Code No: 07A70802 **R07** **Set No. 2**

**IV B.Tech I Semester Examinations,November 2010**
**CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS**
**Chemical Engineering**

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

**Answer any FIVE Questions**
**All Questions carry equal marks**

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Define:
   i. Normal tax
   ii. Surtax
   iii. Capital gains tax
   iv. Excess profits tax.
   (b) Discuss in detail about the legal responsibilities of a concern with regard to accident and emergencies. [8+8]

2. Describe the total manufacturing costs. [16]

3. What is HAZOP? Explain it by giving a case study in any process industry of your choice. [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 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]

6. Discuss the following:
   (a) Generalization of strategy for linear programming.
   (b) Solution of simultaneous equations using a slack variable. [8+8]

7. (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]

8. Discuss briefly the various methods that can be employed for estimating capital investment. [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A70802 **R07** **Set No. 4**

**IV B.Tech I Semester Examinations,November 2010**
**CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS**
**Chemical Engineering**

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

**Answer any FIVE Questions**
**All Questions carry equal marks**

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Interest effects in a small business
   (b) Explain time value of money
   (c) Interest in a large business. [6+5+5]
2. Give an account of the following methods used for profitability evaluation
   (a) Rate of return on investment
   (b) Discounted cash flow
   (c) Net present worth
   (d) Capitalized cost. [4+4+4+4]
3. In order to make it worthwhile to purchase a new piece of equipment, the annual depreciation costs for the equipment cannot exceed Rs. 3000 at any time. The original cost of the equipment is Rs. 30,000, and it has zero salvage and scrap value. Determine the length of service life necessary if the equipment is depreciated
   (a) by the sum-of-the-years-digits method, and
   (b) by the straight-line method. [8+8]
4. (a) Discuss about optimizing semi-continuous cyclic operations with particular reference to scale formation in evaporation and determining the cycle time for maximum amount of heat transfer.
   (b) In continuation of part (a) obtain the cycle time for minimum cost per unit of heat transfer. [8+8]
5. How is process design important? Briefly explain the steps taken to accomplish it. [16]
6. Explain the following costs:
   (a) Utilities
   (b) Maintenance and repairs
   (c) Operating supplies
   (d) Laboratory charges. [4+4+4+4]

7. 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]

8. The purchased cost of a shell-and-tube heat exchanger (floating head and carbon-steel tubes) with 100 $ft^2$ of heating surface was Rs. 1,50,000 in 1990. What will be the purchase cost of a similar heat exchanger with 200 $ft^2$ of heating surface in 1990 if the purchased-cost-capacity exponent is 0.60 for surface area ranging from 100 to 400 $ft^2$? If the purchased-cost-capacity exponent for this type of exchanger is 0.81 for surface areas ranging from 400 to 2000 $ft^2$, what will be the purchased cost of a heat exchanger with 1000 $ft^2$ of heating surface in 1995? [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A70802 **R07** **Set No. 1**

**IV B.Tech I Semester Examinations,November 2010**
**CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS**
**Chemical Engineering**

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

**Answer any FIVE Questions**
**All Questions carry equal marks**

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Describe the general procedure for optimizing two independent variables both analytically and graphically.
   (b) Discuss about the intangible and practical considerations in optimum design. [8+8]

2. (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]

3. A filtration unit cost Rs. 20,000 with a life of 5 years and having a salvage value of Rs. 2,000 requires Rs. 500 a year for maintenance and operation. Money is worth 15 percent:
   (a) What are the present and future worth of the service rendered by the unit?
   (b) What is the capitalized cost for this service assuming perpetual operation? [8+8]

4. (a) Compare batch and continuous operation.
   (b) Compare materials of construction with homogeneous metal or alloy with glass lined equipment. [8+8]

5. (a) Discuss in detail about the textbook declining-balance method. Compare with straight line method.
   (b) A property has an initial value of Rs. 50,000, service life of 20 years, and final salvage value of Rs. 4000. It has been proposed to depreciate the property by the textbook declining-balance method. Would this method be acceptable for income tax purposes if the income tax laws do not permit annual depreciation rates greater than twice the minimum annual rate with the straight line method? [8+8]

6. Describe cost factors in capital investment. Give some typical percentages of fixed - capital investment values for cost segments. [16]

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 rate of return on initial investment.

| 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. Explain the following:

(a) Patents and royalties

(b) Copy rights

(c) Insurance

(d) Local taxes. [4+4+4+4]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A70802 **R07** **Set No. 3**

**IV B.Tech I Semester Examinations,November 2010**
**CHEMICAL ENGINEERING PLANT DESIGN AND ECONOMICS**
**Chemical Engineering**

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

**Answer any FIVE Questions**
**All Questions carry equal marks**

⋆ ⋆ ⋆ ⋆ ⋆

1. A new piece of completely installed equipment costs Rs.15,00,000 and will have a scrap value of Rs. 5,00,000 at the end of its useful life. If the useful-life period is 10 years and the interest is compounded at 6 percent per year, what is the capitalized cost of the equipment? [16]

2. (a) Describe the general procedure for optimizing two independent variables both analytically and graphically.
   (b) The following equation shows the effect of he variables x and y on the total cost for a particular operation:
   $C_T = 2.33x + \frac{11,900}{xy} + 1.86y + 10$
   Determine the values of and which will give the least total cost analytically. [8+8]

3. (a) Why are taxes levied? Discuss about property taxes, excise taxes and income taxes.
   (b) Discuss about self insurance in detail. [10+6]

4. The total capital investment for a chemical plant is Rs. 15,00,000, and the working capital is Rs 2,00,000. If the plant can produce an average of 8000 kg of final product per day during a 365-day year, what selling price in Rupees per kilogram of product would be necessary to give a turnover ratio of 1.0? [16]

5. (a) Explain various types of depreciation.
   (b) An asset with an original cost of Rs. 10,000 and no salvage value has a depreciation charge of Rs. 2381 during its second year of service when depreciated by the sum-of-the-years-digits method. What is its expected useful life?[8+8]

6. (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]

7. What are the variable production cost? Explain in detail the cost of raw meterial. [16]

8. What are the factors considered in the design of a process? Explain any one of them in detail. [16]

⋆ ⋆ ⋆ ⋆ ⋆