SEMESTER - I
DIFFERENTIAL EQUATIONS

1. Course Description

Programme: B.Sc
Course Code: U26/MAT/DSC/101
Course Type: DSC- I
No. of credits: 4

Max. Hours : 60
Hours per week: 04
Max. Marks : 100

2. Course Objectives

1. To develop the ability to solve various types of differential equations using analytical methods and explore applications of differential equations in Biology, Chemistry and Social Sciences.
2. To introduce students to the basic theory of Partial Differential Equations and develop in them competence in solving higher order linear differential equations with constant coefficients.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Classify ordinary differential equations into exact and non-exact forms to determine appropriate solution strategies. (L II)
CO2: Solve first-order differential equations that are not of first degree and interpret their applications in modelling real-world phenomena. (L II)
CO3: Apply various methods for solving higher order linear differential equations with constant coefficients. (L III)
CO4: Analyze higher order differential equations with non-constant coefficient and Partial Differential Equations. (L IV)

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4. Course Content

MODULE I: **15 Hours**

Differential Equations of First Order & 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.

Sections: - 2.1- 2.8, Pg. No. 27-55, 60-61

MODULE II: **15 Hours**

Differential Equations of the First Order but not of the First Degree:
Equations solvable for p, y, x, that do not contain x or y, Homogeneous in x & y, Equations of the first degree in x & y, Clairaut's Equation.

Sections: 3.1- 3.2.5, Pg. No.63-74

Applications of First Order Differential Equations:
Growth and Decay, Dynamics of Tumour growth, Radioactivity and Carbon Dating, Compound Interest, Biological Growth, A problem in Epidemiology, Orthogonal Trajectories.

Sections: 4.1- 4.4, 4.8-4.9, 4.20, Pg. No. 75-84, 92-98, 133-140

MODULE III: **15 Hours**

Higher Order Linear Differential Equations:

Introduction, Solution of homogeneous linear differential equations of order n with constant coefficients, Solution of non-homogeneous linear differential equations with constant coefficients by means of polynomial operators:

1. When $Q(x) = b x^k$ and $P(D) = D - a^n$, $a^n \neq 0$
2. When $Q(x) = b x^k$ and $P(D) = a^n D^n + a^{n-1} D^{n-1} + \ldots\ldots + a^1 D$
3. When $Q(x) = b e^{ax}$
4. When $Q(x) = b \sin ax$ or $b \cos ax$
5. When $Q(x) = e^{ax} V$, where V is a function of x
6. When $Q(x) = be^{ax}$ & $P(a) = 0$
7. When $Q(x) = xV$ where V is any function of x

Method of Undetermined Coefficients, Method of Variation of Parameters.

Sections: - 5.1-5.5, Pg. No. 159-190, 239- 241

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MODULE IV: **15 Hours**

Higher Order Linear Differential Equations with Non-Constant Coefficients:

Linear Differential Equations with non-constant coefficients, The Cauchy- Euler Equations, Legendre's Linear Equation.

Sections: - 5.6-5.8, Pg. No. 190– 196, 241

Partial Differential Equations

One dimensional Heat Flow, Introduction, Formation and Solution of Partial Differential Equations, Equations Easily Integrable, Linear Equations of the First Order, Nonlinear Equations of the First Order. **Sections: 4.15, 9.1-9.5, Pg. No. 110,428- 439, 537**

5. Reference Books

1. Zafar Ahsan, Differential Equations & their Applications (Third Edition), Prentice Hall of India, Pvt. Ltd., New Delhi.
2. Rai Singhania, Ordinary & Partial Differential Equations, S. Chand & Co., New Delhi.
3. Richard Bronson, Differential Equations International Edition, Schaum's Outline Series.
4. V. Venkateshwara Rao, N. Krishna Murthy, B.V.S.S. Sarma, S. Anjaneya Sastry, The Textbook of B.Sc. Mathematics, Revised edition of 2014, Volume 1, S.Chand and Co Private Ltd.
5. B. Sc First Year Mathematics, Telugu Akademi.

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6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
National	Differential equations help students understand how changing quantities are related and modelled, enabling their application in scientific research, engineering, economics, and technology across the country.
Global	Differential equations serve as foundational mathematical tools for modelling dynamic systems, enabling the prediction of system behaviour, optimization of processes, and evidence-based solutions to complex real-world challenges. Their interdisciplinary applications span celestial mechanics, population dynamics, epidemiological modelling, and beyond.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module I, III & IV	Solving differential equations using Mathematical Software.
Employability	Module II	Modelling of real-world problems

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Skill Tests, Quiz, Group Discussions, Presentations
2.	Experiential Learning	Field Trips
3.	Problem Solving	Assignments, Research Projects

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA- I (Written Exam)	Written Exam
CO2	CIA- I (Written Exam)	
CO3	CIA- II (Skill Tests)	
CO4	CIA- II (Assignments/Presentations)	

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b) Model Question Paper- End Semester Exam Theory

DIFFERENTIAL EQUATIONS

Course Code: U26/MAT/DSC/101 **Max. Marks :60M**
No. of credits: 4 **Time: 2 Hours**

Note: This question paper consists of Section A and B. The answer to Section A & B must be written in the answer book given.

SECTION – A (Long Essay Type)

I. Answer ALL questions: **Marks: 4 x 10 =40M**

1. Solve $xdx + ydy + \frac{xdy - ydx}{x^2+y^2} = 0.$

OR

2. Solve $(1+x)\frac{dy}{dx} - xy = 1 - x.$
3. Solve $p^2 + 2pycotx = y^2.$

OR

4. A culture initially has N_0 number of bacteria. At $t = 1$ hour the number of bacteria is measured to be $\left(\frac{3}{2}\right)N_0$. If the rate of growth is proportional to the number of bacteria present, determine the time necessary for the number of bacteria to triple.
5. Solve $(D^3 + 2D^2 + D)y = x^2 + e^{2x} + x.$

OR

6. Using method of variation of parameters solve $y'' + 3y' + 2y = 12e^x$
7. Solve $x^2\left(\frac{d^2y}{dx^2}\right) + x\frac{dy}{dx} - 4y = x^2.$

OR

8. Solve $y\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial z}{\partial x} = 4xy$

SECTION –B (Short Essay Type)

II. Answer any <u>FOUR</u> of the following questions: **Marks: 4 x 5=20M**

9. Solve $\frac{dy}{dx} = (x^2 + y^2 + 1)/2xy.$
10. Solve $y(1 - xy)dx - (1 + xy)xdy = 0.$
11. Solve $sinpxcosy = cospxsiny + p.$
12. Find the particular integral of $(D^2 - 3D + 2)y = x.$
13. Solve $(D^2 - 2D + 5)y = 0$ given that y=0 and $\frac{dy}{dx} = 4$ when x=0.
14. Solve $p^2 + q^2 = x+y.$

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Question Paper Format- Bloom's Taxonomy Level

SECTION A-INTERNAL CHOICE				**4Q X10=40M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Bloom's Taxonomy Level)**
1	Module I	Solve $xdx + ydy + \frac{xdy - ydx}{x^2+y^2} = 0.$	CO1	Level II
2	Module I	Solve $(1+x)\frac{dy}{dx} - xy = 1 - x.$	CO1	Level II
3	Module II	Solve $p^2 + 2pycotx = y^2.$	CO2	Level II
4	Module II	A culture initially has N_0 number of bacteria. At $t = 1$ hr. the number of bacteria is measured to be $\left(\frac{3}{2}\right)N_0$. If the rate of growth is proportional to the number of bacteria present, determine the time necessary for the number of bacteria to triple.	CO2	Level II
5	Module III	Solve $(D^3 + 2D^2 + D)y = x^2 + e^{2x} + x.$	CO3	Level III
6	Module III	Using method of variation of parameters solve $y'' + 3y' + 2y = 12e^x$	CO3	Level III
7	Module IV	Solve $x^2\left(\frac{d^2y}{dx^2}\right) + x\frac{dy}{dx} - 4y = x^2.$	CO4	Level IV
8	Module IV	Solve $y\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial z}{\partial x} = 4xy.$	CO4	Level IV
SECTION B-ANSWER ANY 4 OUT OF 6				**4Q X 5M=20M**
(To compulsorily have ONE question from each module)				
9	Module I	Solve $\frac{dy}{dx} = (x^2 + y^2 + 1)/2xy$	CO1	Level II

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10	Module I	Solve $y(1-xy)dx-(1+xy)xdy=0.$	CO1	Level II
11	Module II	Solve $sinpxcosy=cospxsiny+p.$	CO2	Level II
12	Module III	Find the particular integral of $(D^2-3D+2)y=x.$	CO3	Level III
13	Module III	Solve $(D^2-2D+5)y=0$ given that y=0 and $\frac{dy}{dx}=4$ when x=0.	CO3	Level III
14	Module IV	Solve $p^2+q^2=x+y$	CO4	Level IV

c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4 x 10=40	6 (By taking at least one question from each Module)	4x5=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Class room sessions(hours)
1	1,2	Classify	15
2	1,2	Understanding	15
3	1,7	Applying	15
4	1,2	Analyze	15

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DIFFERENTIAL EQUATIONS

Practical Syllabus

1. Course Description

Programme: B.Sc.
Course Code: U26/MAT/DSC/101/P
Course Type: DSC-1
No. of credits: 01

Max. Hours: 30
Hours per week: 02
Max. Marks : 50

2. Course Objectives

1. To solve differential equations using analytical and computational methods.
2. To apply differential equation models to real-world problems and interpret the results graphically.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Solve first order differential equations using Bernoulli's method.

CO2: Solve problems of first order but not of first degree.

CO 3: Apply various methods to solve linear differential equations with constant coefficients.

CO 4: Solve linear equations with non-constant coefficients and Partial Differential Equations.

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PRACTICAL SESSIONS

1. Linear and Bernoulli Differential Equations.
2. Exact Differential Equations and Integrating Factors – I.
3. Integrating Factors-II.
4. Equations solvable for p and y.
5. Equations solvable for x and Clairaut's equations.
6. Applications of First Order Differential Equations.
7. Higher Order Linear Differential Equations.
8. Method of Undetermined Coefficients and Variation of Parameters.
9. Linear Differential Equations with non- constant coefficients, Cauchy- Euler Equations, Legendre's Linear equations
10. Partial Differential Equations.

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6. Model Question Paper – End Semester Exam Practical

MODEL QUESTION PAPER
PRACTICAL

Course Code: U26/MAT/DSC/101/P | **Max. Marks: 30**

No. Of Credits: 1 | **Time: 2 Hours**

I. Answer the following: **5 x 6 = 30 M**

1. Solve $\frac{dy}{dx} = \frac{\sin^2 x}{1+x^3} - \frac{3x^2}{1+x^3}y$
2. Solve $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$
3. Solve $y + px = p^2x^4$
4. If *Rs.* 10,000 is invested at 6 percent per annum, find what amount has accumulated after years if interest is compounded: (a) annually, (b) quarterly, and (c) continuously.
5. Find the particular integral of $y'' + 3y' + 2y = 8 + 6e^x + 2\sin x$
6. Solve the following differential equations by the method of variation of parameters.

   $y'' + 2y' + y = x^2e^{-x}$
7. Solve $(2x+3)^2\frac{d^2y}{dx^2} - 2(2x+3)\frac{dy}{dx} - 12y = 6x.$
8. Solve (y +z) p + (x + z) q = x + y

Prepared by Course Teacher [Name & Signature]	Checked &Verified by HOD [Name & Signature]	Approved by Principal
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SEMESTER - I

PROGRAMMING IN C

1. Course Description

Programme: B.Sc. **Max. Hours: 60**
Course Code: U26/CSC/DSC/101 **Hours per week:4**
Course Type: DSC **Max. Marks: 100**
No. of credits: 4

2. Course Objectives

1. To understand the art of writing programs using C
2. To apply all the concepts learnt in C programming in developing programs and applications in C.
3. To practice writing codes efficiently.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: ***Explain*** basic concepts of C programming and program structure. (L II)

CO2: ***Apply*** control structures and arrays to develop C programs. (L III)

CO3: ***Analyze*** programs using functions, strings, structures, and unions (L IV)

CO4: ***Implement*** pointer-based programs with dynamic memory and file I/O. (L III)

4. Course Content

MODULE I: **15 Hours**

Programming Fundamentals

Introduction to Computer Software, classification of computer Software, Programming Languages, Algorithms and Flow charts.

Basics of C Programming

Introduction, Characteristics of C, uses of C, Structure of a C, writing, compiling and Executing C Program. Preprocessor Directives Processes involved in program execution: compilation, interpretation, loading and linking. Comments, Keywords, Identifiers, Basic

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data types, variables, constants, Input /Output Statements, operators in C, type Conversion and type casting.

MODULE II: **15 Hours**

Control Structures and Arrays

Control Statements: Introduction, Conditional Branching Statemen: if, if-Else, if-Else-if Statement, Switch Case. Iterative statements: while, do-while and For, Nested loops, Arrays: Introduction, Declaration, Initialization, Accessing elements, storing values on One-dimensional arrays and two-dimensional arrays.

MODULE III **15 Hours**

Functions

Functions: Introduction, Declaration, Definition, Function call, return statement, passing Parameters to the function, and calling mechanisms, types of functions, String: string functions, call-by-value, call-by-reference. Passing arrays to functions, Scope of variables, Storage classes. recursive Function.

Strings, Structures, Unions

Strings: Introduction, String Operations. Structures and Unions: Introduction-Declaration, initialization, Accessing the members, Structures vs. Unions. Enumerated data types.

MODULE IV: **15 Hours**

Pointers and Files

Pointers: Introduction, Declaring Pointer variables, Pointer Expressions and Pointer, Arithmetic, Null Pointers, Dynamic Memory Allocation, Drawback of Pointers. Files: Introduction, Reading Data from files, Writing data to files. Working with text and binary files.

5. References Books

1. "Programming in C", by Reema Thareja, Oxford University Press, Second Edition, 2016
2. Programming with C, by Byron S. Gottfried, Schaum's Outline Series ,2E
3. Let Us C, by Yashwant Kanetkar, BPS Publications, 13E,
4. Programming in ANSI C, by Balaguruswamy, McGraw Hill Education, 7E
5. C Programming Language, by Brian W. Keringhan, Dennis M Ritchie, Pearson Publications, 2E
6. A Structured Programming Approach Using C by B. A. Forouzan.

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6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

S. No	Local/Regional/National /Global Development Needs	Relevance
1.	National	C is an adaptable, effective, and performance-driven language.
2.	Global	C is language and is widely employed in everything from system software to game development.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Modules 1I, III &IV	Designing algorithms, flowcharts and writing C programs for given algorithm and testing programming skills in C.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Seminars, Presentations and Group discussions.
2..	Problem solving	Case Studies

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA -40%	End Semester Examination-60%
CO1	CIA 2– Test 1: MCQ's, Quiz test or subjective	Written Exam
CO2	CIA 2 – Subjective	
CO3		
CO4	CIA 2 – Test 2: MCQ's or Presentation	

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b) Model Question Paper- End Semester Exam Theory

PROGRAMMING IN C

Course Code: U26/CSC/DSC/101 **MAX MARKS: 60**
Credits: 4 **TIME: 2 hours**

Note: This question paper consists of Section A and B. The answer to Section A & B must be written in the answer book given.

Section - A (Long Essay Type)

Answer ALL questions: **Marks:4 x 10 = 40**

1. What are the different symbols used in flow charts? Design a flow chart to find the maximum of three numbers

OR

2. What are different data types supported in C with examples.
3. What are arrays? Explain one-dimensional array with an appropriate program

OR

4. Explain the concept of if-else and nested if. Write a program to show the usage of both if else and nested if.
5. Elaborate the need for recursion. Write a program to print factorial of a number using recursion.

OR

6. Explain the difference between structure and union with an example
7. Explain the concept of Pointers with a suitable example.

OR

8. Explain various file operations and their functions in C.

Section – B (Short Essay Type)

II. Answer any Four: **4 x 5 = 20M**

9. Explain switch case with example.
10. Define Algorithms and write an algorithm to display the multiplication table of a given number.
11. What is the purpose of the scanf function? Explain various formats with example.
12. Differentiate while loop and do-while loop.
13. Write a C program to display the smallest elements in an array using one dimensional array.
14. What a brief note on Dynamic Memory allocation.

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	What are the different symbols used in flow charts? Design a flow chart to find the maximum of three numbers.	CO 1	Level II
2	Module 1	What are different data types supported in C with examples.	CO 1	Level II
3	Module 2	Elaborate the need for recursion. Write a program to print factorial of a number using recursion.	CO 2	Level III
4	Module 2	Explain the concept of if-else and nested if. Write a program to show the usage of both if else and nested if.	CO 2	Level III
5	Module 3	What are arrays? Explain one-dimensional array with an appropriate program	CO 3	Level IV
6	Module 3	Explain the difference between structure and union with an example	CO 3	Level IV
7	Module 4	Explain the concept of Pointers with a suitable example.	CO 4	Level III
8	Module 4	Explain various file operations and their functions in C	CO 4	Level III
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)				**4Q X 5 M = 20 M**
9	Module 2	Explain switch case with example.	CO 2	Level III
10	Module 1	Define Algorithms and write an algorithm to display the multiplication table of a given number.	CO 1	Level II
11	Module 1	What is the purpose of the scanf function? Explain various formats with example	CO 1	Level II
12	Module 2	Differentiate while loop and do-while loop?	CO 2	Level III
13	Module 3	Write a program to accept and print single dimensional array	CO 3	Level IV
14	Module 4	What a brief note on Dynamic Memory allocation.	CO 4	Level III

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c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	6 (By taking at least one question from each Module)	4x5=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1, 2	Analyze	15
2	2, 7	Understand	15
3	1, 2	Remember	15
4	1, 2	Understand	15

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PROGRAMMING IN C

Practical Syllabus

1. Course Description

Programme:	**B. Sc**	**Max. Hours:**	**30**
Course Code:	**U26/CSC/ DSC/101/P**	**Hours per week:**	**2**
Type of Course:	**DSC-1**	**Max. Marks:**	**50**
No. of Credits:	**1**		

2. Course Objectives

1. To Introduce the Fundamental Concepts of Programming through C Language.
2. To write C Programs.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: To Design Simple Algorithms for Arithmetic and Logical Problems.

CO2: To Understand Conditional Branching, Iteration, Recursion, Arrays, Structures and Unions

4. Course Content

1. Program to display Area, Perimeter of circle.
2. Program to calculate Simple Interest by accepting data
3. Program to display all Data types supported by C
4. Program to find Greatest of 3 numbers using Relational operator
5. Program to swap two numbers i) using third variable ii) without using third variable
6. Program to find Minimum of 3 numbers using Ternary operator (conditional Operator)
7. Program to find Sum of first "n" Even numbers using While loop.
8. Program to find out whether given number is palindrome or not using do while
9. Program to find the Factorial of given number using for loop
10. Program to perform Arithmetic operations using Switch case

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11. Program to generate Fibonacci series.
12. Program to read an array, display the elements in the in reverse order
13. Program to find maximum and Minimum number in an array
14. Program to find the Factorial of given number using recursion
15. Write a C program to multiply two matrices.
16. Write a C program to demonstrate the use of different storage classes (auto, register, static, extern).
17. Write a C program to demonstrate the concepts of call-by-value and call-by-reference
18. Write a C program that demonstrates various string functions from the library.
19. Write a C program that demonstrates structures and unions.
20. . Write a C program that opens a file and counts the total number of characters in it.
21. Write a C program that copies content from an existing text file to a new file
22. Write a C Program to swap two numbers using Pointes
23. Write a C Program to read and display the contents of File.

4. References Books

1. Programming with C, by Byron S. Gottfried, Schaum's Outline Series ,2E
2. Let Us C, by Yashwant Kanetkar, BPS Publications, 13E,
3. Programming in ANSI C, by Balaguruswamy, McGraw Hill Education, 7E
4.C Programming Language, by Brian W. Keringhan, Dennis M Ritchie, Pearson Publications, 2E
5. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language
6. B. A. Forouzan, R. F. Gilberg, A Structured Programming Approach Using

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PROGRAMMING IN C
PRACTICAL MODEL PAPER

Course Code: U26/CSC/DSC/101/P **Time: 2Hrs**

No. of Credits:1 **Max Marks:50**

Answer any two:

1. Write a C Program to find the greatest of three numbers.
2. Write a C program to find the factorial of a given number using recursion
3. Write a C program to display the numbers of 1D array in reverse order.

Prepared by	Checked &Verified by	Approved by
D.B.Rekha **Teaching faculty**	**Dr. Sr. Sujatha Yeruva** **HoD**	**Prof. Uma Joseph** **Principal**

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SEMESTER - I

MECHANICS AND OSCILLATIONS

1. Course Description

Programme: B. Sc
Course Code: U26/ PHY/ DSC/101
Type of Course: DSC-1
No. of Credits: 4

Max. Hours: 60
Hours per week: 4
Max. Marks: 100

2. Course Objectives

1. To study the fundamentals of Mechanics.
2. To understand the significance of Oscillations.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Analyze mathematical methods and rotational dynamics principles in the study of vector fields and rigid body motion. (L IV)

CO2: Understand the principles of Central Forces and Special Theory of Relativity. (L II)

CO3: Summarise simple harmonic motion and interpret it's applications. (L II)

CO4: Remember the fundamental behaviour and practical applications of wave motion. (L II)

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4. Course content

MODULE I: **15 Hours**

Vector Analysis

Scalar and Vector fields, Gradient of a Scalar field, Divergence and Curl of a Vector field and their physical significance and related problems. Vector integration, line, surface and volume integrals. Applications of Stokes, Gauss's and Green's theorems.

Rigid Body Dynamics

Definition of Rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertial tensor. Euler's equation, precession of a top, Gyroscope.

MODULE II: **15 Hours**

Central Forces

Central forces – definition and examples, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force, gravitational potential and gravitational field, motion under inverse square law, derivation of Kepler's laws.

Special theory of Relativity

Galilean relativity, absolute frames, Michelson-Morley experiment, Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation. Concept of four vector formalism.

MODULE III: **15 Hours**

Oscillations

Simple harmonic oscillator, and solution of the differential equation– Physical characteristics of SHM, torsion pendulum measurements of rigidity modulus, compound pendulum, measurement of g.

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance, velocity resonance.

MODULE IV: **15 Hours**

Waves

Fundamentals of Waves -Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones, energy transport, transverse impedance.

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Longitudinal vibrations in bars- wave equation and its general solution. Special cases (i) bar fixed at both ends ii) bar fixed at the mid point iii) bar free at both ends iv) bar fixed at one end. Transverse vibrations in a bar - wave equation and its general solution.

5. Reference Books

1. **Fundamentals of Physics**. Halliday/Resnick/Walker *Wiley India Edition 2007.*
2. **First Year Physics** -*Telugu Academy.*
3. **Introduction to Physics for Scientists and Engineers**. F.J. Ruche.*McGraw Hill.*
4. **Berkeley Physics** Course. Vol.1, **Mechanics** by C. Kittel, W. Knight, M.A. Ruderman
5. **Fundamentals of Physics** by Alan Giambattista et al. *Tata-McGraw Hill Company* Edition, 2008.
6. **Introduction to Physics for Scientists and Engineers**. F.J. Ruche. *McGraw Hill.*
7. **Sears and Zemansky's University Physics** by Hugh D. Young, Roger A. Freedman *Pearson Education Eleventh Edition.*
8. **University Physics** by Young and Freeman, *Pearson Education, Edition 2005.*
9. **An introduction to Mechanics** by Daniel Kleppner & Robert Kolenkow. *The McGraw Hill Companies.*
10. **Mechanics**. Hans & Puri. *TMH Publications.*
11. **Vibrations and Waves,** A.P.French, MIT, Introductory Series in Physics, 2003.
12. **Waves**, Crawford, Berkely Physics Series, Mc Graw Hill, 1968.

6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local/Regional/National/ Global Development Needs	**Type/Description of Activity**
National	Advances in this subject contribute to space exploration, satellite communications, and national security.
Global	Indispensable for driving innovation across a wide range of sectors critical for global development.

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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module III & IV	Hands- on Practicals

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Presentations and Group discussions
2.	Experiential Learning	Field Trips to research organizations
3.	Problem solving	Research Projects

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination- 60%
CO1	CIA 2 – Test 1: MCQ's, Quiz test or subjective	Written Exam
CO2	CIA 1 - Subjective	
CO3		
CO4	CIA 2 – Test 2: MCQ's or Presentation	

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b) Model Question Paper – End Semester Exam Theory

MECHANICS AND OSCILLATIONS

Course Code: U26/ PHY/ DSC/101 **MAX MARKS: 60**
Credits: 4 **TIME: 2 hours**

Note: This question paper consists of Section A and B. The answer to Section A & B must be written in the answer book given.

SECTION – A (Long Essay Type)

Answer ALL questions: **Marks: 4 x 10 = 40**

1. Define scalar and vector fields. State and prove Stoke's theorem.

OR

2. Deduce Euler's equations of rotational motion of a rigid body fixed at one end.

3. State and Prove Kepler's laws of planetary motion.

OR

4. Describe the working of Michelson- Morley experiment and derive an equation for fringe shift.

5. Derive an equation for measurement of rigidity modulus using torsional pendulum.

OR

6. What is a damped harmonic oscillator? Find the solution of the differential equation of damped oscillator.

7. Obtain the equation of motion for a transverse wave travelling along the length of a stretched string kept under tension.

OR

8. Obtain the equation of longitudinal wave for a (i) bar fixed at both ends ii) bar fixed at the mid point.

SECTION –B (Short Essay Type)

II. Write short notes on any **FOUR** of the following: **Marks: 4 x 5 = 20**

9. Find curl **r**, if **r** is a position vector
10. Explain the working of gyroscope.
11. Show that the central forces are conservative.
12. What is the velocity of the rod when its length will appear 90% of its proper length?
13. Outline the physical characteristics of simple harmonic motion.
14. If tension is doubled, how does the velocity of the transverse wave change along a stretched string?

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Define scalar and vector fields. State and prove Stoke's theorem.	CO 1	Level II & IV
2	Module 1	Deduce Euler's equations of rotational motion of a rigid body fixed at one end.	CO 1	Level IV
3	Module 2	State and Prove Kepler's laws of planetary motion.	CO 2	Level II & IV
4	Module 2	Describe the working of Michelson- Morley experiment and derive an equation for fringe shift.	CO 2	Level II
5	Module 3	Derive an equation for measurement of rigidity modulus using torsional pendulum.	CO 3	Level IV
6	Module 3	What is a damped harmonic oscillator? Find the solution of the differential equation of damped oscillator.	CO 3	Level II
7	Module 4	Obtain the equation of motion for a transverse wave travelling along the length of a stretched string kept under tension	CO 4	Level IV
8	Module 4	Obtain the equation of longitudinal wave for a (i) bar fixed at both ends ii) bar fixed at the mid point.	CO 4	Level IV
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)				**4Q X 5 M = 20 M**
9	Module 1	Find curl **r**, if **r** is a position vector	CO 1	Level I
10	Module 1	Explain the working of gyroscope.	CO 1	Level II
11	Module 2	Show that the central forces are conservative.	CO 2	Level II
12	Module 2	What is the velocity of the rod when its length will appear 90% of its proper length?	CO 2	Level I
13	Module 3	Outline the physical characteristics of simple harmonic motion.	CO 3	Level II
14	Module 4	If tension is doubled, how does the velocity of the transverse wave change along a stretched string?	CO 4	Level I

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c) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	6 (By taking at least one question from each Module)	4x5=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1, 2	Analyze	15
2	1, 2	Understand	15
3	1, 2	Remember	15
4	1, 2	Understand	15

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MECHANICS AND OSCILLATIONS
Practical Syllabus

1. Course Description

Programme:	**B. Sc**	**Max. Hours:**	**30**
Course Code:	**U26/ PHY/ DSC/101/P**	**Hours per week:**	**2**
Type of Course:	**DSC-1**	**Max. Marks:**	**50**
No. of Credits:	**1**		

2. Course Objectives

1. To evaluate elastic constants of solids and viscosity of fluids.
2. To develop hands-on skills in analysing mechanical and oscillatory systems and validating theoretical principles.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Analyse basics of the kinematics and dynamics in linear and rotational motion.

CO 2: Prepare a technical record on the experiments carried.

4. Course Content

1. Study of a compound pendulum determination of 'g' and 'k'.
2. Determine moment of Inertia of a fly wheel.
3. Measurement of errors –simple Pendulum.
4. Study of oscillations of a mass under different combination of springs-Series and parallel
5. Calculation of slope and intercept of a Y= mX +C graph by theoretical method (simple pendulum experiment)
6. Determine rigidity modulus by Torsion Pendulum.
7. Determine of Viscosity of a fluid.
8. Study of oscillations of a mass under different combination of springs-Series and parallel
9. Study of Oscillations under Bifilar suspension-Verification of axis theorems.
10. Verification of Laws of a stretched string (Three Laws).
11. Velocity of Transverse wave along a stretched string.
12. Verification of Stokes, Gauss-Divergence and Green's theorem using simulation.
13. Experimental analysis of gyroscope using simulation.

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5. Reference Books

1. D.P. Khandelwal, "**A laboratory manual for undergraduate classes**" (Vani Publishing House, New Delhi).
2. S.P. Singh, "**Advanced Practical Physics**" (Pragati Prakashan, Meerut).
3. Worsnop and Flint- **Advanced Practical physics for students.**
4. "**Practical Physics**" R.K Shukla, Anchal Srivastava

6. Model Question Paper – End Semester Exam Practical

MECHANICS AND OSCILLATIONS

Programme : B.Sc.
Course Code : U26/PHY/DSC/101/P
Type of Course: DSC-1
No. of credits : 1

Time: 2 hrs
Max. Marks: 50

Answer any ONE of the Following

1. Using compound pendulum, determine the acceleration due to gravity.
2. Determine the moment of inertia of the fly wheel about its axis of rotation.
3. Determine the Viscosity of a fluid.
4. Using simple Pendulum, calculate the errors in determining the acceleration due to gravity.
5. Verify the perpendicular axis theorem of moment of inertia of a regular body using Bifilar arrangement.
6. Determine rigidity modulus by Torsion Pendulum.
7. Study the oscillations of a mass connected to springs in series and parallel arrangements.
8. From the observations of a simple pendulum experiment, plot the graph between L and T^2 and calculate the slope and intercept of a Y= mX +C of the straight-line graph by theoretical method.
9. Determine the velocity of a transverse wave along a stretched string using the relation between tension, mass per unit length, and frequency of vibration.
10. Verify the three laws of a stretched string using Sonometer.

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