Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (CHEMICAL ENGINEERING)

ENDSEM EXAMINATIONS, NOV 2022

SUBJECT: PE-IV PROJECT ENGINEERING [CHE 4069]

REVISED CREDIT SYSTEM
(23/11/2022)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1.A	Discuss the various preliminary data to be collected regarding weather conditions for the construction of the plant.	4
1.B	Develop the instrumentation symbol for the following: combined dual service board mounted manual flow recording controller number 3 connected to equipment through pneumatic transmission and connected to controller through electrical connection, locally mounted pressure recorder number 2 by mechanical transmission to the pipeline	3
1.C	Explain intangible factors (with rough estimates) involved in the calculation of fixed cost for the industry.	3
2.A	Explain safety critical equipment, shape factor, cold strength	3
2.B	Explain the working of carbon dioxide extinguishers used for extinguishing fire.	3
2.C	Evaluate the optimum pipe diameter for a Dichlorobenzene flow rate of 9000 kg/h, at 25^{O}C. Stainless steel pipe will be used. Density of Dichlorobenzene, 1300 kg/m^3 Viscosity of Dichlorobenzene 1.324×10^{-3} Ns/m^2 at 25°C. The optimum pipe diameter for turbulent flow is given by Carbon steel pipe: $d_{i,optimum} = 0.664\, G^{0.51}\rho^{-0.36}$	4

	Stainless steel pipe: $d_{i,optimum} = 0.465\ G^{0.43}\rho^{-0.31}$ ρ the density in kg/m^3, G the flow rate in kg/s	
3.A	(a) Distinguish between plant service air and instrumentation air. (b) Why do we use dome shaped structure to store hygroscopic materials.	2
3.B	Classify the different types of liquids which are stored in the industry. Discuss the methods used and how do we store these liquids.	4
3.C	The fluid from the reactor is to be transported to the storage tank through various pipelines. Initially the fluid from the reactor flows through the first pipe and then it is connected to an open ball valve, then the ball valve is connected to second pipe. The fluid flows through the second pipe and the second pipe is connected to closed globe valve and globe valve is connected to third pipe. Finally, third pipe is connected to storage tank. The first pipe and second pipe are attached to ball valve by flanged connection. The second pipe and third pipe are connected to globe valve by threaded connection. Compile the data given and make a relationship among the parts and construct the piping and instrumentation diagram.	4
4.A	The motion of sand grains through water is studied on an enlarged scale by means of plastic model 10 times the prototype grain size. Solve and get the specific gravity of the plastic which will yield an immersed weight of the proper magnitude to ensure dynamic similarity? The particle moving with a uniform velocity through a fluid experiences a force given by $F = \frac{\pi}{6} d^3(\rho_p - \rho_f)g$ Take specific gravity of sand as 2.65	2
4.B	With the help of sketches, distinguish between slip on flange and lap joint type of flange used in pipelines.	3

<table>
<tr><td>4.C</td><td>An aqueous slurry is to be filtered in a plate and frame filter press (with a=0.25) and the characteristics are given by the equation $Q = (K\theta_f)^{0.5} A$, where K value is 1.32×10^{-6}, Q is tons of filtrate in filtering time of θ_f hours and A is area of the filter, m^2. The slurry is filtered at constant pressure in the filter press at a rate to process an average of 1.25 ton/hr of feed and it is to be washed with an equal amount of water equal to one-eighth the volume of the filtrate. The dumping and assembling time is taken as 7 hr. The direct costs for power, washing and labor during filtering are estimated as Rs. 15 per m^2, and cleaning cost Rs. 12 per m^2. The plant operates 6500 hr/yr and the slurry feed contains 13 per cent (weight) solids and the cake contains 74 per cent solids. The annual fixed costs are found to be Rs. 20 per m^2 of filtering area. Solve and find the optimum cycle time.</td><td>5</td></tr>
<tr><td>5.A</td><td>Draw a network diagram for a construction project with the information given below.
<table>
<tr><th colspan="2">Job i-j</th><th rowspan="2">Duration time (weeks)</th></tr>
<tr><th>Successor event j</th><th>Predecessor event i</th></tr>
<tr><td>100</td><td>90</td><td>8</td></tr>
<tr><td>90</td><td>80</td><td>5</td></tr>
<tr><td>80</td><td>60</td><td>9</td></tr>
<tr><td>90</td><td>70</td><td>8.33</td></tr>
<tr><td>80</td><td>50</td><td>4</td></tr>
<tr><td>70</td><td>50</td><td>0</td></tr>
<tr><td>60</td><td>20</td><td>8.33</td></tr>
<tr><td>70</td><td>30</td><td>12</td></tr>
<tr><td>60</td><td>50</td><td>0</td></tr>
<tr><td>50</td><td>40</td><td>10</td></tr>
<tr><td>40</td><td>20</td><td>6</td></tr>
<tr><td>30</td><td>10</td><td>6</td></tr>
<tr><td>40</td><td>10</td><td>8.33</td></tr>
<tr><td>20</td><td>10</td><td>4</td></tr>
</table>
Estimate the project completion time.</td><td>5</td></tr>
<tr><td>5.B</td><td>With a neat sketch explain the working of fluid expansion thermometers.</td><td>3</td></tr>
<tr><td>5.C</td><td>Show the flowsheet for showing recycle and bypassing in process flow diagrams.</td><td>2</td></tr>
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