

Name:

Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**Online End Semester Examination, May 2021**

**Course: Process Technology & Economics**  
**B. Tech: CE+RP**  
**Course Code: CHCE 3032**

**Semester: VI Program**  
**Time: 03 hrs.**  
**Max. Marks: 100**

**SECTION A**

- 1. All questions are compulsory**
- 2. Each question carries 5 marks**
- 3. Assume suitable and necessary data if required and Justify**

|     |  |   |     |
|-----|--|---|-----|
| Q 1 | The Nitrogenous fertilizer with the highest percentage of nitrogen is<br>a. Calcium Nitrate<br>b. Ammonium Sulphate<br>c. Urea<br>d. Ammonium Nitrate  | 5 | CO1 |
| Q 2 | The catalyst used in manufacture of sulfuric acid by contact process is<br>a. Vanadium Pentoxide<br>b. Nickel<br>c. Iron<br>d. Platinum  | 5 | CO1 |
| Q 3 | The operating temperature and pressure in Urea Autoclave is<br>a. 550 <sup>0</sup> C and 1000 atm<br>b. 100 <sup>0</sup> C and 1000 atm<br>c. 185 <sup>0</sup> C and 180 atm<br>d. 25 <sup>0</sup> C and 1 atm | 5 | CO2 |
| Q 4 | The feedstock for catalytic reforming unit is<br>a. Kerosene<br>b. Diesel<br>c. Fuel Oil<br>d. Naptha  | 5 | CO2 |

| Q 5   | For most chemical plants the ratio of working capital to total capital investment varies from<br>a. 1 % - 5%<br>b. 50%-60%<br>c. 90%-95%<br>d. 10%-20%  | 5                                      | CO3             |  |                 |              |               |         |                 |   |      |  |  |
|---|---|--|-----------------|--|-----------------|--------------|---------------|---------|-----------------|---|------|--|--|
| Q 6   | An infinitely lived stream is called<br>a. Perpetuity<br>b. Annuity<br>c. Margin<br>d. Arbitrage  | 5                                      | CO3             |  |                 |              |               |         |                 |   |      |  |  |
| <b>SECTION B</b>  |   |  |                 |  |                 |              |               |         |                 |   |      |  |  |
| <ol style="list-style-type: none"> <li>1. All questions are compulsory</li> <li>2. Each question carries 10 marks</li> <li>3. Assume suitable and necessary data if required and justify</li> </ol> |   |  |                 |  |                 |              |               |         |                 |   |      |  |  |
| Q 7   | Explain different methods for improving the productivity of a chemical plant  | 10                                     | CO1             |  |                 |              |               |         |                 |   |      |  |  |
| Q 8   | Describe the manufacturing process of ethylene oxide with neat flow scheme  | 10                                     | CO2             |  |                 |              |               |         |                 |   |      |  |  |
| Q 9   | A heat exchanger has been designed for use in chemical process. A standard type of heat exchanger with a negligible scrap value costs \$4000 and will have a useful life of 6 years. Another proposed heat exchanger of equivalent design capacity costs \$6800 but will have a useful life of 10 years and a scrap value of \$800. Assuming an effective compound interest rate of 8% per annum, determine which heat exchanger is cheaper by comparing capitalized costs      | 10                                     | CO3             |  |                 |              |               |         |                 |   |      |  |  |
| Q 10  | Estimate by the turnover ratio method, the FCI required for a proposed sulfuric acid plant(battery-limit) which has an annual capacity of $1.3 \times 10^8$ kg/yr of 100 percent sulfuric acid (Contact process), using the given data, when the selling price for the sulfuric acid is \$ 86 per metric ton. The plant will operate 325 days/year. Repeat the calculation, using the cost capacity exponent method by given data<br>Capital cost data for chemical processing: | 10                                     | CO3             |  |                 |              |               |         |                 |   |      |  |  |
|   | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Process/Product</th> <th>Process</th> <th>Size, <math>10^3</math> kg/yr<br/>(<math>10^3</math> ton/yr)</th> <th>FCI, million \$</th> <th>Power factor</th> </tr> </thead> <tbody> <tr> <td>Sulfuric Acid</td> <td>Contact</td> <td><math>9 \times 10^4</math></td> <td>4</td> <td>0.65</td> </tr> </tbody> </table>   | Process/Product                        | Process         | Size, $10^3$ kg/yr<br>( $10^3$ ton/yr) | FCI, million \$ | Power factor | Sulfuric Acid | Contact | $9 \times 10^4$ | 4 | 0.65 |  |  |
| Process/Product   | Process   | Size, $10^3$ kg/yr<br>( $10^3$ ton/yr) | FCI, million \$ | Power factor                           |                 |              |               |         |                 |   |      |  |  |
| Sulfuric Acid   | Contact   | $9 \times 10^4$                        | 4               | 0.65                                   |                 |              |               |         |                 |   |      |  |  |



|  |             |
|--|-------------|
| Land & Premises                          | 125,000,000 |
| NPV of Production Plant                  | 150,000,000 |
| Furniture and fixtures(at Present value) | 8,000,000   |
| Government Bonds                         | 300,000,000 |
| Mortgage Payable                         | 9,000,000   |
| Pre-paid rent                            | 10,000,000  |
| Long Term Debts                          | 50,000,000  |
| Salary Accruals                          | 50,000,000  |
| Crude in Storage                         | 20,000,000  |
| Materials and Supplies                   | 20,000,000  |
| Reserves for contingencies               | 100,000,000 |
| Surplus                                  | 4,000,000   |
| Stock holders Equity                     | 250,000,000 |
| Earnings Employed in business            | 125,000,000 |
| Accounts receivable                      | 57,000,000  |
| Gasoline in Storage                      | 25,000,000  |

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