Code No: M0803/R05 **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, March 2010
CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. What is HAZOP? Explain it by giving a case study in any process industry of your choice. [16]
2. Explain different items under service facilities contributing to fixed capital investment. [16]
3. Explain the modular estimate and unit-operation estimate methods in estimating fixed capital investment. [16]
4. Explain the following:
   (a) Future worth
   (b) Nominal Interest rate
   (c) What will be the total amount available 10 years from now if Rs. 2,00,000 is deposited at the present time with nominal interest at the rate of 10 percent compounded semiannually? [5+5+6]
5. (a) Write about
      i. Tax exemptions for dividends received
      ii. Contributions
      iii. Investment credit
      iv. Capital gains tax
   (b) Write about the major insurance requirements for manufacturing concerns. [8+8]
6. (a) Describe the sum-of-the-years-digits method for determining depreciation, with an example.
   (b) The total value of a new plant is Rs. 2,000,000. A certificate of necessity has been obtained permitting a write-off of 60% of the initial value in 5 years. The balance of the plant requires a write-off period of 15 years. Using the straight line method and assuming negligible salvage and crap value, determine the total depreciation cost during the first year. [8+8]
7. A company must purchase one reactor to be used in an overall operation. Four reactors have been designed, all of which are equally capable of giving the requires service. The following data apply to the four designs:

	Design 1	Design 2	Design 3	Design 4
Fixed-capital investment	Rs.10,000	Rs.12,000	Rs.14,000	Rs.16,000
Sum of operating and fixed costs per year (all other costs are constant)	3,000	2,800	2,350	2,100

If the company demands a 15% return on any unnecessary investment, which of the four designs should be accepted? [16]

8. (a) What is optimum economic design? Illustrate the principles of an optimum economic design by means of an example.

   (b) Describe the general procedure for optimizing a single variable, both analytically and graphically. [8+8]

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Code No: M0803/R05 **Set No. 2**

IV B.Tech I Semester Supplementary Examinations, March 2010
CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Discuss the maintenance of accounting records. [16]
2. Explain the factors affecting Investment and production costs. [16]
3. A plant operating at 100% capacity has a net profit of Rs. 40,000 with a 38% profit tax:
   (a) If the fixed costs are Rs. 1,10,000 and variable costs are 61% of the net sales. What is the break-even point? And
   (b) If the variable costs are increased 10% per unit at operations above 100% capacity, what is the net profit for sales at 120% of capacity? [8+8]
4. (a) Interest effects in a small business
   (b) Explain time value of money
   (c) Interest in a large business. [6+5+5]
5. (a) Give the three different types of classification of taxes and discuss about them in detail.
   (b) Explain
      i. Carry-back and carry-forward of losses
      ii. Excess profits tax
      iii. Capital gains tax. [10+6]
6. (a) Distinguish between book value, market value and replacement value.
   (b) The original investment for an asset was Rs. 10,000, and the asset was assumed to have a service life of 12 years with Rs. 2,000 salvage value at the end of service life. After the asset has been in use for 5 years, the remaining service life and final salvage value are reestimated at 10 years and Rs. 1000, respectively. Under these conditions, what is depreciation cost during the sixth year of the total life if straight line depreciation is used? [6+10]
7. A company has three alternative investments which are being considered. Because all three investments are of the same type of unit and yield the same service, only one of the investments can be accepted. The risk factors are the same for all three cases. Company policies, based on the current economic situation dictate that a minimum annual return on the original investment of 15% after taxes must be predicted for any unnecessary investment with interest on investment not included

as a cost. (This may be assumed to mean that other equally sound investments yielding a 15% return after taxes are available) Company policies also dictate that, where applicable, straight-line depreciation is used and, for time value of money interpretations, end-of-year cost and profit analysis is used. Land value and pre-startup costs can be ignored.
Given the following data, determine which investment, if any, should be made by alternative-analysis profitability-evaluation method of discounted cash flow.

In-vest-ment num -ber	Total initial fixed -capital . - investment, Rs.	Working capital investment, Rs.	Salvage value at end of service life, Rs.	Service life, years	Annual cash flow to project after taxes, Rs.	Annual cash expenses (constant for each year), Rs.
1	100,000	10,000	10,000	5	See yearly tabulation*	44,000
2	170,000	10,000	15,000	7	52,000 (constant)	28,000
3	210,000	15,000	20,000	8	59,000 (constant)	21,000

*For investment number 1, variable annual cash flow to project is:
year 1 = Rs. 30,000, year 2 = Rs. 31,000, year 3 = Rs. 36,000, year 4 = Rs.40,000, year 5 = Rs. 43,000. [4+12] *For investment number 1, variable annual cash flow to project is: year 1 = Rs. 30,000, year 2 = Rs. 31,000, year 3 = Rs. 36,000, year 4 = Rs.40,000, year 5 = Rs. 43,000. [4+12]

8. Solve graphically:
The objective function is to maximize $3x_1 + 4x_2$ subject to the linear constraints o
$2x_1 + 5x_2 \leq 10$
$4x_1 + 3x_2 \leq 10$
$x_1 \geq 0, x_2 \geq 0.$ [16]

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Code No: M0803/R05 **Set No. 3**

IV B.Tech I Semester Supplementary Examinations, March 2010
CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Compare the advantages and disadvantages of different types of heat exchangers used in chemical process industries. [16]

2. Write about the following:
   (a) Cost index
   (b) Engineering news - record construction cost index
   (c) Chemical Engineering plant cost index. [5+5+6]

3. Describe the total manufacturing costs. [16]

4. (a) Interest effects in a small business
   (b) Explain time value of money
   (c) Interest in a large business. [6+5+5]

5. (a) Give the three different types of classification of taxes and discuss about them in detail.
   (b) Explain
      i. Carry-back and carry-forward of losses
      ii. Excess profits tax
      iii. Capital gains tax. [10+6]

6. (a) Distinguish between book value, market value and replacement value.
   (b) The original investment for an asset was Rs. 10,000, and the asset was assumed to have a service life of 12 years with Rs. 2,000 salvage value at the end of service life. After the asset has been in use for 5 years, the remaining service life and final salvage value are reestimated at 10 years and Rs. 1000, respectively. Under these conditions, what is depreciation cost during the sixth year of the total life if straight line depreciation is used? [6+10]

7. (a) Discuss about capitalized costs method for determining profitability.
   (b) A company has three alternative investments which are being considered. Because all three investments are of the same type of unit and yield the same service, only one of the investments can be accepted. The risk factors are the same for all three cases. Company policies, based on the current economic situation dictate that a minimum annual return on the original investment of 15% after taxes must be predicted for any unnecessary investment with

interest on investment not included as a cost. (This may be assumed to mean that other equally sound investments yielding a 15% return after taxes are available) Company policies also dictate that, where applicable, straight-line depreciation is used and, for time value of money interpretations, end-of-year cost and profit analysis is used. Land value and pre-startup costs can be ignored.
Given the following data, determine which investment, if any, should be made by alternative-analysis profitability-evaluation method of capitalized costs.

In-vest-ment num -ber	Total initial fixed -capital . - investment, Rs.	Working capital investment, Rs.	Salvage value at end of service life, Rs.	Service life, years	Annual cash flow to project after taxes, Rs.	Annual cash expenses (constant for each year), Rs.
1	100,000	10,000	10,000	5	See yearly tabulation*	44,000
2	170,000	10,000	15,000	7	52,000 (constant)	28,000
3	210,000	15,000	20,000	8	59,000 (constant)	21,000

*For investment number 1, variable annual cash flow to project is:
year 1 = Rs. 30,000, year 2 = Rs. 31,000, year 3 = Rs. 36,000, year 4 = Rs.40,000, year 5 = Rs. 43,000. [4+12]

8. Discuss the following:

   (a) Generalization of strategy for linear programming.

   (b) Solution of simultaneous equations using a slack variable. [8+8]

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Code No: M0803/R05 **Set No. 4**

IV B.Tech I Semester Supplementary Examinations, March 2010
CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the different stages in the plant design? [16]
2. What are the utilites? Explain their role in chemical processing and what category the cost of utilities to be included? [16]
3. Discuss the following:
   (a) Depreciation
   (b) Plant overhead costs
   (c) Administrative costs
   (d) Distribution and marketing costs. [4+4+4+4]
4. Explain the following:
   (a) Simple interest
   (b) Compound interest
   (c) Nominal and effective interest rates. [16]
5. Self insurance is being considered for one portion of a chemical company. The fixed-capital investment involved is Rs. 2,50,000, and insurance costs for complete protection would amount to Rs. 2,000 per year. If self insurance is used, a reserve fund will be set up under the companys jurisdiction, and annual insurance premiums of Rs. 1,500 would be deposited in this fund under an ordinary annuity plan. All money in the fund can be assumed to earn interest at a compound annual rate of 5%. Neglecting any charges connected with administration of the fund, how much money would be deposited in the fund at the beginning of he program in order to have enough money accumulated to replace a complete Rs. 2,50,000 loss after 10 years. [16]
6. (a) Derive the expression for the asset value by the sinking fund method. Compare the salient features of sinking fund method with straight line method for determining depreciation.
   (b) The original cost of a property is Rs. 30,000, and it is depreciated by a 6% sinking fund method. What is the annual depreciation charge if the book value of the property after 10 years is the same as if it had been depreciated at Rs. 2,500 per year by the straight line method? [8+8]
7. (a) Explain rate of return on investment for profitability analysis.

(b) An investigation of a proposed investment has been made. The following result has been presented to management: The minimum payout period based on capital recovery using a minimum annual return of 10% as a fictitious expense is 10 years; annual depreciation costs amount to 8% of the total investment. Using this information, determine the standard rate of return on the investment. [6+10]

8. (a) Discuss about the intangible and practical considerations in optimum design.

(b) Describe the general procedure for optimizing a single variable, both analytically and graphically. [8+8]

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