

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Com. DEGREE EXAMINATION – COMMERCE

FOURTH SEMESTER – APRIL 2022

UMT 4401 – MATHEMATICS FOR COMMERCE

Date: 27-06-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

PART – A

Answer ALL questions:

(10 × 2 = 20)

1. A pressure cooker is available for Rs. 250 each or Rs. 100 cash down payment followed by Rs. 165 after six months. Find the rate of interest charged under the instalment plan.
2. Define depreciation value of an asset.
3. Suppose P and Q are statements: P: Jack passed math. Q: Jill passed math.
(a) Translate "Jack and Jill both passed math" into symbols.
(b) Translate " $\neg(P \wedge Q) \rightarrow Q$ " into English.
4. Construct the truth table for $\neg(P \wedge Q)$.
5. Find the equilibrium price given the functions: $Q_d = 2 - 0.02P$; $Q_s = 0.2 + 0.07P$.
6. When does the commodities x_1 and x_2 are said to be complementary, competitive or neither?
7. Evaluate $\int_1^2 \frac{t^2 + 2t + 5}{t} dt$.
8. Define Producer surplus.
9. Define Boolean algebra.
10. Let $a \in B$, B is an Boolean algebra then prove that a' is a unique element.

PART – B

Answer any FIVE questions:

(5 × 8 = 40)

11. (a) Calculate the nominal rate of interest convertible half-yearly when the effective rate is 6% per annum.
(b) A person deposited Rs. 4,000 in a bank at 6% compounded continuously. After 3 years, the rate of interest was increased to 7% and after 5 more years, the rate was further increased to 8%. The money was withdrawn at the end of 10 years. Find the amount. (4+4)
12. (a) In lieu of a single payment of Rs. 5,000 at the present moment a person agrees to receive three equal payments at the end of 3 years, 6 years and 10 years respectively. Assuming a rate of interest of 6% p. a., what should be the value of each of the three payments? (4+4)
(b) A sum of Rs. 1,000 is due at the end of 10 years 6 months. The present interest rates are 7% p.a. but it is expected that there will be a fall in the rates after 6 years bringing down the rate to 6% p.a. Find the present value of the sum of money under these assumptions.
13. (a) Define existential and universal quantifiers with example each. (4+4)
(b) Consider the statement, "If you will give me a cow, then I will give you magic beans." Decide whether each statement below is the converse, the contrapositive, or neither.
 - i. If you will give me a cow, then I will not give you magic beans.
 - ii. If I will not give you magic beans, then you will not give me a cow.
 - iii. If I will give you magic beans, then you will give me a cow.
 - iv. If I will give you magic beans, then you will not give me a cow.
14. A radio manufacturer produces x sets per week at a total cost of Rs. $x^2 + 78x + 2500$. He is a monopolist and the demand function for his product is $x = \frac{600-p}{8}$ when the price is Rs. p per set,

show that maximum net revenue is obtained when 29 sets are produced per week. What is the monopoly price?

15. (a) Find the elasticities of demand and supply at equilibrium price for demand function $p = \sqrt{100 - x}$ and supply function $x = 2p - 10$, where p is the price and x is quantity.
 (b) Given the production function $P = 4KL - 2K^2 - L^2$, find the maximum P with the constraint $L + K = 10$. (4+4)
16. Assume that the marginal cost in lakhs of rupees is given by $MC = 4 + 5x^2 + \frac{3}{2}e^{-x}$, where x is the quantity produced. Find the total cost of production when $x = 2$, if fixed cost is Rs. 6 lakhs.
17. The marginal cost of production of a firm is given as $C'(q) = 5 + 0.13q$. Further, the marginal revenue is $R'(q) = 18$. Also, it is given that $C(0) = \text{Rs. } 120$. Compute the total profit.
18. Using truth table find the value for the Boolean function $(x \cap y) \cup [(x \cup y') \cap y]'$.

PART – C

Answer any TWO questions: (2 × 20 = 40)

19. (a) Find for each of the following, the amount to which Rs. 100 will accumulate:
 i. at the rate of interest 12% per annum compounded quarterly for 10 years.
 ii. at the force of interest 3% per annum for 3.5 years.
 iii. at the effective rate of interest 3% per annum for 10 years, 4% per annum for 4 years and 5% per annum for 2 years.
 iv. at the rate of interest corresponding to 3% per annum effective rate of discount for 8 years.
 (b) The yearly output of a certain mine is found to decrease every year at the rate of 8% of its output in the previous year. The output was worth Rs. 1 crore in the first year. It would be unprofitable to run the mine when the worth of the yearly output falls below Rs. 1 million. For how many years the mine be run profitable? (10+10)
20. (a) Construct the truth table for the following:
 (i) $\neg(P \wedge Q) \Leftrightarrow (\neg P \vee \neg Q)$
 (ii) $((P \rightarrow Q) \wedge (Q \rightarrow R)) \rightarrow (P \rightarrow R)$.
 (b) Let the cost function of a firm be given by the following equation: $C = 300x - 10x^2 + \frac{1}{3}x^3$, where C stands for cost and x for output. Calculate (i) Output, at which marginal cost is minimum. (ii) Output, at which average cost is minimum. (iii) Output, at which average cost is equal to marginal cost. (10+10)
21. (a) Verify Euler's theorem for $u = x^n \log \frac{y}{x}$. (10+10)
 (b) Convert the following expression in canonical form as intersection of unions:
 $(x \cup y) \cap (y \cap z) \cap (x' \cup z) \cap (x' \cup y')$.
22. (a) State and prove five properties of definite integration. (10+10)
 (b) Determine consumer surplus and producer surplus under pure competition for the demand function $p = 36 - x^2$ and supply function $p = 6 + \frac{x^2}{4}$, where p is the price and x are quantity.

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