TDC (CBCS) Odd Semester Exam., 2019

ECONOMICS

(1st Semester)

Course No. : ECOHCC-102T

(Mathematical Methods in Economics—I)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* of the following : 2×2=4

(a) State De Morgan's law.

(b) Define range of a function.

(c) Show that $(ab)^{-1} = a^{-1}b^{-1}$ (if $a \neq 0$, $b \neq 0$).

2. *(a)* If

$$A = \{1, 2, 3, 4, 5\}$$
$$B = \{3, 4, 5, 6, 7\}$$
$$C = \{0, 1, 8, 9\}$$

find the following : 6

(i) $A \cap B$

(ii) $A \cup B$

(iii) $A - B$

(iv) $A \cup (B \cap C)$

(v) $(A \cup B) - C$

(vi) $A \cup B - C'$

(b) In a class of 50 students, 30 students take Economics, 25 students take Mathematics and 10 take both. Find the number of students taking neither of the two subjects.

OR

3. *(a)* Define limit of a function.

(b) Show that

$$\lim_{x \to \infty} \frac{5x^2 + 4x^4}{5x^2 - 4x^4} = 1$$

(Continued

(c) State the conditions for continuity of a function. Determine whether the following function is continuous or not at $x = 2$: 2+3=5

$$f(x) = x^2 - 4x + 3$$

UNIT—II

4. Answer any *two* of the following : 2×2=4

(a) Define constant function with example.

(b) Give one example each of finite sequence and infinite sequence.

(c) Define domain and range of a function.

5. Explain with diagram (a) linear function, (b) quadratic function, (c) exponential function, (d) polynomial function and (e) logarithmic function. 10

OR

6. (a) (i) State necessary and sufficient conditions for convergency.

(ii) Test the convergency of the series

$$1 - 1 + \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!} - \cdots$$

2+3=5

(b) Formulate the model for the sum of the series, $\{1^2+3^2+5^2+7^2+9^2+\cdots+n^2\}$ and determine the sum up to the 7th term. 5

UNIT—III

7. Answer any *two* of the following : $2\times2=4$

(a) Define differentiable function.

(b) Find the differential coefficients of e^{-x} and 2^x.

(c) Find the second-order differential coefficient w.r.t. x, when $y=3x^3-9x$.

8. (a) Find $\frac{dy}{dx}$, when—

(i) $y=x^{ex}$;

(ii) $y=\frac{1}{\sqrt{5x^3-9x^2+7}}$. 3+4=7

(b) If the demand law is $x=\frac{20}{p+1}$, find e_d with respect to price at the point where $p=3$.

OR

9. (a) If the utility function is $u = \log(ax_1 + bx_2 + c\sqrt{x_1 x_2})$, obtain the ratio of marginal utilities. 4

(b) The total cost function of a firm is $C = \frac{1}{3}x^3 - 5x^2 + 28x + 10$, where C is the total cost and x is the output. A tax at the rate of ₹2 per unit of output is imposed and the producer adds it to his cost. If the demand function is given by $p = 2530 - 5x$, find the profit maximizing output and the price at the level. Also find the maximum profit. 6

UNIT—IV

10. Answer any *two* of the following : 2×2=4

(a) Define convex function for a single-variable case.

(b) Determine whether $y = 1 + 2x - x^2$ rises, falls or remains stationary at $x = 1$.

(c) Write single-variable optimization conditions for $y = f(x)$.

11. (a) State and explain the geometric characteristics of local and global optima. 6

(b) If the total cost function is $C = \frac{1}{3}Q^3 - 3Q^2 + 9Q$, find at what level of output AC be minimum and what level it will be.

OR

12\. (a) "For the function $y = f(x)$, the first derivative $\frac{dy}{dx}$ refers to the absolute value of function and the second derivative $\frac{d^2y}{dx^2}$ refers to the slope of the curve." Explain the statement with graphical representation.

(b) Given the function $y = 10x^3 - 15x^2 + 10$, determine whether the function rises, falls or remains stationary at $x = 2$ and at $x = 3$.

UNIT—V

13\. Answer any *two* of the following : 2×2

(a) Define definite integral.

(b) Define first-order difference equation.

(c) Find $\int e^{x/2} dx$.

14. Find the integral of the following :

(a) $y = \dfrac{4x^7 + 3x^3 - 5x^2}{x^4}$ 3

(b) $y = \dfrac{6x - 8}{3x^2 - 8x + 5}$ 3

(c) $y = x \log x$ 4

OR

15. (a) Evaluate :

(i) $\int_1^5 \left(x - \dfrac{2}{x}\right) dx$ 3

(ii) $\int x^2 e^{3x} dx$ 3

(b) If the demand function is $P = 35 - 2x - x^2$ and the demand x_0 is 3, find the consumer's surplus. 4

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