

# 22608

**22223**

**3 Hours / 70 Marks**

Seat No. 

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- Instructions* –
- (1) All Questions are *Compulsory*.
  - (2) Illustrate your answers with neat sketches wherever necessary.
  - (3) Figures to the right indicate full marks.
  - (4) Assume suitable data, if necessary.
  - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

**Marks**

- 1. Attempt any FIVE of the following: 10**
  - a) Write the applications of CAD Software in Chemical industry.
  - b) State the use of copy command in CAD software.
  - c) Give the names of any 4 pipe joints.
  - d) Write the names of any 4 pipe supports.
  - e) Give the names of any 4 parts of shell and Tube heat exchanger.
  - f) Write the names of any 4 parts of a Batch Reactor.
  - g) Draw the symbol for centrifugal pump and fan.
  
- 2. Attempt any THREE of the following: 12**
  - a) Describe the fundamentals of CAD software.
  - b) Explain the use of Line Command in CAD software
  - c) Draw a neat sketch of Elbow and Tee.
  - d) Draw a neat sketch of straight skirt support for vertical vessel.

P.T.O.

- 3. Attempt any THREE of the following: 12**
- a) Explain following two object selection methods in CAD software
    - i) Picking selection
    - ii) Window selection
  - b) Describe any two modify commands used in CAD software.
  - c) Draw a neat sketch of Gate valve.
  - d) Draw a neat sketch of Single Rod hanger and Double Rod hanger.
- 4. Attempt any THREE of the following: 12**
- a) Draw a neat sketch of cross and plug.
  - b) Draw a neat sketch of saddle support (plate type) used for horizontal vessels.
  - c) Draw a neat sketch of U-tube heat exchanger.
  - d) Draw the instrumentation symbols for the following -
    - i) Batch Reactor
    - ii) Pulverizer
    - iii) Filter Press
  - e) Draw the instrumentation symbols for the following -
    - i) Batch Tray Dryer
    - ii) Plate column
    - iii) Storage tank (fixed roof)
- 5. Attempt any TWO of the following: 12**
- a) Draw a neat sketch of Batch Reactor with names.
  - b) Draw a specification sheet for centrifugal pump.
  - c) Ortho-nitro-Aniline (ONA) is to be manufactured by ammination of ortho-nitro-chloro-benzene (ONCB). Water is taken into a reactor (high pressure batch reactor) and ammonia (excess) is taken into it at a low temperature. Molten ONCB is then added to the reactor and mass in the reactor is heated with a low pressure steam, so as to reach the reaction temperature

and pressure. The reaction temperature is held constant over a period of 8 hrs for complete conversion of ONCB to ONA.

After the reaction is over, ammonia recovery is started. Ammonia from the reaction vessel is sparged into a mechanically agitated vessel via a pressure reducing valve. Ammonia is absorbed in water in the mechanically agitated vessel which is maintained at a temperature less than 20°C by recirculating chilled water through a coil dipped in it.

The unabsorbed gas from the mechanically agitated vessel is sent to two scrubbers in series where it is further absorbed in water spread from the top of scrubbers. Scrubbers are packed columns containing saddle packings, NH<sub>3</sub> liquor from the bottom of scrubber goes to a liquor storage tank which is kept in circulation till NH<sub>3</sub> recovery is complete. After recovery of NH<sub>3</sub>, the product mass containing ONA is cooled to room temperature by cooling tower water, the product mass i.e. slurry of ONA is then fed via a screw pump to a batch centrifuge. Wet ONA is then dried in a tray dryer and dried ONA is pulverised in a hammer mill to get product ONA in powder form. The reaction conditions are Temp = 169°C, Pressure = 41 kg f/cm<sup>2</sup>.

Draw a process flow diagram (PFD) of the above mentioned plant.

**6. Attempt any TWO of the following:**

**12**

- a) Draw triangular pitch and square pitch methods of fixing tube sheets in shell and Tube heat exchanger.
  - b) Draw a process and Instrumentation (P and I) diagram of ONA plant [See Q. 5 (C)]
  - c) Draw equipment layout of ONA plant (See Q. 5 (c))
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