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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## August 2024 Supplementary Examinations

**Programme: B.E.** **Semester: III**
**Branch: Chemical Engineering** **Duration: 3 hrs.**
**Course Code: 19CH3DCMOP** **Max Marks: 100**
**Course: Mechanical Operations**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

| | | | CO | PO | Marks |
|---|---|---|---|---|---|
| | | **UNIT - I** | | | |
| 1 | a) | Derive an expression for screen effectiveness by material balance over a screen. | *CO1* | *PO1* | **12** |
| | b) | Explain in detail, working of trommel with a neat sketch. | *CO1* | *PO1* | **08** |
| | | **UNIT - II** | | | |
| 2 | a) | Explain with neat sketch the construction and operation of gyratory crusher; also mention the advantages and disadvantages. | *CO2* | *PO2* | **14** |
| | b) | To crush 150 tons per hour of limestone, if 80% of the feed passes 50 mm screen and 80% of the product passes a 3.125mm screen. What will be the power required? Work index of limestone = 12.74. | *CO2* | *PO2* | **06** |
| | | **UNIT - III** | | | |
| 3 | a) | Define fluidization. Explain the condition for fluidization with the help of pressure drop and bed height. | *CO3* | *PO3* | **10** |
| | b) | A plate and frame filter press when filtering a sludge gave 8 $m^3$ of filtrate in 1800 sec and 11 $m^3$ of filtrate in 3600 sec when filtration was stopped. Calculate the washing time if 3 $m^3$ of wash water is used to wash the cake. Neglect the resistance of the filter cloth and assume a constant pressure filtration. Rate of washing = ¼ (final rate of filtration). | *CO3* | *PO3* | **10** |
| | | **OR** | | | |
| 4 | a) | Determine the settling velocity of steel ball 0.03 cm diameter in oil of specific gravity 0.82 and viscosity of 1 cP specific gravity of steel is 7.84. Justify your answer. | *CO3* | *PO3* | **06** |
| | b) | Derive *Kozeny-Carman* equation for the flow of fluids through a bed of spherical solid particles. State all the assumptions used in its derivation. | *CO3* | *PO3* | **14** |

<table>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>Explain in detail the working of batch sedimentation test with neat sketch.</td><td>CO4</td><td>PO4</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Illustrate on open and closed storage of solids.</td><td>CO4</td><td>PO4</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>6</td><td>a)</td><td>Calculate the minimum cross-sectional area of a continuous thickener required to handle 50 tons/h of dry solids to produce a thickened sludge of 530 kg solids per $m^3$ of water. The initial concentration of slurry is 240 kg/ $m^3$ of slurry. The following data of settling velocity versus solid concentration was obtained in a batch settling test.
<table>
<tr><td>V, m/h</td><td>0.1</td><td>0.08</td><td>0.06</td><td>0.03</td><td>0.02</td><td>0.01</td></tr>
<tr><td>$C_L$, kg/ $m^3$</td><td>265</td><td>285</td><td>325</td><td>415</td><td>465</td><td>550</td></tr>
</table></td><td>CO4</td><td>PO4</td><td>12</td></tr>
<tr><td></td><td></td><td>b)</td><td>Derive an equation for terminal settling velocity.</td><td>CO4</td><td>PO4</td><td>08</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>With the help of a neat sketch explain different types of impellers for agitation of liquids along with application.</td><td>CO2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Explain the principle of ribbon blender with its different industrial application.</td><td>CO2</td><td>PO2</td><td>10</td></tr>
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