KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May 2023

Marks Scored:

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

Course : MGTS 301
Semester : I

Exam Roll No.:

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 02 MAY 2023

SECTION "A"
[20Q. × 0.5 = 10 marks]

Encircle the most appropriate alternative from the given choices.

1. To be economically acceptable, solutions to engineering problems must demonstrate
   a. a positive balance of current benefits over current costs
   b. a positive balance of long-term benefits over current costs
   c. a positive balance of current benefits over long-run costs
   d. a positive balance of long-term benefits over long-run costs

2. Which one of the following is **NOT** among one of the Principles of Engineering Economy?
   a. Develop the alternatives
   b. Focus on the expected future outcomes
   c. Use a consistent viewpoint
   d. Make risk and uncertainty explicit

3. _____ is common to all alternatives, is not part of the future (prospective) cash flows, and can be disregarded in an engineering economic analysis.
   a. Standard cost b. Incremental cost c. Sunk cost d. Opportunity cost

4. A company produces an electronic timing switch that is used in consumer and commercial products. The fixed cost is $73,000 per month, and the variable cost is $83 per unit. The selling price per unit (p) is expressed as p = $180 – 0.02(D), where D represents the demand. What is the optimal volume for this product?
   a. 932 units per month
   b. 2,425 units per month
   c. 3,918 units per month
   d. 1,493 units per month

5. Which one of the following statements is **NOT** correct regarding cost estimation?
   a. A "bottom-up" procedure for estimating total product cost is commonly used by companies to help them make decisions about what to produce and how to price their products.
   b. The objective of target costing, which is a top-down approach, is to design products out of costs before those products enter the manufacturing process.
   c. The practice of considering cost performance as important as technical performance during the design process is termed design to cost.
   d. Conventional tools, such as work breakdown structure and cost estimating, are used to prepare a bottom-up total manufacturing cost projection.

6. Which of the following methods convert cash flows resulting from a proposed problem solution into their equivalent worth at some point (or points) in time by using an interest rate known as the MARR?
   a. Present Worth Method and Annual Worth Method
   b. Present Worth Method and Internal Rate of Return
   c. Internal Rate of Return and Payback Period
   d. Internal Rate of Return and External Rate of Return

7. Your monthly mortgage payment (principal plus interest) is $1,500. If you have a 30-year loan with a fixed interest rate of 0.5% per month, how much did you borrow from the bank to purchase your house?
   a. $180,000 b. $250,000 c. $300,000 d. $540,000

8. What is the principal remaining after 20 monthly payments have been made on a $20,000 five-year loan? The annual interest rate is 12% nominal compounded monthly?
   a. $10,224 b. $13,333 c. $14,579 d. $16,073

9. MARR, which is sometimes called the _____, stands for _____.
   a. breakeven interest rate; minimum average rate of return
   b. hurdle rate; minimum attractive rate of return
   c. hurdle rate; minimal attractive rate of return
   d. breakeven interest rate; minimal attractive rate of return

10. Which one of the following statements regarding return to capital is **CORRECT**?
   a. If capital is invested in a project, investors would expect, as a minimum, to receive a return at least equal to the amount they have sacrificed by not using it in some other available opportunity of comparable risk.
   b. If capital is invested in a project, investors would expect, as a minimum, to receive a return equal to the amount they have sacrificed by not using it in some other available opportunity of comparable risk.
   c. If capital is invested in a project, investors would expect, as a minimum, to receive a return greater than the amount they have sacrificed by not using it in some other available opportunity of comparable risk.
   d. If capital is invested in a project, investors would expect, as a minimum, to receive a return that is equal to or greater than the amount they have sacrificed by not using it in some other available opportunity of comparable risk.

11. A corporate jet costs $1,350,000 and will incur $200,000 per year in fixed costs and $277 per hour in variable costs. The jet will be operated for 1,200 hours per year for five years and then sold $650,000. Given MARR = 15%, what is the capital recovery cost of the jet?
   a. CR = $1,350,000 (A/P, 15%, 5) - $650,000 (A/F, 15%, 5)
   b. CR = $1,350,000 (P/A, 15%, 5) - $650,000 (F/A, 15%, 5)
   c. CR = $1,350,000 (A/F, 15%, 5) - $650,000 (A/P, 15%, 5)
   d. CR = $1,350,000 (P/A, 15%, 5) - $650,000 (A/F, 15%, 5)

12. A specialized automatic machine costs $300,000 and is expected to save $111,837.50 per year while in operation. Using a 12% interest rate, what is the discounted payback period?
   a. 4 years b. 5 years c. 6 years d. 7 years

13. When comparing and selecting among mutually exclusive alternatives where useful lives are unequal, the most preferred method is _____.
   a. Present Worth (PW) method b. Capitalized Worth (CW) method
   c. Annual Worth (AW) method d. Future Worth (FW) method

14. An equipment that costs $12,000 has a life of eight years with a salvage value $2,000. What is the straight line depreciation amount for each year?
   a. $1,500 b. $1,000 c. $1,200 d. $1,250

15. The three major reasons for replacement analysis include_____.
    a. physical impairment, altered requirements, technology
    b. depreciation, physical deterioration, altered requirements
    c. depreciation, physical impairment, obsolescence
    d. physical impairment, technology, sunk cost

16. _____ is normally used for the evaluation of public projects.
    a. Present worth method
    b. Breakeven analysis
    c. Benefit-cost ratio method
    d. Internal rate of return method

17. As a rule, _____ are expected to earn direct revenues that offset their costs, but they are not expected to earn profits or pay income taxes.
    a. self-liquidating projects
    b. multiple-purpose projects
    c. mutually exclusive projects
    d. public projects

18. Which one of the following is **NOT** among the criticisms of the B-C ratio?
    a. It is often used as a tool for after-the-fact justifications rather than for project evaluation.
    b. Serious distributional inequities (i.e., one group reaps the benefits while another incurs the costs) may not be accounted for in B-C studies.
    c. Qualitative information is often ignored in B-C studies.
    d. Computational difficulty and possible multiple values associated with B-C ratio.

19. _____ is used to explore what happens to a project's profitability when the estimated value of study factors is changed.
    a. Breakeven analysis
    b. Sensitivity analysis
    c. Spiderplot
    d. Breakeven chart

20. The relative degree of sensitivity of the PW to each factor is indicated by the slope of the curves.
    a. The steeper the slope of a curve the less sensitive the PW is to the factor.
    b. The steeper the slope of a curve the more sensitive the PW is to the factor.
    c. The larger the value of PW the more sensitive it is to the factor.
    d. The smaller the value of PW the less sensitive it is to the factor.

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SECTION "B"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Explain with relevant examples fixed costs, variable costs, and overhead costs.

2. a. What is the size of eight equal annual payments to repay a loan of $1,000? The first payment is due one year after receiving the loan.

   b. A credit card company charges an interest rate of 1.375% per month on the unpaid balance of all accounts. The annual interest rate, they claim is 16.5%. What is the effective rate of interest per year being charges by the company?

3. You are faced with making a decision on a large capital investment proposal. The capital investment amount is $640,000. Estimated annual revenue at the end of each year in the eight-year study period is $180,000. The estimated annual year-end expenses are $42,000 starting in year one. These expenses begin decreasing by $4,000 per year at end of year four and continue decreasing through end of year eight. Assuming a $20,000 market value at the eighth year and a MARR = 12% per year. Use the PW method to determine the profitability of this investment.

4. The International Parcel Service has installed a new radio frequency identification system to help reduce the number of packages that are incorrectly delivered. The capital investment in the system is $65,000, and the projected annual savings are given below. The system's market value at the end of fifth year is negligible, and MARR = 18%. Determine the discounted payback period.

EOY	1	2	3	4	5
Savings ($)	25,000	30,000	30,000	40,000	46,000

5. An established consulting company has purchased new furniture for their offices at a retail price of $100,000. An additional $20,000 has been charged for insurance, shipping and handling. The company expects to use the furniture for 10 years and then sell it at a salvage value of $10,000. Determine the annual depreciation amounts using the SL method. Tabulate the annual depreciation amounts and the book value of the furniture at the end of each year.

6. A project is being considered by the Department of Transportation to replace an aging bridge across the state highway. The existing two-lane bridge is expensive to maintain and creates a traffic bottleneck because the state highway is four lanes wide on either side of the bridge. The new bridge can be constructed at a cost of $300,000, and estimated annual maintenance costs are $10,000. The existing bridge has annual maintenance costs of $18,500. The annual benefit of the new four-lane bridge to motorists, due to the removal of the traffic bottleneck, has been estimated to be $25,000. Using a MARR of 8% and a study period of 25 years, determine whether the new bridge should be constructed.

7. Write short notes on (*ANY TWO*):
   a. Value engineering
   b. Sunk cost trap
   c. Evaluating public-sector projects

SECTION "C"
[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Suppose that the parents of a young child decide to make annual deposits into a savings account, with the first deposit being made on the child's fifth birthday and the last deposit being made on the 15th birthday. Then, the parents plan to withdraw $2,000, $2,400, $2,800, and $3,200 respectively starting on the child's 18th birthday. If the effective annual interest rate is 8% during this period of time, what are the annual deposits to be made from year five to year fifteen? Use the concept of uniform gradient to find the solution. Draw a cash flow diagram.

9. Four mutually exclusive projects are being considered for a new two-mile jogging track. The life of the track is expected to be 80 years, and the sponsoring agency's MARR is 12% per year. Annual benefits to the public have been estimated by an advisory committee and are shown below. Use the IRR method (incrementally) to select the best jogging track.

	Alternative			
	A	B	C	D
Initial cost	$62,000	$52,000	$150,000	$55,000
Annual benefits	$10,000	$8,000	$20,000	$9,000
Rate of return on investment	16.1%	15.4%	13.3%	16.4%

10. Zenith P. Ltd. is considering the capital investment of $30,000. The estimated annual revenues and expenses are $20,000 and $5,000 respectively. At the end of the useful life of five years, the market value is expected to be $1,000. MARR is 15% per year. 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%. Analyze the sensitivity of PW to changes in each estimate individually and graph your results.