પરિપત્ર:

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટીની સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે સાયન્સ વિદ્યાશાખા હેઠળનો NEP-૨૦૨૦ અંતર્ગત મેથેમેટિક્સ વિષય સેમેસ્ટર-૨નો અભ્યાસક્રમ આ સાથે સામેલ છે.

માનનીય કુલપતિશ્રીની મંજુરી અનુસાર સદર અભ્યાસક્રમ શૈક્ષણિક વર્ષ જુન,૨૦૨૩ થી અમલવારી કરવાની રહે છે. સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજો ધ્વારા તેની અમલવારી કરવા જણાવવામાં આવે છે.

નોંધ: તા ૦૩.૦૧.૨૦૨૪નાં પરિપત્રનં: ૪૨/૨૦૨૪માં મેથેમેટિક્સનાં અભ્યાસક્રમમાં ફેરફાર કરવામાં આવેલ છે.

18/6/2025

Bhakta Kavi Narsinh Mehta University Junagadh

ખાસ ફરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/ એકેડેમિક/૨૮૭/૨૦૨૫
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી,
સરકારી પોલીટેકનિક કેમ્પસ,
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી રોડ,
ખડીયા, જૂનાગઢ-૩૬૨૨૬૩
તા.૧૮.૦૬.૨૦૨૫

પ્રતિ,

- ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમો ચલાવતી તમામ કોલેજોના આચાર્યશ્રીઓ તરફ....

નકલ સાદર રવાના:-

- માન.કુલપતિશ્રી/ કુલસચિવશ્રીનાં અંગત સચિવશ્રી.
- પરીક્ષા નિયામકશ્રી, ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી, જુનાગઢ

નકલ રવાના જાણ તથા યોગ્ય કાર્યવાહી અર્થે:

- સીસ્ટમ મેનેજરશ્રી, આઇ.ટી.સેલ વિભાગ (વેબસાઇટ ઉપર પ્રસિદ્ધ થવા અર્થે.)

પ્રો. ડૉ. નાગ્રેચા
ચેરમેન,
BOS (Mathematics)
જી.કે. જોન. ચેમ. યુ.,
જૂનાગઢ.
તા. 11/07/2025

પ્રતિશ્રી,
એકેડેમીક ઓફિસરશ્રી,
જી.કે. જોન. ચેમ. યુ.,
જૂનાગઢ.

વિષય: રીપીટર્સ વિદ્યાર્થીઓ માટે NEP Syllabus બંધો.

માનનીયશ્રી,

જય ભારત સાથે જણાવવાનું કે BOS (Mathematics) દ્વારા NEP-2020 અન્વયેના Sem-1 થી 4 ના અભ્યાસક્રમો રીવાઈઝડ કરવામાં આવેલ છે. રીપીટર્સ (ATKT) વાળા લાગુ પડતા વિદ્યાર્થીઓએ નવો અભ્યાસ કરેલ NEP-2020 અન્વયેનો જુનો અભ્યાસક્રમ પ્રમાણે પરીક્ષા આપવાની રહેશે.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

JUNAGADH

BOARD OF STUDIES

FACULTY OF SCIENCE

SYLLABUS FOR MATHEMATICS (HONOURS)

PROGRAMME (SEMESTER- II)

EFFECTIVE FROM JUNE, 2023

• Programme:	**B.Sc. (Honours)**
• Semester:	**2**
• Subject:	**Mathematics**
• Course code:	**DSC – 201 (Major Course – 3)**
• Title of the course	**Theory of Ordinary Differential Equations (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation (**CCE**)-Formative- **50 Marks**		Semester End Evaluation (**SEE**)-Summative-**50 Marks**
Theory (25 Marks) 1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	**Practicals (25 Marks)** 1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours:** 3 Hours/Week (Theory) + 2 Hours /Batch/Week (Practicals)

DSC – 201 (Major Course – 3)

Theory of Ordinary Differential Equations

Course Learning Outcome:

- Student will recollect the definition of differential equation, its order and degree.
- Student will recollect the meaning of general solution of a differential equation.
- Student will also recollect the previously studied methods of finding general solution of a given differential equation such as variable separable method, linear differential equation of integrating factor type and homogenous differential equation.
- Student will be able to find general solution of Bernoulli's differential equation and exact differential equation.
- Student will be able to find singular solution of a differential equation.
- Student will be able to know the geometrical meaning of ordinary differential equation.
- Student will be able to find orthogonal trajectories and also they will get its geometric insight.
- Student will be able to solve a differential equation of first order and higher degree.
- Student will be able to solve homogeneous linear differential equations with constant coefficients and with variable coefficients.

UNIT 1: ODE -First order and first degree [11 hours]

Introduction & review of studied methods to solve first order and first-degree differential equations, Bernoulli`s differential equation, exact differential equation, geometric meaning of an ODE, orthogonal trajectories.

UNIT 2: Differential equations of first order and higher degree [10 hours]

Differential equation of first order solvable for *x*, solvable for *y*, solvable for *p*; singular solution of an ordinary differential equation; Clairaut`s & Lagrange`s forms of differential equations.

UNIT 3: Linear differential equations of higher order [12 hours]

Linear differential equation of higher order with constant coefficients, meaning of complimentary function (C.F.) & particular integral (P.I.), operator D, meaning of auxiliary equation, roots of auxiliary equation, real and complex roots of auxiliary equation $f(D)y = 0$.

Operator $\frac{1}{D}$, solution of differential equation of the form $f(D)y = X$, method to find P.I. when $X = e^{ax}, X = \sin(ax + b)$, $X = \cos(ax + b)$, $X = x^m$, $X = e^{ax}\,V$.

UNIT 4: Linear differential equations with variable coefficients [12 hours]

Homogeneous linear differential equation including theory of solving Cauchy Euler equation and Legendre's equation, methods for finding complementary function (C.F.), methods for finding particular integral (P.I.), the symbolic operators (θ) & $\frac{1}{f(\theta)}$, particular integral (P.I.) corresponding to a term of the form x^{α}.

Mathematics Practicals

Practical No.	Title
1.	To obtain solution of linear differential equation of first order.
2.	To obtain solution of Bernoulli`s differential equation.
3.	To obtain orthogonal trajectories of given family of curves.
4.	To obtain solution of exact differential equation.
5.	To obtain solution of differential equation of first order which is solvable for *x*, y and p.
6.	To obtain solution of Clairaut`s differential equation and Lagrange`s differential equation.
7.	To obtain *singular* solution of differential equation of first order and first degree.
8.	To obtain solution of differential equation $f(D)y = X$, where $f(D)$ is a polynomial in *D* with constant coefficients.
9.	To obtain solution of Cauchy Euler homogeneous linear differential equation $f(xD)y = X$, where $f(xD)$ is a polynomial in *xD* with constant coefficients.
10.	To obtain solution of Legendre`s homogeneous linear differential equation.

Reference Books:

1. Differential Calculus by Shanti Narayan.
2. Differential Calculus by Gorakh Prasad.
3. Integral Calculus by Shanti Narayan.
4. Integral Calculus by Gorakh Prasad.
5. Differential Equations by D. A. Murray.
6. Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.
7. Theory and problems of differential equations by Frank Ayres, Schaum's outline series, McGraw Hill Publisher.
8. Ordinary and partial differential equations by Dr. M. D. Raisinghania, S.Chand

• Programme:	**B.Sc. (Honours)**
• Semester:	**2**
• Subject:	**Mathematics**
• Course code:	**DSC – 202 (Major Course – 4)**
• Title of the course	**Partial Derivatives & Differential Geometry (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation (**CCE**)-Formative- **50 Marks**		Semester End Evaluation (**SEE**)-Summative-**50 Marks**
Theory (25 Marks) 1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	**Practicals (25 Marks)** 1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total Marks 25	**Total Marks 25**	**Total Marks 50**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours:** 3 Hours/Week (Theory) + 2 Hours /Batch/Week (Practicals)

DSC – 202 (Major Course – 4)

Partial Derivatives & Differential Geometry

Course Learning Outcome:

- Student will be introduced to functions of several variables, their domain and range.
- Student will be able to realize the differences in the concept of limits and continuity of functions of several variables.
- Student will be able to find partial derivative of functions of several variables.
- Student would be acquiring the important theories governing the existence of continuity, partial derivatives and total derivative.
- Student will be able to compute the approximations using total differentials.
- Student will know the concept of homogeneous functions, implicit functions, composite functions and their partial derivatives.
- Student will learn the use of Jacobians.
- Student will be able to find the extremum values (local and/or global) of a function of several variables.
- Student will learn the Lagrange`s method of undetermined multipliers.

UNIT 1: Partial derivatives [15 hours]

Limit and continuity of functions of two variables.
Partial derivatives of first and higher order, partial differentiation of composite functions, partial differentiation of homogeneous functions, Euler`s theorem on homogeneous functions of two and three variables, total differential and chain rule, change of variables, partial differentiation of implicit functions, Young`s and Schwartz`s theorem (without proof).

UNIT 2: Applications of partial derivatives [10 hours]

Errors and approximate values, Jacobians, Taylor`s theorem for functions of two variables, maxima, minima and saddle points of functions of several variables, Lagrange`s method of undetermined multipliers.

UNIT 3: Curvature [10 hours]

Definition of tangent, normal, subtangent, subnormal, curvature and radius of curvature; Formulae for length of tangent, length of normal, length of subtangent, length of subnormal, radius of curvature (for Cartesian, parametric and polar equations); Newton`s method for finding curvature at origin.

UNIT 4: Asymptotes [10 hours]

Concavity, convexity and point of inflexion, asymptotes parallel to co-ordinate axes, oblique type, algebraic methods for finding asymptotes, rules for finding asymptotes.

Mathematics Practicals

Practical No.	Title
1.	Problems based on limit & continuity of functions of two variables.
2.	To obtain partial differentiation using the first principle.
3.	To obtain partial differentiation of composite functions.
4.	To obtain partial differentiation of implicit functions.
5.	Errors and approximates of functions of several variables using partial derivatives.
6.	To obtain Jacobians for functions of two and three variables.
7.	Problems based on partial derivative using Euler`s theorem.
8.	To obtain points of local (and global if exist) maxima and minima of multivariate functions.
9.	To determine local maxima and minima of functions of several variables by the Lagrange`s method of undetermined multipliers.
10.	To obtain Taylor's series expansion of multivariate functions.

Reference Books:

1. Differential Calculus by Shanti Narayan.
2. Differential Calculus by Gorakh Prasad.
3. Calculus: Concept and Context, Second edition, By James Stewart Pitamber Publishing Company Ltd. Delhi.
4. Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.
5. Theory and problems of differential equations by Frank Ayres, Schaum's outline series, McGraw Hill Publisher.
6. Ordinary and partial differential equations by Dr. M. D. Raisinghania, S.Chand

• Programme:	**B.Sc. (Honours)**
• Semester:	**2**
• Subject:	**Mathematics**
• Course code:	**DSM – 201 (Minor Course - 2)**
• Title of the course	**Theory of Ordinary Differential Equations (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation (**CCE**)-Formative- **50 Marks**		Semester End Evaluation (**SEE**)-Summative-**50 Marks**
Theory (25 Marks) 1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	**Practicals (25 Marks)** 1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours:** 3 Hours/Week (Theory) + 2 Hours /Batch/Week (Practicals)

DSM – 201 (Minor Course - 2)

Theory of Ordinary Differential Equations

Course Learning Outcome:

- Student will recollect the definition of differential equation, its order and degree.
- Student will recollect the meaning of general solution of a differential equation.
- Student will also recollect the previously studied methods of finding general solution of a given differential equation such as variable separable method, linear differential equation of integrating factor type and homogenous differential equation.
- Student will be able to find general solution of Bernoulli's differential equation and exact differential equation.
- Student will be able to find singular solution of a differential equation.
- Student will be able to know the geometrical meaning of ordinary differential equation.
- Student will be able to find orthogonal trajectories and also they will get its geometric insight.
- Student will be able to solve a differential equation of first order and higher degree.
- Student will be able to solve homogeneous linear differential equations with constant coefficients and with variable coefficients.

UNIT 1: ODE - First Order and First Degree [11 hours]

Introduction & review of studied methods to solve first order and first degree differential equations, Bernoulli`s differential equation, exact differential equation, geometric meaning of an ODE, orthogonal trajectories.

UNIT 2: Differential equations of first order and higher degree [10 hours]

Differential equation of first order solvable for *x*, solvable for *y*, solvable for *p*; singular solution of an ordinary differential equation; Clairaut`s & Lagrange`s form of differential equations.

UNIT 3: Linear differential equations of higher order [12 hours]

Linear differential equation of higher order with constant coefficients, meaning of complimentary function (C.F.) & particular integral(P.I.), operator D, meaning of auxiliary equation, roots of auxiliary equation, real and complex roots of auxiliary equation $f(D)y = 0$.

Operator $\frac{1}{D}$, solution of differential equation of the form $f(D)y = X$, method to find P.I. when $X = e^{ax}, X = \sin(ax + b)$, $X = \cos(ax + b)$, $X = x^m$, $X = e^{ax}\,V$.

UNIT 4: Linear differential equations with variable coefficients [12 hours]

Homogeneous linear differential equation including theory of solving Cauchy Euler equation and Legendre's equation, methods for finding complementary function (C.F.), methods for finding particular integral (P.I.), the symbolic operators (θ) & $\frac{1}{f(\theta)}$, particular integral (P.I.) corresponding to a term of the form x^{α}.

Mathematics Practicals

Practical No.	Title
1.	To obtain solution of linear differential equation of first order.
2.	To obtain solution of Bernoulli`s differential equation.
3.	To obtain orthogonal trajectories of given family of curves.
4.	To obtain solution of exact differential equation.
5.	To obtain solution of differential equation of first order which is solvable for x, y and p.
6.	To obtain solution of Clairaut`s differential equation and Lagrange`s differential equation.
7.	To obtain *singular* solution of differential equation of first order and first degree.
8.	To obtain solution of differential equation $f(D)y = X$, where $f(D)$ is a polynomial in D with constant coefficients.
9.	To obtain solution of Cauchy Euler homogeneous linear differential equation $f(xD)y = X$, where $f(xD)$ is a polynomial in xD with constant coefficients.
10.	To obtain solution of Legendre`s homogeneous linear differential equation.

Reference Books:

1. Differential Calculus by Shanti Narayan.
2. Differential Calculus by Gorakh Prasad.
3. Integral Calculus by Shanti Narayan.
4. Integral Calculus by Gorakh Prasad.
5. Differential Equations by D. A. Murray.
6. Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.
7. Theory and problems of differential equations by Frank Ayres, Schaum's outline series, McGraw Hill Publisher.
8. Ordinary and partial differential equations by Dr. M. D. Raisinghania, S.Chand

• Programme:	**B.Sc. (Honours)**
• Semester:	**2**
• Subject:	**Mathematics**
• Course code:	**MDC – 201 (Multidisciplinary Course – 2)**
• Title of the course	**Theory of Ordinary Differential Equations (Including Practicals)**

Evaluation of 100 Marks (4 Credit Paper)

Continuous and Comprehensive Evaluation(**CCE**)- Formative- **50 Marks**		Semester End Evaluation(**SEE**)- Summative-**50 Marks**
Theory (25 Marks) 1. Written Test 15 Marks 2. Assignment 05 Marks 3. Attendance 05 Marks	**Practicals (25 Marks)** 1. Performance 15 Marks 2. Viva-voce 10 Marks	1. Writing and Memory Skill Test
Total 25 Marks	**Total 25 Marks**	**Total 50 Marks**

• Credit of the course and teaching hours per week	Course credit – 4 **Teaching hours :** 3 Hours/Week (Theory) + 2 Hours /Batch/Week (Practicals)

MDC – 201 (Multidisciplinary Course - 2)

Theory of Ordinary Differential Equations

Course Learning Outcome:

- Student will recollect the definition of differential equation, its order and degree.
- Student will recollect the meaning of general solution of a differential equation.
- Student will also recollect the previously studied methods of finding general solution of a given differential equation such as variable separable method, linear differential equation of integrating factor type and homogenous differential equation.
- Student will be able to find general solution of Bernoulli's differential equation and exact differential equation.
- Student will be able to find singular solution of a differential equation.
- Student will be able to know the geometrical meaning of ordinary differential equation.
- Student will be able to find orthogonal trajectories and also they will get its geometric insight.
- Student will be able to solve a differential equation of first order and higher degree.
- Student will be able to solve homogeneous linear differential equations with constant coefficients and with variable coefficients.

UNIT 1: ODE - First Order and First Degree [11 hours]

Introduction & review of studied methods to solve first order and first degree differential equations, Bernoulli`s differential equation, exact differential equation, geometric meaning of an ODE, orthogonal trajectories.

UNIT 2: Differential equations of first order and higher degree [10 hours]

Differential equation of first order solvable for *x*, solvable for *y*, solvable for *p*; singular solution of an ordinary differential equation; Clairaut`s & Lagrange`s form of differential equations.

UNIT 3: Linear differential equations of higher order [12 hours]

Linear differential equation of higher order with constant coefficients, meaning of complimentary function (C.F.) & particular integral(P.I.), operator D, meaning of auxiliary equation, roots of auxiliary equation, real and complex roots of auxiliary equation $f(D)y = 0$.

Operator $\frac{1}{D}$, solution of differential equation of the form $f(D)y = X$, method to find P.I. when $X = e^{ax}, X = \sin(ax + b)$, $X = \cos(ax + b)$, $X = x^m$, $X = e^{ax}\,V$.

UNIT 4: Linear differential equations with variable coefficients [12 hours]

Homogeneous linear differential equation including theory of solving Cauchy Euler equation and Legendre's equation, methods for finding complementary function (C.F.), methods for finding particular integral (P.I.), the symbolic operators (θ) & $\frac{1}{f(\theta)}$, particular integral (P.I.) corresponding to a term of the form x^{α}.

Mathematics Practicals

Practical No.	Title
1.	To obtain solution of linear differential equation of first order.
2.	To obtain solution of Bernoulli`s differential equation.
3.	To obtain orthogonal trajectories of given family of curves.
4.	To obtain solution of exact differential equation.
5.	To obtain solution of differential equation of first order which is solvable for *x*, *y* and p .
6.	To obtain solution of Clairaut`s differential equation and Lagrange`s differential equation.
7.	To obtain *singular* solution of differential equation of first order and first degree.
8.	To obtain solution of differential equation $f(D)y = X$, where $f(D)$ is a polynomial in *D* with constant coefficients.
9.	To obtain solution of Cauchy Euler homogeneous linear differential equation $f(xD)y = X$, where $f(xD)$ is a polynomial in *xD* with constant coefficients.
10.	To obtain solution of Legendre`s homogeneous linear differential equation.

Reference Books:

1. Differential Calculus by Shanti Narayan.
2. Differential Calculus by Gorakh Prasad.
3. Integral Calculus by Shanti Narayan.
4. Integral Calculus by Gorakh Prasad.
5. Differential Equations by D. A. Murray.
6. Calculus, By G. B. Thomas and R. L. Finney, Pearson Education, 2007.
7. Theory and problems of differential equations by Frank Ayres, Schaum's outline series, McGraw Hill Publisher.
8. Ordinary and partial differential equations by Dr. M. D. Raisinghania, S.Chand

Format of Question Papers for External Theory Examination
(Semester End Evaluation (**SEE**)-Summative-**50 Marks)**
for
Major Course-3 & 4, Minor Course-2 and Multidisciplinary Course-2
(*Effective from Academic Year 2025 – 26 onwards*)

- There will be total FIVE questions.
- One question from every unit comprising of 10 marks each.
  Remaining one question will be asked from all four units of 10 marks

Question No. **1 to 4** (A) Answer any ONE out of TWO. 05 Marks (B) Answer any ONE out of TWO. 05 Marks **Total of each question from 1 to 4 10 MARKS**
Question No. **5** (A) Answer any ONE out of TWO 05 Marks (one question each from unit no-1 & 2) (B) Answer any ONE out of TWO 05 Marks (one question each from unit no-3 & 4) **TOTAL 10 MARKS**