KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR

B.Sc. Curriculum as Per NEP

Mathematics Subject Syllabus
Semester 4

W.E.F. June 2024

KADI SARVA VISHWAVIDYALAYA
B.Sc Semester 4 (Mathematics Subject's Syllabus)

Mathematics Major Course – 8

MTM242-2C Numerical Analysis

Learning Outcomes:

After completing this course student will be able to

- Understand the concept of finite differences
- Understand the concept of interpolation and extrapolation
- Understand the concept of numerical differentiation and apply to various problems
- Understand the concept of numerical integration and its applications.
- Solve algebraic and transcendental equations

TEACHING AND EVALUATION SCHEME:

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
				Hrs.	Max Marks		
		Theory Hrs Per Week			CCE	SEE	
MTM242-2C	Numerical Analysis	4	4	2.5	50	50	100

Unit 1 Finite Differences **Teaching Hours: 15**

Approximations and errors in computation, Finite differences, Forward differences, Backward differences, Central differences, Differences of a polynomial, Factorial polynomial, Symbolic operators, Relation between operators.

Unit 2 Solution of Algebraic and Transcendental Equations **Teaching Hours: 15**

Algebraic equations, Transcendental equations, Bisection method, Method of false position, Newton-Raphson method, Secant method.

Unit 3Interpolation **Teaching Hours: 15**

Introduction, Newton's forward and backward interpolation formula, Central difference interpolation formula, Gauss forward and backward interpolation formula, Sterling interpolation formula, Bessel's interpolation formula**,** Interpolation with unequal intervals, Divided differences and its properties, Newton's divided difference formula, Relation between divided and forward differences, Lagrange's interpolation formula for equal and unequal intervals

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Unit 4 Numerical Differentiation and Integration	**Teaching Hours: 15**
Numerical differentiation using Newton's forward and backward method, Maxima and minima of a tabulated function, Numerical integration: Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8th rule	

- *Continuous Evaluation: It consists of Assignments / Seminars / Presentations / Quizzes / Surprise Tests

Reference Books:

1. Numerical Methods in Engineering and Science, Dr B.S Grewal, Grewal J. S., Khanna Publication.
2. Numerical Analysis and Computational Procedures, S.A Mollah, Books & Allied Ltd.
3. Numerical Analysis,Kaiser S. Kunz, Mcgraw-hillInc
4. Methods in Numerical Analysis, Kaj L. Nielsen, Macmilllan Company.
5. Numerical Methods, V.N. Vedamurthy, N. Iyengar, Vikas Publishing, House Pvt. Ltd.
6. Numerical Mathematical Analysis, James B. Scarborough, Oxford University Press.
7. Numerical Analysis, Vithal A. Patel, Harcourt Brace College Publishers.
8. Introductory Methods of Numerical Analysis, S.S. Sastry, Prentice Hall of India Pvt. Ltd. New Delhi

KADI SARVA VISHWAVIDYALAYA
B.Sc Semester 4 (Mathematics Subject's Syllabus)
Mathematics Major Course - 9

MTM243-2C Differential Equations

Learning Outcomes:

After completing this course student will be able to

- Understand the concept of linear differential equations
- Find general solution of linear differential equations of first order using the concept of C.F. and P.I.
- Understand the concept of homogeneous linear differential equations
- Find general solution of linear differential equations of second order
- Understand the basics of partial differential equations

TEACHING AND EVALUATION SCHEME:

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
				Hrs.	Max Marks		
		Theory Hrs Per Week			CCE	SEE	
MTM243-2C	Differential Equations	4	4	2.5	50	50	100

Unit 1 **Teaching Hours: 15**

Linear differential equations with constant coefficients, Determination of complementary function of the given equation, The symbolic function $\frac{1}{f(D)}$, Determination of the particular integral (P.I.) of the given equation, General method of getting P.I., Short methods for finding P.I. of f(D)y = X, when X is of certain special form, Short method of finding P.I. of f(D)y = X when $X = e^{ax}$, Short method of finding P.I. of f(D)y = X when $X = \sin ax \ or \ \cos ax$, Short method of finding P.I. of f(D)y = X when $X = x^m$, Short method of finding P.I. of f(D)y = X when $X = e^{ax}V$ where V is any function of x, Short method of finding P.I. of f(D)y = X when $X = xV$ where V is any function of x.

Unit 2 **Teaching Hours: 15**

Method of undetermined coefficients for solving linear equations with constant coefficients, Homogeneous linear equation, method of solution of homogeneous linear differential equations, Definition of $\{1/f(D_1)\}X$, *where* $D_1 \equiv d/\mathrm{dz}, \mathrm{x} = \mathrm{e}^z$ and X is any function of x, An alternative method of getting P.I. of homogeneous equations, Equations reducible to homogeneous linear form, Legendre's linear equations.

Unit 3 **Teaching Hours: 15**

method of variation of parameters for solving $dy/dx + P(x)y = Q(x)$, method of variation of parameters for solving $d^2y/dx^2 + P(x)(\mathrm{d}\,y/dx) + Q(x) = R(x)$, Complete solution of $y'' + Py' + Qy = R$ in terms of one known integral belonging to the complementary function (C.F)

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Unit 4 **Teaching Hours: 15**

Definition of partial differential equation (PDE), Order and degree of PDE, Linear and nonlinear PDE, Classification of first order PDE, origin of PDE, Derivation of PDE by elimination of arbitrary constants, Derivation of PDE by elimination of arbitrary functions ϕ from the equation, $\phi(u,v)=0$ where u and v are function of x, y and z, Cauchy's problem for first order equations.

- *Continuous Evaluation: It consists of Assignments / Seminars / Presentations / Quizzes / Surprise Tests

Reference Books:

1. Ordinary and Partial Differential Equations, M.D. Raisinghania, S. Chand & Company Ltd.
2. Differential Equations with Applications and Historical Notes, Simmons G.F., Tata McGraw-Hill Publishing Co. Ltd.
3. Differential Equations, Rukumangadachari E. Pearson Education
4. Ordinary Differential Equations-A First course, Brauer R., Nohel J, Benjamin Inc.
5. Ordinary Differential Equations, G. Birkoff and G. C. Rota, Ginn and Co.
6. Introduction to Ordinary Differential Equations, E. A. Coddington,Prentice Hall of India.
7. Elements of Ordinary Differential Equations, M Golom and M. E. Shinks, McGraw- Hill Books Co., 1965.
8. Theory and Problems of Differential Equations, F. Ayers, McGraw Hill.
9. Advanced Engineering Mathematics, E. Kreyzig, John Willey and Sons.
10. Introductory Course in Differential Equations, Daniel A.Murray, New York Longmans, Green, and Co.

KADI SARVA VISHWAVIDYALAYA
B.Sc Semester 4 (Mathematics Subject's Syllabus)

Mathematics Major Course- 10

MTM244-2C Application of Numerical Analysis and Differential Equations

Learning Outcomes:

After completing this course student will be able to

- Understand the concept of interpolation and extrapolation
- Understand the concept of numerical differentiation and apply to various problems
- Understand the concept of numerical integration and its applications.
- Solve algebraic and transcendental equations
- Understand the concept of linear differential equations
- Find general solution of linear differential equations of first order using the concept of C.F. and P.I.
- Understand the concept of homogeneous linear differential equations
- Find general solution of linear differential equations of second order
- Understand the basics of partial differential equations
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TEACHING AND EVALUATION SCHEME

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Practical Hrs Per Week		Hrs.	Max Marks		
					CCE	SEE	
MTM244-2C	Application of Numerical Analysis and Differential Equations	8	4	5	50	50	100

Unit 1Application of Numerical Analysis **Teaching Hours: 60**

1. Evaluation of finite differences of various functions.
2. Evaluation of differences of a polynomial.
3. Application of Newton's forward formula.
4. Application of Newton's backward formula.
5. Application of Gauss forward interpolation formula.
6. Application of Gauss backward interpolation formula.
7. Application of Sterling interpolation formula.
8. Application of Bessel's interpolation.
9. Applications of Newton's divided difference formula.
10. Application of Lagrange's interpolation formula for equal and unequal intervals.
11. Application of Numerical differentiation using Newton forward formula.
12. Application of Numerical differentiation using Newton backward formula
13. Application of Trapezoidal rule.
14. Application of Simpson's $1/3^{rd}$ rule & $3/8^{th}$ rule.

Unit 2 Application of Differential Equations **Teaching Hours:60**

1. Examples to find C.F. when all the roots of the auxiliary equation are real and different.
2. Examples to find C.F. when auxiliary equation has equal roots.
3. Examples to find C.F. when auxiliary equation has complex roots.
4. Examples to find C.F. when auxiliary equation has surd roots.
5. Examples to find P.I. of f(D)y = X when $X = e^{ax}$.
6. Examples to find P.I. of f(D)y = X when $X = \sin ax \ or \ \cos ax$.

7. Examples to find P.I. of f(D)y = X when $X = x^m$.
8. Examples to find P.I. of f(D)y = X when $X = e^{ax}V$ where V is any function of x.
9. Examples to find P.I. of f(D)y = X when $X = xV$ where V is any function of x.
10. Examples to solve linear equations with constant coefficients using method of undetermined coefficients.
11. Examples to find P.I. of homogeneous equations.
12. Examples based on Legendre's linear equations.
13. Solve examples of the form $dy/dx + P(x)y = Q(x)$ with the method of variation of parameters .
14. Solve examples of the form $d^2y/dx^2 + P(x)(\mathrm{d}\,y/dx) + Q(x) = R(x)$ with the method of variation of parameters.
15. Examples to solve the problems of the form $y'' + Py' + Qy = R$.
16. To find order and degree of partial differential equations.
17. Examples to derive partial differential equation by elimination of arbitrary constants.
18. Examples to derive partial differential equation by elimination of arbitrary functions ϕ from the equation $\phi(u,v) = 0$, where u and v are function of x, y and z, Cauchy's problem for first order equations.

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2. Numerical Analysis and Computational Procedures, S.A Mollah, Books & Allied Ltd.
3. Numerical Analysis,Kaiser S. Kunz, Mcgraw-hillInc
4. Methods in Numerical Analysis, Kaj L. Nielsen, Macmilllan Company.
5. Numerical Methods, V.N. Vedamurthy, N. Iyengar, Vikas Publishing, House Pvt. Ltd.
6. Numerical Mathematical Analysis, James B. Scarborough, Oxford University Press.
7. Numerical Analysis, Vithal A. Patel, Harcourt Brace College Publishers.
8. Introductory Methods of Numerical Analysis, S.S. Sastry, Prentice Hall of India Pvt. Ltd. New Delhi.
9. Ordinary and Partial Differential Equations, M.D. Raisinghania, S. Chand & Company Ltd.
10. Differential Equations with Applications and Historical Notes, Simmons G.F.,Tata McGraw-Hill Publishing Co. Ltd.
11. Differential Equations, Rukumangadachari E. Pearson Education
12. Ordinary Differential Equations-A First course, Brauer R., Nohel J,Benjamin Inc.
13. Ordinary Differential Equations, G. Birkoff and G. C. Rota, Ginn and Co.
14. Introduction to Ordinary Differential Equations, E. A. Coddington,Prentice Hall of India.
15. Elements of Ordinary Differential Equations, M Golom and M. E. Shinks,McGraw- Hill Books Co., 1965.
16. Theory and Problems of Differential Equations, F. Ayers,McGraw Hill.
17. Advanced Engineering Mathematics, E. Kreyzig,John Willey and Sons.
18. Introductory Course in Differential Equations, Daniel A.Murray,New York Longmans, Green, and Co.

KADI SARVA VISHWAVIDYALAYA
B.Sc Semester 4 (Mathematics Subject's Syllabus)

Mathematics Minor Course – Semester 4

MTE224-2C Python Programming

Learning Outcomes:

After completing this course student will be able to

- Understand the basic terminology used in computer programming to write, compile and debug programs in Python programming language.
- Use different data types to design programs involving decisions, loops, and functions.
- Understand the various data structures available in Python programming language and apply them in solving computational problems.
- Handle the exceptions which are raised during the execution of Python scripts.
- Implement files and classes in the Python programming environment.

TEACHINGANDEVALUATIONSCHEME:

Subject Code	Subject Title	Teaching Scheme Per Week		Credits	Examination Scheme			Total Marks
					Hrs.	Max Marks		
		Theory Hrs Per Week	Practical Hrs Per week			CCE	SEE	
MTE224-2C	Python Programming	2	4	4	2(Th.) 2.5(Pr.)	50	50	100

Unit1 **Teaching Hours:15**

Introduction and Basics of Python: Python IDE, interacting with Python programs, Elements of Python, variables, Immutability, Expressions, Operators and Boolean expressions, Operator precedence, Conditional statements and Control loop, Break and Continue, range (), User defined functions, Types of arguments in function, Local and Global variables, Recursive functions.

String Handling: Lists-Creating Lists, Accessing the elements of a list, List slicing, Python in-built functions for lists, List comprehension, List methods, passing list to a function, Returning a list to function.

Tuples: Creating tuples, tuple () function, Inbuilt functions for tuples, Indexing and Slicing, Operations on tuples, Passing variable length arguments to tuples, Sort tuples, Traverse tuplesfrom a list

Sets: Creating sets, the set in and not in operator, The Python set class, Set operations.

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Unit 2 **Teaching Hours:15**

Dictionaries: Basics of dictionaries, creating a Dictionary, Adding and replacing values, retrieving values, formatting dictionaries, deleting items, comparing two dictionaries, Methods of dictionary class, traversing dictionaries, Nested dictionaries, Traversing nested dictionaries

Anonymous Functions: Lambda (), filter(), map (), reduce (), zip (), Inverse zip (*), Function Decorators, Generators.

Error and Exceptions: Errors in a Python Program (Compile-Time Errors, Runtime Errors, Logical Errors), NameError, Index Error, Type Error, Import Error, Value Error, Exception Handling, Types of Exceptions,

Classes and object-Oriented Programming, Abstract data type and classes, Inheritance, Encapsulation and Information Hiding, File handling, Basic file operations of text and binary files.

Practical's **TeachingHours:60**

1. Introduction to Python Editors like IDE, Jupyter, Google Colab etc.
2. Introduction to basic operations in python.
3. Develop programs to understand the control structures of python.
4. Develop programs to understand the string handling operations.
5. Develop programs to understand the User-Defined functions with different types of arguments.
6. Develop programs to learn concept of functions scoping, recursion and list mutability.
7. Develop programs to learn different types of structures (sets, list, dictionary, tuples) in python.
8. Develop programs to understand working of exception handling and assertions.
9. Develop programs to learn different Files operations in python.

- *ContinuousEvaluation:ItconsistsofAssignments/Seminars/Presentations/Quizzes/ Surprise Tests

Reference Books:

1. Introduction to Computation and Programming Using Python, John V Guttag, Prentice Hall of India.
2. Core Python Programming, R. Nageswara Rao,Dreamtech Press, Wiley India.
3. Core Python Programming, Wesley J. Chun, Prentice Hall.
4. Fundamentals of Python – First Programs, Kenneth A. Lambert, CENGAGE Publication.

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B.Sc Semester 4 (Mathematics Subject's Syllabus)

Mathematics SEC (Skill Enhancement Course)

SEC268-2C Quantitative Aptitude-II

Learning Outcomes:

After completing this course student will be able to

- Solve examples related to trains, boats and streams.
- Understand the concepts of the problems related to mixture.
- Calculate simple interest and compound interest.
- Solve the problems related to logarithm, area volume and surface area.
- Understand the concept of the problems related to calendar and clock.
- Develop the concepts of permutation and combination.
- Solve examples on height, distance and series.
- Develop confidence to appear in competitive exam.

TEACHING AND EVALUATION SCHEME:

Subject Code	Subject Title	Teaching Scheme Per Week		Credits	Examination Scheme			Total Marks
					Hrs.	Max Marks		
		Theory Hrs Per Week	Practical Hrs Per week			CCE	SEE	
SEC268-2C	Quantitative Aptitude-II	2	0	2	2	25	25	50

Unit1 **Teaching Hours: 15**

Examples related to trains, Examples on boats and streams, Problem solving on mixture, Examples on simple interest and compound interest, Examples on logarithms, Problem solving on area, volume and surface area.

Unit2 **Teaching Hours: 15**

Examples related to calendar, Problems related to clock, Problem solving on permutations and combinations, Examples on heights and distances, Examples on series.

- *Continuous Evaluation: It consists of Assignments / Seminars / Presentations / Quizzes / Surprise Tests

Reference Books:

1. Quantitative Aptitude for Competitive Examinations, Dr. R. S. Aggarwal, S Chand Publishing
2. The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Dinesh Khattar, Pearson
3. CSIR-NET General Aptitude - A New Outlook, Christy Varghese, Lilly Publishing House