



YBN UNIVERSITY

Established by the Act of Government of Jharkhand Act15, 2017

Gazette Notification No.505, Dated 17th July 2017

As per Section 2(f) of UGC Act.1956

NEP-2020
SCHOOL OF SCIENCE
MATHEMATICS COURSE / STRUCTURE
For
FOUR-YEAR UNDERGRADUATE PROGRAMMES
(FYUGP)
UNDER YBNU RANCHI JHARKHAND
Implemented in the Department of Mathematics
in the
Semester-I, II, III & IV
from
Academic Session-2023



RAJALATU, NAMKUM, RANCHI, JHARKHAND-834010

COURSES OF STUDY OF FOUR-YEAR UNDERGRADUATE PROGRAMME FOR TWO (2)

YEARS-2023 onwards

AIMS OF BACHELOR'S DEGREE PROGRAMME IN MATHEMATICS

The broad aims of Bachelor's Degree Programme in Mathematics are to:

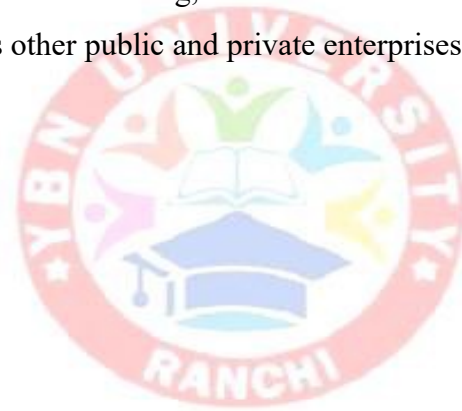
- i. create deep interest in learning mathematics.
- ii. develop broad and balanced knowledge and understanding of definitions, concepts, principles and theorems.
- iii. familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.
- iv. enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problems in mathematics.
- v. provide students/learners sufficient knowledge and skills enabling them to undertake further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics.
- vi. encourage the students to develop a range of generic skills helpful in employment, internships

PROGRAM LEARNING OUTCOMES

The broad aims of Bachelor's Degree Programme in Mathematics are:

- i. Bachelor's degree in mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, Mechanics and several other branches of mathematics. This also leads to study of related areas like computer science and statistics. Thus, this programme helps learners in building a solid foundation for higher studies in mathematics.
- ii. The skills and knowledge gained has intrinsic beauty, which also leads to proficiency in analytical reasoning. This can be utilised in modelling and solving real life problems.

- iii. Students undergoing this programme learn to logically question assertions, to recognise patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing interdependent society.
- iv. Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.
- v. Completion of this programme will also enable the learners to join teaching profession in primary and secondary schools.
- vi. This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.



Semester-I

**Table 1: Course structure for Undergraduate Certificate Programme
[May Exit after Sem.-I]**

Semester	Common Course			Introductory Course		Major	Total credits
Sem-I	LCS (MIL/TRL)	Understanding India	Health & Wellness, Yoga Education, Sports & Fitness	IRC-1	IVS-1A	MJ-1	
	(6Credits)	(2Credits)	(2Credits)	(3Credits)	(3Credits)	(6Credits)	(22)

Total = 22 Credits

(LCS: Language and Communication Skills; MIL: Modern Indian Languages; TRL: Tribal Regional Languages; IRC: Introductory Regular Courses; IVS; Introductory Vocational Studies, MJ: Major)

**SEMESTER WISE COURSE OF STUDY FOR FOUR YEAR UNDERGRADUATE
MATHEMATICS PROGRAMME 2023 ONWORDS**

Table 2: Semester Wise Course Code and Credits Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Course		Credits and Marks Distribution				
	Code	Paper	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical / Viva/(F.M.)	Total
I	1Y4CC-1	Language and Communication Skills (Modern Indian Language including TRL)	6	75	25	...	100
	1Y4CC-2	Understanding India	2	75	25	....	100
	1Y4CC-3	Health & Wellness, Yoga Education, Sports & Fitness	2	50	25	25	100
	1Y4IRC-1	Introductory Regular Course-1:: Introductory Mathematics	3	75	25	....	100
	1Y4IVSCM-1A	Introductory Vocational Studies-I COMPUTER BASICS AND MULTIMEDIA – IVS1A	3	50	25	25	100
	1Y4MATMJ-1	Major paper-1 (Disciplinary/Interdisciplinary Major): Calculus & Geometry	6	75	25	....	100

Abbreviations:

CC Common Course

IRC Introductory Regular Courses

IVS Introductory Vocational Courses

MJ Major Disciplinary/Interdisciplinary Courses

MAT Mathematics

Table 3: Semester Wise Course Code and Credits Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure				Total
	Code	Papers	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical/ Viva/(F.M.)	
I	MJ-1	Calculus & Geometry	6	75	25	---	100

Table 7: Semester wise Course Code and Credit Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses	Examination Structure	Credits	Examination Structure			Total
				Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical/ Viva/(F.M.)	
I/II/II I	IRC	Introductory Mathematics	3	100	---	---	100

SEMESTER-1

ENGLISH LANGUAGE & COMMUNICATION SKILLS

Course code (1Y4CC-1)

**Total Marks: 100
(Credits-6)**

OBJECTIVE:

To equip students effectively to acquire skills in reading, writing, comprehension and communication for English language & Communication.

COURSE OUTCOMES:

- Students will improve their speaking ability in English both in terms of fluency and comprehensibility
- Students will give oral presentations and receive feedback on their performance
- Students will increase their reading speed and comprehension of academic articles
- Students will strengthen their ability to write academic papers, essays and summaries using the process approach.
- Students will enlarge their vocabulary. They will also heighten their awareness of correct usage of English grammar in writing and speaking

Unit I:

Communication – Meaning, Types, Channels, Barriers. Skills of Language learning: Listening, Speaking, Reading & Writing.

Unit II:

English as a Global Language Growth & Status of English language in India

Unit III:

Class-presentation – Introduction, Conversation, Greetings, Likes and Dislikes, Opinion, Agreeing, Disagreeing, Complaint, Apology

Unit IV:

Writing skills –, notice writing, précis writing, essay writing, letter writing resume writing.

Unit V:

Vocabulary building: One-word substitution, synonyms and antonyms, idioms and phrases, Common Errors, Prefix, Suffix, Homophones, Confusing words

Suggested Reading:

1. *Technical Communication*, M.H. Rizvi, Tata McGrawhill
2. *Everyday Smart English*, Dr. Arti Gupta, I.D. Publishers
3. *Effective Business Communication*, Asha Kaul
4. *Developing Communication Skills*, Krishnamohan
5. *Functional Grammar and Spoken and Written Communication in English*, Bikram K. Das, Orient Blackswan
6. *Precis, Paraphrase and Summary*, P.N. Gopalkrishnan, Authors Press
7. *Communication Skills*, Sanjay Kumar and Pushplata, Oxford Publication



SEMESTER-1

UNDERSTANDING INDIA

Course code-1Y4CC-2

Total Marks: 100
(Credits-2)

Objective:

This course is designed: to expose the students to our social, economic and cultural heritage

Learning Outcome:

On successful completion of this course, the student will be able to have a knowledge regarding

- Contemporary India with its historical perspective
- Constitutional obligations: fundamental rights and duties.
- Indian knowledge systems
- India's struggle for freedom

Unit I:

Background of India's culture: Harappan civilisation and Vedic Age Buddhism, Jainism, Sanatan (Hinduism) and Islam

Unit II: Growth and development of Indian Education and literature: Bharat's Natyashastra, Kalidas, Panini, Patanjali Taxila, Nalanda, Vishwa Bharati, BHU, AMU, IIT, IISC, AIIMS

Unit III:

Leaders of India's freedom struggle: Mahatma Gandhi, Jawaharlal Nehru, Subhash Chandra Bose, Freedom fighter of Jharkhand (Tilka Manjhi, Sidho-Kanho, , Birsa Munda & Jatra Bhagat)

Unit IV:

Geographical features of India

1. India on the map of world and its neighbouring Countries.
2. Physical features of India including 1 mountain, plateau, plain, coast, island, vegetation, rivers, soils, and climate

Unit V:

The People of India: Racial diversities, Population, its growth, distribution, Migration.

Unit VI:

Indian Constitution:

1. Preamble
2. Salient feature
3. Fundamental rights
4. Fundamental duties

Unit VII:

Political ideas: Non-violence, Satyagraha and Social Justice

Unit VIII:

The Indian Economy: The Indian Economy through the Ages (Agriculture, Industry and Trade-Transport)

Suggested Readings

1. A. L. Basham, *A Cultural History of India*, Oxford University Press, 1997
 2. A. L. Basham, *A Wonder that was India*, Rupa, New Delhi, 1994
 3. N. R. Ray, *An Approach to Indian Art*, Publication Bureau, Chandigarh, 1974
 4. A. L. Basham, *A Cultural History of India*, Oxford University Press, 1999
 5. Nayanjot Lahiri, *Marshaling the Past: Ancient India and its Modern Histories*, Permanent Black, 2012
 6. R.C. Majumdar (ed.), *History and Culture of Indian People* (Relevant Volumes and Chapters), Bhartiya Vidya Bhawan, Bombay.
 7. S. C. Ghosh, *History of Education in Modern India, 1758-1986*, Orient Longman, Hyderabad, 1995
 8. Tirthankar Ray, *The Economic History of India 1857-1947*, OUP, 2006
 9. Vijay Joshi and I.M.D. Little, *India's Economic Reforms, 1991-2001*, OUP, 1999
-

SEMESTER-1

HEALTH AND WELLNESS, YOGA EDUCATION

Course code-1Y4CC-3

Total Marks: 100

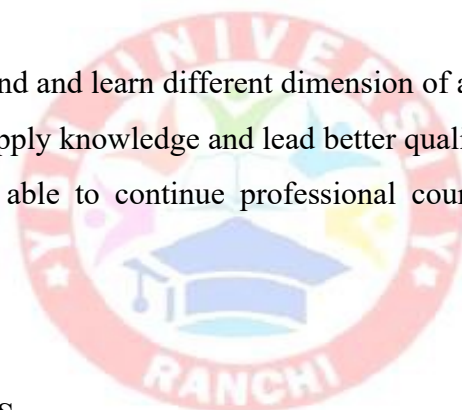
(Credits-2)

OBJECTIVE:

- To raise awareness towards fitness among the students.
- To develop the individual as a fit citizen in the society.
- To acquire knowledge about yoga and health & wellness.

COURSE OUTCOMES:

- Students will understand and learn different dimension of active lifestyle
- Student will learn to apply knowledge and lead better quality life
- The students will be able to continue professional courses and research in health & wellness & yoga



HEALTH AND WELLNESS

Unit 1: -Introduction

1. Meaning, Definition and Dimensions of Health and Wellness.
2. Factors affecting Fitness and Wellness
3. Role of Fitness in maintaining Health and Wellness
4. Importance of Health Education and Wellness

Unit2: -Methods to Maintain Health and Wellness

1. Role of Physical Activities and Recreational Games for Health and Wellness
2. Role of Yoga Asanas and Meditation in maintaining Health and Wellness
3. Nutrition for Health & Wellness.

Unit3: -Anxiety, Stress and Aging

1. Meaning of Anxiety, Stress and Aging
2. Types and Causes of Stress
3. Stress relief through Exercise and Yoga

Suggested Readings:

1. Reklau Marc (2019), “30 Days: Change your habits, Change your life”, Rupa Publications, India
2. Russell, R.P.(1994).*Health and Fitness Through Physical Education*. USA Human Kinetics.
3. Scates Samantha (2019) “ *Healthy Habits for a Healthy Life*” Samantha, Ireland
3. D.M Jyoti, *Yoga and Physical Activities (2015) lulu.com3101*, Hillsborough, NC2 7609, United States.

HEALTH & WELLNESS, YOGA EDUCATION, SPORTS & FITNESS

Unit -I:

Theory: Introduction to Health and Wellness

1. Meaning, definition and importance of Yoga
2. Types of Yoga, Introduction of Sat-karma, definition of asana and Pranayama, it's physical and mental benefits
3. Stretching exercises
4. Warming up and limbering down
 - a) General warm up exercises
 - b) Specific warm up exercises

UNIT II Practical

A) Sukshma Vyayama

B) Suryanamaskara (Poses are Compulsory)

1. Ardhashankrasana
2. Padhashtasana
3. Ashwasanchalanasana
4. Dhandasana.
5. Shashangasana
6. Astangasana
7. Bhujangasana
8. Parvathasana
9. Shashangasana
10. Ashwasanchalanasana
11. Padhashtasana

12. Ardhashakrasana

B) **Basic Set of Yoga Asanas -Sitting Poses:**

Padmasana, Sukhasana, Vajrasana, Gomukhasana,

Prone Position. Noka asang Bhujangasang Salabhasana Marjariasana makarasana

Spine Position: Ustrasana Setu Bandhasana chakrasana

Invert Position: Sarvangasana halasana Salambha Sarvangasana Sirsasana

Relaxing Position: Shavasana

D) **Basic Set of Pranayama, Meditation & Mudra**

Pranayama- Anulom-Vilom Pranayama, Bhramari Pranayama, Ujjai

Pranayama, Bhastrika Pranayama, Sitali Pranayama

Meditation- Omkar meditation

Mudra – Pranav mudra, Gyan mudra, Hridaya mudra

Suggested Readings:

1. Nagendra, H.R.& Nagarathna, R. (2002).*Samagra Yoga Chikitse. Bengaluru:* Swami Vivekananda Yoga Prakasana.
 2. Kumar, Ajith. (1984) *Yoga Pravesha. Bengaluru:* Rashtrothanna Prakashana.
 3. Shanti KY(1987) “*The Science of Yogic Breathier*” (Pranayama) DB Bombay.
 4. Iyengar B.K.S.(2006) “*Light on Yoga*” Thorsons (Publ.) India.
-

SEMESTER-1
INTRODUCTORY MATHEMATICS: IRC-1
Course code- 1Y4IRC-1

Total Marks: 100
(Credits-3)
Theory: 45 Lectures

Introductory Mathematics

Course Objectives & Learning Outcomes:

This course will enable the students to:

- Be familiar with the upcoming concepts of Differential calculus, Integral calculus, Vector calculus, Analytical Geometry 2D, Set theory and Trigonometry in minor paper
- The students will be able to solve independently all sorts of problems of Calculus, Vector Calculus, Analytical Geometry 2D, Set theory and Trigonometry correctly.

Unit-I: Differential Calculus

Successive Differentiation. n th order derivatives of standard functions. Partial derivatives

Unit-II: Integral Calculus

Integration of rational & irrational functions. Partial fractions.

Unit-III: Vector Calculus

Scalar point functions. vector point functions. Differentiation of a vector of scalar variables.

Unit-IV: Analytical Geometry 2D

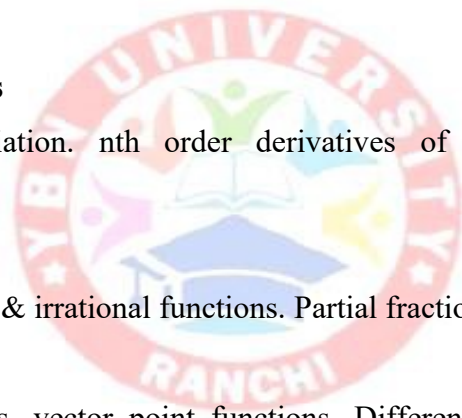
Change of rectangular axes. Rotation & shifting of origin.

Unit-V: Set Theory

Indexed family of sets. Generalized set operations. DeMorgan's Law.

Unit-VI: Trigonometry

DeMoivre's theorem & its Applications.



Reference Books:

1. *Differential Calculus*: Lalji Prasad
 2. *Integral Calculus*: Dasgupta & Prasad.
 3. *Vector Calculus*: Dasgupta & Prasad
 4. *Coordinate Geometry*: A Das Gupta
 5. *Set Theory*: K K Jha
 6. *Trigonometry*: Dasgupta & Prasad
-



SEMESTER-1

COMPUTER BASICS AND MULTIMEDIA: IVS1

Course Code: 1Y4IVS-1A

Total Marks: 100

Introductory Vocational Studies-I: (Credits: Theory-01 + Practical 02) (Credits-3)

OBJECTIVE:

- **To equip students effectively to acquire skills in basic organisatin of Computer and its languages with Operating system and its versions.**

COURSE OUTCOMES:

- **Students will be exposed to Historical development of Computers with its Languages and Operating systems particularly XP and Windows.**
- **Students will receive feedback on their performance in depth in Microsoft Office 2016-I.**
- **Students will be able to perform well with Microsoft Office 2016-II.**
- **Students will strengthen their ability to interact with Computer Internet and its various applications.**
- **Students will enlarge their awareness of files handling with different apps correctly.**

Course Content:

UNIT- I Introduction to Computer System

Basic Computer Concept Computer Organisation, Windows OS: Windows XP Vs Windows7

UNIT-II Microsoft Office 2016-I

MS Word-Tools, menu Bar, Insert, Design, Layout, References, Mailing, Review, View

UNIT-III Microsoft Office 2016-II

MS Excel, MS PowerPoint - Tools, menu Bar, Insert, Design, Layout, References, Mailing, Review, View

UNIT-IV Internet & its usage

Social media, Facebook, Instagram, WhatsApp, Telegram, Twitter, LinkedIn, YouTube,

COMPUTER BASICS AND MULTIMEDIA PRACTICAL- IVS1

Course Code: 1Y4IVS-1A-LAB

PRACTICALS: 60 Lectures

Practical Activities:

1. Create a Visiting Card of your college using page size as follows a) Page width="3.2" b) Page height="2.2"
2. Write a leave letter to the Principal by using different alignments, correct formats in MSWord
3. Mail Merge in MS Word
4. Creating different types of charts
5. Create different types of power point presentation



SEMESTER-1

CALCULUS & GEOMETRY: MAJOR COURSE:

Course Code-1Y4MATMJ-1

Total Marks: 100

(Credits: Theory-04, Practicals-02) (Credits-6)

Theory: 90 Lectures

Course Objectives and Learning Outcomes:

This course will enable the students to:

- Understand the consequences of various mean value theorems for differentiable functions.
- Sketch curves in Cartesian and polar coordinate systems.
- Apply derivative tests in optimization problems appearing in social sciences, physical sciences, life sciences and a host of other disciplines.
- Evaluate integrals of different rational and irrational functions.
- Evaluate nth order integration by means of reduction formulae.
- Explain the properties of three dimensional shapes.

Course Content:

Unit-I: Differentiability:

Differentiability of a real valued function, Geometrical interpretation of differentiability, Relation between differentiability and continuity, Differentiability and monotonicity, Chain rule of differentiation; Darboux's theorem, Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Geometrical interpretation of mean value theorems; Successive differentiation, Leibnitz's theorem.

Unit-II: Expansions of Functions: Maclaurin's and Taylor's theorems for expansion of a function in an infinite series, Taylor's theorem in finite form with Lagrange, Cauchy and Roche-Schlomilch forms of remainder; Maxima and minima.

Unit-III: Curvature, Asymptotes and Curve Tracing:

Curvature; Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflection, Tangents at origin, Multiple points, Position and nature of double points; Tracing of Cartesian, polar and parametric curves.

Unit-IV: Integral Calculus:

Integration of rational and irrational functions. Evaluation of definite integrals, Special integrals, differentiation and integration under the sign of integration (Beta and Gamma functions are excluded), reduction formulae.

Unit-V: Geometry of Integral Calculus:

Point of inflexion, double point, Length of plane curve and area bounded by plane curves. Volume and surface area of solid of revolution.

Unit-VI: Planes, Straight Lines and Spheres:

Planes: Distance of a point from a plane, Angle between two planes, pair of planes, Bisectors of angles between two planes; Straight lines: Equations of straight lines, Distance of a point from a straight line, Distance between two straight lines, Distance between a straight line and a plane; Spheres: Different forms, Intersection of two spheres, Orthogonal intersection, Tangents and normal, Radical plane, Radical line, Coaxial system of spheres, Pole, Polar and Conjugacy.

Reference Books:

1. Howard Anton, I. Bivens & Stephan Davis (2016). *Calculus* (10th edition). Wiley India.
2. Gabriel Klambauer (1986). *Aspects of Calculus*. Springer-Verlag.
3. Gorakh Prasad (2016). *Differential Calculus* (19th edition). Pothishala Pvt. Ltd.
4. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). *Thomas' Calculus* (14th edition). Pearson Education.
5. *Integral Calculus* – Lalji Prasad.
6. *Higher Engineering Mathematics* – B S Grewal

7. D. Chatterjee (2009). *Analytical Geometry: Two and Three Dimensions*. Narosa Publishing House.

Semester-II

**Table I: Course structure for Undergraduate Certificate Programme
[May Exit after Sem.-I]**

Semester	Common Course			Introductory Course		Major	Total credits
Sem -II	LCS (Hindi)	Global Citizenship Education	Mathematical & Computational Thinking	IRC-2	IVS-1B	MJ-2	
	(6Credits)	(2Credits)	(2Credits)	(3Credits)	(3Credits)	(6Credits)	(22)

Total = 22 Credits

(LCS: Language and Communication Skills; MIL: Modern Indian Languages; TRL: Tribal Regional Languages; IRC: Introductory Regular Courses; IVS; Introductory Vocational Studies, MJ: Major)

**SEMESTER WISE COURSE OF STUDY FOR FOUR YEAR UNDERGRADUATE
MATHEMATICS PROGRAMME 2023 ONWORDS**

Table 3: Semester Wise Course Code and Credits Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Course		Credits and Marks Distribution				
	Code	Paper	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical / Viva/(F.M.)	Total
II	2Y4CC-4	Language and Communication Skills (Hindi)	6	75	25	....	100
	2Y4CC-5	Mathematical and Computational Thinking Analysis	2	50	25	25	100
	2Y4CC-6	Global Citizenship Education & Education for Sustainable Development	2	50	25	25.	100
	2Y4MATIRC-2	Introductory Regular Course-2: Introductory Mathematics	3	75	25	....	100
	2Y4IVSCM-1B	Introductory Vocational Studies-2 COMPUTER BASICS AND MULTIMEDIA- IVS1B	3	50	25	25	100
	2Y4MATMJ-2	Major paper-2 (Disciplinary/Interdisciplinary Major): Multivariate Calculus	6	75	25	....	100

Abbreviations:

CC Common Course

IRC Introductory Regular Courses

IVS Introductory Vocational Courses

MJ Major Disciplinary/Interdisciplinary Courses

MAT Mathematics

Table 3: Semester Wise Course Code and Credits Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure				Total
	Code	Papers	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical/ Viva/(F.M.)	
II	MJ-2	Multivariate Calculus	6	75	25	---	100

Table 7: Semester wise Course Code and Credit Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure				Total
	Code	Papers	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical/ Viva/(F.M.)	
I/ II/III	IRC	Introductory Mathematics	3	100	---	---	100

SEMESTER-2

LANGUAGE AND COMMUNICATION SKILLS (HINDI) LCS हिंदी भाषा

Course Code- 2Y4CC-4

अंक: 100

(Credits: Theory-04, Practicals-02)

इकाई-1 हिन्दीव्याकरण और रचना, संज्ञा, सर्वनाम, विशिष्टाण, क्रिया, अव्यय, कारक, वचन, सठिय, उपसर्ग, प्रत्ययासमास, लिंगनिर्णय शब्द लोड शब्द, अनेक शब्दों के लिए एक शब्द, शब्द-शुद्धि, वाक्य शुद्धि, मुहावरे ओर लोकोकिया, पल्लवन एवं संक्ष पण।

इकाई-2

निबंध, कला तथा समसामयिक एवं राष्ट्रीय विषय पर लेखन

इकाई-3

संप्रेषण (संचार)- संप्रेषण की अवधारण और महत्व, संप्रेषण के लिए आवश्यक शर्त संप्रेषण के प्र कार, संप्रेषण की तकनीक, वाचनकला, समाचारवाचन, साक्षात्कारकला, रचनात्मक लेखनका लक्ष्य, रचनात्मक लघु का आधार, भारत की भाव और विचारो की प्रस्तुति, वाक कला की उपयोहगता।

अनुशंसित पुस्तकें:-

1. हई तहनबंध् ाभास्कर डो0 र्चनदर् कु मार
2. आधुहनकहहन्दीव्याकरणऔररचना े डो 0 ेरासुद र्चनदनप्रसाद
3. रचनामानस े प्रो0 राम श्वरनाथहतर्ारी
4. व्यर्हाररकहहन्दी े डो 0 जंग बहादुरपाण्ड य
5. रचनात्मक खन े डो 0 रमशे ेगौतम
6. राजहंसहहन्दीहनबंध े प्रो0 आर 0 एन 0 गौड़
7. सफ हहन्दीहनबंध े रत्न श्वर
8. हनबंध सहचर े डो 0 क्षमणप्रसाद
9. उपकारमहु ार् और ाक ोहियाँ े पार् 0 राज श्वरप्रसादचतर्वु दी
10. कहाहनयोँकहातर्ि की े प्रतापअनम
11. सम्प्र षणपरकहहन्दीभाषाहशक्षण डो 0 ेरैश्रानारंग
12. शै ीहर्ज्ञान े डो 0 सुर शकुमार
13. शै ीहर्ज्ञानप्रहतमानऔरहर्शल षण डो0 पाडं य शहशभषे ेण „शीताशे े ो“ु
14. शै ीहर्ज्ञानकाइहतहास े डो0 पाडं ेय शहशभषे ेण „शीताशे े ो“
15. ेरूहतव्याकरणभास्कर े डो 0 र्चनद कुंमार

SEMESTER-2

MATHEMATICAL AND COMPUTATIONAL THINKING AND ANALYSIS

Course Code-2Y4CC-5

Total Marks: 100

(Credits-2)

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

- Understand the notions of logic and Mathematical Induction.
- Basic concepts of sets.
- Analytic approach toward the solution of algebraic equations.
- Connections of roots and coefficients.
- Understand basic concept of Probability and statistics.
- Understand and analyze the coordinate systems.

UNIT-1: Logic: statement, truth table, quantifiers, connectives and tautology, Mathematical induction.

UNIT-2: Sets and Number System: operations on sets, Elementary Properties, Decimal system, binary decimal, octal system, hexadecimal system, arithmetic, conversion from binary to decimal and decimal to binary.

UNIT-3: Theory of Equation: Relation between roots and coefficients, Transformation of equation, Symmetric functions of roots, Solutions of cubic and biquadratic equations.

UNIT-4: Statistics and Probability: Data collection and presentation using bar chart, column chart, line chart, pie chart, scatter chart, surface chart. Calculation of frequency. Measure of central tendency, Mean, Median and Mode, Definition of Probability, Elementary properties, addition theorem, multiplication theorem, independent events.

UNIT-5: Geometry: Cartesian, spherical polar and Spherical cylindrical coordinate systems; their interrelationship.

Suggested reading:

1. *An introduction to the theory of Numbers*, 4th Ed., G. H. HARDY AND E. M. WRIGHT, 1975, Oxford university Press.
2. *An Introduction to The Modern Theory of Equations*, Florian Cajori, The Macmillan Company ' London: Macmhian & Co., Ltd., 1904.
3. N. K. Singh, *A text book of Probability and Statistics*, 1 st Edition, Pragati Publication, Meerut.
4. *Probability and Statistics* (4th Edition)4 th Edition,Morris H. DeGroot (Author), Mark J. Schervish, Pearsion Education limited 2014.
5. N. K. Singh, *Theory of Equations*, 1 st Edition, Pragati Publication, Meerut.
6. R.G. Bartle and D. R. Sherbert, *Introduction to Real Analysis* (3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore,2002.
7. *Discrete Mathematical Structure*, 4th Ed., Kolman, Busby and Ross, Pearson Education Asia, 2002.



SEMESTER-2

GLOBAL CITIZENSHIP EDUCATION& EDUCATION FOR SUSTAINABLE DEVELOPMENT

Course Code-(2Y4CC-6)

Total Marks: 100
(Credits-2)

OBJECTIVE:

- To understand the concept and structure of global governance
- To empower learners to become aware of and understand global and sustainable development issues
- To become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies.
- Enabling students to embrace and practice constitutional, humanistic, ethical, and moral values in conducting one's life, including universal human values and citizenship values.
- To practice responsible global citizenship required for responding to contemporary global challenges

COURSE OUTCOMES:

- Enhance the capacity of the learners to acquire and demonstrate problem-solving skills involving the capacity to solve different kinds of problems in familiar and nonfamilies contexts and apply one's learning to real-life situations.
- Creativity characterized by the ability to create or think in different and diverse ways, deal with problems and situations that do not have simple solutions; view a problem or a situation from multiple perspectives; think 'out of the box' and generate solutions to complex problems in unfamiliar contexts.
- Communication Skills characterized by skills that enable a person to present complex information in a clear and concise manner to different groups/audiences; express thoughts and ideas effectively in writing and orally and communicate with 3 others using appropriate media, convey ideas, thoughts and arguments using language that is respectful and sensitive to gender and social groups.

UNIT 1: Global Citizenship Education (GCE) and Education for Sustainable Development

- 1.1. Global Citizenship Education; its meaning, characteristics, scope and subject –matter emergence and development.
- 1.2. Rights and responsibilities of Global citizenship
- 1.3. Benefits, Importance and theories of Global Citizenship
- 1.4. Global governance – concept and structure
- 1.5. Global Citizenship: (a) General idea, (b) Multi culturalism & diversity, (c) tolerance &(d) Acharya Vinoba’s ideas of ‘Jai Jagat.’

UNIT2: Global Poverty, Inequalities and social change

- 2.1. Concept of Global Poverty and its impact on World economy
- 2.2. Concept of social change, its types and theories.
- 2.3. Human Right Education: Special reference to Universal Declaration of Human Rights, 1943
- 2.4. Concept of Peace and Security: Special reference to United Nations Charter

UNIT 3: Sustainable Development – Global Issues and Sustainable Issues

- 3.1. Global environment Issue-Climate change mitigation and adaptation
- 3.2. Sustainable Development: Brief overview
- 3.4. Biodiversity loss, Global warming and carbon emission
- 3.5. Effect of Global Issue on Human Species
- 3.6. Environmental justice

UNIT 4: Citizenship Education & Culture, Globalization

- 4.1. Gender equality
- 4.2. Meaning of Globalization and its impact of world economy
- 4.3. Meaning of culture, crucial factors in the Globalization of culture

Suggested Readings:

1. *Global Politics* – Rupak Dattagupta
2. *Understanding Global Politics* – Chanchal Kumar
3. *Global Citizenship Education for Young Children* – Robin Elizabeth Hancock

4. *A New-World Education: The Global Citizen* – Roy Andersen
 5. *Global Citizenship Education, A Critical and International Perspectives* Springer – Adeel Jalil, A.K. Kari, Kathrine Meleg
 6. *Citizenship in a Globalising World* – Ashok Acharya
 7. *Redesign the World: A Global Call to Action* – Sam Pitroda
 8. *Measuring the World* – Daniel Kehlmann
 9. *Global Citizenship Education: Challenges and Successes* – Eva Aboagye & S. Nomburo Dlamini
 10. *Global Citizenship Education* - William Gaudelli
 11. *Multiculturalism: A very short Introduction* – Ali Rattansi
 12. *Diversity and Inclusion Matters* – Jason Thompson
 13. *Multiculturalism* – C. W. Watson
 14. *Multiculturalism, Identity and Rights* – Bruce Haddock and P
-

SEMESTER-2

INTRODUCTORY MATHEMATICS: IRC-2

Course code- 2Y4MATIRC-2

Total Marks: 100
(Credits-3)

Introductory Mathematics

Theory: 45 Lectures

Course Objectives & Learning Outcomes:

- This course will enable the students to:
Be familiar with the upcoming concepts of Differential calculus, Integral calculus, Vector calculus, Analytical Geometry 2D, Set theory and Trigonometry in minor paper
- The students will be able to solve independently all sorts of problems of Calculus, Vector Calculus, Analytical Geometry 2D, Set theory and Trigonometry correctly.

Unit-I: Differential Calculus

Successive Differentiation. n th order derivatives of standard functions. Partial derivatives

Unit-II: Integral Calculus

Integration of rational & irrational functions. Partial fractions.

Unit-III: Vector Calculus

Scalar point functions. vector point functions. Differentiation of a vector of scalar variables.

Unit-IV: Analytical Geometry 2D

Change of rectangular axes. Rotation & shifting of origin.

Unit-V: Set Theory

Indexed family of sets. Generalized set operations. DeMorgan's Law.

Unit-VI: Trigonometry

DeMoivre's theorem & its Applications.

Reference Books:

1. *Differential Calculus*: Lalji Prasad
 2. *Integral Calculus*: Dasgupta & Prasad.
 3. *Vector Calculus*: Dasgupta & Prasad
 4. *Coordinate Geometry*: A Das Gupta
 5. *Set Theory*: K K Jha
 6. *Trigonometry*: Dasgupta
-



SEMESTER-2

COMPUTER BASICS AND MULTIMEDIA – IRC-3

Course Code: 2Y4IVSCM-1B

Total Marks: 100

(Credits: Theory-01 + Practical 02)

Theory :15 Lectures

Course Content:

UNIT- I Multi Media Fundamentals

Multimedia, Multimedia Objects, Multimedia in business and work, Multimedia hardware, Memory & Storage devices, Communication devices.

UNIT- II Multi Media Fundamentals

Presentation tools, object generation which includes video sound; image capturing, Authoring tools, card and page-based authoring tools.

UNIT- III Sound/Audio-I

Perception of sound, hearing sensitivity, frequency range, sound- wave length, the speed of sound. measuring the sound, musical sounds, noise signal, dynamic range, pitch, harmonics- equalization- reverberation time, Sound isolation and room acoustics- treatments- studio layout –room dimensions.

UNIT- III Sound/Audio-II

The Basic set-up of recording system; The production chain and responsibilities. Microphones types -phantom power, noise, choosing the right mike; Mixing console; Input devices; Output devices; Audio Publishing.

COMPUTER BASICS AND MULTIMEDIA PRACTICAL-IRC-3

Course Code: 2Y4IVSCM-1B-LAB

PRACTICALS:

60

Lectures

1. Photoshop-Use different tools
 2. Page maker -Use different tools
 3. Corel Draw – Use different tools
 4. Flash – Use different tools
-



SEMESTER-2

MULTIVARIATE CALCULUS -MJ 2

Course Code-2Y4MATMJ-2

Total Marks: 100

(Credits: Theory-04, Practicals-02) (Credits-6)

Course Objectives & Learning Outcomes:

This course will enable the students to:

- Learn conceptual variations while advancing from one variable to several variables in calculus.
- Apply multivariable calculus in optimization problems.
- Inter-relationship amongst the line integral, double and triple integral formulations.
- Applications of multivariable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.
- Realize importance of Green, Gauss and Stokes' theorems in other branches of mathematics.

Course Content:

Unit-I: Partial Differentiation:

Functions of several variables, Level curves and surfaces, Limits and continuity, Partial differentiation, Tangent planes, Chain rule, Directional derivatives, The gradient, Maximal and normal properties of the gradient, Tangent planes and normal lines.

Unit-II: Differentiation:

Higher order partial derivatives, Total differential and differentiability, Jacobians, Change of variables, Euler's theorem for homogeneous functions, Taylor's theorem for functions of two variables and more variables, Envelopes and evolutes.

Unit-III: Differentiation of a vector function:

Vector point function, Scalar point function, Differentiation of a vector function. Derivatives of a sum of vectors. Derivatives of a product of vectors (both scalar and vector products)

Unit-IV: Extrema of Functions and Vector Field:

Extrema of functions of two and more variables, Method of Lagrange multipliers, Constrained optimization problems, Definition of vector field, Divergence, curl, gradient and vector identities.

Unit-V: Double and Triple Integrals:

Double integration over rectangular and nonrectangular regions, Double integrals in polar coordinates, Triple integral over a parallelepiped and solid regions, Volume by triple integrals, Triple integration in cylindrical and spherical coordinates, Change of variables in double and triple integrals, Dirichlet integral.

Unit-VI: Green's, Stokes' and Gauss Divergence Theorem

Line integrals, Applications of line integrals: Mass and Work, Fundamental theorem for line integrals, Conservative vector fields, Green's theorem, Area as a line integral, Surface integrals, Stokes' theorem, The Gauss divergence theorem.

Reference Books:

1. Jerrold Marsden, Anthony J. Tromba & Alan Weinstein (2009). *Basic Multivariable Calculus*, Springer India Pvt. Limited.
2. James Stewart (2012). *Multivariable Calculus* (7th edition). Brooks/Cole. Cengage.
3. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2011). *Calculus* (3rd edition). Pearson Education. Dorling Kindersley (India) Pvt. Ltd.
4. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). *Thomas' Calculus* (14th edition). Pearson Education.
5. *Vector Calculus* – Dasgupta.

Semester-III

**Table 2: Course structure for Undergraduate Diploma Programme:
[May Exit after Sem.-IV]**

Semester	Common Course			Introductory Course	Major	Minor	Internship/Project	Vocational	Total credits
Sem-III	Environmental Studies EVS	Community Engagement/ NCC /NSS	Digital Education	IRC-3	MJ-3		Internship / Project		
	(3Credits)	(3Credits)	(3Credits)	(3Credits)	(6Credits)		(4Credits)		(22)

Total=22 Credits

(MN: Minor; VS: Vocational Studies)

SEMESTER WISE COURSE OF STUDY FOR FOUR YEAR UNDERGRADUATE

Semester	Common, Introductory, Major, Minor, Vocational & Internship Course	Credits and Marks Distribution					
		Code	Paper	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical/Viva/ (F.M.)	Total
III	2Y4EVSCC-7	Environmental Studies	3	50	25	25	100
	2Y4CC-8	Digital Education (Elementary Computer Applications)	3	50	25	25	100
	2Y4CC-9	Community Engagement & Service (NSS/NCC/Adult education)	3	50	25	25	100
	3Y4IMATIRC-3	Introductory Regular Course-3: Introductory Mathematics	3	75	25	....	100
	3Y41AP	Internship/ Apprenticeship/Project	4	75	25	....	100
	3Y4MATMJ-3	Major paper-3 (Disciplinary/Interdisciplinary Major) :Ordinary and Partial Differentiation	6	75	25	....	100

Abbreviations:

CC Common Course

IRC Introductory Regular Courses

IAP Internship/Apprenticeship/Project

MJ Major Disciplinary/Interdisciplinary Courses

MAT Mathematics

Table 3: Semester Wise Course Code and Credits Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses			Examination Structure				Total
	Code	Papers		Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical/ Viva/(F.M.)	
III	MJ-3	Ordinary and Partial Differentiation	6	75	25	---	100	

Table 7: Semester wise Course Code and Credit Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure				Total
	Code	Papers	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical/ Viva/(F.M.)	
I/ II/III	IRC	Introductory Mathematics	3	100	---	---	100

Semester-III

ENVIRONMENTAL STUDIES:

Course Code-2Y4EVSCC-7

Total Marks: 100

(Credits-3)

Course Objectives:

The course will seek to achieve the following objectives:

- Generating the awareness about environmental problems among people and society.
- To clarify modern environmental concept like how to conserve biodiversity.
- Inculcating basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and environment improvement.
- Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
- Striving to attain harmony with Nature.

Course Learning Outcomes:

At the end of the course students will be able to:

- Know the more sustainable way of living.
- Use natural resources more efficiently.
- Know the behaviour of organism under natural conditions.
- . Know the interrelationship between organisms in populations and communities.
- Aware and educate people regarding environmental issues and problems at local, national and international levels.

Course Content:

Unit 1:

Introduction to environmental studies

Multidisciplinary nature of environmental studies;

Scope and importance; Concept of sustainability and sustainable development.

Unit 2: Ecosystems:

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:

- a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem
- d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources:

Natural Resources: Renewable and Non-renewable Resources

Land resources and land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts conflicts over water (international & inter-state).

Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation:

Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots, India as a mega-biodiversity nation; Endangered and endemic species of India.

Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5: Environmental Pollution:

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial waste, Pollution case studies.

Unit 6: Environmental Policies & Practices:

Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture

Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7: Human Communities and the Environment:

Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies.

Disaster management: floods, earthquake, cyclones and landslides.

Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.

Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g. CNG vehicles in Delhi)

Environment Studies Field Work:

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems-pond, river, Spring, etc.

References:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security*. Stockholm Env. Institute, Oxford Univ. Press.

5. Room, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*.
 6. *Sunderland*: Sinauer Associates, 2006.
 7. Grumbine, R. Edward, and Pandit, M.K. 2013. *Threats from India's Himalaya dams*. Science, 339: 36- 37.
 8. McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29-64). Zed Books.
 9. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
 10. Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
 11. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press.
 12. Rao, M.N. Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
 13. Raven, P.H., Hassenzahl, D.M. Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.
 14. Rosencranz, A., Divan, S., & Noble, M.L. 2001. *Environmental law and policy in India*. Tripathi 1992.
 15. Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*. OUP.
 16. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
 17. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
 18. Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
 19. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
 20. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
 21. *World Commission on Environment and Development. 1987. Our Common Future*. Oxford University.
-

SEMESTER-3

DIGITAL EDUCATION (ELEMENTARY COMPUTER APPLICATIONS)

Course Code: 2Y4CC-8

Total Marks: 100

(Credits-3)

Course Objectives:

- This course is specially designed for better understanding of digital education in India.
- The course has been designed to introduce key concepts in digital education to the students to sharpen their understanding of importance and significance of digital education in India.
- The students need to develop a critical thinking about the development of India in the background of expanding digital networks and our constant dependence on them in our day-to-day life.

Learning Outcome

- Students will understand the meaning of digital education and its importance.
- They will be able to focus on different digital platform, its utility and its applications.
- The students will be exposed to different tools of digital education available in India.
- They will understand the importance of E-Learning in the changing context of Digital India.
- They will come to know about their responsibility as citizen in digital growth in India.

Course content:

UNIT I: Introduction to Digital Education:

Meaning & Evolution of Digital Systems. Role & Significance of Digital Technology, digital education vs traditional education, advantages and disadvantages of digital education.

UNIT II: Digital Education Tools:

Information & Communication Technology & Tools Interactive tools- Microsoft Teams, Google Classroom, LinkedIn Creative Tools - Google Slides, Google Spreadsheets, Google form, Youtube)

UNIT III: Digital Education in India:

Government initiatives for Digital education in India: SWAYAM, E-Pathshala, National digital library of India (NDL India), DigiLocker. Advantages & challenges in digital education in India.

UNIT IV: E- Governance:

Introduction of E-Governance in India, Types of E-Governance-G2C (Government to Citizen), G2E (Government to Employee), G2B (Government to Business), G2G (Government to Government), E – Governance in Jharkhand.

Suggested Readings:

1. E-Governance in India: Initiatives and issues by R.P.Sinha
2. Information & Communication Technology (ICT) in Education by Dr. Vanaja M, Dr. S Rajasekar, Dr. Arulsamy.
3. Digital India: Understanding Information, Communication and Social Change by Pradip N.

References:

1. www.slideshare.net
2. www.lisportal.com/en/lis-blog

SEMESTER-3

COMMUNITY ENGAGEMENT & SERVICE (NSS/NCC/ADULT EDUCATION)

Course Code:: 2Y4CC-9

Total Marks: 100

(Credits-3)

OBJECTIVES:

- Understand the community in which they work and their relation
- Identify the needs and problems of the community and involve them in problem-solving.
- Develop capacity to meet emergencies and natural disasters.
- Practice national integration and social harmony and
- Utilize their knowledge in finding practical solutions to individual and community problems.

Course contents:

Unit-I: NSS:

NSS: Introduction, Origin and growth of NSS, Objectives, Motto, Symbol, NSS, Import National Days, NSS Song, Environmental.

Awareness: Natural Resources – Conservation and Management, Water conservation and Rain water harvesting, Solid waste management,

Pollution control: Water, Air, Noise and Soil; Energy Conservation-Wildlife Conservation, Global warming.

Unit-II: Special Programme:

Legal Awareness –Health awareness: –Blood Donation Camp, First –Aid –Career Guidance – Leadership. Training cum –Cultural Programme –Globalization ant its Economic Social and Cultural Impacts. Planning and Preparation of special Camping Programme.Planning at institutions level – Guidelines for the success of Camp-

Importance of successful camping programme – Guiding principles – organization of camp – Administration of camp.

Unit-III: Social Awareness:

Basics and Social Service, Weaker Section of our society and their needs – NGOs:
Role and Contribution – Civic responsibility – causes and Prevention; role of youth – Drug Abuse and Trafficking – awareness of IV / AIDS.

National Integration: Importance and Necessity – Freedom Struggle and Nationalistic movement in India – National interests, Objectives, Threats and Opportunities – Unity in Diversity – Contribution of Youth in Nation Building.

Unit-IV: First Aid:

Artificial Respiration – Control of Bleeding – Fractures – Burns – Shock – Wounds – Eye Injuries – Heat Stroke – Snake Bite – Dog Bites – Poisoning.,

Disaster Management: Characteristics and types of Disasters (Geological and Mountain Area Disaster, Wind and Water Related Natural Disaster, Manmade Disaster), Causes and effects, Assistance during Natural / Other Calamities Flood / Cyclone / Earth Quake / Accident etc.

Unit-V: N.S.S. Regular Activities:

NSS Programme Officer – NSS Volunteer – Community – Aims of NSS Programme Activities – Classification of NSS Programme – Adoption of Villages – Contacting Villages / Area Leaders – Survey of the Villages / Area Identification of Problem(s) Completion of Projects – Evaluation of Project – Adoption of Slums – Survey of the Slum – Services in Slums - Coordination with Voluntary – Organizations.

REFERENCES:

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. University of Mumbai National Service Scheme Manual 2009.

3. Avhan Chancellor's Brigade-NSS Wing, Training camp on Disaster Preparedness Guidelines, March 2012.
4. Rashtriya Seva Yojana Sankalpana- Prof. Dr. Sankay Chakane, Dr. Pramod Pabrekar, Diamond Publication, Pune.
5. National Service Scheme Manual for NSS District Coordinators, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya,
6. Annual report of National Service Scheme (NSS) published by Dept. of Higher and Technical Education, Mantralaya,
7. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.
8. Case material as a Training Aid for Field Workers, Gurmeet Hans.
9. Social service opportunities in hospitals, Kapil K. Krishnan, TISS
10. New Trends in NSS, Research papers published by University of Pune.
11. ANOOGUNJ Research Journal, published by NSS Unit C. K. Thakur college
12. Training Manual for Field Work published by RGNIYD, Shreeperumbudur
13. Prof. Ghatole R.N. Rural Social Science and Community Development.
14. Purushottam Sheth, Dr. Shailaja Mane,

National Service Scheme Related Online Contents:

1. <https://en.wikipedia.org/w/index.php?search=National-service-scheme&title=Special%3ASearch&fulltext=1&ns0=1>
 2. <https://nss.gov.in>
 3. <https://twitter.com/nssybnuranchi1>
 4. <https://twitter.com/nssybnuranchi2>
 5. <https://www.facebook.com/profile.php?id=100083943787477>
-

SEMESTER-3

INTRODUCTORY MATHEMATICS: IRC3

Course Code-3Y4IMATIRC-3

Total Marks: 100

(Credits-3)

Introductory Mathematics

Theory: 45 Lectures

Course Objectives & Learning Outcomes:

This course will enable the students to:

- Be familiar with the upcoming concepts of Differential calculus, Integral calculus, Vector calculus, Analytical Geometry 2D, Set theory and Trigonometry in minor paper
- The students will be able to solve independently all sorts of problems of Calculus, Vector Calculus, Analytical Geometry 2D, Set theory and Trigonometry correctly.

Unit-I: Differential Calculus

Successive Differentiation. n th order derivatives of standard functions. Partial derivatives

Unit-II: Integral Calculus

Integration of rational & irrational functions. Partial fractions.

Unit-III: Vector Calculus

Scalar point functions. vector point functions. Differentiation of a vector of scalar variables.

Unit-IV: Analytical Geometry 2D

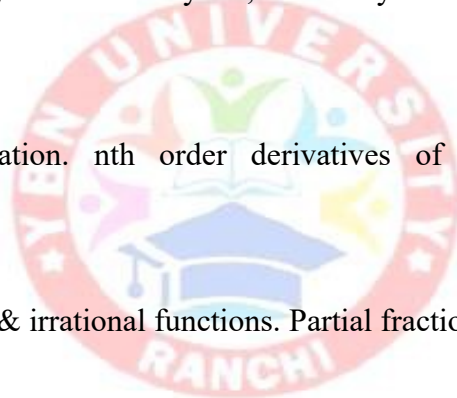
Change of rectangular axes. Rotation & shifting of origin.

Unit-V: Set Theory

Indexed family of sets. Generalized set operations. DeMorgan's Law.

Unit-VI: Trigonometry

DeMoivre's theorem & its Applications.



Reference Books:

1. *Differential Calculus*: Lalji Prasad
 2. *Integral Calculus*: Dasgupta & Prasad.
 3. *Vector Calculus*: Dasgupta & Prasad
 4. *Coordinate Geometry*: A Das Gupta
 5. *Set Theory*: K K Jha
 6. *Trigonometry*: Dasgupta & Prasad
-



SEMESTER-3

INTERNSHIP/APPRENTICESHIP/PROJECT

Course Code: 3Y41AP

Total Marks: 100

(Credits-4)

OBJECTIVES:

- Understand the ability to how to apply knowledge on the floor work and their relation.
- Identify the needs of physical problems and difficulties and challenges involve in solving them as problem-solving.
- Develop capacity to meet the objectives within a time frame.
- Practice unfolding their skill and potential hidden within them.
- Utilize their knowledge in finding practical solutions to different case studies and unseen problems.

Course Content:

1. Sponsored by the concerned department and Schools to tag-up with good Companies in pace with the domain of their knowledge.
 2. To accomplish a new project under the guidance and supervision of the expert wherever sponsored as the trainee.
 3. Present and participate in National and International Conferences /Seminars or symposium what they achieved in their ongoing project and acquire the Certificates.
-

SEMESTER-3
ORDINARY AND PARTIAL DIFFERENTIATION: MAJOR PAPER-3
(DISCIPLINARY/INTERDISCIPLINARY MAJOR)

Course Code: 3Y4MATMJ-3

Total Marks: 100

(Credits-6)

ORDINARY AND PARTIAL DIFFERENTIATION

Theory: 90 Lectures

Course Objectives & Learning Outcomes:

This course will enable the students to:

- Understand the genesis of ordinary differential equations.
- Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.
- Know Picard's method of obtaining successive approximations of solutions of first order differential equations, passing through a given point in the plane.
- Grasp the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.
 - a. Apply a range of techniques to solve first & second order partial differential equations.
 - b. Model physical phenomena using partial differential equations such as the heat and wave equations

Course Content:

Unit-I: First Order Differential Equations:

Basic concepts and genesis of ordinary differential equations, Order and degree of a differential equation, Differential equations of first order and first degree, Equations in which variables are separable, Homogeneous equations, Linear differential equations and equations reducible to linear form, Exact differential equations, Integrating factor, First order higher degree equations solvable for x , y and p . Clairaut's form and singular solutions. Picard's method of successive approximations and the statement of Picard's

theorem for the existence and uniqueness of the solutions of the first order differential equations.

Unit-II: Second Order Linear Differential Equations:

Statement of existence and uniqueness theorem for linear differential equations, General theory of linear differential equations of second order with variable coefficients, Solutions of homogeneous linear ordinary differential equations of second order with constant coefficients, Transformations of the equation by changing the dependent/independent variable, Method of variation of parameters and method of undetermined coefficients, Reduction of order, Coupled linear differential equations with constant coefficients.

Unit-III: Higher Order Linear Differential Equations:

Principle of superposition for a homogeneous linear differential equation, Linearly dependent and linearly independent solutions on an interval, Wronskian and its properties, Concept of a general solution of a linear differential equation, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler-Cauchy equation, Method of variation of parameters and method of undetermined coefficients, Inverse operator method.

Unit-IV: First Order Partial Differential Equations:

Order and degree of Partial differential equations (PDE), Concept of linear and non-linear partial differential equations, Partial differential equations of the first order, Lagrange's method, Some special type of equation which can be solved easily by methods other than the general method, Charpit's general method.

Unit-V: Second Order Partial Differential Equations with Constant Coefficients:

Classification of linear partial differential equations of second order, Homogeneous and nonhomogeneous equations with constant coefficients.

Unit-VI: Second Order Partial Differential Equations with Variable Coefficients:

Partial differential equations reducible to equations with constant coefficient, Second order PDE with variable coefficients, Classification of second order PDE, Reduction to canonical or normal form; Monge's method; Solution of heat and wave equations in one and two dimensions by method of separation of variables.

Reference Books:

1. Daniel A. Murray (2003). *Introductory Course in Differential Equations*, Orient.
2. B. Rai, D. P. Choudhury & H. I. Freedman (2013). *A Course in Ordinary Differential Equations* (2nd edition). Narosa.
3. Shepley L. Ross (2007). *Differential Equations* (3rd edition), Wiley India.
4. Erwin Kreyszig (2011). *Advanced Engineering Mathematics* (10th edition). Wiley.
5. Ian N. Sneddon (2006). *Elements of Partial Differential Equations*. Dover Publications.
6. *Differential Equations* – M D Raisinghania.



Semester-IV

**Table 2: Course structure for Undergraduate Diploma Programme:
[May Exit after Sem.-IV]**

Semester	Common Course	Introductory Course	Major	Minor	Internship/ Project	Vocational	Total credits
IV			MJ-4, MJ-5	MN-1		VS-1	
			(6+6=12 Credits)	(6Credits)		(3Credits)	(22)

Total=22

Credits_

SEMESTER WISE COURSE OF STUDY FOR FOUR YEAR UNDERGRADUATE MATHEMATICS PROGRAMME 2023 ONWARDS

Table 3: Semester Wise Course Code and Credits Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Course		Credits and Marks Distribution				
	Code	Paper	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical / Viva/(F.M.)	Total
IV	4Y4MATMJ-4	Major paper-4 (Disciplinary/Interdisciplinary Major): Real Analysis	6	75	25	....	100
	4Y4MATMJ-5	Major paper-5	6	75	25	....	100

		(Disciplinary/Interdisciplinary Major) :Mechanics					
	4Y4MATMN-1	Minor paper-1 (Disciplinary/Interdisciplinary Minor): Differential, Integral & Vector Calculus	6	75	25	....	100
	4Y4VS-1	Vocational Studies-1 (Minor)	4	50	25	25	100

(MN: Minor; VS: Vocational Studies)

Abbreviations:

VS Vocational Studies

MJ Major Disciplinary/Interdisciplinary Courses

MN Minor Disciplinary/ Interdisciplinary Courses

MAT Mathematics

Table 3: Semester Wise Course Code and Credits Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		Examination Structure				Total
	Code	Papers	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical/ Viva/(F.M.)	
IV	MJ-4	Real Analysis	6	75	25	---	100
	MJ-5	Mechanics	6	75	25	---	100

Table 7: Semester wise Course Code and Credit Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses	Examination Structure	

	Code	Papers	Credits	Theory (F.M.)	Internal Assessment Theory (F.M.)	Practical/ Viva/ (F.M.)	Total
IV	MN-1	Differential, Integral & Vector Calculus	6	75	25	---	100

SEMESTER-4

REAL ANALYSIS: MAJOR PAPER-4 (DISCIPLINARY/INTERDISCIPLINARY MAJOR)

Course Code: 4Y4MATMJ-4

Total Marks: 100

(Credits: Theory-06) (Credits-6)

REAL ANALYSIS:

Theory: 90 Lectures

Course Objectives & Learning Outcomes:

This course will enable the students to:

- Understand many properties of the real line \mathbb{R} and learn to define sequence in terms of functions from \mathbb{R} to a subset of \mathbb{R} .
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.
- Learn some of the properties of Riemann integrable functions, and the applications of the fundamental theorems of integration

Course Content:

Unit-I: Real Number System:

Algebraic and order properties of \mathbb{R} , Absolute value of a real number; Bounded above and bounded below sets, Supremum and infimum of a nonempty subset of \mathbb{R} , The completeness property of \mathbb{R} , Archimedean property, Density of rational numbers in \mathbb{R} , Definition and types of intervals, Nested intervals property; Neighborhood of a point in \mathbb{R} , Open, closed and perfect sets in \mathbb{R} , Connected subsets of \mathbb{R} , Cantor set and Cantor function.

Unit-II: Sequences of Real Numbers:

Convergent sequence, Limit of a sequence, Bounded sequence, Limit theorems, Monotone Weierstrass theorem for–sequences, Monotone convergence theorem, Subsequences, Bolzano sequences, Limit superior and limit inferior of a sequence of real numbers, Cauchy sequence, Cauchy’s convergence criterion.

Unit-III: Infinite Series:

Convergence and divergence of infinite series of positive real numbers, Necessary condition for convergence, Cauchy criterion for convergence; Tests for convergence of positive term series; Basic comparison test, Limit comparison test, D’Alembert’s ratio test, Cauchy’s nth root test, Integral test; Alternating series, Leibniz test, Absolute and conditional convergence, Rearrangement of series and Riemann’s theorem.

Unit-IV: Riemann Integration: Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of integral calculus, First mean value theorem, Bonnet and Weierstrass forms of second mean value theorems.

Unit-V: Uniform convergence of sequence and series of functions:

Pointwise and uniform convergence of sequence and series of functions, Weierstrass’s M-test, Dirichlet test and Abel’s test for uniform convergence, Uniform convergence and continuity, Uniform convergence and differentiability,

Unit-VI: Convergence of Improper integrals

Convergence of improper integrals, comparison tests, absolute convergence, Abel’s and Dirichlet’s tests. Frullani’s Integrals. Definition & convergence of Beta & Gamma functions and their properties, duplication formula, inter-relation. Evaluation of double and triple integrals. Multiple Integrals of Dirichlet’s form, Liouville’s extension. Change of order of integration and change of variables.

Reference Books:

1. Robert G. Bartle & Donald R. Sherbert (2015). *Introduction to Real Analysis* (4th edition). Wiley India.

2. Gerald G. Bilodeau, Paul R. Thie & G. E. Keough (2015). *An Introduction to Analysis* (2nd edition), Jones and Bartlett India Pvt. Ltd.
 3. K. A. Ross (2013). *Elementary Analysis: The Theory of Calculus* (2nd edition). Springer.
 4. Shanti Narayan & M. D. Raisinghania. *Elements of Real Analysis*.
-

SEMESTER-4

MECHANICS: MAJOR PAPER-5 (DISCIPLINARY/INTERDISCIPLINARY MAJOR)

Course Code: 4Y4MATMJ-5

Total Marks: 100

(Credits: Theory-06) (Credits-6)

MECHANICS

Theory: 90 Lectures

Course Objectives & Learning Outcomes:

This course will enable the students to:

- Familiarize with subject matter, which has been the single centre, to which were drawn mathematicians, physicists, astronomers, and engineers together.
- Understand necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body.
- Determine the centre of gravity of some materialistic systems and discuss the equilibrium of a uniform cable hanging freely under its own weight.
- Deal with the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles.
- Learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions, which were deduced by him long before the mathematical theory given by

Course Content:

Unit-I: Statics:

Equilibrium of a particle, Equilibrium of a system of particles, Necessary conditions of equilibrium, Moment of a force about a point, Moment of a force about a line, Couples, Moment of a couple, Equipollent system of forces, Work and potential energy, Principle

of virtual work for a system of coplanar forces acting on a particle or at different points of a rigid body, Forces which can be omitted in forming the equations of virtual work.

Unit-II: Centres of Gravity:

Centres of gravity of plane area including a uniform thin straight rod, triangle, circular arc, semicircular area and quadrant of a circle, Centre of gravity of a plane area bounded by a curve, Centre of gravity of a volume of revolution; Flexible strings,

Unit-III Common Catenary

Common Catenary, Intrinsic and Cartesian equations of the common catenary, Approximations of the catenary.

Unit-IV: Rectilinear Motion:

Simple harmonic motion (SHM) and its geometrical representation, SHM under elastic forces, Motion under inverse square law, Motion in resisting media, Concept of terminal velocity, Motion of varying mass.

Unit-V: Motion in a Plane

Kinematics and kinetics of the motion, Expressions for velocity and acceleration in Cartesian, polar and intrinsic coordinates; Motion in a vertical circle, projectiles in a vertical plane and cycloidal motion.

Unit-VI: Central Orbits:

Equation of motion under a central force, Differential equation of the orbit, (p, r) equation of the orbit, Apses and apsidal distances, Areal velocity, Characteristics of central orbits, Kepler's laws of planetary motion

Reference Books:

1. S. L. Loney (2006). *An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies*. Read Books.
2. P. L. Srivastava (1964). *Elementary Dynamics*. Ram Narin Lal, Beni Prasad Publishers Allahabad.
3. J. L. Synge & B. A. Griffith (1949). *Principles of Mechanics*. McGraw-Hill.
4. S. Ramsey (2009). *Statics*. Cambridge University Press.
5. S. Ramsey (2009). *Dynamics*. Cambridge University Press.
6. R. S. Varma (1962). *A Text Book of Statics*. Pothishala Pvt. Ltd.

SEMESTER-4

DIFFERENTIAL, INTEGRAL & VECTOR CALCULUS: MINOR PAPER-1

(DISCIPLINARY/INTERDISCIPLINARY MINOR)

Course Code: 4Y4MATMN-1

Total Marks: 100

(Credits: Theory-06) (Credits-6)

DIFFERENTIAL, INTEGRAL & VECTOR CALCULUS

Theory: 90 Lectures

Course Objectives & Learning Outcomes:

This course will enable the students to:

- Expand different functions in series form.
- Handle partial differentiations and related geometry.
- Evaluate maxima & minima of function of two variables.
- Integrate rational and irrational functions and definite integrals.
- Understand differentiation and integration under the sign of integration.
- Familiarize with curve tracing and to calculate related area and volume.
- Evaluate Gradient, Divergence & Curl.

Course Content:

UNIT 1: Differential calculus

Leibnitz's Theorem. Taylor's and Macularuins's series expansions of functions. Applications of Taylors's and Maclaurins' Series. Tangent and Normal, (Cartesian, Parametric form), Angle between two Curves. Length of tangent, Normal, Sub Tangent, Subnormal in Cartesian Forms. Partial Differention: Eulers' Theorem, Curvature. Asymptotes. Maxima and Minima of functions of two variables.

UNIT 2: Integral Calculus

Integration by Transformation, Integration by Substitution, Integration by Parts. Evaluation of Definite Integrals, Reduction Formulae, Curve Tracing, Length and Area, Surface Area and Volume of Solids of Revolution.

UNIT 3: Vector Calculus

Differentiation of a vector function. Derivatives of a sum of vectors, Derivatives of a product of vectors (both Scalar and Vector Products). Gradient, Divergence and Curl and Second Order Vector Differential Operators in Cartesian coordinates systems.

Reference Books:

1. *Differential Calculus*: A Das Gupta & S B Prasad.
2. *Differential Calculus*: Lalji Prasad
3. *Integral Calculus*: Dasgupta & Prasad.
4. *Integral Calculus*: Lalji Prasad
5. *Vector Calculus*: Dasgupta & Prasad
6. *Vector Calculus*: Lalji Prasad



SEMESTER-4

INTRODUCTION TO STOCK MARKET VOCATIONAL STUDIES-1 (MINOR)

Subject Code: 4Y4VS-1

Total Marks: 100

(Credits: Theory-01 + Practical 02) (Credits-4)

INTRODUCTION TO STOCK MARKET – VS-1

This course will enable the students to:

- Achieve knowledge and ability to apply knowledge in Financial system and services.
- Handle Financial Markets with adequate exposure of organization, management and function of RBI and other Banks along with Insurance companies.
- Capable of having knowledge of Financial instruments, Mutual Funds, Capital Market and Stock exchange with functioning of Trading and stock market indices.
- Understand different role in globalizing economy as well as familiarize with Application of principles of comparative advantage of international trade.

Course Content:

Unit I: Financial System and Services:

Nature and role of financial structure - Financial system and financial markets - Financial system and economic development -Indian financial system: an overview; Investment alternatives and evaluation; Reforms in financial system, Investment banking; Credit Rating; Factoring and Forfaiting; Housing Finance; Leasing and hire purchase; Financial inclusion and Microfinance

Unit II: Financial Markets:

Money market- meaning, constituents & function; Money market instruments – call money, treasury bills, and certificate of deposits, Commercial bills, and trade bills, Acceptance Houses, Discount Houses; Capital markets – primary and secondary market; Government securities markets; Role of SEBI - an overview and recent developments. Role of RBI, SEBI, DFHI, SHCI in Financial Markets.

Unit III: Financial Institutions:

Reserve bank of India – organization, management, and function; Commercial banks - meaning, functions and investment policies; Development banks – concept, objectives, and function; Insurance companies – objectives, role, and investment practices, -IRDS; Unit Trust of India – objective, function, and schemes; role and functions of non-banking financial institutions; Merchant banking-functions and role.

Unit IV: Financial Instruments

Sources of finance – Financial Instruments – Types, Features and advantages – Equity and special types of equity, ADRs & GDRs; Preferred stock - Equity derivatives – Credit Derivatives-Asset –backed securities - Convertibles and warrants - Types of Bonds and debentures- Non- Marketable Financial Assets - Options instruments – securitization.

Unit V: Mutual Funds:

Concept and performance of Mutual funds; Regulation of Mutual funds (with special reference to SEBI guidelines); Designing and marketing of mutual fund schemes; Latest mutual funds schemes in India – an overview; Mutual Fund Evaluation and Tax aspects of Mutual Fund Investments.

Unit VI: Capital Markets in India

An overview of Indian Securities Market, Meaning, Functions, Intermediaries, Role of Primary Market – Methods of floatation of capital – Problems of New Issues Market – IPO's- Investor protection in primary market – Recent trends in primary market – SEBI measures for primary market.

Unit VII: Stock exchanges and its Functions:

Meaning, Nature, Functions of Secondary Market – Organisation and Regulatory framework for stock exchanges in India – SEBI: functions and measures for secondary market – Overview of major stock exchanges in India - Listing of Securities: Meaning – Merits and Demerits – Listing requirements, procedure, fee – Listing of rights issue, bonus issue, further issue – Listing conditions of BSE and NSE – Delisting

Unit VIII: Trading, settlement and Surveillance System in Stock Exchanges:

Different trading systems – BSE - BOLT System – Different types of settlements - Pay-in and Pay-out – Bad Delivery – Short delivery – Auction – NSE – NEAT system options – Market types, Order types and books – De-mat settlement – Physical settlement – Institutional segment – Funds settlement – Valuation debit – Valuation price – Bad and short delivery Risk management system in BSE & NSE – Margins – Exposure limits – Surveillance system in BSE & NSE – Circuit breakers

Unit IX: Stock Market Indices:

Meaning, Purpose, and Construction in developing index – Methods (Weighted Aggregate Value method, Weighted Average of Price Relatives method, Free-Float method) – Stock market indices in India – BSE Sensex - Scrip selection criteria – Other BSE indices (briefly) – NSE indices – S&P CNX Nifty – Scrip selection criteria – Construction – Stock market indices in foreign countries (Overview).

Unit X: Commodity and Currency Markets:

Commodity exchanges: evolution and history- role in globalizing economy – governing regulations – price –risk management – commodity exposure – hedge accounting – currency futures – managing exchange rate – carbon markets – weather derivatives – ETFs – Purpose, Importance, types, construction

INTRODUCTION TO STOCK MARKET PRACTICAL- VC-1 LAB:

PRACTICALS:

60 Lectures

1. Visit to a local market to study various marketing functions performed by different agencies (market functionaries).
 2. Identification of marketing channels for selected mutual fund.
 3. Identification of marketing channels for selected Equity
 4. Identification of marketing channels for selected commodity.
 5. Computation of marketable and marketed surplus of important commodities.
 6. Construction of index numbers.
 7. Collection of data regarding marketing cost and marketing margins of different commodities and presentation of report in the class.
 8. Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning.
 9. Application of principles of comparative advantage of international trade
 10. Plotting and study of demand and supply curves and calculation of elasticities.
 11. Study of relationship between market arrivals and prices of some selected commodities.
 12. Study of price behaviour over time for some selected commodities.
-