2B1N23290

(Pages : 2)

Reg. No:.........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

First Semester B.Sc Mathematics Degree Examination, November 2023

BMT1B01 – Basic Logic and Calculus – I

(2022 Admission onwards)

Time : 2 ½ hours

Max. Marks : 80

Section A

All questions can be attended

Each question carries 2 marks

1. Write the sentence in *if-then* form:'$x = 1$ *is sufficient for* $x^2 = 1$
2. Show that $p \to q \equiv \sim q \to \sim p$
3. Rewrite the implication in inferential form:

   $[(p \to q) \wedge (\sim q)] \to \sim p$
4. Find $\lim_{x\to 2} \frac{x^2-4}{x-2}$
5. Let $f(x) = \frac{1}{x^2}$. Evaluate $\lim\limits_{x\to 0+} f(x)$, $\lim\limits_{x\to 0-} f(x)$and $\lim\limits_{x\to 0} f(x)$, if they exist.
6. Show that $\lim\limits_{x\to 2}[x]$ does not exist.
7. Find the extrema of $f(x) = x^2, -1 < x < 2$.
8. Verify that $f(x) = x^2 + 1$ satisfies the hypothesis of Mean Value Theorem on $[0,2]$.

   Find the value of c.
9. Find the points of inflection of $f(x) = x^4 - 4x^3 + 12$
10. Find the horizontal and vertical asymptotes of $g(x) = \frac{x}{x+1}$
11. Find two numbers whose difference is 50 and whose product is minimum.
12. Find all the anti-derivatives of $f(x) = 1$ on $(-\infty, \infty)$
13. Evaluate $\int \frac{\sin t}{\cos^2 t} dt$
14. Evaluate the sum: $\sum_{k=1}^{n} \frac{1}{n}\left(1 + \frac{k}{n}\right)^2$
15. Divide the interval $[2, 5]$ imnto n subintervals of equal length and let $c_k$be any point

    in $[x_{k-1}, x_k]$. Write $\lim\limits_{n\to\infty} \sum_{k=1}^{n} \sqrt{1 + c_k^2}\ \Delta x$ as an integral.

(ceiling 25 Marks)

Section B

All questions can be attended

Each question carries 5 marks

16. Let $P(x,y): y^2 < x$ and x and y are real numbers. Determine the truth values of :

    i) $(\forall x)(\forall y)P(x,y)$ ii) $(\exists y)(\forall x)P(x,y)$

17. Construct truth table and verify: $\sim (p \to q) \equiv p \wedge \sim q$

18. Find $\lim_{x\to 0} x^2 \sin\frac{1}{x}$.

19. Using formal definition prove that $\lim\limits_{x\to 2} x^2 = 4$

20. Determine the intervals where the function $f(x) = x + \frac{1}{x}$ is increasing and where it decreasing.

21. Prove that $\lim\limits_{x\to 0}\frac{1}{x^2} = \infty$.

22. Show that $\int_a^b x\,dx = \frac{1}{2}(b^2 - a^2)$

23. Find the average value and c guaranteed by the Mean Value Theorem for Integrals for $f(x) = 4 - 2x$on $[0,2]$.

(ceiling 35 Marks)

Section C

Answer any two questions

Each question carries 10 marks

24. a) Test the validity of the argument

$$\begin{array}{c} p \vee q \\ q \vee r \\ \sim r \\ \hline \therefore p \end{array}$$

    b) Prove by contradiction that there is no largest prime number

25. Let $f(x) = \begin{cases} ax + b, if\ x \le 1 \\ 4, if\ x = 1 \\ 2ax - b, if\ x > 1 \end{cases}$. Find the value of a and b that will make f continuous on $(-\infty, \infty)$.

26. Sketch the graph $f(x) = x^3 - 3x^2 + 1$.

27. a) Find $\frac{dy}{dx}$ if $y = \frac{1}{1+t^2}dt$

    b)Evaluate $\int_{-2}^{2} f(x)dx$ where, $f(x) = \begin{cases} -x^2 + 1, if\ x < 0 \\ x^3 + 1, if\ x \ge 0 \end{cases}$

(2 x 10 = 20 Marks)

2B1N23291

(Pages : 2)

Reg. No:..........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

First Semester B.Sc (Chemistry, Physics & Statistics) Degree Examination, November 2023

BMT1C01 – Mathematics – I

(2022 Admission onwards)

Time : 2 hours

Max. Marks : 60

Section A

All questions can be attended

Each question carries 2 marks

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

2. Show that $y=\sin\frac{1}{x}$ has no limit as x approaches zero from either side.

3. For what value of , $f(x)=\begin{cases}x^2-1, & x<3\\ 2ax, & x\geq 3\end{cases}$ is continuous at every x?

4. Define $g(4)$ in a way that extends $g(x)=\frac{(x^2-16)}{(x^2-3x-4)}$ to be continuous at $x=4$.

5. Suppose that $f(-1)=3$ and $f'(x)=0$. Then find $f(x)$.

6. Find $\lim_{x\to 0}\frac{\sin x-x}{x^3}$.

7. Find the horizontal tangents of the function $f(x)=\frac{x^3}{3}-\frac{x^2}{2}+1$.

8. State first derivative theorem for local extreme values.

9. Define point of inflection of a graph of a function. Give an example.

10. Show that the value of $\int_0^1 \sin x^2 dx$ cannot possibly be 2.

11. Find all points in the interval $[0,\ 1]$ at which the function $f(x)=-3x^2-1$ assumes its average value.

12. If $y=\int_1^{\sin x} 3t^2 dt$ find $\frac{dy}{dx}$ by differentiating integral directly.

(Ceiling: 20 Marks)

Section B
All questions can be attended
Each question carries 5 marks

13. Find the derivative of $g(t) = \tan(5 - \sin 2t)$.
14. Show that the equation $x^3 - 15x + 1 = 0$ has three solutions in the interval $[-4, 4]$.
15. Find an equation of the tangent line to the curve $y = \frac{8}{\sqrt{x-2}}$ at $(6, 4)$.
16. Find the tangent and normal to the curve $x^2 + xy - y^2 = 1$ at the point $(2, 3)$.
17. A hot balloon rising straight up from a level field is tracked by a range finder 500 ft from the lift-off point. At the moment the range finder's elevation angle is $\frac{\pi}{4}$, the angle is increasing at the rate of 0.14 rad/mm. How fast is the balloon rising at the moment?
18. Find the absolute extrema of $h(x) = x^{\frac{2}{3}}$ on $[-2, 3]$.
19. Find the total area of the region between x-axis and the graph of the function $f(x) = -x^2 - 2x, -3 \leq x \leq 2$.

(Ceiling; 30 Marks)

Section C
Answer any one question
Question carries 10 marks

20. Graph the function $y = \frac{x^3+1}{x}$. Include the equations of asymptotes and dominant terms.
21. (i) Find the intervals on which $f(x) = -x^3 + 12x + 5, \ -3 \leq x \leq 3$ is increasing and decreasing. Where does the function assume extreme values and what are these values?

    (ii) Find the asymptotes of the graph of $y = -\frac{x^2-4}{x+1}$.

$(1 \times 10 = 10$ Marks)

2B1N23291(B)

(Pages : 2) Reg. No:........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

First Semester B.Sc Computer Science Degree Examination, November 2023

BMT1C01(CS) – Mathematics – I

(2022 Admission onwards)

Time : 2 hours

Max. Marks : 60

Section A
All questions can be attended
Each question carries 2 marks

1. The power set of the set consists of the letters of the word MATHS is.........
2. Let A be the set of all straight lines. A relation on R is defined by xRy iff x is perpendicular to y, for all x,y ϵ A. Is this a transitive relation? Justify.
3. Dual of $(A\cap B^c)^c \cup B$ is..........
4. Negate the statement $\neg(p\wedge\neg q\vee r)$.
5. Define Proposition. Give an example.
6. Write a short note on universal and existential quantifiers.
7. Position of a particle at a time t is given by the function $p(t) = 3t^2 + 2 - \sqrt{t}$. Find the velocity and acceleration of the particle at t = 2.
8. Find $\lim_{x\to\frac{\pi}{4}}(2x^2 - cotx)$.
9. Find $\frac{d}{dx}(\frac{x}{x^2+1})$.
10. Define an increasing function. Give an example.
11. Find all the asymptotes of $f(x) = \frac{x^2-4}{x-1}$.
12. If $f'(x) = 2x,\ for\ all\ x \neq -2\ and\ f(-2) = 3.\ Find\ f(2)$

(Ceiling: 20 Marks)

Section B
All questions can be attended
Each question carries 5 marks

13. In an examination 40% students passed in Maths only, 30% students passed in Physics only and 10% students failed in both subjects. If 400 students passed in Physics, find the total number of students by drawing Venn diagram.
14. Show that $[(p\rightarrow q)\wedge(q\rightarrow r)] \rightarrow (p\rightarrow r)$.
15. If P and Q are two relations on a set A , Show that $P\cap Q$ is a relation on A.

16. Test the continuity of the function $f(x) = \begin{cases} x\sin\left(\frac{1}{x}\right) & , x \neq 0 \\ 0 & , x = 0 \end{cases}$

17. Find the equations of all the lines having slope -1 that are tangent to the curve

$y = \frac{1}{(x-1)}$.

18. Find the points of inflection of the function $f(x) = 3x^4 - 4x^3 + 1$.

19. Find the local and absolute extreme values of the function $\frac{1}{3}x^3 - 2x^2 + 4x$, $0 \le x < \infty$.

(Ceiling: 30 Marks)

Section C
Answer any one question
Question carries 10 marks

20. i) a)Evaluate $\lim_{x\to\infty} \frac{x+\sin x}{2x+7-5\sin x}$ b) Find y' at (-1,1) if $x^2 + 3xy + y^2 = -1$.

ii)Define contingency. Show that $(p \vee q) \wedge (\neg q)$ is a contingency .

21. Graph the function $f(x) = \frac{1}{6}(x^3 - 6x^2 + 9x + 6)$.

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(Pages : 2)

Reg. No:.........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

First Semester BVOC AUTOMOBILE Degree Examination, November 2023

SDC1MT01 – Mathematics

(2022 Admission onwards)

Time: 2 ½ hours

Max. Marks : 80

PART A

Answer *all* questions.

Each question carries *Two* marks.

1. Find $\lim_{x\to 2}\frac{x^2+3x-10}{x-2}$
2. Find $\lim_{x\to\infty}\frac{x-5}{3x-4}$
3. State Rolle's theorem for derivative.
4. Differentiate $f(x) = 6x^3 + 2x^2 + x + 4$.
5. Find the slope of the tangent line to the graph of $f(x) = 3\sqrt{x}$ at $x = 9$.
6. A sphere of radius r millimetres has volume $V = \frac{4}{3}\pi r^3$ cubic millimeters. Find the rate of increase of volume with respect to radius at $r = 3$.
7. Find the second derivative of $f(x) = 2x^3 - 5x^2 + 4x + 8$
8. Evaluate $\int_0^3 (x^2 + x - 1)dx$
9. If $y = f(x)$ and $2x^2 + 5y^2 = 1$, express dy/dx in terms of x and y.
10. Find the sum of the first 100 integers.
11. Find the inflection points of $f(x) = x^3 - x^2$.
12. Analyze the concavity of $f(x) = 10x^3$ at the points $x = -1$, $x = 0$, and $x = 1$.
13. Find the volume of a ball of radius r.
14. Is the function $f(x) = x^4 + 3x^2 + 12$ odd or even?
15. A bus travels $2x^2$ meters in x seconds. Find the instantaneous velocity at the time $x = 4$.

[Ceiling = 25 Marks]

PART B

Answer *all* questions.

Each question carries *Five* marks.

16. Differentiate $f(x) = (2x^3 - 5)(4x + 8)$

17. Find the equation of the tangent line to the parametric curve $x = t^3$ and $y = t^5$ at $t = 2$.

18. Find the critical points of the function $f(x) = x^3 - x$. Are they local maximum or minimum points?

19. Find $\sum_{j=3}^{102} (j - 2)$.

20. A car has position $2t^4 + 5t - 6$ at time t. Find the velocity and acceleration of the car at $t = 2$.

21. Find $\lim_{x \to 0} \frac{\cos x - 1}{x^2}$

22. Draw the graph of the step function g on [-1,2] defined by

$$g(x) = \begin{cases} -4 & if \ -1 \leq x < 0 \\ 2 & if \ 0 \leq x \leq 1 \\ 3 & if \ 1 < x \leq 2 \end{cases}$$

Compute the signed area of the region between its graph and the x axis.

23. Find the area between the graphs $y = x^2$ and $y = x + 3$ on [-1,1].

[Ceiling = 35 Marks]

PART C

Answer any *two* questions

Each question carries *Ten* marks.

24. Sketch the graph of $f(x) = 2x^3 + 8x + 1$.

25. Calculate an approximate value for $\frac{1}{(2.01)^2 + (2.01)^3}$.

26. (a) Find the average value of $f(x) = x^2$ on [0,2].

    (b) The region under the graph of $y = x^2$ on [0,1] is revolved about the x axis. Sketch the resulting solid and find its volume.

27. (a) Show that if $f'(x_0)$ exists, then f is continuous at x_0.

    (b) Does $\lim_{x \to \infty} \frac{|x|}{x}$ exist?

[2 x 10 = 20 Marks]