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Course: B. Tech in Petrochemical Engineering

Sem: VI

Subject Name: Process Economics and Project Management

Subject Code: BTCHC603

Question Bank (For reference only)

Q.1.	Write a note on Property tax.	2 M
Q.2.	Write a note on Excise tax.	2 M
Q.3.	Write a note on Income tax.	2 M
Q.4.	With the Federal income-tax regulations in effect in 1988, the graduated tax rate was phased out for gross earnings above \$100,000 by increasing taxes for gross earnings above \$100,000 by the lesser of 5 percent of the gross earnings in excess of \$100,000 per year or \$11,750 (with effect from Federal Income Tax 1988). Show that this results in a flat, overall tax rate of 34 percent for all cases of annual gross earnings exceeding \$335,000.	3 M
Q.5.	Define the following: 1. Obsolescence 2. Book value 3. Depreciation 4. Depletion etc.	1 M each
Q.6.	The original value of a piece of equipment is \$22,000, completely installed and ready for use. Its salvage value is estimated to be \$2000 at the end of a service life estimated to be 10 years. Determine the asset (or book) value of the equipment at the end of 5 years using: (a) Straight-line method. (b) Textbook declining-balance method. (c) Double declining-balance method (i.e., the declining-balance method using a fixed-percentage factor giving a depreciation rate equivalent to twice the minimum rate with the straight-line method)	2 M for each method
Q.7.	A proposed manufacturing plant requires an initial fixed-capital investment of \$900,000 and \$100,000 of working capital. It is estimated that the annual income will be \$800,000 and the annual expenses including depreciation will be \$520,000 before income taxes. A minimum annual return of 15 percent before income taxes is required before the investment will be worthwhile. Income taxes amount to 34 percent of all pre-tax profits. Determine the annual percent return on the average investment before income taxes assuming straight-line depreciation and zero salvage value.	2 M
Q.8.	Original value for a piece of equipment is \$22000, completely installed & ready for use. Its salvage value is estimated to be \$2000 at the end of the service life estimated to be 10 years. Determine the asset value of the equipment at the end of the fifth year using textbook declining balance method.	2M

Q.9.	An asset with an original amount of \$10000 & no salvage value, has a depreciation charge of \$2381 during its second year of service when depreciated by sum of the year digit method. What is its expected service life?	3M														
Q.10.	Explain the following method for determining profitability. 1. Rate of return on investment 2. Discounted cash flow based on full-life performance 3. Net present worth 4. Capitalized costs 5. Payout period	2 or 3 M each														
Q.11.	A proposed manufacturing plant requires an initial fixed-capital investment of \$900,000 and \$100,000 of working capital. It is estimated that the annual income will be \$800,000 and the annual expenses including depreciation will be \$520,000 before income taxes. A minimum annual return of 15 percent before income taxes is required before the investment will be worthwhile. Income taxes amount to 34 percent of all pre-tax profits. Determine the following: (a) The annual percent return on the total initial investment before income taxes. (b) The annual percent return on the total initial investment after income taxes. (c) The annual percent return on the total initial investment before income taxes based on capital recovery with minimum profit. (d) The annual percent return on the average investment before income taxes assuming straight-line depreciation and zero salvage value.	2 or 3 M each														
Q.12.	Define capitalized cost & give the formula to calculate it.	2M														
Q.13.	Define payout period.	1M														
Q.14.	A proposed chemical plant will require a fixed-capital investment of \$10 million. It is estimated that the working capital will amount to 25 percent of the total investment, and annual depreciation costs are estimated to be 10 percent of the fixed-capital investment. If the annual profit will be \$3 million, determine the standard percent return on the total investment and the minimum payout period.	4 M														
Q.15.	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 required service. The following data apply to the four designs:	4 M														
<table border="1"> <thead> <tr> <th></th> <th>Design 1</th> <th>Design 2</th> <th>Design 3</th> <th>Design 4</th> </tr> </thead> <tbody> <tr> <td>Fixed-capital investment</td> <td>\$10,000</td> <td>\$12,000</td> <td>\$14,000</td> <td>\$16,000</td> </tr> <tr> <td>Sum of operating and fixed costs per year (all other costs are constant)</td> <td>3,000</td> <td>2,800</td> <td>2,350</td> <td>2,100</td> </tr> </tbody> </table> <p>If the company demands a 15 percent return on any unnecessary investment, which of the four designs should be accepted?</p>			Design 1	Design 2	Design 3	Design 4	Fixed-capital investment	\$10,000	\$12,000	\$14,000	\$16,000	Sum of operating and fixed costs per year (all other costs are constant)	3,000	2,800	2,350	2,100
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Q.16.	Write a note on alternative investment.	3 M																
Q.17.	Define the following: 1. Working capital investment 2. Fixed capital investment 3. Total capital investment 4. Salvage value etc.	1 M each																
Q.18.	What is breakeven point? Explain with the help of diagram.	3 M																
Q.19.	Enlist the methods of capital cost estimates.	2 M																
Q.20.	Draw neat and completely labelled tree diagram showing cash flow for industrial operations.	3 M																
Q.21.	Define cumulative cash position.	1 M																
Q.22.	Write down a brief note on source of capital.	2 M																
Q.23.	Explain the factors affecting investment & production costs.	1 M for each																
Q.24.	Enlist the types of capital cost estimates.	2 M																
Q.25.	The purchased cost of a 50-gal glass-lined, jacketed reactor (without drive) was \$8350 in 1981. Estimate the purchased cost of a similar 300-gal, glass-lined, jacketed reactor (without drive) in 1986. The cost capacity exponent is 0.54.	2 M																
Q.26.	Prepare a study estimate of the fixed capital investment for the process plant, if the delivered equipment cost is \$200000. Direct costs are given as a percentage of delivered equipment cost. For direct cost components, use table given below. Also find out total direct cost.	4 M																
	<table border="1"> <thead> <tr> <th>Direct Costs</th> <th>% of delivered equipment cost</th> </tr> </thead> <tbody> <tr> <td>Purchased Equipment installation</td> <td>39</td> </tr> <tr> <td>Instrumentation (installed)</td> <td>43</td> </tr> <tr> <td>Piping (installed)</td> <td>31</td> </tr> <tr> <td>Electrical (installed)</td> <td>10</td> </tr> <tr> <td>Buildings (including services)</td> <td>15</td> </tr> <tr> <td>Yard Improvements</td> <td>12</td> </tr> <tr> <td>Service facilities</td> <td>55</td> </tr> </tbody> </table>	Direct Costs	% of delivered equipment cost	Purchased Equipment installation	39	Instrumentation (installed)	43	Piping (installed)	31	Electrical (installed)	10	Buildings (including services)	15	Yard Improvements	12	Service facilities	55	
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Q.27.	Calculate the cost of a vacuum filter which is 10 m long, 4 m diameter in 1985, if the cost of	3 M																

	a similar filter was Rs. 50,000 / 150m ² of peripheral area in 1976. Cost index in 1976 was 151 & in 1985 is 182.	
Q.28.	<p>With total yearly payments of \$10,000 for 10 years, find the compound amount accumulated at the end of 10 years if the payments are</p> <ol style="list-style-type: none"> 1. At the end of the year 2. Weekly, and 3. Continuous. <p>The effective annual interest rate is 8% and the payments are uniform. Also determine the present worth at time zero for payment at the end of each year.</p>	5 M
Q.29.	A new storage tank can be purchased and installed for \$10,000. The estimated service life of this tank is 10 years. It has been proposed that an available tank with the capacity equivalent to the new tank can be used instead of buying the new tank. If the latter tank were repaired, it would have a service life of 3 years before similar repairs would be needed again. Neither of the tanks has any scrap value. Money is worth 6% compounded annually. On the basis of equal capitalized costs for the two tanks, how much can be spent for repairing the existing tank?	3 M
Q.30.	Give the formulas to calculate future sum accumulated by simple interest & compound interest.	2 M
Q.31.	Give the formula for ordinary & exact simple interest.	2 M
Q.32.	Define nominal & effective interest rate.	2 M
Q.33.	<p>It is desired to borrow \$1000 to meet a financial obligation. This money can be borrowed from a loan agency at a monthly interest rate of 2 percent. Determine the following:</p> <ol style="list-style-type: none"> (a) The total amount of principal plus simple interest due after 2 years if no intermediate payments are made. (b) The total amount of principal plus compounded interest due after 2 years if no intermediate payments are made. (c) The nominal interest rate when the interest is compounded monthly. (d) The effective interest rate when the interest is compounded monthly. 	8 M
Q.34.	<p>A bond has a maturity value of \$1000 and is paying discrete compound interest at an effective annual rate of 3 percent. Determine the following at a time four years before the bond reaches maturity value:</p> <ol style="list-style-type: none"> (a) Present worth. (b) Discount. (c) Discrete compound rate of effective interest which will be received by a purchaser if the bond were obtained for \$700. (d) Repeat part (a) for the case where the nominal bond interest is 3 percent compounded continuously 	4 M

Q.35.	Define annuity & enlist types of annuity.	2 M
Q.36.	A piece of equipment has an initial installed value of \$12,000. It is estimated that its useful life period will be 10 years and its scrap value at the end of the useful life will be \$2000. The depreciation will be charged as a amount by making equal charges each year, the first payment being made at the end of the first year. The depreciation fund will be accumulated at an annual interest rate of 6 percent. At the end of the life period, enough money must have been accumulated to account for the decrease in equipment value. Determine the yearly cost due to depreciation under these conditions.	2 M
Q.37.	Give the formula for compounding factor & discounting factor.	2 M
Q.38.	What is the use of capitalized cost method?	2 M
Q.39.	What is an optimum design?	2 M
Q.40.	Give the general procedure to determine optimum condition for single variable optimization.	4 M
Q.41.	Give the general procedure to determine optimum condition for two variable optimization.	4 M
Q.42.	Determine the optimum thickness of insulation for a given steam-pipe installation by analytical as well as graphical method.	4 M
Q.43.	<p>The following equation shows the effect of the variables x and y on the total cost for a particular operation:</p> $C_T = 2.33x + \frac{11,900}{xy} + 1.86y + 10$ <p>Determine the values of x and y which will give the least total cost.</p>	4 M
Q.44.	Compare the graphical and analytical method for finding optimum conditions.	3 M
Q.45.	Draw the breakeven point chart for operating production plant & explain it.	4 M
Q.46.	<p>A plant produces refrigerators at the rate of P units per day. The variable costs per refrigerator have been found to be $\\$47.73 + 0.1 P^{1.2}$. The total daily fixed charges are \$1750, and all other expenses are constant at \$7325 per day. If the selling price per refrigerator is \$173, determine:</p> <p>(a) The daily profit at a production schedule giving the minimum cost per refrigerator. (b) The daily profit at a production schedule giving the maximum daily profit. (c) The production schedule at the break-even point</p>	6 M
Q.47.	Write a note on optimum conditions in cyclic operations.	3 M

Q.48.	<p>An organic chemical is being produced by a batch operation in which no product is obtained until the batch is finished. Each cycle consists of the operating time necessary to complete the reaction plus a total time of 1.4 h for discharging and charging. The operating time per cycle is equal to $1.5P_b^{0.25}$ h, where P_b is the kilograms of product produced per batch. The operating costs during the operating period are \$20 per hour, and the costs during the discharge-charge period are \$15 per hour. The annual fixed costs for the equipment vary with the size of the batch as follows:</p> $C_F = 340P_b^{0.8} \text{ dollars per batch}$ <p>Inventory and storage charges may be neglected. If necessary, the plant can be operated 24 h per day for 300 days per year. The annual production is 1 million kg of product. At this capacity, raw-material and miscellaneous costs, other than those already mentioned, amount to \$260,000 per year. Determine the cycle time for conditions of minimum total cost per year.</p>	8 M
Q.49.	Write a note on perpetuities & capitalized costs.	3 M
Q.50.	A new piece of completely installed equipment costs \$12,000 and will have a scrap value of \$2000 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?	2 M
Q.51.	A reactor, which will contain corrosive liquids, has been designed. If the reactor is made of mild steel, the initial installed cost will be \$5000, and the useful-life period will be 3 years. Since stainless steel is highly resistant to the corrosive action of the liquids, stainless steel, as the material of construction, has been proposed as an alternative to mild steel. The stainless-steel reactor would have an initial installed cost of \$15,000. The scrap value at the end of the useful life would be zero for either type of reactor, and both could be replaced at a cost equal to the original price. On the basis of equal capitalized costs for both types of reactors, what should be the useful-life period for the stainless-steel reactor if money is worth 6 percent compounded annually?	4 M
Q.52.	A new storage tank can be purchased and installed for \$10,000. This tank would last for 10 years. A worn-out storage tank of capacity equivalent to the new tank is available, and it has been proposed to repair the old tank instead of buying the new tank. If the tank were repaired, it would have a useful life of 3 years before the same type of repairs would be needed again. Neither tank has any scrap value. Money is worth 9 percent compounded annually. On the basis of equal capitalized costs for the two tanks, how much can be spent for repairing the existing tank?	3 M
Q.53.	Explain turnover ratio method for estimating capital investment.	3 M
Q.54.	The purchased cost of a shell-and-tube heat exchanger (floating head and carbon-steel tubes) with 100 ft ² of heating surface was \$3000 in 1980. What will be the purchased cost of a similar heat exchanger with 200 ft ² of heating surface in 1980 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	3 M

	surface in 1985?	
Q.55.	The purchased and installation costs of some pieces of equipment are given as a function of weight rather than capacity. An example of this is the installed costs of large tanks. The 1980 cost for an installed aluminium tank weighing 100,000 lb was \$390,000. For a size range from 200,000 to 1,000,000 lb, the installed cost-weight exponent for aluminium tanks is 0.93. If an aluminium tank weighing 700,000 lb is required, what is the present capital investment needed?	3 M
Q.56.	Write a note on interest effect in large businesses.	2 M
Q.57.	Write a note on concept of a project.	2 M
Q.58.	Explain characteristics of a project.	3 M
Q.59.	Give a descriptive note on categories of project.	4 M
Q.60.	Explain various project lifecycle phases.	10 M
Q.61.	Explain the steps in project management.	4 M
Q.62.	What are the roles and responsibilities of a project manager?	6 M
Q.63.	Write a note on project managers authority.	6 M
Q.64.	Give the block diagram of matrix organization.	3 M
Q.65.	What is a hammock?	2 M
Q.66.	What are the advantages of CPM?	4 M
Q.67.	Problem on CPM network	6 M
Q.68.	Explain Precedence diagram method in detail.	4 M
Q.69.	Explain different types of constraints in Precedence diagram method (PDM).	4 M
Q.70.	What is the significance of float?	3 M
Q.71.	For particular equipment, the cost price is \$10,000 & selling price is \$15,000. The government tax amount is 25%. The depreciation charges are \$1000. Calculate: 1. Gross profit before taxes 2. Gross profit after taxes 3. Net profit before taxes 4. Net profit after taxes	4M
Q.72.	An asset is having total capital investment of \$18,000 & Working capital investment is \$3575. Calculate its fixed capital investment.	2M
Q.73.	The cost of a blower in 1980 is Rs.10,000. What is the cost of the blower in 1980 with double the capacity?	2M

Q.74.	Estimate the percentage increase in purchased cost when the capacity of equipment is doubled.	3M
Q.75.	The purchased cost of a shell-and-tube heat exchanger (floating head and carbon-steel tubes) with 100 ft^2 of heating surface was \$3000 in 1980. What will be the purchased cost of a similar heat exchanger with 200 ft^2 of heating surface in 1980 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 1985?	5M
Q.76.	What will be the total amount available 10 years from now if \$2000 is deposited at the present time with nominal interest at the rate of 6 percent compounded semiannually?	3M
Q.77.	A cash flow of Rs. 12000/year is received at the end of each year (uniform periodic payment) for seven consecutive years. The rate of interest is 9% per year compounded annually. The present worth of such cash flow at time zero is?	2M
Q.78.	<p>A plant is being designed in which 450,000 lb per 24-h day of a water-caustic soda liquor containing 5 percent by weight caustic soda must be concentrated to 40 percent by weight. A single-effect or multiple-effect evaporator will be used, and a single-effect evaporator of the required capacity requires an initial investment of \$18,000. This same investment is required for each additional effect. The service life is estimated to be 10 years, and the salvage value of each effect at the end of the service life is estimated to be \$6000. Fixed charges minus depreciation amount to 20 percent yearly, based on the initial investment. Steam costs \$0.60 per 1000 lb, and administration, labor, and miscellaneous costs are \$40 per day, no matter how many evaporator effects are used.</p> <p>Where X is the number of evaporator effects, $0.9X$ equals the number of pounds of water evaporated per pound of steam. There are 300 operating days per year. If the minimum acceptable return on any investment is 15 percent, how many effects should be used?</p>	12M
Q.79.	<p>The facilities of an existing chemical company must be increased if the company is to continue in operation. There are two alternatives. One of the alternatives is to expand the present plant. If this is done, the expansion would cost \$130,000. Additional labor costs would be \$150,000 per year, while additional costs for overhead, depreciation, taxes, and insurance would be \$60,000 per year.</p> <p>A second alternative requires construction and operation of new facilities at a location about 50 miles from the present plant. This alternative is attractive because cheaper labor is available at this location. The new facilities would cost \$200,000. Labor costs would be \$120,000 per year. Overhead costs would be \$70,000 per year. Annual insurance and taxes would amount to 2 percent of the initial cost. All other costs except depreciation would be the same at each location. If the minimum return on any acceptable investment is 9 percent, determine the minimum service life allowable for the facilities at the distant location for this alternative to meet the required incremental return. The salvage value should be assumed to be zero, and straight-line depreciation accounting may be used.</p>	6M

Q.80.

8M

A heat exchanger has been designed and insulation is being considered for the unit. The insulation can be obtained in thickness of 1, 2, 3, or 4 in. The following data have been determined for the different insulation thicknesses:

	1 in.	2 in.	3 in.	4 in.
Btu/h saved	300,000	350,000	370,000	380,000
Cost for installed insulation	\$1200	\$1600	\$1800	\$1870
Annual fixed charges	10%	10%	10%	10%

What thickness of insulation should be used? The value of heat is 30 cents/1,000,000 Btu. An annual return of 15 percent on the fixed-capital investment is required for any capital put into this type of investment. The exchanger operates 300 days per year.