KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.E./B.Sc./B.Tech.
Year : III

Course : MGTS 301
Semester : I/II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 12 DEC 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option from each set of choices

1. Which of the following statements is not one of the four fundamental principles of engineering economics?
   a. Receiving a dollar today is worth more than a dollar received in the future.
   b. To expect a higher return on investment, you need to take a higher risk.
   c. Marginal revenue must exceed marginal cost to justify any production.
   d. When you are comparing different alternatives, you must not focus only on differences in alternatives.

2. Sam bakes a cake and sells it to Carla for $10. Woody pays Diane $30 to tutor him. In this economy, GDP is
   a. $10. b. $20. c. 30. d. $40.

3. What is the primary purpose of the Work Breakdown Structure (WBS) in project management and engineering economy studies?
   a. To manage human resources effectively.
   b. To serve as a framework for defining project work elements, organizing information, and integrating project activities.
   c. To optimize the design of engineering systems.
   d. To track project delays and cost overruns.

4. A certain index for the cost of purchasing and installing utility boilers is keyed to 1988, where its baseline value was arbitrarily set at 100. Company XYZ installed a 50,000-lb/hour boiler for $525,000 in 2000 when the index had a value of 468. This same company must install another boiler of the same size in 2017. The index in 2017 is 542. What is the approximate cost of the new boiler?
   a. $808,013 b. $525,000 c. $608,013 d. $453,321.03

5. What does a learning curve represent in the context of production and organizational performance?
   a. A mathematical model describing increased efficiency and reduced input resources with repetitive production.
   b. The relationship between employee satisfaction and organizational goals.
   c. The trend of production costs increasing as the number of units produced rises.
   d. A tool for tracking defects in the manufacturing process.

6. When you were born, your grandfather established a trust fund for you in the Cayman Islands. The account has been earning interest at the rate of 10% per year. If this account will be worth $100,000 on your 25th birthday, how much did your grandfather deposit on the day you were born?
   a. $4,000 b. $9,230 c. $10,000 d. $10,150

7. Calculate the future worth of 12 annual $5,000 deposits in a savings account that earns 7% (compounded annually). Assume that all deposits are made at the beginning of each year.
   a. $126,005 b. $111,529 c. $95,703 d. $92,037

8. You wish to have $10,000 in an account 8 years from now. How much money must be deposited in the account now in order to have this amount if the account pays 10% compounded annually?
   a. $3,855 b. $4,665 c. $5,403 d. $5,835

9. If you invest $5,123 in a long-term venture, you will receive $1,110 per year forever. Assuming your interest rate is 10% per year, what is the capitalized worth of your investment? Choose the most closest answer below.
   a. $4,327 b. $5,977 c. $5,819 d. $6,103

10. An investment project costs $100,000. It is expected to have an annual net cash flow of $25,000 for five years. What is the project's payback period?
   a. 2 years b. 3 years c. 4 years d. 5 years

11. What does the Internal Rate of Return (IRR) indicate in project evaluation?
   a. The discount rate that makes the net present value (NPV) of a project equal to zero.
   b. The annual percentage return that a project will generate after taxes.
   c. The maximum allowable investment cost for a project to break even.
   d. The average annual return of a project over its lifetime.

12. What does it mean when a project has multiple Internal Rate of Return (IRR) values?
   a. The project generates inconsistent cash flows, making it unsuitable for evaluation.
   b. The project has unconventional cash flows, such as alternating positive and negative cash flows.
   c. The project's Net Present Value (NPV) is always positive, regardless of the discount rate.
   d. The project has multiple periods of profitability, indicating greater financial potential.

13. What does the Present Worth (PW) method evaluate in project analysis?
   a. The total future value of a project's cash flows at the end of its lifespan.
   b. The equivalent value of a project's cash flows at a specific interest rate, discounted to the present time.
   c. The annualized return on investment for a project.
   d. The rate at which a project's cash flows reach breakeven.

14. An oil refinery has decided to purchase some new drilling equipment for $550,000. The equipment will be kept for 10 years before being sold. The estimated SV for depreciation purposes is to be $25,000. Using the SL method, the annual depreciation on the equipment is
   a. $50,000 b. $51,500 c. $52,500 d. $55,000

15. The estimated value of a property at the end of its useful life is
    a. Market value b. Salvage value c. Book value d. Original value

16. Which of the following is an example of book cost?
    a. material cost b. labor cost c. depreciation d. electricity charge

17. The period of time that results in the minimum equivalent uniform annual cost of and operating of assets is called:
    a. Economic life b. Ownership life c. Physical life d. Useful life

18. The conventional B/C ratio is written as
    a. B/C= (Benefits- Disbenefits)/Costs
    b. B /C= Benefits/(Costs +Disbenefits)
    c. B/C = (Benefits + Disbenefits)/Costs
    d. B/C= (Benefits * Disbenefits)/ Costs

19. Identify the following interest rates as nominal or effective.
    Rate 1: 1.5% per quarter
    Rate 2: 1.5% per quarter, compounded monthly
    a. Both are nominal rates.
    b. Rate 1 is nominal and rate 2 is effective.
    c. Rate 1 is effective and rate 2 is nominal.
    d. Both are effective.

20. If an investment quadruple in value in seven years, the rate of return on the investment is nearest to:
    a. 6% b. 22% c. 19% d. 25%

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Draw diagrams or cash flow diagrams as needed. Missing parameters can be assumed appropriately.

SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Using supply-and-demand diagrams, show the effect of the following events on the market for sweatshirts.
   a. A hurricane in South Carolina damages the cotton crop.
   b. The price of leather jackets falls.
   c. All colleges require morning exercise in appropriate attire.
   d. New knitting machines are invented.

2. An exporter of leather handbags has just entered a new market. This exporter faces the following relationship between the price of handbags and the demand for them:

$$p = 5 + \frac{4800}{P} - \frac{3000}{D} \qquad \text{for } D > 0$$

   where p is the price per unit in dollars and D is the demand per month. The exporter wants to maximize his profit. The fixed cost is \$2,000 per month and the variable cost (c_v) is \$35 per unit.
   a. What is the number of leather handbags that should be produced and sold each month, in order to maximize profit?
   b. How do you know that your answer to Part (a) maximizes profit?

OR

   The Mechanical Engineering department has a student team that is designing a formula car for national competition. The time required for the team to assemble the first car is 100 hours. Their improvement (or learning rate) is 0.8, which means that as output is doubled, their time to assemble a car is reduced by 20%. Use this information to determine
   a. the time it will take the team to assemble the 10th car.
   b. the total time required to assemble the first 10 cars.
   c. the estimated cumulative average assembly time for the first 10 cars.

3. How much money should be deposited each year for 10 years if you wish to withdraw \$400 each year for 6 years, beginning at the end of the 12th year? Let i = 5% per year.

4. An asset for drilling was purchased and placed in service by a petroleum production company. Its cost basis is \$60,000, and it has an estimated MV of \$12,000 at the end of an estimated useful life of 14 years. Compute the depreciation amount in the third year and the BV at the end of the fifth year of life by each of these methods:
   a. The SL method.
   b. The 200% DB method with switchover to SL.

P.T.O.

5. A firm owns a pressure vessel that it is contemplating replacing. The old pressure vessel has annual operating and maintenance expenses of $60,000 per year and it can be kept for five more years, at which time it will have zero MV. It is believed that $30,000 could be obtained for the old pressure vessel if it were sold now.
A new pressure vessel can be purchased for $120,000. The new pressure vessel will have an MV of $50,000 in five years and will have annual operating and maintenance expenses of $30,000 per year. Using a before-tax MARR of 20% per year, determine whether or not the old pressure vessel should be replaced. A study period of five years is appropriate.

6. In the development of a publicly owned, commercial waterfront area, three possible independent plans are being considered. Their costs and estimated benefits are as follows:

	System		
	A	B	C
PW of costs	$123	135	99
PW of benefits	$139	150	114

a. Which plan(s) should be adopted, if any, if the controlling board wishes to invest any amount required, provided that the B–C ratio on the required investment is at least 1.0?
b. Suppose that 10% of the costs of each plan are reclassified as disbenefits. What percentage change in the B–C ratio of each plan results from the reclassification?
c. Comment on why the rank-orderings in (a) are unaffected by the change in (b).

7. Albert Einstein once noted that "compounding of interest is one of humanity's greatest inventions." To illustrate the mind-boggling effects of compounding, suppose $100 is invested at the end of each year for 25 years at i = 50% per year. In this case, the accumulated sum is $5,050,000! Now it is your turn. What amount is accumulated after 25 years if the interest rate is 30% per year?

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. The managers of a company are considering an investment with the following estimated cash flows. MARR is 15% per year.

Capital investment	$30,000
Annual revenues	$20,000
Annual expenses	$5,000
Market value	$1,000
Useful life	5 years

The company is inclined to make the investment; however, the managers are nervous because all of the cash flows and the useful life are approximate values. The capital investment is known to be within ±5%. Annual expenses are known to be within ±10%. The annual revenue, market value, and useful life estimates are known to be within ±20%.
a. Analyze the sensitivity of PW to changes in each estimate individually. Based on your results, make a recommendation regarding whether or not they should proceed with this project. Graph your results for presentation to management.
b. The company can perform market research and/or collect more data to improve the accuracy of these estimates. Rank these variables by ordering them in accordance with the need for more accurate estimates (from highest need to lowest need).

9. You owe your best friend \$3,000. Because you are short on cash, you offer to repay the loan over 24 months under the following condition. The first payment will be \$100 at the end of month one. The second payment will be \$100 + G at the end of month two. At the end of month three, you'll repay \$100 + 2G. This pattern of increasing G amounts will continue for all remaining months.
   a. What is the value of G if the interest rate is 1% per month?
   b. What is the equivalent uniform monthly payment?
   c. Repeat Part (a) when the first payment is \$120 (i.e., determine G).

10. As the supervisor of a facilities engineering department, you consider mobile cranes to be critical equipment. The purchase of a new medium-sized, truck-mounted crane is being evaluated. The economic estimates for the two best alternatives are shown in the following table. You have selected the longest useful life (nine years) for the study period and would lease a crane for the final three years under Alternative A. On the basis of previous experience, the estimated annual leasing cost at that time will be \$66,000 per year (plus the annual expenses of \$28,800 per year). The MARR is 15% per year and in annual expenses excludes the cost of an operator, which is the same for both alternatives. Show that the same selection is made with

	Alternatives	
	A	B
Capital investment	\$272,000	\$346,000
Annual expenses	28,800	19,300
Useful life (years)	6	9
Market value (at end of life)	\$25,000	\$40,000

   a. PW method.
   b. the IRR method.
   c. the ERR method.
   d. Would leasing crane A for nine years, assuming the same costs per year as for three years, be preferred over your present selection? (ϵ = MARR = 15%).

Use following formulas if needed:
Uniform Series

$$(F\_, i, N) = \{(1 + i) - 1\}/i$$
$$A$$

$$(P\_, i, N) = \{(1 + i) - 1\}/\{i(1 + i)^N\}$$
$$A$$

Gradient Series

$$\frac{1}{i} - \frac{N}{\{i\,[\,(1 + i)_N - (1 + i)_N]\}}$$