KOLHAN UNIVERSITY

CHAIBASA

UNIVERSITY DEPARTMENT OF MATHEMATICS

Course Content of FYUGP (Mathematics)

Under NEP 2020

Syllabus Scheme for FYUGP

State Universities Jharkhand Regulation, 2024

Effective from Academic Session 2025-2026

(For Syllabus Mathematics in FYUGP)
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6. **Dr. P. C. Banerjee,** **(Member)**
   Assistant Professor, Karim City College,
   Jamshedpur

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Major:

Semester	Paper	Code	Course Title	Credit
I	Major-01	MJ-1	Calculus	4
II	Major-02	MJ-2	Real Analysis-I & Analytic Geometry-I	4

Program: **Certificate** Class: **UG**	Year: **First**	Semester: **I**
Subject: **Mathematics**		
Course Code: **MJ-1**	Course Title: **Calculus**	

Course Learning Outcomes: This course will enable the students to:

a) Apply successive and partial differentiation techniques including Leibnitz's, Euler's, Maclaurin's and Taylor's theorem to solve problems.
b) Analyze the functions by determining their tangent, normal, pedal equation, evolute & asymptote.
c) Evaluate indefinite & definite integrals using various techniques including properties of definite integral.
d) Apply definite integral & reduction formulae to solve problems involving Area under the curve, arc length, volume & surface area of solids of revolution.

Credit: **4 (Theory)**	**Compulsory**
Full Marks: **75**	Time: **3 Hours**

Unit	Content	Hours
I	**Successive Differentiation**: Successive differentiation, Leibnitz's theorem. **Expansions of Functions:** Maclaurin's and Taylor's theorems for expansion of a function in an infinite series. **Partial Differentiation:** Partial differentiation of first order & second order, Eulers theorem, Total Differentiation	**15 h**
II	**Tangent & Normal:** Equation of tangent & normal, Subtangent & subnormal, Derivative of arc, Pedal equation. **Curvature:** Radius of curvature for cartesian, Pedal & polar curves, Chord of curvature & center of curvature, Evolute & involute **Asymptotes:** Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes, Asymptotes at origin.	**15 h**
III	**Indefinite Integration:** Integration by substitution, by parts, by partial fraction, Integration of rational & irrational function, Integration of trigonometric function. **Definite Integration:** Properties of definite integration, Special definite integral, Differentiation & Integration under sign of integration	**15 h**
IV	**Application of Definite Integration:** Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x\, dx, \int \cos^n x\, dx, \int \tan^n x\, dx, \int \sin^n x \cos^m x\, dx,$ $\int \cos^m x \cos nx\, dx,$ Curve tracing, Area under the curve, Arc length, Volume & Area of surface of revolution.	**15 h**

Sessional Internal Assessment (SIA) Full Marks – 25 Marks
A – Internal written Examination – 20 Marks (1 Hr)
B – Over All Performance including Regularity – 05 Marks

Books Recommended:

1. R. K. Dwivedi, Calculus, 1st Edition, Pragati Prakashan, Meerut, India (2019).
2. Howard Anton, I. Bivens & Stephan Davis (2016). Calculus (10th edition). Wiley India.
3. Differential Calculus by Lalji Prasad: Paramount Publication
4. Integral Calculus by Lalji Prasad: Paramount Publication

Program: **Certificate** Class: **UG**	Year: **First**	Semester: **II**
Subject: **Mathematics**		
Course Code: **MJ-2**	Course Title: **Real Analysis-I & Analytic Geometry-I**	

Course Learning Outcomes: This course will enable the students to:

a) Analyze the behavior of real sequence using the concept of monotonicity, convergence and boundedness and apply theorems like Bolzano-Weierstrass & Cauchy's theorems.
b) Determine the convergence & divergence of infinite series and alternating series using various standard tests for convergence.
c) Analyze & classify the conic section by reduction of general equation of second degree to standard forms and apply calculus to find tangent, normal, polar etc.
d) Analyze and interpret conic section geometrically and solve problems involving polar equation of conics.

Credit: **4 (Theory)**	**Compulsory**
Full Marks: **75**	Time: **3 Hours**

Unit	Content	Hours
I	**Sequences of Real Numbers:** Convergent sequence, Limit of a sequence, Bounded sequence, Limit theorems, Monotone sequences, Monotone convergence theorem, Subsequences of sequences, Bolzano-Weierstrass theorem for sequences, Limit superior & limit inferior of a sequence of real numbers, Cauchy sequence, Cauchy's first theorem on limit, Cauchy's convergence criterion. Completeness property of set of real number.	**15 h**
II	**Infinite Series:** Convergence and divergence of infinite series of positive real numbers, Cauchy criterion for convergence, Tests for convergence of positive term series, Basic comparison test, Limit comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Logarithmic test, Cauchy's condensation test, De Morgan & Bertrand's test, Higher logarithmic test, Gauss's test. **Alternating series**: Alternating series, Leibniz test, Absolute & conditional convergence, Properties of absolutely convergent series.	**15 h**
III	**Conic sections and axis transformation of two-dimension:** Change of rectangular axis, Conic section, Conditions for the general equation of second degree to represent Parabola, Ellipse & Hyperbola, Reduction into standard forms, Equation of tangents & normals (using calculus), Chord of contact, Polar & Pair of tangents.	**15 h**
IV	**Conic Sections and their geometric interpretations:** Axes, Centre director circle in reference to general equation of conic & related problems, Polar equation of conic, Equation of chord, tangent, normal, asymptote, director circle & related problems.	**15 h**

Sessional Internal Assessment (SIA) Full Marks – 25 Marks
A – Internal written Examination – 20 Marks (1 Hr)
B – Over All Performance including Regularity – 05 Marks

Books Recommended:

1. Sequence & Series by Lalji Prasad: Paramount Publication
2. Two-Dimensional Coordinate Geometry by Lalji Prasad: Paramount Publication
3. Mathematical Analysis by S.C. malik, New Age International
4. Geometry (2D & 3D) by A. R. Vashishta: Krishna Prakashan, Meerut

Associated Core

Semester	Paper	Code	Course Title	Credit
I/II	Associated Core-1/2	AC-1/2	Calculus	4

Program: **Certificate** Class: **UG**	Year: **First**	Semester: **I/II**
Subject: **Mathematics**		
Course Code: **AC-1/2**	Course Title: **Calculus**	

Course Learning Outcomes: This course will enable the students to:

a) Apply techniques of differential calculus including successive & partial differentiation, use of Leibnitz, Euler, Maclaurin and Taylor's theorem.
b) Analyze the geometric properties of functions by determining the tangent, normal, radius of curvature and asymptotes.
c) Evaluate indefinite integral using techniques such as substitution, integration by parts, integration by partial fractions etc.
d) Be able to apply the properties of definite integrals to solve problems involving area under the curve, arc length, surface area and volume of solids of revolution.

Credit: **4 (Theory)**	**Compulsory**
Full Marks: **75**	Time: **3 Hours**

Unit	Content	Hours
I	**Differential calculus:** Successive differentiation, Leibnitz theorem, Expansion, Taylor's & Maclaurin's theorem for infinite series, Partial Differentiation, Eulers theorem,	**15 h**
II	**Tangent, normal, curvature & asymptote:** Tangent and Normal, Subtangent & subnormal, Curvature, Radius of curvature in different forms, Asymptotes.	**15 h**
III	**Integral calculus:** Integration by substitution, by parts, by partial fraction, Integration of rational & irrational functions.	**15 h**
IV	**Definite integration:** Properties definite integral, Curve tracing, Length of curve, Area & Volume of surface of revolution.	**15 h**

Sessional Internal Assessment (SIA) Full Marks – 25 Marks
A – Internal written Examination – 20 Marks (1 Hr)
B – Over All Performance including Regularity – 05 Marks

Books Recommended:

1. R. K. Dwivedi, Calculus, 1st Edition, Pragati Prakashan, Meerut, India (2019).
2. Howard Anton, I. Bivens & Stephan Davis (2016). Calculus (10th edition). Wiley India.
3. Differential Calculus by Lalji Prasad: Paramount Publication
4. Integral Calculus by Lalji Prasad: Paramount Publication

Multi-Disciplinary Course

Semester	Paper	Code	Course Title	Credit
I	Multi-Disciplinary Course	MDC	Introduction Course in Mathematics	3

Program: **Certificate** Class: **UG**	Year: **First**	Semester: **I**
Subject: **Mathematics**		
Course Code: **MDC**	Course Title: **Introduction Course in Mathematics**	

Course Learning Outcomes: This course will enable the students to:

a) Construct and evaluate formal proofs using various proof strategies, including mathematical induction, to demonstrate the validity of logical arguments.

b) Analyse and apply the properties of relations and functions, including reflexivity, symmetry, transitivity, injectivity, surjectivity, and bijectivity, to solve mathematical problems in various contexts.

c) Analyse and apply the concepts of modular arithmetic and congruence relations to solve problems related to divisibility, linear congruences, and arithmetic functions, as well as understand and apply advanced topics such as the Chinese remainder theorem, Fermat's little theorem, and Wilson's theorem to solve more complex problems.

d) Analyse and apply concepts related to the real number system, including its field and order structures, bounded sets, supremum and infimum of sets, and completeness property.

e) Analyse and determine the convergence or divergence of sequences and series using various techniques, including the comparison test and advanced tests such as the ratio test and root test.

Credit: **3 (Theory)**	**Compulsory**
Full Marks: **75**	Time: **3 Hours**

Unit	Content	Hours
I	**Logic**: Statement, Truth table, Quantifiers, Proof strategies, Mathematical induction.	**8 h**
II	**Sets and functions and relations**: Reflexive, Symmetric, Asymmetric and Transitive relations, Injective, Surjective and Bijective functions.	**10 h**
III	**Theory of numbers**: Modular arithmetic, Divisibility, Congruence relation, Linear congruence and Chinese remainder theorem, Fermat's little theorem, Wilson's theorem, Arithmetic functions and Set of residue classes modulo n: 'Z_n'.	**8 h**
IV	**Real number system**: Field and Order structure, Bounded sets, Supremum and Infimum of sets, Completeness property of set of Real number $\mathbb{R}$.	**8 h**
V	**Sequences and series**: Limit of a sequence, Convergent and non-convergent sequence, Limit points of a sequence, Positive term series, convergent and divergent series, Comparison test of positive term series.	**11 h**

***Remarks -: No Internal Exam**

Books Recommended:

1. R.G. Bartle and D. R. Sherbert (2002). Introduction to Real Analysis (3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore.
2. R. K. Dwivedi (2019). Real Analysis, 1 st Ed., Pragati Prakashan.
3. S.C. Mallik and S. Arora-Mathematical Analysis, New Age International Publications.
4. F. Cajori (1904). An Introduction to The Modern Theory of Equations. The Macmillan Company.
5. Kolman, Busby and Ross (2002). Discrete Mathematical Structure, 4th Ed., Pearson Education Asia.
6. V. Rajaraman (1993). Computer oriented numerical methods, Prentice Hall India.