C 82446–C (Pages : 4) Name..................................

Reg. No..................................

SECOND SEMESTER B.A./B.Sc. DEGREE EXAMINATION, APRIL 2020

(CBCSS—UG)

Mathematics

MEC 2C 02—MATHEMATICAL ECONOMICS

(2019 Admissions)

(Multiple Choice Questions for SDE Candidates)

Time : 15 Minutes	Total No. of Questions : 20	Maximum : 20 Marks

INSTRUCTIONS TO THE CANDIDATE

1. This Question Paper carries Multiple Choice Questions from 1 to 20.
2. The candidate should check that the question paper supplied to him/her contains all the 20 questions in serial order.
3. Each question is provided with choices (A), (B), (C) and (D) having one correct answer. Choose the correct answer and enter it in the main answer-book.
4. The MCQ question paper will be supplied after the completion of the descriptive examination.

MEC 2C 02—MATHEMATICAL ECONOMICS

(Multiple Choice Questions for SDE Candidates)

1. The law which studies the direct relationship between price and quantity supplied of a commodity is :
   - (A) Law of demand.
   - (B) Law of variable proportion.
   - (C) Law of supply.
   - (D) None of the above.

2. When price rises, quantity supplied ?
   - (A) Expands.
   - (B) Falls.
   - (C) Increases.
   - (D) Unchanged.

3. When a percentage in price results in equal change in quantity supplied, it is called :
   - (A) Elastic supply.
   - (B) Perfectly inelastic.
   - (C) Elasticity of supply.
   - (D) Unitary elastic supply.

4. When supply of a commodity decreases on a fall in its price, it is called :
   - (A) Expansion of supply.
   - (B) Increase in supply.
   - (C) Contraction of supply.
   - (D) Decrease in supply.

5. At what point does total utility starts diminishing ?
   - (A) When marginal utility is positive.
   - (B) When it remains constant.
   - (C) When marginal utility is increasing.
   - (D) When marginal utility is negative.

6. Market which have two firms are known as :
   - (A) Oligopoly.
   - (B) Monopoly.
   - (C) Duopoly.
   - (D) Perfect competition.

7. In perfect competition a firm increases profit when ———— exceeds ————.
   - (A) TC, TR.
   - (B) MC, MR.
   - (C) AR, AC.
   - (D) TR, TFC.

8. If the coefficient of income elasticity of demand is higher than 1 and the revenue increases, the share of expenditures for commodity X in total expenditure :

   (A) Will increase.
   (B) Will decrease.
   (C) Will remain constant.
   (D) Can not be determined.

9. Suppose the price of a good decreases by 10 % and the quantity demanded for a certain period of time increases by 15 %. In these conditions :

   (A) The revenues earned by producers decrease.
   (B) The revenues earned by producers increase.
   (C) The revenues are not influenced in any way.
   (D) The company's expenses rise.

10. Which of the following statements is false ?

   (A) Perfect competition involves many sellers of standardized products.
   (B) Monopolistic competition involves many sellers of homogeneous products.
   (C) The oligopoly involves several producers of standardized or differentiated products.
   (D) Monopoly involves a single product for which there are no close substitutes.

11. A basic solution in a LPP is a ———— if it is feasible.

   (A) Basic feasic solution.
   (B) Non-basic feasible solution
   (C) Both (A) and (B).
   (D) None.

12. A basic feasible solution is a basic solution whose variables are ————.

   (A) Feasible.
   (B) Negative.
   (C) Non-negative.
   (D) None.

13. The divergence between Lorenz curve and line of perfect equality can be measured by :

   (A) Gini coefficient.
   (B) Coefficient of variation.
   (C) Both.
   (D) None.

14. In LPP, the simplex method was developed by :

   (A) Koopman.
   (B) G. B. Dantzig.
   (C) Leontief.
   (D) None of these.

15. Any non-negative value of (x_1, x_2) is a feasible solution of the LPP if it satisfies all the ————.

(A) Non-negativity conditions. (B) Constraints.

(C) Objective function. (D) None.

16. LP is a quantitative technique of decision-making using ———— constraints.

(A) Inequality. (B) Equality.

(C) Both (A) and (B). (D) None.

17. In LPP we deal with ———— objectives.

(A) Many. (B) Two.

(C) Three. (D) Four.

18. One of the limitations of LPP is to satisfy the assumption of ———— of objective function and constraints.

(A) Certainty. (B) Continuity.

(C) Linearity. (D) None.

19. Every linear programming problem has a ———— associated with it.

(A) Dual problem. (B) Assignment problem.

(C) Both. (D) None.

20. Zero sum game is also referred to as :

(A) Constant sum game. (B) Negative sum game.

(C) Both. (D) None.

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Reg. No..................................

SECOND SEMESTER B.A./B.Sc. DEGREE EXAMINATION, APRIL 2020

(CBCSS—UG)

Mathematics

MEC 2C 02—MATHEMATICAL ECONOMICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A

Answer any number of questions.
Maximum marks : 20.

1. Define Gini co-efficient.
2. What is meant by Price discrimination ?
3. What is a Non-negativity constraints ?
4. Explain the term Regression.
5. What is an Exogenous variable ?
6. Explain the Open input-output model.
7. State the Young's theorem.
8. What is meant by Local maxima and minima ?
9. Define a Symmetric matrix.
10. What is meant by Continuously differentiable functions ?
11. What is meant by Constrained optimization ?
12. Define Lorenz curve.

Section B

Answer any number of questions.
Maximum marks : 30.

13. From the data points, find the equation of the line which best fits the data points (1, 2),(3, 4), (5, 3),(6, 6).
14. Explain the sufficient and necessary conditions for unconstrained optimization.
15. Show whether the following function $x^4 + x^2 + 6xy + 3y^2$ has global minima or maxima.

Turn over

16. Examine whether the input-output system with the following co-efficient matrix is feasible :

$$\begin{bmatrix} 1/2 & 3/5 \\ 1/3 & 5/7 \end{bmatrix}.$$

17. Explain the optimization of a function with several equality constraints.

18. Compute the Hessian matrix of the function $4x^2y - 3xy^3 + 6x$.

19. Describe the Kuhn-Tucker formulation for a constrained minimization problem.

Section C

Answer any **one** (10 *marks*)

20. Explain the determination of equilibrium prices in an economy with two sectors using input-output model.

21. Explain the method of least squares and derive the normal equations.

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SECOND SEMESTER B.A./B.Sc. DEGREE EXAMINATION, APRIL 2020

(CBCSS—UG)

Mathematics

MAT 2C 02—MATHEMATICS—II

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A

Answer any number of questions.
Each question carries 2 marks.
Maximum 20 marks.

1. If $f(x) = x^3 + 2x + 1$, show that f has an inverse on [0, 2], Find the derivative of the inverse function at $y = 4$.
2. Calculate the slope of the line tangent to $r = f(\theta)$ at (r, θ) if f has a local maximum there.
3. Prove that $\tanh^2 x + \text{sech}^2 x = 1$.
4. Find $\int \frac{dx}{\sqrt{4 + x^2}}$.
5. Show that $\int_0^\infty \frac{dx}{\sqrt{1 + x^8}}$ is convergent, by comparison with $\frac{1}{x^4}$.
6. Find $\lim_{n \to \infty} \left(\frac{n^2 + 1}{3n^2 + n} \right)$.
7. Sum the series $\sum_{i=1}^{\infty} \left(\frac{7}{8} \right)^i$.
8. State integral test and show that $\sum_{m=2}^{\infty} \frac{1}{m(\ln m)^2}$ converges.
9. Define dimension of a vector space. Find the dimension of the vector space P_n of all polynomial of degree less than or equal to n.
10. Determine whether the set of all functions f with $f(1) = 0$ is a subspace of the vector space $C(-\infty, \infty)$.

Turn over

11. Use inverse of coefficient matrix to solve the system :

$$\begin{aligned} 2x_1 - 9x_2 &= 15 \\ 3x_1 + 6x_2 &= 16. \end{aligned}$$

12. Find the eigenvalues and eigenvectors of $A = \begin{pmatrix} 6 & -1 \\ 5 & 4 \end{pmatrix}$.

Section B

Answer any number of questions.
Each question carries 5 marks.
Maximum 30 marks.

13. Polygonal line joining the points (2, 0), (4, 4), (7, 5) and (8, 3) is revolved about the x-axis. Find the area of the resulting surface of revolution.

14. Find the length of the cardiod $r = 1 + \cos\theta, 0 \le \pi \le 2\pi$.

15. Find the power series of the form $\sum_{i=0}^{\infty} a_i x^i$ for $\frac{23-7x}{(3-x)(4-x)}$. Also find the radius of convergence.

16. Evaluate $\lim_{x \to \infty} \frac{\sin x - x}{x^3}$ using a Macluarin's series.

17. Use Gram Schmidt orthonormalization process to transform the basis $\{u_1, u_2, u_3\}$ for $\mathbb{R}^3$ into an orthonormal basis $B' = \{w_1, w_2, w_3\}$, where $u_1 = (1, 1, 0)$, $u_2 = (1, 2, 2)$ and $u_3 = (2, 2, 1)$.

18. Compute A^m for $A = \begin{pmatrix} 8 & 5 \\ 4 & 0 \end{pmatrix}$.

19. Find LU factorization of $A = \begin{pmatrix} 2 & -8 \\ 3 & 0 \end{pmatrix}$.

Section C

Answer any **one** *question.*
The question carries 10 marks.
Maximum 10 Marks.

20. (a) Find the area enclosed by the cardiod $r = 1 + \cos\theta$.

(b) Calculate $\sin\left(\frac{\pi}{4} + 0.06\right)$ to within 0.0001 by using Taylor's series about $x_0 = \frac{\pi}{4}$.

21. (a) Use an LU factorization to evaluate the determinant of $A = \begin{pmatrix} -1 & 2 & -4 \\ 2 & -5 & 10 \\ 3 & 1 & 6 \end{pmatrix}$.

(b) Find the rank of $A = \begin{pmatrix} 1 & 1 & -1 & 3 \\ 2 & -2 & 6 & 8 \\ 3 & 5 & -7 & 8 \end{pmatrix}$.

(1 × 10 = 10 marks)

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SECOND SEMESTER B.A./B.Sc. DEGREE EXAMINATION, APRIL 2020

(CBCSS—UG)

Mathematics

MTS 2B 02—CALCULUS OF SINGLE VARIABLE—I

(2019 Admissions)

(Multiple Choice Questions for SDE Candidates)

Time : 15 Minutes	Total No. of Questions : 20	Maximum : 20 Marks

INSTRUCTIONS TO THE CANDIDATE

1. This Question Paper carries Multiple Choice Questions from 1 to 20.
2. The candidate should check that the question paper supplied to him/her contains all the 20 questions in serial order.
3. Each question is provided with choices (A), (B), (C) and (D) having one correct answer. Choose the correct answer and enter it in the main answer-book.
4. The MCQ question paper will be supplied after the completion of the descriptive examination.

MTS 2B 02—CALCULUS OF SINGLE VARIABLE—I

(Multiple Choice Questions for SDE Candidates)

1. Given $f(x) = 3x$ and $g(x) = x^2 - 1$. Then, the domain of $\frac{f}{g}$ is :

   (A) $[1, \infty)$. (B) $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$.

   (C) $(0, \infty)$. (D) $(1, \infty)$.

2. $\lim_{x \to \infty} \sin(x)$ is :

   (A) 0. (B) 1.

   (C) 1 or – 1. (D) Limit does not exists.

3. If f is continuous at every point of a closed interval I, then f assumes :

   (A) An absolute maximum value M but not an absolute minimum value.

   (B) An absolute minimum value m but not an absolute maximum value.

   (C) Both an absolute maximum value M and an absolute minimum value m.

   (D) Neither an absolute maximum nor an absolute minimum.

4. On $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, $f(x) = \sin(x)$ takes on :

   (A) A maximum value of 1 (once) and a minimum value of 0 (twice).

   (B) A maximum value of 1 (once) and minimum value of – 1.

   (C) A maximum value of 1 (once) and no minimum value.

   (D) A minimum value of – 1 (once) and no maximum value.

5. The only domain points where a function can assume extreme values are ————————.

   (A) Critical points and end points. (B) Critical points only.

   (C) End points only. (D) None of the above.

6. Using which of the following reasons, can we conclude that "The Rolle's theorem cannot be applied to the function $f(x) = \tan x$ for the interval $[0, \pi]$."

   (i) There is a discontinuity at $x = \frac{\pi}{2}$ to the function $f(x) = \tan x$.

   (ii) $f'(x) = \sec^2 x$ which does not exist at $x = \frac{\pi}{2}$.

   (A) Both (i) and (ii). (B) (i) only.

   (C) (ii) only. (D) None of the above.

7. The value or values of c that satisfy the equation $\frac{f(b)-f(a)}{b-a}=f'(c)$ in the conclusion of Mean Value Theorem for the function $f(x)=x^2+2x-1$ and the interval $[0,1]$ is :

(A) 1. (B) $\frac{1}{2}$.

(C) $\frac{1}{3}$. (D) $\frac{1}{4}$.

8. At a critical point c, if f' changes from positive to negative at c ($f'>0$ for $x<c$ and $f'<0$ for $x>c$), then f has ——————.

(A) A local maximum value at c. (B) A local minimum value at c.

(C) Global minimum value at c. (D) None of the above.

9. A curve is said to be concave upwards (or convex downwards) at or near P when at all points near P on it ——————.

(A) Lies *above* the tangent at P. (B) Lies *below* the tangent at P.

(C) Lies *on* the tangent at P. (D) None of these.

10. $\lim_{x\to\infty}\left(5+\frac{1}{x}\right)=$ ——————.

(A) 0. (B) $\frac{1}{5}$.

(C) 5. (D) ∞.

11. $\lim_{x\to-\infty}\frac{11x+2}{2x^3-1}=$ ——————.

(A) 0. (B) $\frac{11}{2}$.

(C) ∞. (D) $-\infty$.

12. $\lim_{x\to 0}\frac{\sin(3x)}{\sin(4x)}$:

(A) 1. (B) $\frac{4}{3}$.

(C) $\frac{3}{4}$. (D) 0.

13. $\lim_{x\to 0}\frac{\sin(x)}{x^2+3x}$:

(A) 1. (B) $\frac{1}{3}$.

(C) 3. (D) $\frac{1}{4}$.

14. Use the linear approximation of $f(x) = \sqrt{1+x}$ at $a = 0$ to estimate $\sqrt{0.95}$:

(A) 0.942.

(B) 0.995.

(C) 0.9820.

(D) 0.9750.

15. If $x^2 + 2xy = y^2$, then $\frac{dy}{dx}$ is :

(A) $\frac{x+y}{y-x}$.

(B) $2x + 2y$.

(C) $\frac{x+1}{y}$.

(D) $-x$.

16. If $y = 9x^2 - 4x + 3$, then $\frac{d^2y}{dx^2}$ is :

(A) $18x - 4$.

(B) -4.

(C) 22.

(D) 18.

17. Determine the extremas of the following function $4x^3 - 48x$:

(A) $(2, -64)$.

(B) $(2, -64)$ and $(-2, 64)$.

(C) $(2.3, -61.9)$ and $(-2, 64)$.

(D) $(-2.3, 61.9)$ and $(2, -64)$.

18. The linearization of $f(x) = x^3$ at $x = 2$ is ————————.

(A) $2(6x - 7)$.

(B) $2(6x + 7)$.

(C) $3x$.

(D) 0.

19. $d(\cot u) =$ ————————.

(A) $-\operatorname{cosec}^2 u\, du$.

(B) $\operatorname{cosec}^2 u\, du$.

(C) $\sin u\, du$.

(D) $-\sec^2 u\, du$

20. The radius r of a circle increases from $r_0 = 10\, m$ to $10.1\, m$. Estimate the increase in the circle's area A by calculating dA :

(A) $dA = 2\pi\, m^2$.

(B) $dA = -2\pi\, m^2$.

(C) $dA = \pi\, m^2$.

(D) $dA = -\pi\, m^2$.

C 82445 (Pages : 3) Name.................................

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SECOND SEMESTER B.A./B.Sc. DEGREE EXAMINATION, APRIL 2020

(CBCSS—UG)

Mathematics

MTS 2B 02—CALCULUS OF SINGLE VARIABLE—I

(2019 Admissions)

Time : Two Hours and a Half Maximum : 80 Marks

Section A

Answer any number of questions.
Each question carries 2 marks.
Maximum 25 marks.

1. Let f and g be functions defined by $f(x) = x + 1$ and $g(x) = \sqrt{x}$. Find the functions gof and fog. What is the domain of gof?

2. Find $\lim_{x \to 0} \frac{\sqrt{1+x} - 1}{x}$.

3. Let $f(x) = \begin{cases} \frac{x^2 - x - 2}{x - 2} & \text{if } x \neq 2 \\ 1 & \text{if } x = 2. \end{cases}$ Show that f has a removable discontinuity at 2. Redefine f at 2 so that it is continuous everywhere.

4. Find $\lim_{x \to \pi/4} \frac{\sin x}{x}$.

5. Show that $f(x) = |x|$ is continuous everywhere.

6. Find the derivative of $\sqrt[3]{x} + \frac{1}{\sqrt{x}}$.

7. Find the critical points of $f(x) = x^3 - 6x + 2$.

8. Find $\lim_{x \to \infty}(2x^3 - x^2 + 1)$ and $\lim_{x \to -\infty} 2x^3 - x^2 + 1$.

9. Find the interval on which $f(x) = x^2 - 2x$ is increasing or decreasing.

10. Find the vertical asymptote of the graph of $f(x) = \frac{1}{x - 1}$.

Turn over

11. Find $\int \frac{\cos x}{1-\cos^2 x}\, dx$.

12. Find $\int xe^{-x^2} dx$.

13. Suppose $\int_1^6 f(x)dx = 8$ and $\int_4^6 f(x)dx = 5$, what is $\int_1^4 f(x)dx$.

14. Find the volume of the solid obtained by revolving the region under the graph of $y = \sqrt{x}$ on [0, 2] about the x-axis.

15. Find the work done in lifting a 2.4 kg. package 0.8 m. off the ground (given g = 9.8 m./sec.^{2}).

Section B

Answer any number of questions.
Each question carries 5 marks.
Maximum 35 marks.

16. Find the slope and an equation of the tangent line to the graph of the equation $y = -x^2 + 4x$ at the point p (2, 4).

17. Suppose that $g(x) = \left(x^2+1\right) f(x)$ and it is known that $f(2) = 3$ and $f'(2) = -1$. Evaluate $g'(2)$.

18. (a) Show that $f(x) = x^3$ satisfies the hypothesis of the mean value theorem on [– 1, 1].

    (b) Find the numbers c in (– 1, 1) that satisfies the equation as guaranteed by the mean value theorem.

19. Find the slant asymptotes of the graph of $f(x) = \frac{2x^2-3}{x-2}$.

20. A car moves along a straight road with velocity function $v(t) = t^2 + t - 6, 0 \le t \le 10$, where $v(t)$ is measured in feet per second.

    (a) Find the displacement of the car between t = 1 and t = 4.

    (b) Find the distance covered by the car during this period.

21. (a) Evaluate $\int_{-3}^{0} \left(x^2 - 4x + 7\right) dx$ by Fundamental theorem of Calculus.

    (b) Use the definition of definite integral to show that if $f(x) = c$, a constant function, then $\int_a^b f(x)\, dx = c(b-a)$.

22. Find the center of mass of a system comprising three particles with masses 2, 3 and 5 slugs, located at the points (– 2, 2), (4, 6) and (2, – 3) respectively.

23. Find the lengh of the graph of $x = \frac{1}{3}y^3 + \frac{1}{4y}$ from $P\left(\frac{7}{12}, 1\right)$ to $G\left(\frac{67}{24}, 2\right)$.

Section C

Answer any **two** *questions.*
Each question carries 10 *marks.*

24. (a) Find $\lim_{\theta \to 0} \frac{\cos\theta - 1}{\theta}$.

    (b) Use intermediate value theorem to find the value of c such that $f(c) = 7$, where $f(x) = x^2 - x + 1$ on $[-1, 4]$.

    (c) In a fire works display, a shell is launched vertically upwards from the ground, reaching a height $S = -16t^2 + 256t$ feets after t seconds. The shell burst when it reaches its maximum height :

    (i) A what time after launch will the shell burst.

    (ii) What will be the altitude of the shell when it explodes ?

25. Find the dimensions of the rectangle of greatest area that has its base on the x-axis and is inscribed in the parabola $y = 9 - x^2$.

26. Using the definiton of definite integral evaluate $\int_a^b x\,dx$.

27. Find the aera of the surface obtained by revolving the graph of $f(x) = \sqrt{x}$ on the interval $[0, 2]$ about the x-axis.

(2 × 10 = 20 marks)