	Sub Q. N.	Answer	Marking Scheme
4	e	**Specification Sheet of Heat Exchanger**	4 marks

1.	Specification No.	Date	
2.	Number required	Location	
3.	Type	Duty as	
4.	Operating data/conditions		
5.	Fluid description	Shell side	Tube side
6.	Name	In ... out ...	In ... out ...
7.	Composition	In ... out ...	In ... out ...
8.	Flow rate, kg/h	In ... out ...	In ... out ...
9.	Density, kg/m^3	In ... out ...	In ... out ...
10.	Viscosity, cP	In ... out ...	In ... out ...
11.	Specific heat,	.....	.....
12.	Latent heat, kcal/kg	.....	.....
13.	Thermal conductivity	.....	.....
14.	Temperature, ^oC	In ... out ...	In ... out ...
15.	Operating pressure, kgf/cm^2·g	In ... out ...	In ... out ...
16.	No. of passes	.....	.....
17.	Velocity, m/s	.....	.....
21.	Tube : OD ..... mm, length ..... m, wall thickness (BWG) ..... pitch ..... mm □ Δ material		
22.	Shell : Nom. OD ..... length ..... mm thickness		
23.	Shell cover : ..... Material		
24.	Channel ..... Channel cover		
25.	Tube sheet type ..... (stationary/floating)		
26.	Baffles : type ..... No. ..... Thickness		
27.	Shell side nozzles : Inlet ..... outlet ..... drain		
28.	Tube side nozzles : Inlet ..... outlet		
29.	Corrosion allowance : shell side ..... tube side		
30.	Gaskets		
31.	Design code		
32.	Design pressure and temperature | ... kgf/cm^2·g, ... ^oC | ... kgf/cm^2·g, ... ^oC		
33.	Test pressure and temperature ....., ... , ..., ...		
34.	Weight : Dry ....., Tube bundle ..... Unit full of water ..... kg.		
35.	Remarks		
	Prepared by ..... Checked by ..... Approved by ..... Name and Address		

SUMMER – 2022 EXAMINATION

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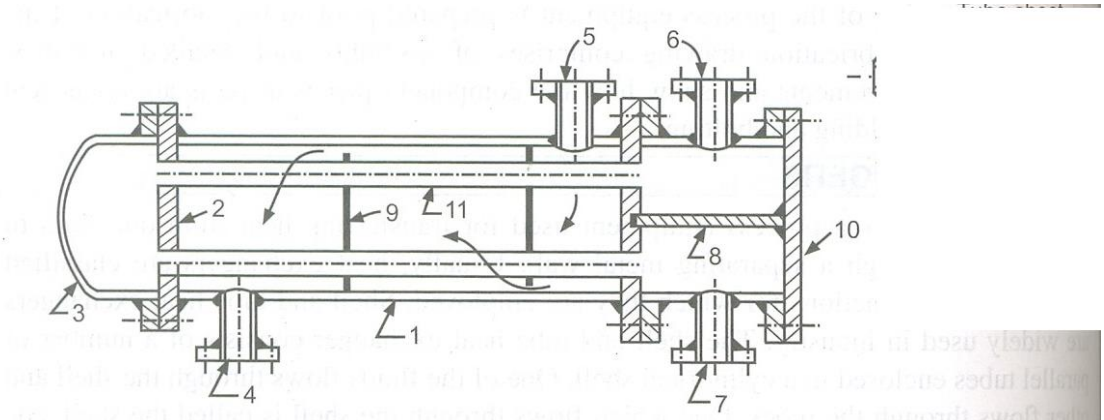
Q. No.	Sub Q. N.	Answer	Marking Scheme
5	a	**1-2 Shell and Tube Heat Exchanger**  **1 - shell, 2 - tube sheet, 3 - cover, 4, 5 - shell side nozzle inlet/outlet** **6, 7 - tube nozzle-inlet/outlet, 8 - pass partition, 9 - baffle, 10 - channel cover, 11 - tube** **Section lines are not shown for shell, cover and nozzles**	3 marks for drawing , 1 mark for labels

SUMMER – 2022 EXAMINATION

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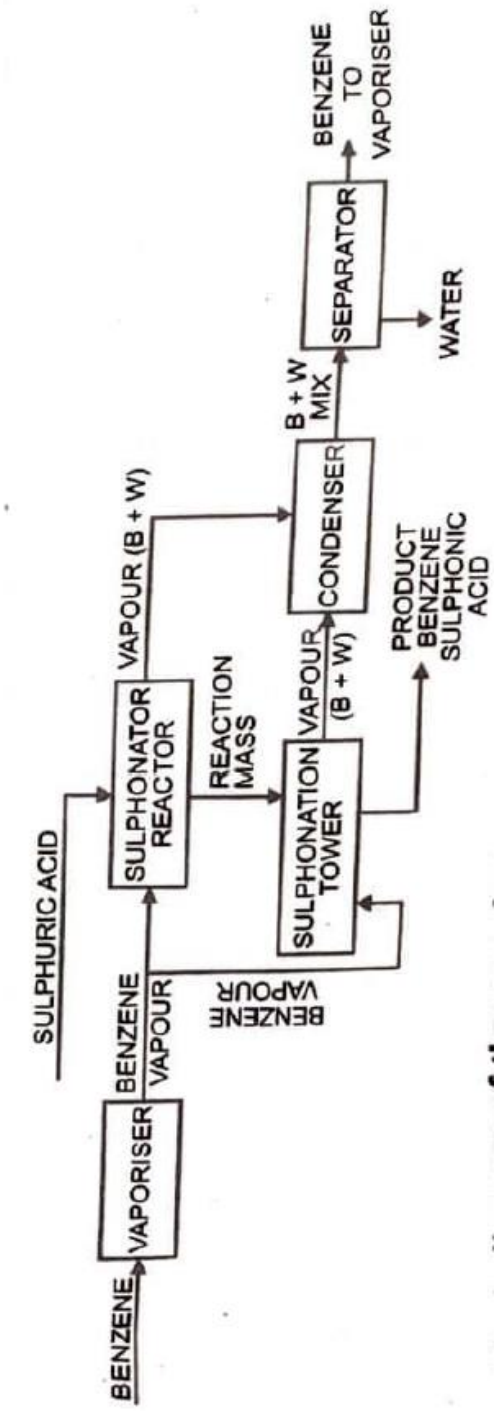
Q. No.	Sub Q. N.	Answer	Marking Scheme
5	b	**Block Diagram** 	6 marks

SUMMER – 2022 EXAMINATION

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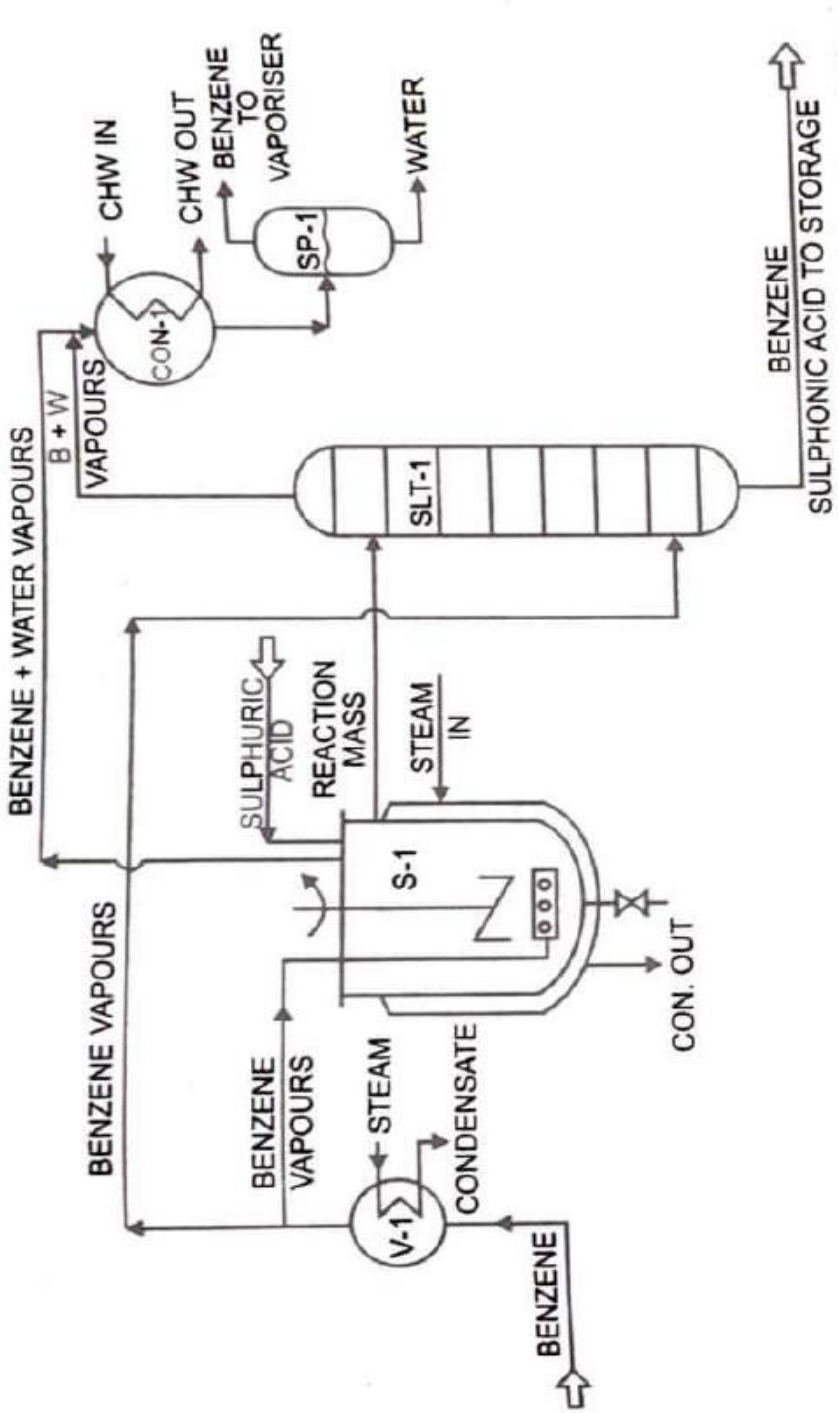
Q. No.	Sub Q. N.	Answer	Marking Scheme
5	c	**Process Flow Diagram** 	5 marks for PFD 1 mark for legend

SUMMER – 2022 EXAMINATION

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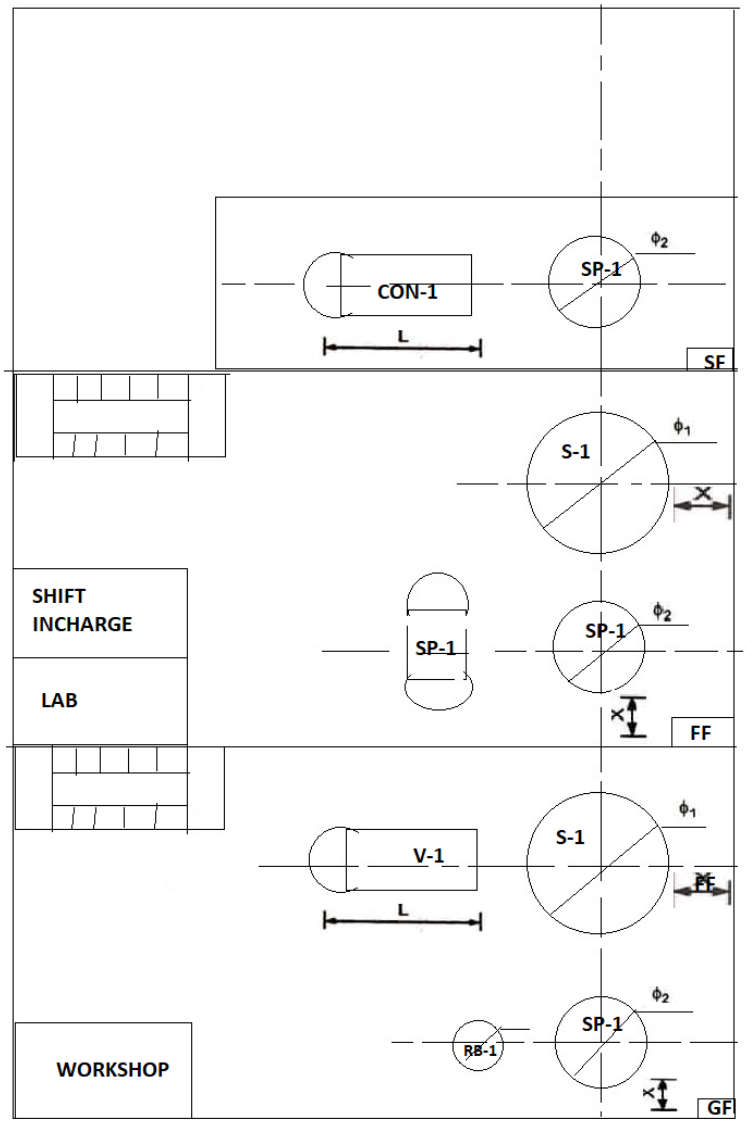
Q. No.	Sub Q. N.	Answer	Marking Scheme
		LEGEND / EQUIPMENT KEY CODE – DESCRIPTION V-1 – VAPORISER S-1 – SULPHONATOR SLT-1 – SULPHONATION TOWER CON-1 – CONDENSER SP-1 – SEPARATOR	
6	a	**Equipment Layout** 	5 marks for layout, 1 mark for legend

SUMMER – 2022 EXAMINATION

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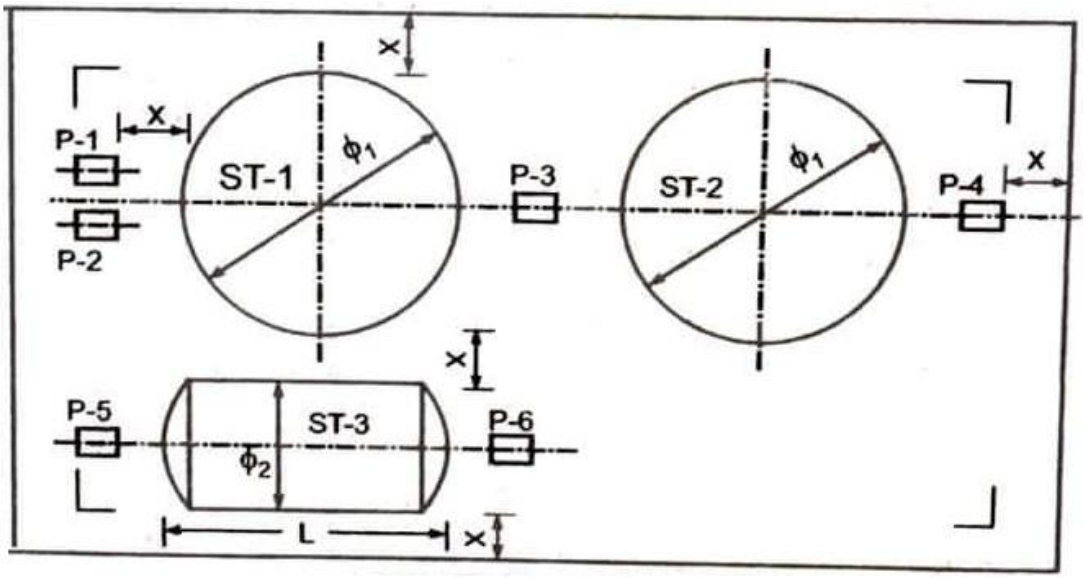
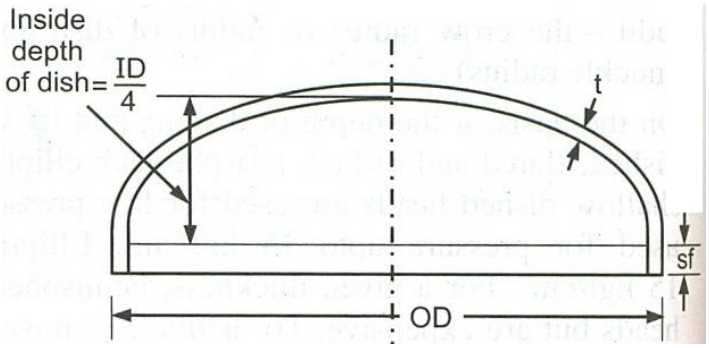
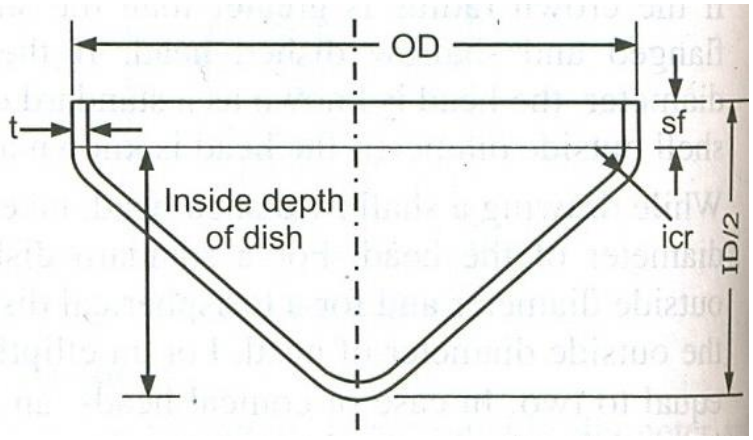
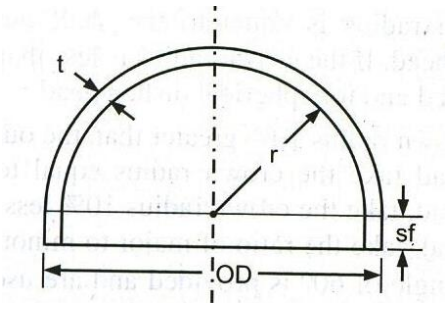
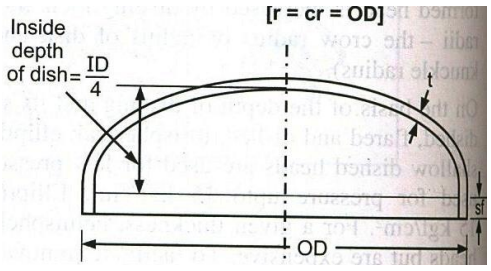
Q. No.	Sub Q. N.	Answer	Marking Scheme
		LEGEND / EQUIPMENT KEY CODE: DESCRIPTION V-1: VAPORISER S-1: SULPHONATOR SLT-1: SULPHONATION TOWER CON-1: CONDENSER SP-1: SEPARATOR	
6	b	**Tank Farm**  **Legend** No / Code / Description 1 / ST-1 / Sulfuric Acid storage tank 2 / ST-2 / Benzene Sulfonic acid storage tank 3 / ST-1 / Benzene storage tank 4 / P-1,2,3 / Pumps for sulfuric acid 5 / P-4 / Pumps for benzene sulphonic acid 6 / P-5,6 / Pumps for benzene	5 marks for layout, 1 mark for legend

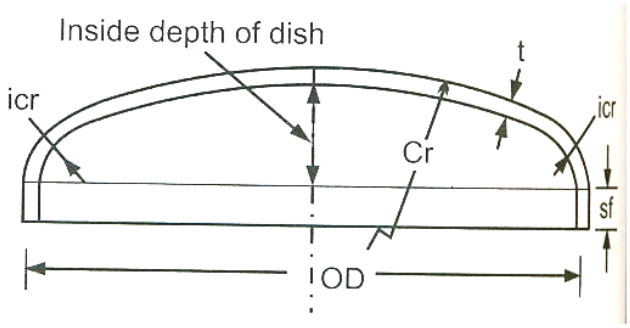
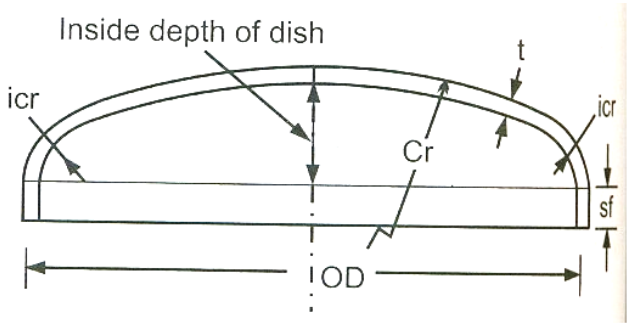
SUMMER – 2022 EXAMINATION

Subject Name: Chemical Engineering Drawing **Model Answer** **Subject Code:** 22608

Q. No.	Sub Q. N.	Answer	Marking Scheme
	c	**Elliptical dished head**  **Conical dished head**  **Hemispherical dished head and Flange and shallow dished head**  	2 marks each for any three heads

SUMMER – 2022 EXAMINATION

Subject Name: Chemical Engineering Drawing **Model Answer** **Subject Code:** 22608

Q. No.	Sub Q. N.	Answer	Marking Scheme
		Flanged and Standard dished head  **Flanged and Standard dished head**  **Torispherical Dished head**