SYLLABUS FOR
THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP) IN MATHEMATICS (MAJOR)

As per provisions of NEP_2020 to be implemented from academic year 2022 onwards.

for
All Constituent / affiliated colleges Under
Binod Bihari Mahto Koyalanchal University,
Dhanbad (Jharkhand).

Members of Board of Studies (BOS) of revised CBSC as per provisions of NEP - 2020 for FYYGP in Mathematics of the Binod Bihari Mahto Koyalanchal University, Dhanbad.

1. **Chairperson: -**   **Dr. R. K. Tiwary**
   Associate professor & Head
   University Department of Mathematics
   Binod Bihari Mahto Koyalanchal University, Dhanbad.

2. **Member: -**   **Dr. Shiv prasad**
   Assistant Professor
   University Department of Mathematics
   Binod Bihari Mahto Koyalanchal University, Dhanbad.

3. **Member: -**   **Dr. Nasim Ahmad**
   Assistant Professor
   Head Department of Mathematics,
   PKRM College, Dhanbad.

4. **Member: -**   **Dr. Anand Mohan** Prasad
   Assistant Professor
   Head Department of Mathematics,
   Chas College Chas, Bokaro.

5. **Special Invite: -**   **Dr. B. K. Singh (Rtd.)**
   Associate professor & Head
   Head Department of Mathematics,
   B.S. City College, Bokaro.

Dr. R. K. Tiwary
H.O.D
BBMKU, Dhanbad

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COURSE STRUCTURE

For Non - Practical Subject

Semester	Course Code	Papers	Credits
I	CC - 1	Language and communication skills (MIL: Hindi communication) or (NH: Non-Hindi + TRL/ other language)	6 or 3 3
	CC - 2	Understanding India	2
	CC - 3	Health & wellness, Yoga Education, Sports & fitness	2
	IRC - 1	Introductory Regular Course - I	3
	IVS - IA	Introductory Vocational studies - I	3
	MJ - 1	Major paper 1 (Disciplinary / Interdisciplinary Major)	6
II	CC - 5	Language and communication skills (English)	6
	CC - 6	Mathematical & computational thinking Analysis	2
	CC - 7	Global citizenship Education & Education for sustainable development	2
	IRC - 2	Introductory Regular course - 2	3
	IVS - IB	Introductory vocational studies - 2	3
	MJ - 2	Major paper 2 (Disciplinary / Interdisciplinary Major	6

Marks Distribution

	Full marks	Pass Marks	Time for Examination
M. S. E	25	10	1 Hr.
E. S. E	75	30	3 Hrs.

Note: I -   M. S. E (Mid Semester Exam)

           II -   E. S. E (End Semester Exam)

MATHS – H-C-101-T	DIFFERENTIAL CALCULUS, INTEGRAL CALCULUS, ANALYTICAL GEOMETRY 2D & VECTOR CALCULUS	(06 Credits, 60 Lectures & 15 Tutorial)

MAJOR COURSE – MJ -1   (Credits: Theory – 05, Tutorial – 01)

Full Marks: 25 (MSE: 1Hr) + 75 (ESE: 3Hrs) = 100   Pass Marks (MSE:10 + ESE:30) = 40.

Instruction to Question Setter for:

Mid Semester Examination (MSE):

There will be two group of questions. Group A is compulsory and will contains two questions in which question No. 1 contains five questions of very short type consisting of 1 mark each, and question No. 2 have one question of short answer type 5 marks. Group B will contain descriptive type two questions of 10 marks each, out of which any one is to answer.

End Semester Examination (ESE):

There will be two group of questions. Group A is compulsory and will contain three questions. Question No. 1 will be very short answer type consisting of five questions of 1 mark each. Question No. 2 and 3 will be short answer type consisting two questions of 5 marks. Group B will contain descriptive type six questions of fifteen marks each, out of which any four are to be answer.

Note: There may be subdivisions in each question asked in End Semester Examinations.

DIFFERENTIAL CALCULUS, INTEGRAL CALCULUS, ANALYTICAL GEOMETRY 2D & VECTOR CALCULUS:

UNIT 1

Successive Differentiation, Expansion, L' Hospital rule, Asymptotes.

<div align="right">15 Lectures (1 Question)</div>

UNIT II

Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x\, dx$, $\int \cos^n x\, dx$, $\int \tan^n x\, dx$, $\int \sin^n x \cos^m x\, dx$, $\int \sin nx\, dx$, $\int \cos nx\, dx$, $\int (\log x)^n dx$, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, volume and area of surface of revolution.

<div align="right">20 Lectures (2 Question)</div>

UNIT III

General equation of the second degree, General conic, polar equation of conics.

<div align="right">20 Lectures (1 Question)</div>

UNIT IV

Triple product, introduction to vector functions, operations with vector – valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration.

<div align="right">20 Lectures (2 Questions)</div>

Books Recommended:

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

2. M.J. Strauss, G.L. Bradley and K.J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.

3. H. Anton, I. Bivens and S. Davis, *Calculus*, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.

4. R. Courant and F. John, *Introduction to Calculus and Analysis (Volume I & II)*, Springer – Verlag, New York, Inc., 1989.

MATHS – C- 203-T	REAL ANALYSIS - I	(06 Credits, 60 Lectures & 15 Tutorial)

MAJOR COURSE – MJ -2   (Credits: Theory – 05, Tutorial – 01)

Full Marks: 25 (MSE: 1Hr) + 75 (ESE: 3Hrs) = 100   Pass Marks (MSE:10 + ESE:30) = 40.

Instruction to Question Setter for:

Mid Semester Examination (MSE):

*There will be **two group of questions.** **Group A is compulsory** and will contains two questions in which question No. 1 contains five questions of **very short type** consisting of 1 mark each, and question No. 2 have one question of short answer type 5 marks. **Group B will contain descriptive type** two questions of 10 marks each, out of which any one is to answer.*

End Semester Examination (ESE):

*There will be **two group of questions.** **Group A is compulsory** and will contain three questions. **Question No. 1 will be very short answer type** consisting of five questions of 1 mark each. **Question No. 2 and 3 will be short answer type** consisting two questions of 5 marks. **Group B will contain descriptive type** six questions of fifteen marks each, out of which any four are to be answer.*

Note: There may be subdivisions in each question asked in End Semester Examinations.

REAL ANALYSIS – I

UNIT I

Idea of countable sets, uncountable sets and uncountability of R. Bounded above sets, bounded below sets, Bounded sets, Unbounded sets, Suprema and Infima, Intervals, limits points of a set, Isolated points, Illustration of Bolzano – Weierstrass theorem for sets.

15 Lectures (1 Question)

UNIT II

Sequences, Bounded sequences, Convergent sequence, Limit of a sequence. Limits theorems, Monotone sequences, Monotone Convergence theorem. Subsequences, Divergence Criteria, Monotone Subsequences theorem (statement only), Bolzano – Weierstrass Theorem for Sequences. Cauchy sequences, Cauchy's Convergence Criterion.

30 Lectures (2 Questions)

UNIT III

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Test for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test, Raabe's test, De-Morgan's and Bertrand's test, Alternative series, Leibnitz test, Absolute and Conditional convergence, Kummer's test, logarithmic test.

30 Lectures (3 Questions)

Books Recommended:

1. R.G. Bartle and D.R. Sherbert, *Introduction to Real Analysis*, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
2. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, *An Introduction to Analysis*, 2nd Ed., Jones & Bartlett, 2010.
3. Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, *Elementary Real Analysis*, Prentice Hall, 2001.
4. S.K. Berberian, *A first Course in Real Analysis*, Springer Verlag, New York, 1994.

Question format for Mid Semester Theory Examination 20 marks:

General Instruction:

1) **Group A** carries very short answer type compulsory questions.

2) Answer **1 out of 2** subjective / descriptive questions given in **Group B**.

3) Answer in your own words as far as practicable.

4) Answer all sub parts of a question at one place.

5) Numbers on the right indicate full marks of the question.

Group A
[5 x 1 = 5]

1.
   i. ....
   ii. ....
   iii. ....
   iv. ....
   v. ....
2. ....   [5]

Group B

3. ....   [10]
4. ....   [10]

Note: There may be subdivisions in each question asked in Theory Examination.

Question format for End Semester Theory Examination 75 marks:

F.M. = 75

Subject / Code
Time = 3 Hrs.

Exam Year

General Instruction:

1) **Group A** carries very short answer type compulsory questions.

2) Answer **4 out of 6** subjective / descriptive questions given in **Group B**.

3) Answer in your own words as far as practicable.

4) Answer all sub parts of a question at one place.

5) Numbers on the right indicate full marks of the question.

Group A

[5 x 1 = 5]

1.
   i.   ....
   ii.   ....
   iii.   ....
   iv.   ....
   v.   ....

2.   ....   [5]
3.   ....   [5]

Group B

4.   ....   [15]
5.   ....   [15]
6.   ....   [15]
7.   ....   [15]
8.   ....   [15]
9.   ....   [15]

Note: There may be subdivisions in each question asked in Theory Examination.

Introductory Mathematics

Course Credits: 03   Total Lecture Hours: 45

UNIT – I: Trigonometry

Simple identities, solutions of triangles, heights and distances, trigonometric equations properties of triangles, and general solutions of trigonometric equations.   (2 Questions)

UNIT – II: Algebra

Fundamental operations in algebra, factorization, expansions, simultaneous linear /quadratic equations, arithmetic, indices, logarithms, geometric and harmonic progressions, determinants, and matrices.   (2 Questions)

UNIT – III: Calculus

Limit of functions, continuous function, differentiation of function, Integration of functions by parts, by substitution and by partial fraction, tangents and normals, simple examples of maxima and minima, indefinite and definite integrals, applications of definite integrals to areas.
                                                                              (2 Questions)

UNIT -IV: Vector Algebra

Position vector, addition and subtraction of vectors, scalar and vector products, and their applications to simple geometrical problems.   (1 Question)