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VII SEMESTER B.TECH. (BIOTECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: PROCESS ENGINEERING ECONOMICS AND OPTIMIZATION [BIO 403]

REVISED CREDIT SYSTEM
(2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A.	A bond with a face value of Rs 5000 pays 14% interest semiannually. The bond matures after 12 years. How much can be paid for the purchase of the above bond if the purchaser is satisfied with 9% interest compounded semiannually.	**3**
1B.	A pharma company manufacturing antibiotics wants to increase its efficiency, from 70% to 90%. Explain the various techniques that can be adopted to increase its economic efficiency.	**4**
1C.	A biochemical process requires 500 units per year costing Rs 102/unit. The same service can be provided by an equipment costing Rs 100000 with salvage value of Rs 25000 at the end of 10 years. Annual operating expense is Rs 5500 plus Rs 31 per unit. What will be the rate of return on investment.	**3**
2A.	The following details of two lease options are available to start a bioprocessing industry. (a)Determine which lease option should be selected on the basis of Present worth method of comparison, if the rate of return is 14% per year (b) If a study period of 5 years is used and the returns are not expected to change which location should be selected.(c) Which location should be selected over a 6 year study period if the return at location B is estimated to be Rs 60000 after 6 years.	**6**
2B.	A person is considering giving an endowment to a university in order to provide 6000, 5000, 4000, 3000 respectively at the end of 1st, 2nd, 3rd,4th quarter during a year. If the interest rate is 8% compounded quarterly, what is the capitalized equivalent that must be deposited now so that the quarterly payments can be repeated forever.	**2**
2C.	The use of special equipment costing Rs 48000 having a life of 8 years and a salvage value of Rs 8000 will permit the elimination of one operator/shift of 8 hrs by converting a batch operation to a continuous operation at a labor cost of Rs 1.80/hr and 300 days a year. What interest rate is earned.	**2**
3A.	A proposed biotech industry has an estimated total capital investment of 1000000 of which 100000 for land and 700000 is for fixed and other physical property subject to depreciation. Profit taxes are	**4**

	Location A	Location B
First cost, Rs	1500000	1800000
Annual lease cost, Rs	350000	310000
Return, Rs	100000	200000
Lease term. yr	6	9

	to be neglected. (a)If the stockholders require 15% interest rate on their money for 10 year period what must be the first year profit before deducting sinking fund depreciation charge at 15% (b) What is the second year depreciation charge and required profit (c) What are the annual depreciation charges for each of the 10 years by SLD and SFD.	
3B.	A luminometer having a negligible salvage value is estimated to have a service life of 10 years. The original cost was Rs 40000. Determine (i) Depreciation charge for 5^{th} year if double declining balance method was used.(ii) percentage original investment paid off in the first half of service life using double declining balance method. (iii) percentage original investment paid off in the first half of service life using sum of years digits method.	**4**
3C.	Differentiate between depletion and depreciation.	**2**
4A.	A bioprocessing industry making 2000 tons/year of a product selling for Rs 1.60 per kg has annual direct production cost of 2 million at 100% capacity and other fixed charges Rs 700000. What is the fixed cost per kg at breakeven point? If the selling price of the product is increased by 10% what is the increase in profit at full capacity if income tax rate is 38% of gross earnings.	**3**
4B.	Explain the variations of breakeven point with respect to the costs with examples.	**3**
4C.	The cost of a jet-powered airplane varies as three halves (3/2) power of its velocity; specifically, $Co = knv^{3/2}$ where n is the trip length in miles, k is the constant of proportionality, and v is the velocity in miles per hour. It is known that at 400 miles per hour the average cost of operation is Rs 300 per mile. The company that owns the aircraft wants to minimize the cost of operation, but that cost must be balanced against the cost of passenger's time (CC) which has been set as Rs 300000 per hour. (a) At what velocity should the trip be planned to minimize the total cost which is the sum of cost of operating the airplane and the cost of passenger's time. (b) How do you know that your answer for the problem in (a) minimizes the total cost.	**4**
5A.	Create and complete a network diagram to represent the following project: (a) Activities A (4 days) and B (5 days) can start simultaneously (b) Activities C (4 days) can begin once activities A and B are complete (c) Activities D (3 days) can begin once activity B is complete (d) Activity E (1 day) ends the project and can begin once activities C and D are complete. Find the critical path for the network, the earliest finish time and the latest finish time.	**4**
5B.	A certain type of rotary kiln costs 12000 for a peripheral area of $400m^2$ with a production rate of 1kg/hr for each m^2 of peripheral area. Service life is 15 years and SLD may be used neglecting salvage value with a fixed cost being 5 times the depreciation charge. If the variable costs for this operation at 100% capacity are Rs 0.024/kg of product what are the comparative costs/unit of product based on 6000 operating hour/year (a) for a production of 800kg/hr of product at 100% capacity factor and (b) when operating a larger kiln at the same average product rate but at 80% with variable costs being Rs 0.03/kg at this production rate?	**6**
6A.	An Item has a yearly demand of 10000 units. There is process X and Y with which the product can be manufactured or can be purchased. The fixed cost per year and variable cost per unit with process X is 100000 Rs and 75 Rs respectively. Similarly the fixed cost per year and variable cost per unit with process Y is 300000 Rs and 70 Rs respectively. Purchase price per unit is Rs 80. (a) Decide whether to produce the product with process X or Y or to buy. (b) At what annual volume should the company switch from buying to manufacturing the product using process X. (c) At what annual volume should the company switch from process X to Y.	**3**
6B.	A biochemical processing unit has a capacity of producing 1 million kg of product per year. After the unit has been put into operation it is found that only 500000kg/year of the product can be disposed of per year. Analysis shows that fixed and other invariant charges amount to 35% of total product cost	**4**

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	when operating at full capacity. Raw material and other production costs amount to 40% of the total production costs at full capacity. The remaining 25% of the total production costs is for variable overheads and miscellaneous expenses and the analysis indicates that these costs are directly proportional to production rate during operation raised to 1.5 power. What will be the percentage change in the total cost per kg of product if the schedule is switched from 1 million kg/year rate to a time schedule which will produce 500000kg/yr at the least total cost ? All the costs referred to above are on per kg basis.	
6C.	Natural gas is sent through an absorber to recover butanes having a marketing value of 20 paise per liter. The additional cost for processing additional butane in the plant is 50ps per liter of butane. Other costs of handling more absorber oil are 75paise per million liters of lean oil circulated. An empirical relation between butane recovery **R** in liter and absorbed oil **A** in millions of liters is as follows: $A=0.003R^{1.5}$. What is the butane recovery and the quantity of circulating oil to be used for optimum operation?	**3**