

Four Year Under Graduate programme (FYUP)
Under NEP 2020
w.e.f. 2025-26 academic session

Course Structure and Credit Allocation
(For Subjects with Minimal or No Practical Component)

The following course structure under FYUP is designed for subjects which do not have practical-based courses or have minimal offerings of practical course-based learning:

First Year (NHEQF Level- 4.5)

Course Category	Semester-I					Semester-II			
	Subject/Title	No. of paper	Credits			Subject /Title	No. of paper	Credits	
			T	P				T	P
Major	Core Subject-I Differential Calculus	1	6	-		Core Subject-I Differential Equations	1	6	-
	Core Subject-II	1	4	2		Core Subject-II	1	4	2
Minor	M.D-I/ I.D-I Basic Calculus	1	4	-		M.D-II/ I.D-II Basic Differential Equations	1	4	-
SEC	SEC-I (Any one) 1. Integral Calculus 2.Vector Calculus 3.TheoryofEquations 4.Analytical Geometry	1	2	-		SEC-II (Any one) 1. Integral Calculus 2. Vector Calculus 3. Theory of Equations 4.Analytical Geometry	1	2	-
VAC	Understanding and connecting with environment Or Life Skills & personality development	1	2	--		Understanding and connecting with environment Or Life Skills & personality development	1	2	-
Total		5	18	2			5	18	2
NHEQF Level 4.5	<p><i>Student on exit after successfully completing first year (i.e., securing minimum required 40 credits + 4 Credits in one vocational course/skills-enhancement course of 4 credits) will be awarded “Undergraduate Certificate” of one year, in related field/discipline/subject</i></p> <p>Note: Students will opt skill course of Mathematics either in first year (I & II Semesters) or second year (III & IV Semester)</p>								

Semester-I

Core Subject-1: Differential Calculus

(Theory- 06-Credits)

Unit-I: Limit and Continuity (ϵ and δ definition), Types of Discontinuities, Differentiability of functions, Rolle's theorem, Lagrange's Mean Value theorem, Cauchy Mean Value Theorem and their applications.

Unit-II: Successive differentiation, Leibnitz's theorem, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^m$ Indeterminate forms.

Unit-III: Partial Differentiation, Euler's Theorem for Homogeneous functions, Maxima and minima of functions of two variables, Tangents and normal, Cartesian and polar subtangent and subnormal, Intercepts, Length of the tangent and normal, Length of the perpendicular from the pole on tangent

Unit IV: Curvature. Cartesian, polar and parametric formulae for radius of curvature Asymptotes, Singular Points. Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates

Books Recommended:

1. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons, Inc., 2011.
2. G.B. Thomas and R.L. Finney, *Calculus*, Pearson Education, 2007.

M.D.-I/I.D.-I

Minor- Basic Calculus (04- Credits)

1. **Unit-I:** Limit, Continuity and Differentiability
2. **Unit-II:** Rolle's Theorem, Lagrange's Mean Value theorems, Cauchy Mean Value Theorem. Expansion of functions, Taylor's and Maclaurin's Series of Functions.
3. **Unit-III:** Indeterminate Forms. Partial Differentiation, Euler's Theorem for Homogeneous Function,
4. **Unit-IV:** Curvature, Tangents and Normal.

Books Recommended

1. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons, Inc., 2011.
2. G.B. Thomas and R.L. Finney, *Calculus*, Pearson Education, 2007.
3. Tom M. Apostol, *Calculus Vol. I*, John Wiley & Sons, Inc. 2007.

Semester-I/II

Skill Papers (Any one paper out of 4 papers)

Skill Paper-I

Integral Calculus (02 Credits)

Unit-I: Integration of rational and irrational functions, Properties of definite integrals. Reduction formulae for integrals of rational and trigonometric functions,

Unit-II: Gamma and Beta functions. Areas and lengths of curves in the plane, Volumes and surfaces of solids of revolution. Double and triple integrals.

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., 2002.

Skill Paper-II
Vector Calculus (02 Credits)

Unit-I: Scalar and vector products of three and four vectors, Reciprocal systems of vectors, Applications of vectors to three dimensional geometry. Differentiation of vectors, partial differentiation of vectors, Velocity and acceleration, Integration of vectors.

Unit-II: Differential operators, Gradient of a scalar point function, Directional Derivative, divergence and curl of vectors. Line integrals, Surface integrals, Applications of Gauss's, Green's and Stokes' theorems.

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.
3. P.C. Matthews, *Vector Calculus*, Springer Verlag London Limited, 1998.

Skill Paper-III
Theory of Equations (02 Credits)

Unit-I: General properties of polynomials, Graphical representation of polynomials, General properties of equations, Descartes's rule of signs, Positive and negative roots, Relation between the roots and the coefficients of equations. Symmetric functions, Applications symmetric function of the roots.

Unit-II Transformation of equations. Solutions of reciprocal and binomial equations, Algebraic solutions of the cubic and biquadratic equations, Properties of the derived function.

Books Recommended

1. W.S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954.
2. C. C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954, India Ltd, 1994.

Skill Paper-IV
Analytical Geometry (02 Credits)

Unit-I Techniques for sketching parabola, ellipse and hyperbola, Definition and equation of sphere, Intersection of a sphere and a line, Intersection of two spheres, Tangent plane, Plane of contact, Angle of intersection of two spheres.

Unit-II: Definition and equation of a cone, Guiding curve, Intersection of a line with cone, Tangent line and tangent plane, Reciprocal cone, Right circular cone, The cylinder, Right circular cylinder, Enveloping cylinder, Central conicoids.

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) Pvt. Ltd., 2002.
3. R.J.T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan

Semester-II**Core Subject-I: Differential Equations
(Theory-06 Credits)**

Unit-I: Classification of differential equations: their origin and applications, initial value problems, boundary value problems, existence of solution. Separable equation and reducible to this form.

Unit-II: Exact differential equations, integrating factors, special integrating factors and transformations. linear differential equation and Bernoulli equations, first order higher degree equations solvable for x , y , p .

Unit-III: Higher-order differential equations with constant coefficients, basic theory of linear differential equations, The Cauchy-Euler equation, Simultaneous differential equations. Wronskian and its properties Second order linear differential equations with variable coefficients, Inspection Method, Reducible to normal form, Change of Independent Variable, Variation of Parameters. Total differential equations.

Unit-IV: Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

Books Recommended

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

M.D.-II/I.D.-II**Minor- Basic Differential Equations (04- Credits)**

Unit-I: Classifications of Differential equations, their origin and applications, initial value problems.

Unit-II: Exact differential equations of first order, Integrating factors, special integrating factor and transformations, Linear differential equations and Bernoulli equation.

Unit-III: First order higher degree equations solvable for x , y , p . Higher order differential equations with constant coefficients.

Unit-IV: Order and degree of partial differential equations, Concept of linear and non-linear p.d.e., formulation of first order partial differential equations.

Books Recommended:

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

Professor R. C. Dimri

Prof. U. C. Gairola

Professor M. C. Sati

Professor R.C.S. Kunwar

**Professor S. B. Singh
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**Professor Mukesh Sharma
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Prof. K. S. Rawat

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