C 82976 (Pages : 4) Name..............................

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

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2015

(CUCBCSS—UG)

Core Course—Mathematics

MAT 2B 02—CALCULUS

Time : Three Hours Maximum : 80 Marks

Part A

Answer all the **twelve** *questions.*
Each question carries 1 *mark.*

1. Evaluate $\lim_{x \to \infty} \frac{5x^2 + 8x - 3}{3x^2 + 2}$.

2. Find the intervals in which the function f is increasing given $f^1(x) = x^{-1/3}(x+3)$.

3. State the Mean Value Theorem.

4. What are the critical points of f given $f'(x) = (x-1)(x+2)(x-3)$.

5. Find dy if $y = \sin 3x$.

6. Evaluate $\int_0^4 \left(3x - \frac{x^3}{4}\right) dx$.

7. The length of the longest subinterval of a partition is called its ———.

8. Write the sums without sigma notation and then evaluate the sum $\sum_{k=1}^{2} \frac{6k}{k+1}$.

9. If $\int_0^3 f(x)\, dx = 5$ find $\int_0^3 \sqrt{2}\, f(x)\, dx$.

10. A function with a continuous first derivative is said to be ———.

11. 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.

12. If f is smooth in $[a, b]$ then the length of the curve $y = f(x)$ from a to b is L = ———.

(12 × 1 = 12 marks)

Turn over

Part B

Answer any **nine** *questions.*
Each question carries 2 marks.

13. Find the work done by a force of $F(x) = \frac{1}{x^2}$ N along the x-axis from $x = 1$m to $x = 10$m.

14. Find the absolute maximum and minimum values of $f(x) = 4 - x^2, -3 \le x \le 1$.

15. Evaluate $\int_0^{2\pi} \frac{\cos z}{\sqrt{4 + 3\sin z}} dz$.

16. Find the volume of the solid generated by revolving the region bounded by the lines $y = 0, x =$ and the curve $y = x^3$.

17. Evaluate $\frac{d}{dx} \int_0^{\sqrt{x}} \cos t \, dt$.

18. Show that if f is continuous on $[a, b]$, $a \neq b$ and if $\int_a^b f(x)\,dx = 0$ then $f(x) = 0$ at least once in $[a, b]$.

19. Evaluate $\sum_{k=1}^{6} (3 - k^2)$.

20. Find the linearization of $f(x) = \sqrt{1+x}$ at $x = 3$.

21. Find the average value of $f(x) = x^2 - 1$ on $[0, \sqrt{3}]$.

22. About how accurately should we measure the radius r of a sphere to calculate the surface area $S = 4\pi r^2$ within 1% of its true value.

23. Find the length of the curve $x = \sin y$, $0 \le y \le \pi$.

24. Find the area of the region enclosed by the parabola $y = 2 - x^2$ and the line $y = -x$.

(9 × 2 = 18 marks)

Part C

Answer any **six** *questions.*
Each question carries 5 *marks.*

25. Find the length of the curve $y = \tan x$, $\frac{-\pi}{3} \leq x \leq 0$.

26. Find the volume of the solid generated by revolving the region bounded by $y = \sqrt{x}$ and the lines $y = 1, x = 4$ about the line $y = 1$.

27. Find the area of the region enclosed by the curve $y = 2x - x^2$ and the line $y = -3$.

28. Find the lateral surface area of the cone generated by revolving the line segment $y = \frac{x}{2}$, $0 \leq x \leq 4$ about the y-axis.

29. Find the asymptotes of the curve $y = \frac{x^2 - 3}{2x - 4}$.

30. Express the solution of the following initial value problem as an integral :

    Differential equation : $\frac{dy}{dx} = \tan x$.

    Initial condition : $y(1) = 5$.

31. Find the intervals on which the function $g(t) = -t^2 - 3t + 3$ is increasing and decreasing.

32. Find the local maxima and local minima of $g(x) = -x^3 + 12x + 5$, $-3 \leq x \leq 3$.

33. Find the area between $y = \sec^2 x$ and $y = \sin x$ from 0 to $\frac{\pi}{4}$.

(6 × 5 = 30 marks)

5

Part D

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

34. Show that the centre of mass of a straight, thin strip or rod of constant density has half way between its two ends.

35. A rectangle is to be inscribed in a semi-circle of radius 2. What is the largest area then rectangle can have and what are its dimensions ?

36. Find the area of the region between the curve $y = 4 - x^2, 0 \leq x \leq 3$ and the x-axis.

(2 × 10 = 20 marks)

C 82970

Repeat

5597

(Pages : 4)

Name.......................................

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

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2016

(CUCBCSS—UG)

Core Course—Mathematics

MAT 2B 02—CALCULUS

Time : Three Hours

Maximum : 80 Marks

Part A

Answer **all** *the twelve questions.*
Each question carries 1 mark.

1. Find the linearization of $f(x) = \cos x$ at $x = \frac{\pi}{2}$.

2. Evaluate $\int_0^{\frac{\pi}{3}} 2\sec^2 x \, dx$.

3. The length of the largest sub-interval of a partition is called its ————.

4. Evaluate $\lim_{x \to -\infty} \frac{2x^2 - 3}{7x + 4}$.

5. What are the critical points of f given $f^1(x) = (x-1)^2 (x+2)$.

6. State the Mean Value Theorem.

7. Find dy if $y = x^5 + 37x$.

8. Write the sums without sigma notation and then evaluate the sum $\sum_{k=1}^{3} (-1)^{k+1} \sin \frac{\pi}{k}$.

9. Suppose that $\int_2^3 f(x)\, dx = 4$. Find $\int_2^3 -f(x)\, dx$.

10. Find the intervals in which the function f is increasing given $f^1(x) = (x-1)^2 (x+2)$.

Turn over

11. Evaluate $\int_{1}^{32} x^{-6/5}\, dx$.

12. Evaluate $\lim_{x \to \infty} \frac{2x+3}{5x+7}$.

(12 × 1 = 12 marks)

Part B

Answer any **nine** *questions.*
Each question carries 2 marks.

13. Suppose that f is continuous and that $\int_{0}^{3} f(z)\, dz = 3$ and $\int_{0}^{4} f(z)\, dz = 7$. Find $\int_{3}^{4} f(z)\, dz$.

14. Find the volume of the solid generated by revolving the region bounded by the line $y = 0$ and the curve $y = x - x^2$.

15. Find the average value of $f(x) = -3x^2 - 1$ on $[0, 1]$.

16. Evaluate $\int_{-\pi/4}^{0} \tan x \sec^2 x\, dx$.

17. Evaluate $\frac{d}{dt} \int_{0}^{t^4} \sqrt{u}\, du$.

18. Find the absolute maximum and minimum values of $f(x) = -x - 4, -4 \le x \le 1$.

19. Evaluate $\sum_{k=1}^{10} k^2$.

20. Find $\frac{dy}{dx}$ if $y = \int_{1}^{x^2} \cos t\, dt$.

Show that the value of $\int_0^1 \sqrt{1+\cos x}\, dx$ cannot possibly be 2.

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.

3. Find the work done by a force of $F(x) = \frac{1}{x^2}$ N along the x–axis is from $x = 1\, m$ to $x = 10\, m$.

4. Find the function $f(x)$ whose derivative is series and whose graph passes through the point (0, 2).

(9 × 2 = 18 marks)

Part C

Answer any **six** *questions.*
Each question carries 5 *marks.*

25. Find the value of local maxima and minima of $g(x) = x^2 - 4, -2 \leq x \leq 2$ and say where they are assumed.

26. Find the surface area of the solid generated by revolving $y = \tan x, 0 \leq x \leq \frac{\pi}{4}$ about the x - axis.

27. Find the area of the region enclosed by the parabola $y = 2 - x^2$ and the line $y = -x$.

28. Find the intervals on which the function $f(x) = 3x^2 - 4x^3$ is increasing and decreasing.

29. Find the volume of the solid generated by revolving the region between the parabola $x = y^2 + 1$ and the line $x = 3$ about the line $x = 3$.

30. Find the asymptotes of the curve $y = \frac{x^2 - 3}{2x - 4}$.

31. Find the length of the curve $x = \sin y, 0 \leq y \leq \pi$.

32. Express the solution of the following initial value problem as an integral :

Differential equation	:	$\frac{dy}{dx} = \tan x$
Initial condition	:	$y(1) = 5$

33. About how accurately should we measure the radius r of a sphere to calculate the surface area $s = 4\pi r^2$ within 1 % of its true value.

(6 × 5 = 30 marks)

Part D

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

34. Find the area of the surface generated by revolving the curve $y = x^3, 0 \le x \le \frac{1}{2}$ about the x-axis.

35. Find the length of the curve $y = \frac{4\sqrt{2}}{3} x^{3/2} - 1, 0 \le x \le 1$.

36. Find the area of the region between the x-axis and the graph of $f(x) = x^3 - x^2 - 2x, -1 \le x \le 2$.

(2 × 10 = 20 marks)

the surface area

Repeat

C 5524738 (Pages : 4) Name..

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

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2017

(CUCBCSS—UG)

Core Course—Mathematics

MAT 2B 02—CALCULUS

Time : Three Hours Maximum : 80 Marks

Part A

Answer all the **twelve** *questions.*
Each question carries 1 *mark.*

1. Find dy if $y = \dfrac{2x}{1+x^2}$.

2. A function with a continuous first derivative is said to be ————.

3. Suppose that $\int_1^3 f(x)\,dx = 6$. Find $\int_1^3 f(u)\,du$.

4. If f is smooth in $[a, b]$ then the length of the curve $y = f(x)$ from a to b is L = ————.

5. Find the intervals in which the function f is increasing given $f'(x) = x(x-1)$.

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

7. Evaluate $\int_0^1 \left(x^2 + \sqrt{x}\right) dx$.

8. Write the sum without sigma notation and then evaluate the sum $\sum_{k=1}^{4} \cos k\pi$.

9. State Rolle's Theorem.

10. What are the critical points of f given $f'(x) = x^{-1/3}(x+2)$.

Turn over

11. Evaluate $\lim_{x \to \infty} \frac{\sin 2x}{x}$.

12. Find the linearization of $f(x) = \sqrt{1+x}$ at $x = 0$.

(12 × 1 = 12 marks)

Part B

Answer any **nine** *questions.*
Each question carries 2 marks.

13. Find the absolute maximum and minimum values of $f(x) = -\frac{1}{x}, -2 \le x \le -1$.

14. Evaluate $\int_0^{\pi/4} \tan x \sec^2 x \, dx$.

15. Find the volume of the solid generated by revolving the region bounded by the line $y = 0$ and the curve $y = x - x^2$.

16. Suppose that f is continuous and that $\int_0^3 f(x)\,dx = 3$ and $\int_0^4 f(x)\,dx = 7$. Find $\int_4^3 f(x)\,dx$.

17. Find the function $f(x)$ whose derivative is $\sin x$ and whose graph passes through the point (0, 2).

18. Find the average value of $f(x) = x^2 - 1$ on $\left(0, \sqrt{3}\right)$.

19. Evaluate $\sum_{k=1}^{7} (-2k)$.

20. Find $\frac{dy}{dx}$ if $y = \int_1^{x^2} \cos t \, dt$.

21. Show that if f is continuous on $[a,b]$ $a \neq b$ and if $\int_a^b f(x)dx = 0$ then $f(x) = 0$ at least once in $[a,b]$.

22. Evaluate $\frac{d}{dt}\int_0^{t^4} \sqrt{u}\, du$.

23. Find the area between $y = \sec^2 x$ and $y = \sin x$ from 0 to $\frac{\pi}{4}$.

24. Express the solution of the following initial value problem as an integral :

Differential equation	:	$\frac{dy}{dx} = \tan x$
Initial condition	:	$y(1) = 5$.

(9 × 2 = 18 marks)

Part C

Answer any **six** *questions.*
Each question carries 5 marks.

25. Find the lateral surface area generated by revolving $xy = 1,\ 1 \leq y \leq 2$ about the y-axis.

26. About how accurately should we measure the radius r of a sphere to calculate the surface area $S = 4\pi r^2$ within 1% of its true value.

27. Evaluate the length of the curve $x = \sqrt{1-y^2}, -\frac{1}{2} \leq y \leq \frac{1}{2}$.

28. Find the volume of the solid generated by revolving the region between the y-axis and the curve $x = \frac{2}{y}, 1 \leq y \leq 4$ about the y-axis.

29. Find the asymptotes of the curve $y = \frac{x+3}{x+2}$.

Turn over

30. Find the intervals on which the function $h(x) = -x^3 + 2x^2$ is increasing and decreasing.

31. Find the length of the curve $x = \sin y, 0 \leq y \leq \pi$.

32. Find the area of the region enclosed by the curve $y = x^2 - 2$ and the line $y = 2$.

33. Find the value of local maxima and minima of $f(x) = x^2 - 4, -2 \leq x \leq 2$ and 2ay where they are assumed.

(6 × 5 = 30 marks)

Part D

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

34. Find the area of the surface generated by revolving the curve $y = 2\sqrt{x}, 1 \leq x \leq 2$ about the x-axis.

35. State and prove the Fundamental Theorem of calculus.

36. Find the centre of mass of a thin plate of constant density δ covering the region bounded by the parabola $y = 4 - x^2$ and below by the x-axis.

(2 × 10 = 20 marks)

C 2473

43194 (Pages : 3) Name..............................

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

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2018

(CUCBCSS—UG)

Mathematics

MAT 2B 02—CALCULUS

Time : Three Hours Maximum : 80 Marks

Part A (Objective Type)

Answer all **twelve** *questions.*
Each question carries 1 *mark.*

1. Absolute maximum of the function $y = x^2$ on $(0, 2]$ is ....

2. Find dy if $y = x^5 + 37x$.

3. Find the interval in which the function $y = x^3$ is concave up.

4. Suppose that $\int_1^4 f(x)\,dx = -2$, evaluate $\int_4^1 f(x)\,dx$.

5. A partition's longest subinterval is called ————.

6. Find $\lim\limits_{x \to -\infty} \dfrac{\pi\sqrt{3}}{x^2}$.

7. Express the limit of Riemann sums $\lim\limits_{\|P\| \to 0} \sum\limits_{k=1}^{n} \left(3c_k^2 - 2c_k + 5\right) \Delta x_k$ as an integral if P denotes a partition of the interval $[-1, 3]$.

8. Find the norm of the partition $[0, 1.2, 1.5, 2.3, 2.6, 3]$.

9. Define critical point of a function.

10. Evaluate $\int 5\sec x \tan x\, dx$.

11. State Rolls' Theorem.

12. Define point of inflection.

(12 × 1 = 12 marks)

Turn over

Part B (Short Answer Type)

Answer any **nine** *questions.*

Each question carries 2 marks.

13. Evaluate $\lim_{x \to \infty} \frac{5x^2 + 8x - 3}{3x^2 + 2}$.

14. Find the absolute extrema of $h(x) = x^{2/3}$ on $[-2, 3]$.

15. Find the interval in which $f(t) = -t^2 - 3t + 3$ is increasing and decreasing.

16. Find dy/dx if $y = \int_1^{x^2} \cos t \, dt$.

17. Suppose $\int_1^x f(t)\, dt = x^2 - 2x + 1$. Find $f(x)$.

18. Evaluate $\sum_{k=1}^{4} (k^2 - 3k)$.

19. Give an example of a function with no Riemann integral. Explain.

20. Find the function $f(x)$ whose derivative is $\sin x$ and whose graph passes through the point $(0, 2)$.

21. Use Max-Min inequality to find upper and lower bounds for the value of $\int_0^1 \frac{1}{1 + x^2} dx$.

22. Show that the value of $\int_0^1 \sqrt{1 + \cos x}\, dx$ cannot possibly be 2.

23. Find the linearization of $f(x) = \cos x$ at $x = \pi/2$.

24. Suppose that $F(x)$ is an antiderivative of $f(x) = \frac{\sin x}{x}, x > 0$. Express $\int_1^3 \frac{\sin 2x}{x} dx$ in terms of F.

(9 × 2 = 18 marks)

Part C (Short Essay Type)

*Answer any **six** questions.*
Each question carries 5 marks.

25. Find the linearization of $f(x) = 2 - \int_2^{x+1} \frac{9}{1+t}\,dt$ at $x = 1$.

26. Find the area of the region between the curve $y = x^2$ and the x-axis on the interval $[0, b]$.

27. Find the asymptotes of the curve $y = 2 + \frac{\sin x}{x}$.

28. A rectangle is to be inscribed in a circle of radius 2. What is the largest area the rectangle can have, and what are its dimensions ?

29. Show that functions with zero derivatives are constant.

30. Find the lateral surface area of the cone generated by revolving the line segment $y = x/2, 0 \le x \le 4$, about the x-axis.

31. Show that if f is continuous on $[a, b, a \neq b$, and if $\int_a^b f(x)\,dx = 0$, then $f(x) = 0$ atleast once in $[a, b]$.

32. Find the area of the region in the first quadrant that is bounded above by $y = \sqrt{x}$ and below by x-axis and the line $y = x - 2$.

33. Find the area of the surface generated by revolving the curve $y = 2\sqrt{x}, 1 \le x \le 2$, about the x-axis.

(6 × 5 = 30 marks)

Part D (Essay Questions)

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

34. (a) Find the curve through the point $(1, 1)$ whose length integral is $L = \int_1^4 \sqrt{1 + \frac{1}{4x}}\,dx$.

    (b) How many such curves are there ?

35. Find the length of the curve $y = (1/3)\left(x^2 + 2\right)^{3/2}$ from $x = 0$ to $x = 3$.

36. Find the volume of the solid generated by revolving the regions bounded by the curve $x = \sqrt{5y^2}, x = 0, y = -1, y = 1$ about x-axis.

(2 × 10 = 20 marks)