KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

Level : B.E./B.Sc.
Year : III
Time : 2 hrs. 30mins.

14 FEB 2024

Course : MGTS 301
Semester : I
F. M. : 40

SECTION "B"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Most investment alternatives created by good engineering ideas are drawn form a larger population of equally good problem solutions. Explain how this larger set of equally good solutions can be trapped into using classical brainstorming and the nominal group technique.

2. A cell phone company has a fixed cost of Rs 1,000,000 per month and a variable cost of Rs 20 per month per subscriber. The company charges Rs 29.95 per month to its cell phone customers.
   a. What is the breakeven point for this company?
   b. The company currently has 95,000 subscribers and proposes to raise the monthly fees to Rs 39.95 to cover add-on features such as text messaging, song downloads, game playing, and video watching. What is the new breakeven point if the variable cost increases to Rs 24 per customer per month?
   c. If 20,000 subscribers will drop their services because of the monthly fee increases in part (b), will the company still be profitable?

OR

In a learning curve application, 846.2work-hours are required for the third production unit and 783.0 work-hours are required for the fifth production unit. Determine the value of n (and therefore s) in the equations $Z_u = K(u^n)$ where n = logS/log2

3. It is likely that your college tuition will increase an average of 5% per year for the next 4 years. The annual cost of tuition at the beginning of your journey in college will be 220,000. How money will you and your parent have to deposit in a bank account one year prior to your college joining date to pay for your tuition for the 4 years you will spend earning your degree in engineering? The bank account will earn an average of 7% annual interest. How much money will be left in your bank account after the payment of fees of second year?

OR

An expenditure of Rs 20,000 is made to modify a material-handling system in a small job shop. This modification will result in first-year savings of Rs 2,000, a second year savings of Rs 4,000, and a savings of Rs 5,000 per year thereafter. How many years must the system last if an 18% return on investment is required? The system is tailor made for this job shop and has no market (salvage) value at any time.

4. A special purpose machine is to be depreciated as a linear function of use (units-of-production method). It cost Rs 2,500,000 and is expected to produce 100,000 units and then be sold for Rs 50,000. Up to the end of the third year, it had produced 60,000 units and during the fourth year it produced 10,000 units. What is the depreciation deduction for the fourth year and the book value at the end of the fourth year?

5. The Ajax Corporation has an overhead crane that has an estimated remaining life of 10 years. The crane can be sold now for Rs 800,000. If the crane is kept in service, it must be overhauled immediately at a cost of Rs 400,000.Operating and maintenance cost will be Rs 300,000 per year after the crane is overhauled. The overhauled crane will have zero market value at the end of 10-year study period. A new crane will cost Rs 1,800,000, will last for 10 years, and will have a Rs 400,000 market value at that time. Operating and maintenance costs are Rs 100,000 per year for the new crane. The firm uses a before-tax interest rate of 10% per year in evaluating investment alternatives. Should the company replace the old machine? Why?

6. A town in northern Nepal is planning on investing in a water purification system. Three mutually exclusive systems have been proposed, and their capital investment costs and net annual benefits are the following (salvage values are negligible).

	System		
EOY	A	B	C
0	-Rs 160,000	-Rs 245,000	-Rs 200,000
1	80,000	120,000	70,000
2	70,000	100,000	70,000
3	60,000	80,000	70,000
4	50,000	60,000	70,000

7. Explain the significance of spider plot in sensitivity analysis with suitable example.

SECTION "C"

[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. A small business owner estimates that the heat loss through the exterior walls of her warehouse will cost approximately Rs 40,000 next year. A local company is offering insulation that can reduce the heat loss by 80%, with an insulation cost of Rs 170,000 now. She intends to keep the warehouse for 10 years. If the cost of the heat loss increases by Rs 3,000 per year, after next year, what is the payback period (PBP), present worth (PW) and internal rate of return (IRR) of her project? Explain the decision rule for selection of project(s) based on PBP, PW and IRR?

9. Two mutually exclusive alternatives are being considered for the environmental protection equipment at a petroleum refinery. One of these alternatives must be selected. The estimated cash flows for each alternative are as follows:

	Alternative A (Rs)	Alternative B (Rs)
Capital investment	20,000,000	38,000,000
Annual expenses	5,000,000	4,000,000
Market value at the end of useful life	1,000,000	4,200,000
Useful life	5 years	10 years

a. Which environmental protection equipment alternative should be selected? The firm's MARR is 20% per year. Assume the equipment will be needed indefinitely.

b. Assume the study period is shortened to five years. The market value of alternative B after five years is estimated to be Rs 15,000,000. Which alternative would you recommend?

10. a. Explain the difficulties in evaluating public-sector projects. [3]

b. Consider the following two investment alternatives. Determine the range of investment cost for Alternative B (i.e. min value < X < max. value) that will convince an investor to select Alternative B, MARR = 10% per year, and other relevant data are shown in the following table. State clearly any assumptions that are necessary. [4+1=5]

	Alternative A	Alternative B
Capital Investment	Rs 5,000,000	Rs X
Net annual receipts	Rs 1,500,000	Rs 1,400,000
Market value	Rs 1,900,000	Rs 4,000,000
Useful life	5 years	7 years

Use following formulas if needed:

Uniform Series	Gradient Series
$(F/A, i\%, N) = \{ (1+i)^N - 1 \} / i$ $(P/A, i\%, N) = \{ (1+i)^N - 1 \} / \{ i (1+i)^N \}$ $(A/F, i\%, N) = i / \{ (1+i)^N - 1 \}$ $(A/P, i\%, N) = \{ i (1+i)^N \} / \{ (1+i)^N - 1 \}$	$(P/G, i\%, N) = 1/i [\{ (1+i)^N - 1 \} / \{ i (1+i)^N \} - N/(1+i)^N]$ $(A/G, i\%, N) = [1/i - N/\{(1+i)^N - 1\}]$ Geometric Sequences of Cash Flows If $f = i$ $P = A1N(P/F, i\%, 1)$ else $P = A1 [1 - (P/F, i\%, N)(F/P, f\%, N)] / (i - f)$

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F. M. : 10

Registration No.:

Date :

SECTION "A"
[20Q. × 0.5 =10 marks]

Encircle the most appropriate option from the given choices.

1. A One of the economic aspects of decision making is non-monetary factors which plays significant role in the final recommendation of the alternative. Which of the following is not included as non-monetary factor that can be important to an organization?
   a. Meeting or exceeding customers' expectations
   b. Safety to employees and to the public
   c. Maintaining production flexibility to meet changing demands
   d. Collection from debtors

2. Engineering economy is based on the set of principles that provide a comprehensive doctrine for developing the methodology. Which of the following is not considered in the set of principles?
   a. Develop the alternatives
   b. Focus on the differences
   c. Consider all irrelevant criteria
   d. Use a common unit of measure

3. A plant operating has fixed costs of Rs 2,000,000 per year, and its output capacity is 100,000 electrical appliances per year. The variable cost is Rs 40 per unit and the product sells for Rs 90 per unit. What is the break-even quantity?
   a. 20,000 units per year
   b. 30,000 units per year
   c. 40,000 units per year
   d. 50,000 units per year

4. Equipment maintenance in a plant is treated as:
   a. Direct cost
   b. Indirect cost
   c. Standard cost
   d. Book cost

5. In power sizing technique or exponential model, what is reflected by cost-capacity factor in general?
   a. Economies of scale
   b. Increasing economies of scale
   c. Decreasing economies of scale
   d. Diseconomies of scale

6. Which of the following is a mathematical model that explains the phenomenon of increased worker efficiency and improved organizational performance with repetitive production of a good or service?
   a. Learning curve
   b. Learning curve exponent
   c. Learning curve slope parameter
   d. Learning and improvement

7. Suppose the average price of petrol was Rs 50 in 2005 where the computed average increase in the price of petrol is to be 7.0 percent. If we assume that the price of petrol will continue to increase at this rate, how long will it be before we are paying Rs 200 per liter?
a. 15 years b. 18 years c. 20 years d. 23 years

8. You can buy a machine for Rs 100,000 that will produce a net income, after operating expenses, of Rs 10,000 per year. If you plan to keep the machine for four years, what must be the market (resale) value be at the end of four years to justify the investment? Suppose annual return on your investment is15%.
a. 120,000 b. 125,000 c. 130,000 d. 140000

9. When you take your first job, you decide to start savings right away for your retirement. You put Rs 5,000 per year into the super savings bank account of ABC Bank, which averages 8% interest per year. Five years later you move to another job and start a new bank account of XYZ Bank. You never get around to merging the funds in the two different bank accounts. If the first plan savings continued to earn interest at the rate of 8% per year for 35 years after you stopped making contributions, how much is the account worth?
a. 433697 b. 493587 c. 421547 d. 454987

10. Which of the following is not true for declining balance (DB) method of depreciation?
a. DB method is also called constant percentage method
b. DB method is also called Matheson formula
c. Ratio of depreciation is constant throughout the life of the assets
d. Annual cost of depreciation is fixed percentage of the market value of the assets

11. Suppose capital investment of the project is Rs 1,300,000, annual savings is 500,000, annual expenses are 100,000 and useful life is 5 years. If sensitivity of the project is investigated using the spider plot, what insights is provided by the spider plot?
a. Sensitivity of capital investment b. Sensitivity of annual expenses
c. Sensitivity of useful life d. Sensitivity of each factor

12. Which of the following is **TRUE** while considering replacement studies?
a. Ownership life and Physical life of the assets are always same
b. Physical life of the assets is always greater than useful life
c. Economic life and ownership life of the assets are always same
d. Physical life of the assets is generally greater than economic life

13. On what basis depreciation is calculated?
a. Market value of assets b. Book value of assets
c. Salvage value of assets d. Both on market and book value

14. A new electric saw for cutting small pieces of lumber in a furniture manufacturing plant has a cost basis of Rs 400,000 and a 10-year depreciable life. The estimated salvage value of the saw is zero at the end of 10 years. Using the 200% declining balance method to calculate the annual depreciation, what is the constant rate of depreciation?
a. 10 percent b. 20 percent c. 30 percent d. 40 percent

15. Which of the following is true when comparing mutually exclusive alternatives with the B-C ration method?
    a. They are first ranked in order of increasing total equivalent worth of cost.
    b. They are first ranked in order of increasing present worth of benefits.
    c. They are fist ranked in order of increasing B-C ratio of individual project.
    d. They are first ranked in order of increasing operating expenses.

16. A hospital is considering energy conservation with a life of six years. This project will save15,000 kilowatt-hours of electric energy per year. The cost of KWh of electricity is Rs 0.09. Maintenance for the project is expected to cost Rs 300 per year. The hospital's MARR is 15% per year. If the simple payback period must be two years (or less), how much money can be invested in this project?
    a. 2100 b. 2300 c. 2500 d. 3000

17. Which of the following method does not consider the interest factor for alternative(s) evaluation purpose?
    a. Internal rate of return b. External rate of return
    c. Simple Payback Period d. Discounted Payback Period

18. Minimum attractive rate of return (MARR) does not depend on which of the following?
    a. The amount of money available for investment
    b. The number of good projects available for investment
    c. The amount of perceived risk associated with investment
    d. The number of shareholders available for investment

19. Which of the following is the correct decision rule for internal rate of return?
    a. Accept the project if IRR > MARR b. Accept the project if IRR > ERR
    c. Accept the project if IRR < MARR d. Accept the project if IRR < ERR

20. What would be the value of present worth if MARR and IRR are equal?
    a. PW > 0 b. PW < 0 c. PW = 0 d. PW = 1