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Program: B. Sc. in Civil Engineering | **Date: 11th October 2023**
Semester: 7th Semester | **Time: 10:30 am – 12:00 pm**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Midterm Examination | **Winter Semester: 2022 - 2023**
Course Number: HUM 4753 | **Full Marks: 75**
Course Title: Engineering Economics and Accounting | **Time: 90 Minutes**

There are **3 (Three)** questions. **Answer all questions**. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are provided in brackets. The examination period is 1.5 hours.

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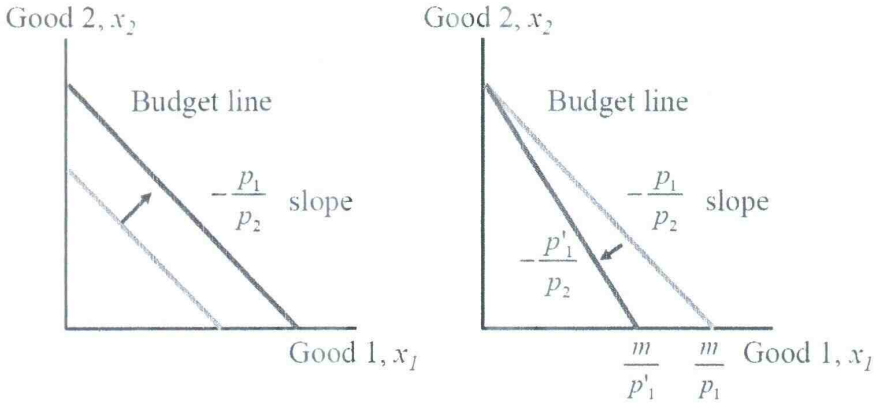
1. (a) What is a desirable IRR? Differentiate between the "Optimization Principle" and "Equilibrium Principle". Explain "Consumer's Surplus". **(8) (CO1) (PO1)**

(b) Analyze the following two graphs. **(3.5) (CO2) (PO2)**



(c) There are no tables in the back of your book for the arithmetic gradient series factors. Calculate the first two annual worth factor values, that is, A values for $n = 1$ and 2, that would be in a 10% interest table for a growth rate of 4% per year. **(5) (CO1) (PO1)**

(d) Austin Utilities is planning to install solar panels to provide some of the electricity for its groundwater desalting plant. The project would be done in two phases. The first phase will cost \$4 million in year 1 and \$5 million in year 2. This investment will result in energy savings (phase 2) of \$540,000 in year 3, \$546,000 in year 4, and amounts increasing by \$6000 each year through year 10. Let, $i = 10\%$ per year. **(8) (CO2) (PO2)**

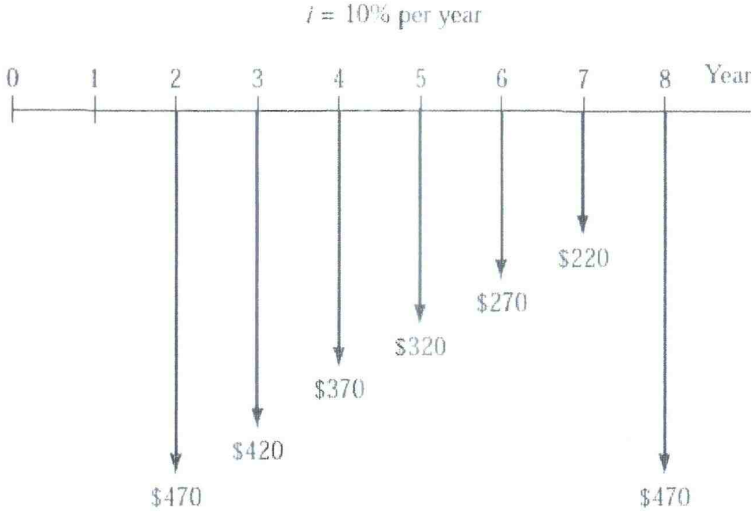
(i) What is the future worth of the savings?

(ii) Is the cost of the solar project justified by the savings?

2. (a) Explain "Pareto Efficiency"? What is the "Law of Diminishing Marginal Utility"? **(8) (CO1) (PO1)**

(b) Describe any *five* components of financial decision making. **(5) (CO1) (PO1)**

(c) For the cash flows shown in the diagram below, determine the future worth in year 8 at an interest rate of 10% per year. **(8) (CO2) (PO2)**



(d) The net cash flow associated with the development and sale of a new product is shown. Determine the present worth at an interest rate of 12% per year. The cash flow is in \$1000 units. **(4) (CO2) (PO2)**

Year	1	2	3	4	5	6	7	8	9
Cash Flow, \$	−120	−100	−40	+50	+50	+80	+80	+80	+80

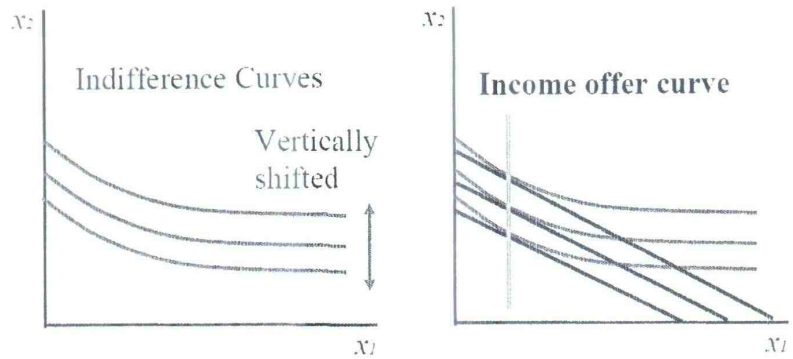
3. (a) Interpret the effect of consumer surplus using a schematic diagram. Exemplify the application of microeconomics in civil engineering. **(8) (CO1) (PO1)**

(b) The Pedernales Electric Cooperative estimates that the present worth *now* of income from an investment in renewable energy sources is \$12,475,000. There will be no income in years 1 and 2, but in year 3 income will be \$250,000, and thereafter it will increase according to an arithmetic gradient through year 15. What is the required gradient, if the interest rate is 15% per year? **(6) (CO2) (PO2)**

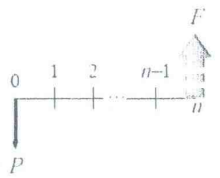
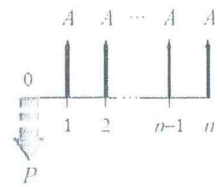
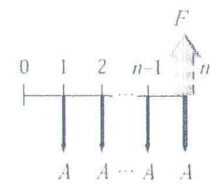
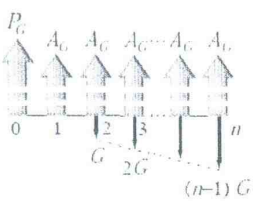
(c) A company that manufactures air-operated drain valve assemblies **(8)**

budgeted $74,000 per year to pay for plastic components over a 5-year period. If the company spent only $42,000 in year 1, what uniform annual amount should the company expect to spend in each of the next *4 years* to expend the entire budget? Assume the company uses an interest rate of 10% per year. **(CO2) (PO2)**

(d) What can be derived from the following diagrams? **(3.5) (CO1) (PO1)**



NOTES

Type	Find/Given	Factor Notation and Formula	Relation	Sample Cash Flow Diagram
Single Amount	F/P Compound amount	$(F/P,i,n) = (1+i)^n$	$F = P(F/P,i,n)$	
	P/F Present worth	$(P/F,i,n) = \frac{1}{(1+i)^n}$	$P = F(P/F,i,n)$	
Uniform Series	P/A Present worth	$(P/A,i,n) = \frac{(1+i)^n - 1}{i(1+i)^n}$	$P = A(P/A,i,n)$	
	A/P Capital recovery	$(A/P,i,n) = \frac{i(1+i)^n}{(1+i)^n - 1}$	$A = P(A/P,i,n)$	
	F/A Compound amount	$(F/A,i,n) = \frac{(1+i)^n - 1}{i}$	$F = A(F/A,i,n)$	
	A/F Sinking fund	$(A/F,i,n) = \frac{i}{(1+i)^n - 1}$	$A = F(A/F,i,n)$	
Arithmetic Gradient	P_G/G Present worth	$(P/G,i,n) = \frac{(1+i)^n - in - 1}{i^2(1+i)^n}$	$P_G = G(P/G,i,n)$	
	A_G/G Uniform series	$(A/G,i,n) = \frac{1}{i} - \frac{n}{(1+i)^n - 1}$ (Gradient only)	$A_G = G(A/G,i,n)$	