



SCHEME OF INSTRUCTION AND EVALUATION
BSc (MSCs)Mathematics
I Year I Semester
2025-26

Subject	Course	Hours / Week		Exam Duration	Marks			No Of Credits
		Theory	Practical/Tutorial		Sem	Internal	Total	
English	General English	4 Hrs		3 Hrs	80	20	100	4
II Language	II language Telugu/Hindi/San scrit	4 Hrs		3 Hrs	80	20	100	4
Mathematics	DSC 1 A: Differential Equations	4 Hrs		3 Hrs	80	20	100	4
Statistics	DSC2 A Basic Statistics and Probability	4 Hrs		3Hrs	80	20	100	4
Computer Science	DSC 3A:Programming in C	4 Hrs		3Hrs	80	20	100	4
Practicals								
Mathematics	DSC 1 A: Differential Equations		2Hrs	3Hrs	25		25	1
Statistics	DSC 2A: Basic Statistics & Probability Using MSExcel and R:		2Hrs	3Hrs	25		25	1
Computer Science	DSC 3A: Programming using C		2Hrs	3Hrs	25		25	1
								23

*Note: In place of Tutorial practicals are introduced for 4hrs theory(4 credits)+2hrs
 Practicals (1 Credit) *Problems solving session for each 20 students one batch(Practicals).

Dr. M. S. Srinivas
 Professor ~~Mathematics~~

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AMSASCW Department of Maths Syllabi 2025-26

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SCHEME OF INSTRUCTION AND EVALUATION
BSc (MSCs)Mathematics
I Year II Semester
2025-26

Subject	Course	Hours / Week		Exam Duration	Marks			No Of Credits
		Theory	Practical/Tutorial		Sem	Internal	Total	
English	General English	4 Hrs		3 Hrs	80	20	100	4
II Language	II language Telugu/Hindi/Sanscrit	4 Hrs		3 Hrs	80	20	100	4
Mathematics	DSC 1B: Real Analysis	4 Hrs		3 Hrs	80	20	100	4
Statistics	DSC2 B Probability Distributions	4 Hrs		3Hrs	80	20	100	4
Computer Science	DSC3B:Data structures using C	4 Hrs		3Hrs	80	20	100	4
Practicals								
Mathematics	DSC 1 B: Real Analysis		2Hrs	3Hrs	25		25	1
Statistics	DSC 2B: Probability Distributions Using MSEExcel and R:1B		2Hrs	3Hrs	25		25	1
Computer Science	DSC 3B: Data structures using C		2Hrs	3Hrs	25		25	1
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Practicals (1 Credit) *Problems solving session for each 20 students one batch(Practicals)**

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AMSASCW Department of Maths Syllabi 2025-26

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SYLLABUS : SEMESTER- I DSC-I : DIFFERENTIAL EQUATIONS

Subject Code: Mat101

Instruction	4 Hrs/Wk
Credits	4
Duration of Semester Examination	3 Hrs
Duration of Sessional Examination	1 Hr
Semester Examination	80 Marks
Sessional Examination	20Marks

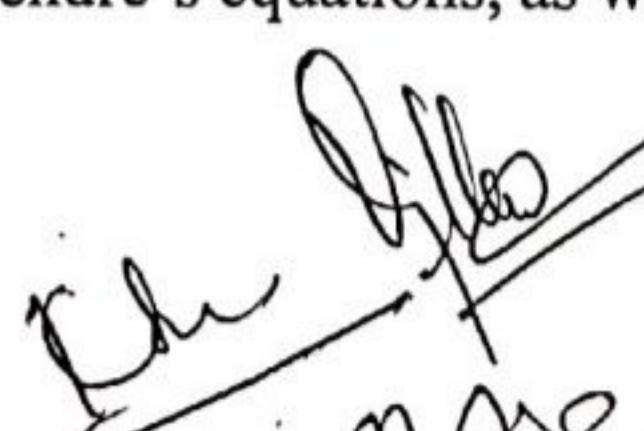
Course Objectives

After studying this course, students will be able to:

- 1: Understand the basic concepts, types, and formation of first-order and first-degree differential equations and learn methods for their analytical solutions.
- 2: Develop problem-solving skills to handle non-linear and higher-order differential equations, particularly those not of the first degree.
- 3: Acquire techniques for solving higher-order linear differential equations with constant coefficients using standard operator methods.
- 4: Explore and apply advanced methods such as variation of parameters, Cauchy–Euler, and Legendre's equations, and understand total and simultaneous differential equations.

Course Outcomes

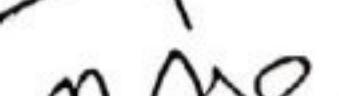
- 1: Apply various methods to solve first-order and first-degree differential equations, including separable, homogeneous, linear, exact, and reducible forms, using integrating factors and variable transformations.
- 2: Analyze and solve first-order but not first-degree differential equations such as Clairaut's equation, and apply them to real-life models like growth, decay, radioactivity, and orthogonal trajectories.
- 3: Solve higher-order linear differential equations with constant coefficients using the operator method and method of undetermined coefficients, and interpret homogeneous and non-homogeneous solutions.
- 4: Employ variation of parameters and handle linear differential equations with variable coefficients, including Cauchy–Euler and Legendre's equations, as well as total and simultaneous differential equations.


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UNIT- I

Differential Equations of First Order and First Degree: Introduction- Equations in Which Variables are Separable – Homogeneous Differential Equations - Differential Equations Reducible to Homogeneous Form – Linear Differential Equations - Differential Equations Reducible to Linear Form – Exact Differential Equations – Integrating Factors – Change in Variables (Text Book : 2.1 to 2.9)

UNIT- II

Equations of First Order But Not of The First Degree: Case I: Equations Solvable for p - Case II : Equations Solvable for y - Equations Solvable for x – Equations that do not Contain x (or y) - Equations Homogeneous in x and y – Equations of First Degree in x and y – Clairaut's Equation. Applications of First Order Differential Equations: Growth and Decay – Dynamics of Tumor Growth– Radioactivity and Carbon Dating – Compound Interest – Orthogonal Trajectories. (Text Book : 3.1 to 3.2 & 4.1 to 4.4 & 4.20)

UNIT- III

Higher Order Linear Differential Equations: Introduction - Solution of Homogeneous Linear Differential Equations of Order n with Constant Coefficients - Solution of the Non-Homogeneous Differential Equations with Constant Coefficients by Means of Polynomial Operators - Method of Undetermined Coefficients.

(Text Book : 5.1 to 5.4)

UNIT- IV

Method of variation of Parameters – Linear Differential Equations with Non-Constant Coefficients – The Cauchy – Euler Equation – Legendre's Linear Equations – Miscellaneous Differential Equations. Total Differential Equations – Simultaneous Total Differential Equations – Equations of the form $dx/p = dy/q = dz/r$. (Text Book : 5.5 to 5.9 & 2.10 to 2.12)

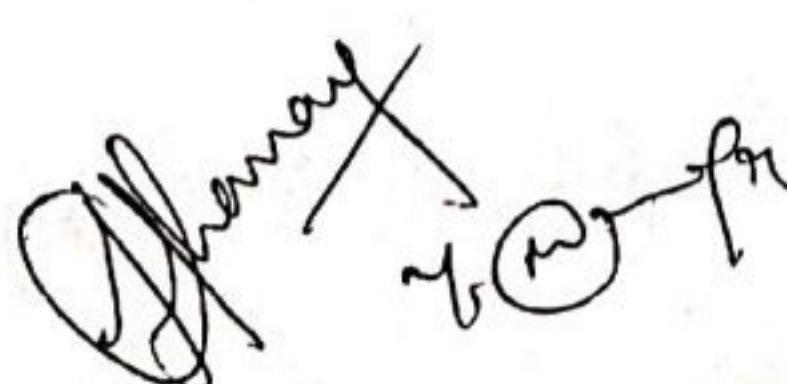
TEXT BOOK:

Zafar Ahsan, Differential Equations and Their Applications (Second Edition)

REFERENCE BOOKS :

1. Frank Ayres Jr, Theory and Problems of Differential Equations.
2. Ford, L.R ; Differential Equations.
3. Daniel Murray, Differential Equations.
4. S. Balachandra Rao, Differential Equations with Applications and Programs.
5. Stuart P Hastings, J Bryce McLead; Classical Methods in Ordinary Differential Equations

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Syllabus for B.Sc I Year
Differential Equations (Practical)
Mathematics- Semester I

Subject Code:Mat101

Instruction	2 Hrs/Week
Duration of Semester Examination	3 Hrs
Semester Examination	25 Marks
Credits	1

UNIT-I

1. Solve $(1-x^2)\frac{dy}{dx} + 2xy = x\sqrt{1-x^2}$
2. Solve $(1+e^y)\frac{x}{y}dx + e^y(1-\frac{x}{y})dy = 0$
3. Solve $x^2ydx - (x^3 + y^3)dy = 0$
4. Solve $(y+z)dx + (x+z)dy + (x+y)dz = 0$
5. Solve $y \sin 2x dx - (1 + y^2 + \cos^2 x)dy = 0$
6. Solve $(x^2+y^2+x)dx + xydy = 0$
7. Solve $(xycos(xy) + \sin(xy))dx + (x^2\cos(xy))dy = 0$
8. $dy/dx + y/x\log x = \sin(2x)/\log x$

UNIT-II

9. $y = 2px + \tan^{-1}(xp^2)$
10. $x^2p^2 - 2xyp + 2y^2 - x^2 = 0$
11. $y = 2p + 3p^2$
12. $\sin(p)x\cos y = \cos(p)x\sin y + p$
13. $(x-a)p^2 + (x-y)p - y = 0$
14. $y + px = p^2x^4$
15. $yp^2 + (x-y)p - x = 0$
16. Find the orthogonal trajectories of $x^2 + y^2 = cx$
17. Find the orthogonal trajectories of $r = c_1(1 - \sin\theta)$
18. If radioactive carbon-14 has a half-life of 5750..what will remain of one gram after 3000 Years



UNIT-III

19. $D^2y + (a + b)Dy + aby = 0$
20. $yy'' + 3y' + 2y = 2(e^{-2x} + x^2)$
21. $(D^2 + 1)y = e^{-x} + \cos(x) + x^3$
22. $(D^2 + 1)(D^2 + 4)y = \cos(x/3) \cos(3x/2)$
23. $4y'' - 5y' = x^2 e^x$
24. $(D^2 + 1)y = \cos x + x e^{2x} + e^x \sin x$
25. Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = \sin x$ by method of undetermined coefficients
26. $(D^2 - 2D - 8)y = 9xe^x + 10e^{-x}$ undetermined coefficients
27. $(D^2 + a^2)y = \sec(ax)$
28. $y^5 + 2y''' + y' = 2x + \sin x + \cos x$

Unit IV

29. $x^2y'' - xy' + 2y = x \log(x)$
30. $x^2y'' - xy' + 2y = x$
31. $(2x^2 + 1)y'' - 4xy' + 4y = 0$
32. $y'' + 2y' + y = x^2 e^x$ by the method of variation of parameters
33. $y'' - 2y' + y = e^x \log x$
34. $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$
35. $x^2y'' + 7xy' + 5y = x$
36. $y'' - \left(\frac{2}{x}\right)y' + \left(\frac{2}{x^2}\right)y = 0, y_1 = x$
37. $x^2y'' + 2xy' - 20y = (x+1)^2$
38. $(x+3)^2y'' - 4(x+3)y' + 6y = \log(x+3)$
39. $x^3y''' - x^2y'' + 2xy' - 2y = x^3 + 3x$
40. $x^2y'' + 2xy' - 20y = (x+1)^2$

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SYLLABUS: SEMESTER- II
DSC-II : REAL ANALYSIS

Subject Code: Mat 15

Instruction:	4Hrs/wk
Credits	4
Duration of Semester Examination	3 Hrs
Duration of Session Examination	1 Hr
Semester Examination	80 Marks
Session Examination	20 Marks

Course Objectives

After successful completion of this course, the students will be able to

- 1: Understand the algebraic, order, and completeness properties of real numbers and explore the behaviour of sets and sequences within the real number system.
- 2: Develop analytical skills to test the convergence and divergence of infinite series and understand the concepts of limits and continuity for real-valued functions.
- 3: Comprehend and apply the principles of differentiation to analyse the behaviour of functions, proving classical results such as Rolle's, Lagrange's, and Cauchy's Mean Value Theorems.
- 4: Grasp the theory of Riemann integration, understand conditions of integrability, and establish the connection between integration and differentiation through the Fundamental Theorem of Calculus.

Course Outcomes

- 1: Explain the field, order, and completeness properties of real numbers, and analyse the properties of open, closed, countable, and uncountable sets along with convergent and monotonic sequences.
- 2: Apply various tests for convergence of infinite series, including comparison, ratio, root, and integral tests, and examine the limits and continuity of real-valued functions.
- 3: Demonstrate understanding of differentiability and apply Rolle's, Lagrange's, and Cauchy's Mean Value Theorems to study the behaviour of functions and their higher-order derivatives.)
- 4: Evaluate Riemann integrals, verify integrability conditions, use Darboux's theorem, and establish the Fundamental Theorem of Calculus linking differentiation and integration.

AMSASCW Department of Maths Syllabi 2025-26

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UNIT-I

Real Numbers: Field Structure and Order Structure-Bounded and Unbounded Sets- Completeness in the Set of Real Numbers- Absolute Value of a Real Number (Text Book : Chapter 1: 2 to 5)Open Sets, Closed Sets and Countable Sets :Limit Points of a Set-Closed Sets-Countable and Uncountable Sets (Text Book : Chapter 2 : 2 to 4)

Real Sequences: Sequences-Limit points of a Sequence-Convergent Sequences-Non-Convergent Sequences (Definitions)-Cauchy's General Principle of Convergence- Algebra of Sequences-Some Important Theorems- Monotonic Sequences.
(Text Book : Chapter 3: 1 to 2 & 4 to 9)

UNIT-II

Infinite Series : Introduction-Positive Term Series- Comparison Tests for Positive Term Series-Cauchy's Root test- D'Alembert's Ratio Test-Integral Test-Alternating Series(Leibnitz Test). (Text Book : Chapter 4 : 1 to 5, 8 & 10.1)

Functions of a Single Variable (I): Limits-Continuous Functions-Functions Continuous on Closed Intervals. (Text Book : Chapter 5: 1 to 3)

UNIT -III

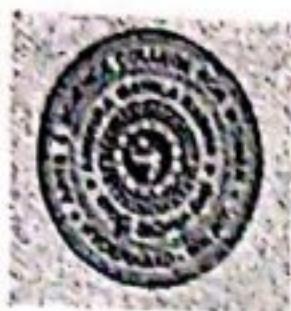
Functions of a Single Variable (II):The Derivative-Increasing and Decreasing Functions- Rolle's Theorem-Lagrange's Mean Value Theorem- Cauchy's Mean Value Theorem- Higher Order Derivatives.(Text Book : Chapter 6: 1, 3 & 5 to 8)

UNIT -IV

The Riemann Integral: Definition and Existence of the Integral-Refinement of Partitions-Darboux's Theorem-Conditions of Integrability-Integrability of the Sum and Difference of Integrable Functions-The Integral as a Limit of Sums-Some Integrable Functions-Integration and Differentiation-The Fundamental Theorem of Calculus.

(Text Book : Chapter 9: 1 to 9)

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Practical Syllabus for B.Sc I Year
Mathematics Semester –II
Real Analysis (Practical)

Subject Code: Mat101

Instruction:	2 Hrs/week
Duration of Semester Examination	3 Hrs
Semester Examination	25 Marks
Credits	1

UNIT-I

1. For each sequence below, determine whether it converges and, if it converges, give its limit. No proofs are required.

(a) $a_n = n/n+1$ (b) $b_n = n^2+3/n^2-3$
(c) $c_n = 2^{-n}$ (d) $t_n = 1 + (2/n)$
(e) $x_n = 73 + (-1)^n$ (f) $s_n = (2)^{1/n}$

2. Determine the limits of the following sequences, and then prove your claims.

(a) $a_n = n/(n^2+1)$ (b) $b_n = 7n-19/3n+7$
(c) $c_n = 4n+3/7n-5$ (d) $d_n = 2n+4/5n+2$ (e) $s_n = (1/n) \sin n$

3. Which of the following sequences are increasing? decreasing? Bounded?

(a) $1/n$ (b) $(-1)^n/n^2$ (c) n^5
(d) $\sin(n\pi/7)$ (e) $(-2)^n$ (f) $n/3^n$

4. Let $t_1 = 1$ and $t_{n+1} = [1 - 1/4n^2] \cdot t_n$ for $n \geq 1$.

(a) Show $\lim t_n$ exists. (b) What do you think $\lim t_n$ is?

5. Let $s_1 = 1$ and $s_{n+1} = 1/3(s_n + 1)$ for $n \geq 1$.

(a) Find s_2, s_3 and s_4 .
(b) Use induction to show $s_n > 1/2$ for all n .
(c) Show (s_n) is a decreasing sequence.
(d) Show $\lim s_n$ exists and find $\lim s_n$.

6. Let $a_n = 3 + 2(-1)^n$ for $n \in \mathbb{N}$.

(a) List the first eight terms of the sequence (a_n) .
(b) Give a subsequence that is constant [takes a single value].

Specify the selection function σ .

7. Prove $\lim \sup |s_n| = 0$ if and only if $\lim s_n = 0$.

8. Let (s_n) and (t_n) be the following sequences that repeat in cycles of four:



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(c) $\liminf s_n + \limsup t_n$, (d) $\limsup(s_n + t_n)$,
 (e) $\limsup s_n + \limsup t_n$, (f) $\liminf(s_n \cdot t_n)$,
 (g) $\limsup(s_n \cdot t_n)$.

9. Determine which of the following series converge. Justify your answers.

(a) $\sum \frac{n^4}{2^n}$ (b) $\sum \frac{2^n}{n!}$ (c) $\sum \frac{n^2}{3^n}$ (d) $\sum \frac{n!}{n^4 + 3}$
 (e) $\sum \frac{\cos^2 n}{n^2}$ (f) $\sum_{n=2}^{\infty} \frac{1}{\log n}$

10. Determine which of the following series converge. Justify your answers

(a) $\sum_{n=2}^{\infty} \frac{1}{\sqrt{n} \log n}$ (b) $\sum_{n=2}^{\infty} \frac{1 \log n}{n}$
 (c) $\sum_{n=4}^{\infty} \frac{1}{n(\log n)(\log \log n)}$ (d) $\sum_{n=2}^{\infty} \frac{1 \log n}{n^2}$

UNIT-II

11. Let $f(x) = 2x^2 + 1$ for $x \in \mathbb{R}$. Prove f is continuous on \mathbb{R} by

(a) Using the definition, (b) Using the ϵ - δ property

12. Let $f(x) = x^2 \sin(1/x)$ for $x \neq 0$ and $f(x) = 0$ if $x=0$. Prove f is continuous on \mathbb{R} by

(a) Using the definition, (b) Using the ϵ - δ property

13. Let $f(x) = \sqrt{4-x}$ for $x \leq 4$ and $g(x) = x^2$ for all $x \in \mathbb{R}$.

(a) Give the domains of $f+g$, fg , $f \circ g$ and $g \circ f$.

(b) Find the values $f \circ g(0)$, $g \circ f(0)$, $f \circ g(1)$, $g \circ f(1)$, $f \circ g(2)$ and $g \circ f(2)$.

(c) Are the functions $f \circ g$ and $g \circ f$ equal?

14. Which of the following continuous functions are uniformly continuous

(a) $f(x) = x^{17} \sin x - e^x \cos 3x$ on $[0, \pi]$,
 (b) $f(x) = x^3$ on $[0, 1]$
 (c) $f(x) = \sin(1/x^2)$ on $(0, 1]$

15. Prove each of the following functions is uniformly continuous on the indicated set by directly verifying the ϵ - δ property in Definition.

(a) $f(x) = 3x + 11$ on \mathbb{R} ,

(b) $f(x) = x/x+1$ on $[0, 2]$

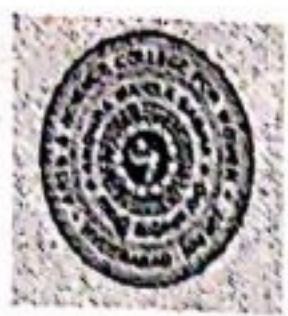
(c) $f(x) = 1/x$ on $[1/2, \infty)$.

16. Prove $|x|$ is a continuous function on \mathbb{R} .

17. Prove each of the following functions is continuous at x_0 by verifying the ϵ - δ property.

(a) $f(x) = x^2$, $x_0 = 2$;

(b) $f(x) = \sqrt{x}$, $x_0 = 0$



18. Prove the following functions are discontinuous at the indicated points. You may use either Definition or the δ -property.

- (a) $f(x) = 1$ for $x > 0$ and $f(x) = 0$ for $x \leq 0$, $x_0 = 0$;
- (b) $g(x) = \sin(\frac{1}{x})$ for $x \neq 0$ and $g(0) = 0$, $x_0 = 0$;

19. Show that if $f(x) = 1/x^2$ is uniformly continuous on any set of the form $[a, \infty)$ where $a > 0$

20. Is the function $f(x) = x^2$ uniformly continuous on $[-7, 7]$?

UNIT-III

21. Use the definition of derivative to calculate the derivatives of the following functions at the indicated points.

- (a) $f(x) = x^3$ at $x = 2$;
- (b) $f(x) = x^2 \cos x$ at $x = 0$;
- (c) Let $h(x) = \sqrt{x} = x^{1/2}$ for $x \geq 0$

22. Let $f(x) = x^2 \sin(1/x)$ for $x \neq 0$, $f(0) = 0$, and $g(x) = x$ for $x \in \mathbb{R}$.

- (a) Observe f and g are differentiable on \mathbb{R} .
- (b) Calculate $f(x)$ for $x = 1/\pi n$, $n = \pm 1, \pm 2, \dots$
- (c) Explain why $\lim_{x \rightarrow 0} \frac{g(f(x)) - g(f(0))}{f(x) - f(0)}$ is meaningless.

23. Let $f(x) = x^2$ for x rational and $f(x) = 0$ for x irrational.

- (a) Prove f is continuous at $x = 0$.
- (b) Prove f is discontinuous at all $x \neq 0$.
- (c) Prove f is differentiable at $x = 0$

24. Determine whether the conclusion of the Mean Value Theorem holds for the following functions on the specified intervals

- (a) x^2 on $[-1, 2]$,
- (b) $\sin x$ on $[0, \pi]$,
- (c) $|x|$ on $[-1, 2]$
- (d) $\operatorname{sgn}(x)$ on $[-2, 2]$.

25. Prove $|\cos x - \cos y| \leq |x - y|$ for all $x, y \in \mathbb{R}$.

26. Let $f(x) = x^2 \sin(1/x) + x/2$ for $x \neq 0$ and $f(0) = 0$.

- (a) Show $f'(0) > 0$.
- (b) Show f is not increasing on any open interval containing 0.

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27. Find $\frac{\sin x}{x}$, $\frac{\cos x - 1}{x^2}$

28. Show that $\frac{x^2}{e^{3x}} = 0$, $x^x = 1$

29. Find the following limits if they exist.

a) $\frac{e^{2x} - \cos x}{x}$ b) $\frac{\sqrt{1+x} - \sqrt{1-x}}{x}$

30. Find the following limits if they exist

a) $\frac{x - \sin x}{x}$ b) $\frac{1 + \cos x}{e^x - 1}$

UNIT-IV

31. Let $f(x) = x$ for rational x and $f(x) = 0$ for irrational x .

(a) Calculate the upper and lower Darboux integrals for f on the interval $[0, b]$.

(b) Is f integrable on $[0, b]$?

32. Let f be a bounded function on $[a, b]$. Suppose there exist sequences (U_n) and (L_n) of upper

and lower Darboux sums for f such that $\lim(U_n - L_n) = 0$. Show f is integrable and $\int_a^b f = \lim U_n = \lim L_n$.

33. A function f on $[a, b]$ is called a step function if there exists a partition $P = \{a = u_0 < u_1 < \dots < u_m = b\}$ of $[a, b]$ such that f is constant on each interval (u_{j-1}, u_j) , say $f(x) = c_j$ for x in (u_{j-1}, u_j) .

(a) Show that a step function f is integrable and evaluate $\int_a^b f$.

(b) Evaluate the integral $\int_0^4 P(x)dx$ for the postage-stamp function.

34. Show $|\int_{-2\pi}^{2\pi} x^2 \sin^8 e^x dx| \leq 16\pi^3/3$.

35. Let f be a bounded function on $[a, b]$, so that there exists $B > 0$ such that $|f(x)| \leq B$ for all $x \in [a, b]$.

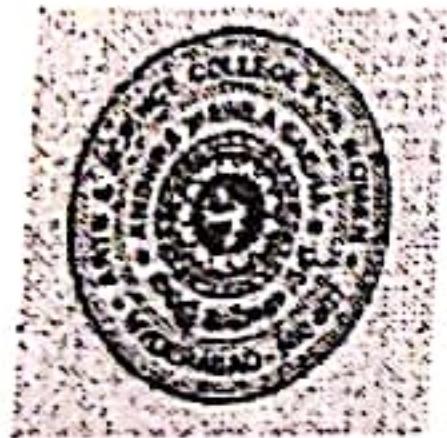
(a) Show $U(f^2, P) - L(f^2, P) \leq 2B[U(f, P) - L(f, P)]$ for all partitions P of $[a, b]$. Hint: $f(x)^2 - f(y)^2 = [f(x) + f(y)][f(x) - f(y)]$

(b) Show that if f is integrable on $[a, b]$, then f^2 also is integrable on $[a, b]$.

36. Calculate

(a) $\frac{1}{x} \int_0^x e^{t^2} dt$ (b) $\frac{1}{h} \int_3^{3+h} e^{t^2} dt$.

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37. Show that if f is a continuous real-valued function on $[a,b]$ satisfying $\int_a^b f(x)g(x)dx = 0$ for every continuous function g on $[a,b]$, then $f(x) = 0$ for all x in $[a,b]$.

38. $f(x)=1$ for rational $f(x)=0$ for irrational in $[a,b]$ find $U(f,p)$, $L(f,p)$

39. Give an example of a function f on $[0,1]$ that is not integrable for which $|f|$ is integrable.

40. $f(x)=\sin 1/x$ for $x \neq 0$ $f(0)=0$.show that f is integrable on $[-1,1]$