Programme: **B.com**	Year: **FRIST**	**Semester: I**
Subject: B.com		
Course Code: **B.com SECRM**	**Skill Enhancement Course in Retail Management** (**SECRM**)	
Course Objectives: Retail Management deals with selling of goods and services to consumers. It involves a direct interactions with the customers and co-coordinating business activities from designing of a product to its delivery and post delivery services		
Course Outcomes: CO 1.Understanding of the retail history and its function CO 2. Retail Formats application CO 3.Buying process, retail market strategy and target market CO 4.Growth strategy of retailing CO 5.Choosing retail location and its evaluation CO 6.Inventory management, Warehousing, Logistics in SCM About CRM		
Credits: **04**	Type of Course:**SEC**	
Max. Marks: **100**	Min. Passing Marks: **36**	
BLOCK-I	**INTRODUCTION TO THE WORLD OF RETAILING**	
UNIT-1	History of retail,	
UNIT-2	Retail overview and present scenario	
UNIT-3	Concept and Functions performed by retailers	
UNIT-4	Emerging Trends and career opportunities in retailing	
BLOCK-II	**TYPES OF RETAILERS:**	
UNIT-5	Retailer characteristics	
UNIT-6	Retail Formats - Store based, Non-store based, Web based	
UNIT-7	Various format within store based retailing e.g. specialty store	
UNIT-8	hyper market, supermarket.	
BLOCK-III	**BUYING DECISION PROCESS**	
UNIT-9	The buying process - need recognition, information search, evaluation of alternatives.	

UNIT-10	Social factors influencing the buying process family, reference groups and culture.
BLOCK-IV	**RETAIL MARKET STRATEGY**
UNIT-12	Definition of retail and market strategy
UNIT-13	Target market
UNIT-14	Building a sustainable competitive advantage like - customers loyalty, location, human resource management, distribution and information system, vendor relations.
UNIT-15	Growth Strategies - Market penetration, market expansion, retail format development diversification, intergration.
UNIT-16	Global Retail Strategies.
UNIT-17	Strategic retail planning process.

Suggested Readings: Newman A. J. and Cullen P - Retailing : Environment and Operations (Vikas).

Berman B abd Evans J. R., Retail Management (Pearson Edition).

Michael Levi M and Weitz B W - Retailing Management (Tata McGraw Hill)

Dunne Patrick M, Lusch Robert F and Griffith David A - Retailing (Cengage Learning).

Suggested online courses (MOOCs) Any course offered in MOOCS/ Swayam Portal conducted by UGC, IIMS or IGNOU shall be consider for the credit transfer. The title of the course must be same as the one in which credit transfer is applied for

.**Note: Latest edition of text books may be used.**

Programme: **B.com**	Year: **FRIST**	Semester: **II**
Subject: B.com		
Course Code: **B.com**- SECSM	**Course Title: Skill Enhancement Course in SALES Management (SECSM)**	
Course Objectives: The objective of the course is to impart basic knowledge of the provisions of the Retail Management .		
Course Outcomes: CO1 To make learners aware about the concept of Retail Management. CO2 To make learners aware with best practices adopted in the industry in the field of Retail Management . CO3 To make learners aware with new rules and regulations adopted by the government. CO4 To develop competitive skills in the learners to deal with new rules and provisions of Retail Management CO5 To develop analytical skills of learners. CO6 To provide practical knowledge of the subject.		
Credits: **04**	Type of Course: **SEC**	
Max. Marks: **100**	Min. Passing Marks: **36**	

BLOCK-I	**Company and its Formation**
UNIT-1	Problem Recognition & Information Search Behaviour, Informatg.
UNIT-2	AlternativeEvaluation, PurchaseProcess&Post-purchase Behaviour.
UNIT-3	Modelling Buyer Behaviour**,**Early Models,Howard Sheth Model.
UNIT-4	Recent Developmentsin ModellingBuyerBehaviour.
BLOCK-II	SALESMANAGEMENT FUNCTIONS
UNIT-5	IntroductiontoSalesManagement,PersonalSellingPersonalSelling.
UNIT-6	Sales Process,Computer ApplicationsinSales Management.
UNIT-7	SellingSkills**,**CommunicationSkills,SalesPresentation,NegotiationSkills.
UNIT-8	Retail Communication-Sales Displays SalesDisplays.
BLOCK-III	**SALESFORCEMANAGEMENT**

UNIT-9	JobAnalysis,Recruitment andSelection.
UNIT-10	Trainingthe Sales Force.
UNIT-11	CompensationandMotivationofSalesForce.
UNIT-12	MonitoringandPerformanceEvaluation.
BLOCK-IV	PLANNINGANDCONTROLOFTHESALESEFFORT
UNIT-13	Sales Planning.
UNIT-14	SalesOrganization.
UNIT-15	SalesForecastingandSalesQuotas.
UNIT-16	ales Budgetingand Control.

Suggested Books: 1.KotlerPhilip,Gary Armstrong, PrafullaAgnihotri and AhsanUlHaque. Principles of

Marketing. 13thedition. Pearson Education.

2. Michael, J. Etzel, Bruce J. Walker, William J Stantion and Ajay Pandit. Marketing

Concept sand Cases.(Special Indian Edition)

3. McCarthy, E Jerome and William D.Perreault, Basic Marketing, Richard D. Irwin.

4. Lamb, Charles W, Joseph F. Hair, Dheeraj Sharma and Carl Mc Daniel Marketing: A

South Asian Perspective Cengage Learning.

5. Pride William M. D. C. Ferell Marketing: Planning, Implementation &Control, Cengage Learning.

Suggested online courses (MOOCs) Any course offered in MOOCS/ Swayam Portal conducted by UGC, IIMS or IGNOU shall be consider for the credit transfer. The title of the course must be same as the one in which credit transfer is applied for.

Note: Latest edition of text books may be used.

Note: Latest edition of text books may be used.

Course prerequisites: For the study of the said course, the learner must fulfill all the eligibility criteria prescribed by the university for the concerned course.		
Programme: B.Sc./B.A.	**Year:** III	**Semester:** VI
Subject: Statistics		
Course Code: *SBSSTAT -04 (N)*	**Course Title:** *Numerical Methods & Basic Computer Knowledge*	
Course Objectives: To study the Numerical Analysis, this is the study of algorithms that use numerical approximation for the problems of mathematical analysis and also the basic knowledge of the computers. To define, design and model; To analyze; To identify the real life applications of stochastic processes. To study various Operational Research Techniques and Models.		
Course Outcomes: **CO1:** This course provides the knowledge of finite differences, interpolation with equal and unequal intervals, Lagrange's Interpolation. **CO2:** Under this course learner will able to understand about the Central Differences, Inverse Interpolation, Numerical Differentiation and also Numerical Integration. **CO3:** Learners also learn about the introduction and history of computers, generations of computers. It gives the knowledge about the hardware and system software.. **CO4:** This course also provides the knowledge about the basic computer programming, concept of algorithm, flow charts and also programming languages..		
Credits: 4	Type of Course: Skill Development	
Max. Marks: 100	**Min. Passing Marks:** 36	
Block 1	**Solutions of Non-Linear Equations in one Variable**	
Unit I	**Basic Properties of Equations:** Review of Calculus, Round off Error, Truncation Error, Some properties of equations, Iteration Methods for finding the roots (zero's) of an equation. Convergence Criterion, Initial Approximation to a Root, Bisection Method	
Unit II	**Solutions of Non-Linear Equations:** Fixed Point Iteration Method, Chord Methods for Finding Roots- Regula Falsi Method, Newton Raphson Method. Order of convergence	
Block 2	**Finite Differences**	
Unit III	**Finite Differences:** Forward Difference Operator, Difference Table, The Operator E, The Operator D, Backward Differences, Factorial Polynomial, Central Differences, Mean Operator.	
Unit IV	**Interpolation with Equal Intervals:** Introduction, Missing Values, Newton- Gregory Forward & Backward Interpolation Formula	
Unit V	**Interpolation with Un-Equal Intervals:** Introduction, Missing Values, Properties of Divided Differences, Newton's Divided Difference Interpolating Polynomial, Error of the interpolation Polynomial Divided Differences and Derivatives	
Unit VI	**Lagrange's Interpolation:** Introduction, Lagrange's Interpolating Polynomial, General Error term or Reminder Term, Linear Interpolation, error in Linear Interpolation	
Block 3	**Central Differences**	
Unit V	**Central Difference Interpolation Formulae:** Introduction, Gauss Forward & Backward Formulae, Stirling's Formula, Bessel's Formula, Bessel's Formula for halves	
Unit VI	**Inverse Interpolation:** Inverse Interpolation by Lagrange's method, method of Successive Approximation, Method of Reversion of Series	
Unit VII	**Numerical Differentiation:** Introduction, Numerical Differential for Equal Intervals, Numerical Differential for Un-Equal Intervals, Approximation Formulae for the Derivative of a Function.	
Unit VIII	**Numerical Integration:** Introduction, Trapezoidal Rule, Simpson's One-Third Rule, Simpson's Three-Eighth Rule, Waddle's Rule, Eular-Maculerian Formula.	
Block 4	**Solution of Differential Equations**	

Unit IX	**Numerical Solution of Ordinary Differential Equations-I:** (first order) by Picard's Iteration Method, Euler's Method, Runge- Kutta Methods- 4th Order
Unit X	**Numerical Solution of Ordinary Differential Equations-II:** (second order and simultaneous) by Picard's Iteration Method, Euler's Method, Runge- Kutta Methods- 4th Order.
Block 5	**Computer**
Unit XI	**Introduction to Computer :** Introduction, Characteristics of computer, Historical Evaluation of Computer, Generation of Computers, Classification of computers.
Unit XII	**Hardware:** Introduction, CPU, Memory Organization, Input-Output Devices
Unit XIII	**System Software:** Introduction, System Software, File Commands, Editing, Commands, Disk Management Commands, Number System
Block 3	**Basics of Computer Programming**
Unit XIV	**Algorithm & Flow Charts :** Introduction, Algorithm, Flow Charts
Unit XV	**Programming Language:** Introduction, Machine Language, Assembly Language & Assembler, High Level Language, Object Oriented Programming, Programming Language Generation

Suggested Text Book Readings:

- Guide to current Indian Official Statistics. Central Statistical Organisation, Govt. of India, New Delhi.
- Saluja, M.P. () : Indian official statistical systems. Statistical Publishing Society, Calcutta.

This course can be opted as an elective by the students of following subjects:

U.G/P.G. in Business & Commerce, all Life Sciences and Social Sciences subjects students etc

Suggested equivalent online courses (MOOCs) for credit transfer: NA

UGFST

विज्ञान एवं प्रौद्योगिकी में आधार पाठ्यक्रम

Foundation Course in Science and Technology

Block-1 History of Science

Unit-1 Science as a Human Endeavour
Unit-2 Science in the Ancient World
Unit-3 Iron Age
Unit-4 The Golden Age of Science in India

Block-2 Emergence of Modern Science

Unit-5 Science in the Medieval Times
Unit-6 Renaissance, the Industrial Revolution and After
Unit-7 Science in Colonial and Modern India
Unit-8 The Method of Science and the Nature of Scientific Knowledge

Block-3 Universe and Life: The Beginning

Unit-9 Universe as a System
Unit-10 Exploring the Universe
Unit-11 The Solar System
Unit-12 Origin and Evolution of Life
Unit-13 Evolution of Man

Block-4 Agriculture, Nutrition and Health

Unit-19 Food and Agriculture
Unit-20 Scientific Possibilities and Social Realities
Unit-21 Food and Nutrition
Unit-22 Health and Disease

Programme: **B.com**	Year: **SECOND**	Semester: **III**
Subject: B.com		
Course Code: **B.com-SESP**	**Course Title: Skill Enhancement Course in Secretarial Practices** [**SESP**]	
Course Objectives:		
Course Outcomes:		
Credits: 04	**Type of Course: SEC**	
Max. Marks: 100	**Min. Passing Marks: 36**	

BLOCK-I	**The Company Secretary**
UNIT-1	**The Company Secretary**-Definition, Who can be company secretary, Appointment, General Legal position, Duties of a Company Secretary, Rights of Company Secretary, Liabilities of Company Secretary, Qualification For Appointment as secretary, Dismissal of the Secretary, Secretary in the Whole time practice, Secretarial Compliance certificate, Specimen form
UNIT-2	**The Companies Act and its Administration-**The companies Act,1956, Applicability of the Act, Special features, Amendments to the Companies Act,1956, Machinery for the Administration of the Companies Act,1956, The company Law Board, MCA-21 E Governance Project, Power of Securities Exchange Board of India, Jurisdiction of Courts.
UNIT-3	**Company Formation And Conversion-**Choice of the form of the business entity, Conversion/reconversion of one form of business entity into another, Procedure for incorporation of private/public companies, Companies limited by gurantee and unlimited companies and their conversion/re-conversion registration., Obtaining certificate of commencement of business, Obtaining certificate of re-registration, Commencement of new business and certification, Filing of agreements with managerial personnel, Formation of associations not for profit and non profit companies, Procedure relating to foreign companies carrying on business in India.
BLOCK-II	**MEMORANDUM ,MEMBERSHIP**
UNIT-4	**Alteration of Memorandum and Articles-** Procedure for alteration of various clauses of memorandum, Procedures for alteration of articles, Effect of alteration, Specimen forms.
UNIT-5	**Membership and Transfer / Transmission-** Membership, Distinction between shareholder and member, Methods of becoming a member, Who may become a member?, Termination of memebership, Rights of members, Contents of the register, Form of the register, Importance of the register, The right of inspection, Rectification of the register, Foreign Register of members, Specimen forms

BLOCK-III	**Directors and Managerial Personnel**
UNIT-6	Procedure for appointment, reappointment, resignation, removal and varying terms of appointment/re-appointment of directors.
UNIT-7	Managerial personnel, Procedure for payment of remuneration to directors.
UNIT-8	Disclosures thereof Compensation for loss of office.
UNIT-9	Waiver of recovery of remuneration, Directors and officers liability insurance.
BLOCK-IV	**BOARD MEETINGS, General Meetings**
UNIT-10	Board meetings, Frequency of board meetings, Notice of meetings, Agenda, Quorum, Resolution by circulation, Validity of acts of directors Committee of the boards,
UNIT-11	Proceeding of Boards, Board resolution,
BLOCK-IV	Minutes of Board meetings, Secretarial Work related to Board meetings, Specimens of minutes of Board of directors meetings.
UNIT-12	Types of General meetings.
UNIT-13	Law, practice and Procedure.
UNIT-14	Resolutions and Minutes
BLOCK-V	**Compromise, Arrangement, Reconstruction and Amalgamation**
UNIT-17	Compromise or arranagement
UNIT-18	Statutory Provisions
UNIT-19	Reconstruction and Amalgamation
UNIT-20	Acquisition of dissenting shareholders in case of take over bid, Amalgamation in nation interest

Suggested Readings: 1. S.Srikanth , Shanti Rekha Rajagopal ,Revathy Blakrishnan, Corporate Laws and Secretarial Practice, Jain Book

2. M C Kuchhal, Secretarial Practice, Vikas Publishing House, New Delhi.

3. Sangeet Kedia, Advanced Company Law And Practice, Pooja Law Publishing Company,**Suggested online courses (MOOCs)**Any course offered in MOOCS/ Swayam Portal conducted by UGC, IIMS or IGNOU shall be consider for the credit transfer. The title of the course must be same as the one in which credit transfer is applied for.

उत्तर प्रदेश
राजर्षि टण्डन मुक्त विश्वविद्यालय

खंड

1

भारतीय संस्कृति : एक परिचय

इकाई 1
भारतीय संस्कृति और विरासत : ऐतिहासिक संदर्भ I 7

इकाई 2
भारतीय संस्कृति और विरासत : ऐतिहासिक संदर्भ II 18

इकाई 3
संस्कृति का संरक्षण 33

इकाई 4
पर्यटन और संस्कृति : कुछ विचार 44

इस खंड के लिए कुछ उपयोगी पुस्तकें 55

इस खंड के लिए अभ्यास 55

NMDC-177

खंड

2

सामाजिक संरचना

इकाई 5
सामाजिक ऐतिहासिक परिदृश्य-I 5

इकाई 6
सामाजिक ऐतिहासिक परिदृश्य-II 15

इकाई 7
रीति रिवाज, अनुष्ठान और पंथ 31

इकाई 8
मेले और त्यौहार 47

इस खंड के लिए कुछ उपयोगी पुस्तकें 61

इस खंड के लिए अभ्यास 61

SEIC & T-02
भारतीय संस्कृति :
पर्यटन परिदृष्टि

उत्तर प्रदेश
राजर्षि टण्डन मुक्त विश्वविद्यालय

खंड

3

ललित कलाएँ

इकाई 9

नृत्य 5

इकाई 10

संगीत 16

इकाई 11

चित्रकला 27

इस खंड के लिए कुछ उपयोगी पुस्तकें 41

इस खंड के लिए अभ्यास 41

NMDC-177

SEIC & T-02/121

उत्तर प्रदेश
राजर्षि टण्डन मुक्त विश्वविद्यालय

SEIC & T-02
भारतीय संस्कृति
पर्यटन परिदृश्य

खंड

4

लोकप्रिय संस्कृति

इकाई 12

भारतीय रंगमंच 5

इकाई 13

भारतीय सिनेमा 28

इस खंड के लिए कुछ उपयोगी पुस्तकें 42

इस खंड के लिए अभ्यास 42

खंड

5

स्थापत्य

इकाई 14

प्रमुख स्थापत्य शैलियाँ 5

इकाई 15

क्षेत्रीय स्थापत्य 18

इकाई 16

स्थापत्य के उपयोग आधारित प्रकार 40

इकाई 17

मूर्तिकला 50

इस खंड के लिए कुछ उपयोगी पुस्तकें 64

अभ्यास 64

खंड

6

पुरातत्व और पुरावशेष

इकाई 18

पुरातात्विक स्थल-1 (पूर्व हड़प्पा और हड़प्पा) 5

इकाई 19

पुरातात्विक स्थल-2 (उत्तर हड़प्पा) 19

इकाई 20

संग्रहालय और पुरावशेष 36

इस खंड के लिए कुछ उपयोगी पुस्तकें 48

इस खंड के लिए अभ्यास 48

उत्तर प्रदेश
राजर्षि टण्डन मुक्त विश्वविद्यालय

खंड

7

हस्तशिल्प : निरंतरता और परिवर्तन

इकाई 21
हस्तशिल्पों का बाजारीकरण 05

इकाई 22
मिट्टी, पत्थर, लकड़ी और धातु शिल्प 17

इकाई 23
हाथी दांत, रत्न और आभूषण 35

इकाई 24
वस्त्र और परिधान 50

इस खंड के लिए कुछ उपयोगी पुस्तकें 70

इस खंड के लिए अभ्यास 70

NMDC-177

उत्तर प्रदेश
राजर्षि टण्डन मुक्त विश्वविद्यालय

खंड

8

जनजातीय संस्कृति

इकाई 25
अस्मिता निर्माण 05

इकाई 26
ऐतिहासिक और भौगोलिक विस्तार 15

इकाई 27
सामाजिक और आर्थिक व्यवस्था 35

इकाई 28
जनजातियां और विकास संबंधी नीतियां 49

अभ्यास 59

इस खंड के लिए कुछ उपयोगी पुस्तकें 60

SEIC & T-02
भारतीय संस्कृति : पर्यटन परिदृष्टि

खंड

9
संस्कृति संबंधी नीतिगत मुद्दे

इकाई 29
सरकार — 05

इकाई 30
व्यापार — 16

इकाई 31
जनसंचार — 23

इस खंड के लिए कुछ उपयोगी पुस्तकें — 31

अभ्यास — 31

Programme: **B.com**	Year: **SECOND**	Semester: **IV**
Subject: B.com		
Course Code: **B.com-[SEINS]**	Course Title: **Skill Enhancement Course in Insurance**	
Course Objectives: The objective of this course is to provide basic knowledge ofPrinciples and practice insurance and life insurance.		
Course Outcomes: 1.To enable the students to know the fundamentals of Insurance. 2. To give exposure to the students about life insurance products, Procedural part and life insurance business in India.		
Credits: **04**	Type of Course:**SEC**	
Max. Marks: **100**	Min. Passing Marks: **36**	

BLOCK-I	**Introduction to Insurance:**
UNIT-1	Definition, characteristics and need of insurance, Economic and commercial significance of insurance, Insurance as a social security tool, Types of insurance in brief, Principles of insurance. Insurance contract and wagering contract.
UNIT-2	**Life Insurance:** Meaning and Nature of life insurance. Life insurance products, - whole life, endowment, term plans, pension and annuity plans, unit linked Insurance plans.
UNIT-3	**Life Insurance Policy:** Meaning, Procedure of taking life insurance policy,
UNIT-4	Policy conditions, settlement of claims.
BLOCK-II	**Life Insurance Business in India:**
UNIT 5	Growth of life insurance business after privatization, Evaluation of performance of LIC of India and private companies,
UNIT-6	Insurance Regulatory and DevelopmentAuthority Act, 1999- structure.
UNIT-7	IRDA-Organizational setup and functions.
BLOCK-III	**Fire Insurance**
UNIT-8	**Fire Insurance**-Meaning, Procedure of taking fire Insurance policy, Policy conditions, kinds of policies, cancellation and forfeiture of policy, Renewal of policy, settlement of claims.
UNIT-9	**Marine Insurance:** Meaning, Procedure of taking marine insurance policy, Difference between fire and marine Insurance, clauses of marine insurance policy, marine losses and perils ,Types

	of policies
UNIT-10	**Miscellaneous Insurance (only nature & cover)** (A) Personal Accident Insurance (B) Health Insurance (C) Motor Insurance (D) Burglary Insurance (E) Liability Insurance (F) Fidelity Guarantee Insurance (G) Cattle Insurance
UNIT-11	Crop Insurance
BLOCK-IV	**General Insurance Business in India**
UNIT-12	Growth of general insurance business after Privatization. currentscenario,
UNIT-13	Merits and demerits
Unit-14	Evaluation of performance of public andprivate companies
UNIT-15	Bank assurance.
UNIT-16	Foreign Direct Investment (FDI) in insurance business.

Suggested Readings: 1.G.S. Panda- ' Principles and Practices of Insurance' Kalyani Publishers, Ludhiana

2. M. Arif khan' and Practice of Insurance' Educational Book House, Aligarh.
3. M.N. Mishra- 'Insurance Principles and Practice' S. Chand & Company Ltd. New Delhi.
4. Kothari &Bahl, Principles and Practice of Insurance' SahityaBhawan, Agra.
5. S. Balachandran, General Insurance, Insurance Institute of India, Mumbai.
6. S. Balachandran, Life Insurance, Insurance Institute of India, Mumbai.
7. Insurance Regulatory Development Authority Act- 1999.

Suggested online courses (MOOCs) Any course offered in MOOCS/ Swayam Portal conducted by UGC, IIMS or IGNOU shall be consider for the credit transfer. The title of the course must be same as the one in which credit transfer is applied for.

Note- Latest edition of text books may be used.

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: III
Subject: Zoology		
Course Code: SBSZY-02 (N)	**Course Title: Fundamental of Animal Behavior**	
Course Objectives- To understand the natural behavioral of various animals. Knowledge the difference between innate and learned behavioural.		
Course Outcomes (CO): • By the completion of this course, students will be expected to gain a comprehensive understanding of the behavior of animals. • To describe innate Taxes, Reflexes, Instincts and Motivation, Kinesis. • To describe the social behavior and parental care in fish and amphibia. • Understand types of animal behavior and there importance to the organisms.		
Credits: 02	**Type of Course:** Core	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	**Fundamental of Animal Behavior – I**
Unit I	**General Survey of Various Kinds of Animal Behavior** • General Survey of Various Kinds of Animal Behavior, Types of Innate Behavior - Taxes, Reflexes, Instincts and Motivation, Kinesis.
Unit II	**Types of Behavior** • Types of Learned Behavior Habituation, Imprinting, Conditioned Reflexes, Trial and Error, Latent Learning, Reasoning.
Unit III	**Introduction and Basic Mechanism of Behavior** • Introduction and Basic Mechanism of Behavior- Role of Nervous System, Hormones, Pheromones and Genetics in Behavior, Difficulties in Studying Behavior Study of Human Behavior
Unit IV	**Social Behavior in Insects** • Social Behavior in Insects, Social structure and functioning of Bees and Termites.
Block 2	**Fundamental of Animal Behavior - II**
Unit V	**Parental Care in Fishes and Amphibia** • Parental Care in Fishes and Amphibia, Maternal Vs Paternal care
Unit VI	**Nest Building** • Nest Building, Nesting and Brooding Behavior in Birds
Unit VII	**Migration in Fishes and Birds** • Migration in Fishes and Birds- physiological and behavioral changes. Cost and benefits of migration.
Unit VIII	**Biological Clock** • Biological Clock, Colouration, Mimicry, Adaptation and anti-predator behavior.

Suggested Text Book Readings:

1. Animal behavior by Reena Mathur
2. The marvels of Animal Behaviour, A publication of National Geographic Society, Washington, DC, USA.
3. Wildlife Wealth of India (Resources and Management), Edited By T.C. Mojupuria. Published and Distributed By: Tecpress Service, Bangkok, Thailand.
4. Wildlife in India, By V.B. Saharia, Natraj Publishers, Dehradun.
5. Indian Wildllife, Edited By Samuel Israel and Toby Sinclair. Directed and Designed By Hans Johannes Hoefer, Singapore.
6. Animal behaviour (ethology) by V.K. Agrawal.
7. Animal Social Behaviour, By James F Wittenberger Duxbury Press, Boston, USA.
8. Animal Behaviour: An Evolutionary Approach, By John Alcock. Sinaver Associates, Inc, USA.
9. Sociology, By Edward O. Wilson. The Bellknap Press, USA.

This course can be opted as an elective by the students of following subjects: NA

Suggested equivalent online courses (MOOCs) for credit transfer: NA

Electronic media and other digital components in the curriculum:

Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)

Name of electronic media	Year of incorporation:
e-SLM	2021-22

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: V
Subject: Zoology		
Course Code: SBSZY-03	**Course Title: Economic Zoology and environmental biology**	
Course Objectives- The main objectives of the course is to make learner aware of economic important of various invertebrates and scope and methodology of aquaculture.		
Course Outcomes:(CO): • Economic uses of various animal products. • Understand morphology, life cycle and economic important protozoa, platyheminthes aschelminths and Arthropods. • Understands concepts of fisheries, fishing tools and site selection. • Aquaculture system, induced breeding techniques, post harvesting techniques.		
Credits: 02	Type of Course: Core (√) /Elective	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	**Economic Zoology**
Unit I	Protozoa • Protozoan Parasitic Diseases Of Man And Domestic Animals With Special Reference To Zoonotic Significance Of Entamoeba histoltica Plasmodium • Protozoa And Soil Fertility
Unit II	PLATYHELMINTHES & ASCHELMINTHES • Life Cycle and Zoonotic Significance of Diphyllobothrium latum • Life Cycle and Zoonotic Significance of Dracunculus medinensis
Unit III	Arthropoda • Life Cycle and Zoonotic Significance of Representation Tick And Mite • Beneficial and Harmful Insects
Unit IV	Plant and stored grain pest and role of insecticides in their control • Interrelationship of mosquito with Malaria, Yellow fever, Dengue, Encephalitis and Dermatobia, their presentation and control • Biological control of insect pests
Block 2	**Environmental Biology**
Unit V	Aquaculture • Its Basic Concepts , Management and Economics(Including Pearl Fishery)
Unit VI	Air Pollution • Nature of Pollutants , Their Sources and Effects On Humans , Plants And Animals And Their Control
Unit VII	Water Pollution& Soil Pollution • Sources , Consequences And Control • Sources , Nature And Harmful Effects
Unit VIII	Environmental Health • Animal In Relation To Human Health • Water In Relation To Human Disease • Urbanisation Stress And Health • Behaviour Patterns Of Health And Disease

Suggested Text Book Readings:

1. Harvey et al: The Vertebrate Life (2006)
2. Parker and Haswell: Text Book of Zoology, Vol. II (1978, ELBS)
3. Romer and Parsons: The Vertebrates Body (6th ed 1986, CBS Publishing Japan)
4. Brusca and Brusca (2016) Invertebrates, Sinauer.
5. Bisht. D.S. Apiculture, Oxford and IBH, New Delhi.
6. Boyd, C.E. & Tucker. C.S., Pond aquaculture water quality management.

Programme: **B.Sc.**	Year: **Second**	Semester: **III**
Subject: **Biochemistry**		
Course Code: **SBSBCH-01N**	Course Title: **BIO ANALYTICAL TECHNIQUES**	

Course Objectives:

- To discuss the basics concepts of bioanalytical techniques
- To discuss the pH, buffer and biological importance
- To discuss the about concept of chromatography and spectroscopy.
- To discuss the basic concept of electrophoresis

Course Outcomes:

CO 1: Able to understanding the concept of normality, molarity and molality.
CO 2: Know the properties of light, optical rotation and optical rotator.
CO 3: Able to know about visible and UV spectroscopy.
CO 4: Learn the basic principle of FT-IR and NMR spectrometer.
CO 5: Discuss the principle of centrifugation and its applications.

Credits: 4	**Type of Course:** Skill Enhancement Course
Max. Marks: 100	Min. Passing Marks: 36

Block 1	**Basics of bio-analytical techniques**
Unit I	**Basic introductions:** Basic concept of bio analytical techniques, normality, morality and molality, brief about purification, centrifugation, filtration, dialysis, homogenization
Unit II	**pH and buffer:** Hydrogen ion concentration, Buffer- definition, types and its preparation, buffers of biological importance such as carbonate bicarbonate, phosphate and acetate.
Unit III	**Properties of Light:** light spectra, wave length, plane polarized light, optical rotation, optical rotatory, absorbance-chromospheres, auxochrome,
Block 2	**Block II- Chromatography and spectroscopy**
Unit IV	**Chromography:** Principals of partition chromatography, exchange, gel filtration chromatography, high performance liquid chromatography (HPLC).
Unit V	**Spectroscopy-I:** Concepts of spectroscopy, Beer-Lambert's law, Visible and UV Spectroscopy, applications of colorimetery.
Unit VI	**Spectroscopy-II** Basic principle of FT-IR and NMR spectrometer and their role in detection of organic molecules detection.
Block 3	**Electrophoresis and Centrifugation**
Unit VII	**Electrophoresis:** Principles of electrophoresis, separation of proteins by PAGE and SDS-PAGE.
Unit VIII	**Centrifugation:** Principles of centrifugation, differential centrifugation, applications of centrifugation and density gradient.

Unit IX	**Microbial techniques**: Isolation of bacteria, antimicrobial activity by using DISC diffusion techniques, use of different solvent system for amino acid, carbohydrate and lipid separation.

Suggested Text Book Readings:

1. David L. Nelson and Michael Cox, "Lehninger Principles of Biochemistry" International Edition-2021.
2. Sabari Ghosal and Anupama Sharma Awasthi, Fundamentals of Bioanalytical Techniques and Instrumentation, Second edition.
3. Abhilasha Shourie (Author), Shilpa S. Chapadgaonkar Bioanalytical Techniques
4. Sabro Ghosal a. K. Srivastava, Fundamentals of Bioanalytical Techniques and Instrumentation
5. Talwar and Srivastava, "Textbook of Biochemistry and Human Biology" Eastern Economy Edition, Prentice Hall, India-2002.

Suggested online link:

1. pH and buffer: pH and Buffers.ppt (csun.edu)
2. Properties of Light: ACL7_light.ppt (umd.edu)
3. spectroscopy: Spectroscopy.pdf (osti.gov)
4. Chromatographic Techniques: 222 Chapter 4.pdf (unipune.ac.in)
5. Microbiological Laboratory Techniques Microbiological Laboratory Techniques (mowr.gov.in)

This course can be opted as an elective by the students of following subjects: NA

Suggested equivalent online courses (MOOCs) for credit transfer:
1. Analytical techniques: by Dr. Moganty r. Rajeswari Analytical Techniques - Course (swayam2.ac.in)

Electronic media and other digital components in the curriculum:

Choose any one or more than one:(Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)

Name of electronic media: YouTube	Year of incorporation: 2023-24

Programme: **B.Sc.**	Year: **Third**	Semester: **VI**
Subject: **Biochemistry**		
Course Code: **SBSBCH-04N**	Course Title: **Clinical biochemistry**	

Course Objectives:

- To discuss the basics of clinical biochemistry and clinical enzymology.
- To discuss the role and regulation of electrolyte content in body fluids
- To discuss the concept disorders of carbohydrate, lipids and nitrogen metabolism.
- To discuss the basic concept of blood clotting, nutrition, drugs and cancer.

Course Outcomes:

CO 1: Able to understanding of electrolyte, enzymes, hormones and bone disorder.
CO 2: able to know the regulation of blood sugar, glycogen, and diabetes mellitus.
CO 3: Able to learn the density of lipoproteins, cholesterol, triglycerides and phospholipids in health and disease.
CO 4: Define the concept of tube feeding, parenteral nutrition, drugs and alcohol
CO 5: Able to known the types of cancer, multiple steps of tumor development.

Credits: 4	**Type of Course:** Skill Enhancement Course
Max. Marks: 100	Min. Passing Marks: 36

Block 1	**Basic in clinical chemistry and Clinical Enzymology**
Unit I	**Basic introduction:** **Basic** concept of clinical biochemistry: A brief review of units and abbreviations used in expressing concentrations and standard solutions.
Unit II	**Electrolytes and acid-base balance**: Role and regulation of electrolyte content in body fluids and maintenance of pH, body fluids and fluid compartments
Unit III	**Clinical enzymology**: Enzymes and hormones, plasma enzymes, isoenzymes with examples, liver damage, bone disorder.
Block 2	**Disorders of carbohydrate, lipids and Nitrogen metabolism**
Unit IV	**Disorders of carbohydrate metabolism:** Regulation of blood sugar, glycogen storage diseases, diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood.
Unit V	**Disorders of lipids:** Low and high density lipoproteins, cholesterol, triglycerides and phospholipids in health and disease, Gaucher's and Tay-Sach's disease
Unit VI	**Disorders Nitrogen metabolism**: Abnormalities in nitrogen metabolism: Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance.
Block 3	**Nutrition, drugs and blood clotting**
Unit VII	**Nutrition and drugs:**

	Routine hospital diets, special feeding methods, tube feeding, parenteral nutrition, drugs, alcohol and toxicants
Unit VIII	**Diagnostic Enzymes**: Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays- SGPT, CPK, LDH.
Unit IX	**Blood Clotting:** Blood clotting mechanism-hemorrhagic disorders-hemophilia, thrombotic thrombocytopenic purpura, blood groups, antigen and antibodies, circulating anticoagulants.
Unit X	**Cancer:** Types of cancer, multiple steps of tumor development, cell death and apoptosis, carcinogens and cancer therapy.

Suggested Text Book Readings:

1. David L. Nelson and Michael Cox, "Lehninger Principles of Biochemistry" International Edition-2021.
2. Dr J L Jain, "Fundamentals of Biochemistry" S. Chand and Company-2020.
3. P S Verma and V K Agarwal, "Cell Biology (Cytology, Biomolecule and Molecular Biology" S. Chand Publication-2016.
4. Talwar and Srivastava, "Textbook of Biochemistry and Human Biology" Eastern Economy Edition, Prentice Hall, India-2002.
5. Satyanarayana U., "Biochemistry" Elsevier India,2021

Suggested online link:

1. Pathophysiology of Water and Electrolyte Metabolism: PowerPoint Presentation (bns-hungary.hu)
2. Nutrient-Drug Interactions and Food: 09361.pdf (colostate.edu)
3. HANDBOOK OF DRUG-NUTRIENT INTERACTIONS: Handbook of Drug-Nutrient Interactions, 2nd Edition (Nutrition and Health) (usp.br)
4. Enzymes of diagnostic values: L12-Enzymes-of-diagnostic-values.pdf (ndvsu.org)
5. Blood Clotting Notes: Blood Clotting Notes (murrieta.k12.ca.us)
6. Cancer: book.pdf (tmc.gov.in)

This course can be opted as an elective by the students of following subjects: NA

Suggested equivalent online courses (MOOCs) for credit transfer: NO

Electronic media and other digital components in the curriculum:

Choose any one or more than one:(Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)

Name of electronic media: Youtube	Year of incorporation: 2023-24

Course prerequisites: To study this course, a student must have qualified 10+2 with Biology		
Programme: B.Sc.	Year: I	Semester: V
Subject: Biology		
Course Code: SBSBY-02(N)	Course Title: **Ecology**	
Course Objectives: The main objective of the course is to make learners aware of- • Ecosystem its various aspects which educate them about environment.		
Course Outcomes (CO): • Understand the concept of environment, ecology and ecosystem. • Structure and organization of ecosystem with biotic and abiotic component. • Energy flow and nutrient cycle in ecosystem. • Community, population and role of ecology in human welfare.		
Credits: 02	Type of Course: Core	
Max. Marks: 100	Min. Passing Marks: 36	
Block 1	**Ecology-I**	
Unit I	Introduction To Ecology	
Unit II	Structure and function of Ecosystem • Biotic and Abiotic components, Food chain, Food web, Pyramid, and Energy flow in ecosystem, Biogeochemical cycle.	
Unit III	Ecological Succession • Basic concept, succession in water and land (hydrosere and xerosere)	
Unit IV	Pollution • Definition, types of pollution: Air pollution, water pollution, Noise pollution, control of pollution.	
Block 2	**Ecology-II**	
Unit V	Ecological Adaptations in Plants • Hydrophytic and xerophytic adaptation.	
Unit VI	Edaphic Factors • Definition and composition of soil, soil profile, soil erosion, soil conservation.	
Unit VII	Phytogeography • Major plant community of world, soil, climate and vegetation of India.	
Unit VIII	Environmental Education	
Suggested Text Book Readings: Ecology And Environmental Biology by RBD Publisher Author: Bhatia - Jain - Kohli - Shrivastava - Singh – Verma Environmental Biology and Phytogeography ISBN #: 978-81-301-0064-7B. L. Chaudhary, Gotam K Kukda & Jitendra Kumar Joshi Odum, F.P. Fundamentals of Ecology, Latest Ed., Saunders Sharma, P.D. Elements of Ecology, Latest Ed., Rastogi Publications Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.		

Year-2023-2024
Syllabus of B.Sc. Programme: [Subject Name: Chemistry]
In accordance with NEP-2020

Year	Sem.	Course Code	Paper Title	Theory/Practical	Max. Marks.	Credits
1	I	UGCHE -101N	INORGANIC CHEMISTRY I (BASIC INORGANIC CHEMISTRY)	Theory	100	2
		UGCHE -101P(N)	Practical Work	Practical	100	2
1	II	UGCHE -102N	ORGANIC CHEMISTRY I (BASIC ORGANIC CHEMISTRY)	Theory	100	2
		UGCHE -102P(N)	Practical Work	Practical	100	2
		Skill Enhancement Course				
		SBSCHE-02N	ADVANCED ANALYTICAL TECHNIQUES	Theory	100	4
2	III	UGCHE -103N	PHYSICAL CHEMISTRY I (BASIC PHYSICAL CHEMISTRY)	Theory	100	2
		UGCHE -103P(N)	Practical Work	Practical	100	2
		Skill Enhancement Course				
		SBSCHE-01N	ORGANIC CHEMISTRY II (ADVANCE ORGANIC CHEMISTRY)	Theory	100	4
2	IV	UGCHE -104N	INORGANIC CHEMISTRY II (ADVANCE INORGANIC CHEMISTRY)	Theory	100	2
		UGCHE -104P(N)	Practical Work	Practical	100	2
Discipline Centric Elective Course						
3	V	DCECHE -105N	PHYSICAL CHEMISTRY II (ADVANCE PHYSICAL CHEMISTRY)	Theory	100	2
		DCECHE -106N	INORGANIC CHEMISTRY III (SELECTED TOPICS IN INORGANIC CHEMISTRY)	Theory	100	2
		DCECHE -107P(N)	Practical Work	Practical	100	2
Discipline Centric Elective Course						
3	VI	DCECHE -108N	ORGANIC CHEMISTRY III (SELECTED TOPICS IN ORGANIC CHEMISTRY)	Theory	100	2
		DCECHE -109N	PHYSICAL CHEMISTRY III (SELECTED TOPICS IN PHYSICAL CHEMISTRY)	Theory	100	2
		DCECHE -110P(N)	Practical Work	Practical	100	2
				Total Marks/Credit	**1600**	**32**

Syllabus for [B.Sc.]: Subject: [Chemistry]

Course prerequisites: 10+2 with Chemistry		
Programme:B.Sc.	Year: 1	Semester: I
Subject: Chemistry		
Course Code: UGCHE -101N	Course Title: INORGANIC CHEMISTRY I (BASIC INORGANIC CHEMISTRY)	

Course Objectives:

To provide knowledge about structure of atoms and associated important rules, importance of chemistry of elements, bonding and properties of any compound/material. Several parameters associated with elements, Solid state chemistry and chemistry of elements belonging to s-block, noble gases and main group.

Course Outcomes:

CO-1 Structure of atoms and associated important rules, importance of chemistry of elements.
CO-2 Ionic, covalent and non-covalent bonding which always play pivotal role in deciding the chemistry and properties of any compound/material.
CO-3 Periodic properties of elements and several parameters associated with elements
CO-4 Solid state chemistry which forms the basis of the development of targeted crystalline solids inculcating varied defects which induces variety of materials properties viz. piezoelectricity.
CO-5 Chemistry of elements belonging to s-block, noble gases and main group.

Credits: 2	**Type of Course:** Core
Max. Marks: 100	Min. Passing Marks: 36

Block 1	
Unit I	**Atomic Structure** Historical concepts of atomic structure. Idea of de-Broglie's matter waves, Heisenberg's uncertainly principle, significant of ψ and ψ^2, Schrodinger's wave equation for H atom; Radial and angular wave functions: quantum numbers and shapes of s, p, d and f orbitals; Aufbau and Pauli Exclusion Principle. Variation of orbital energies with atomic number and energy level diagram; Long form of periodic table based on electronic configuration.
Unit II	**Periodic properties of elements** Types of radii (Covalent, Crystal and Van der Waal); Electron affinity and its variation; Ionisation potential, Factors affecting the magnitude of I.P., Concept of effective nuclear charge and shielding effect (Calculation of Screening constant with Slater's rules.); Electronegativity (Pauling, Mulliken and Allred Rochow scale) and its variation.
Unit III	**Chemical Bonding** (i) **Ionic Bonding:** Conditions favouring the ionic bond, radius ratio and structure of ionic solids. Concept of lattice energy and Born-Haber cycle, Polarisation of ions and Fajan's rules. (ii) **Covalent and brief idea of other bonds:** Concept of directed valence bond theory (VBT) and hybrid orbital description (sp, sp^2, sp^3, sp^3d and sp^3d^2) using simple illustrations, determination of the shapes of molecules and ions viz. NH_3, H_2O, H_3O^+, SF_4, ClF_3, ICl^{2-} and I^{3-} by VSEPR concept, Concept of maximum covalency. Odd electron bond, three centre bond. MO Theory, homonuclear (H_2,H^{2+}, B_2, N_2, O_2, Cl_2) and heteronuclear (CN, CO and

	NO) diatomic molecules, bond strength, and bond energy, percent ionic character from dipole moment and electronegativity. Multicenter bonding in electron deficient molecules. (iii) **Weak Interactions**: Hydrogen bonding (Inter and Intra Molecular), Vander Waals forces. (iv) **Metallic Bond:** Theories of bonding in metals; Free electron, VB and Band theories.
Block 2	
Unit IV	**General Studies of s block elements** Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls; Chemical reactivity of alkali and earth alkaline metals; Uses of s-block elements and their compounds (Li, Na and K only), Organometallic compounds of Li, Na, K, Be and Mg. Polyether complexes (Crown ether complexes) of alkali metals; Extraction and isolation of Li, Be and Ra from their minerals.
Unit V	**General Studies of p- block elements** Group wise discussion with respect to electronic configuration, ionisation potential, electron affinity, electronegativity, atomic and ionic radii, oxidation states, catenation and inert pair effect (wherever applicable). Preparation, properties and structures of diborane, borazine, hydrazine, interhalogens and polyhalides and fluorides of xenon. Structure and basicities of oxyacids of B, P and S. Structural features of hydrides, halides, oxides and oxyacids.
Unit VI	**Oxidation and Reduction** Electrode potential, electrochemical series and its applications. EMF diagrams and their utility. Principle involved in the extraction of the elements.

Suggested Text Book Readings:

Text Books (Theory Courses):

(a) Concise Inorganic Chemistry, J.D. Lee, Blackwell Science Ltd.

(b) Inorganic Chemistry, Puri, Sharma, Kalia and Kaushal.

(c) Pradeep's Inorganic Chemistry, K.K. Bhasin, Pradeep Publication.

(d) Chemistry for degree students, R. L. Madan

Reference Books:

(a) Inorganic Chemistry, J.E.Huheey, Ellen A. Keiter, Richard L. Keiter, Addison Wesley Longman (Singapore) Pvt. Ltd.

(b) Inorganic Chemistry, D.E.Shriver, P W. Atkins and C.H.L. Langford, Oxford.

(c) Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.

(d) Concepts of Models of Inorganic Chemistry, B.Douglas, D.McDaniel and J Alexander, John Wiley.

(e) Inorganic Chemistry, W.W. Porterfield, Addison - Wesley.

(f) Inorganic Chemistry, A.G. Sharpe, ELBS

(g) Inorganic Chemistry, G.L. Meissler and D.A. Tarr, Prentice-Hall.

Suggested online links:

http://heecontent.upsdc.gov.in/Home.aspx

https://nptel.ac.in/courses/104/106/104106096/

https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm

https://nptel.ac.in/courses/104/103/104103071/#

Electronic media and other digital components in the curriculum:

Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2020

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="3">Course prerequisites: Chemistry in 10+2 Level</td></tr>
<tr><td>Programme: B.Sc.</td><td>Year: 1</td><td>Semester: 1</td></tr>
<tr><td colspan="3">Subject: Chemistry</td></tr>
<tr><td>Course Code: UGCHE 101P(N)</td><td colspan="2">Course Title: UGCHE-LAB-WORK-I</td></tr>
<tr><td colspan="3">Course Objectives:
To understand basic knowledge and skills about laboratory methods and tests related to estimation of metals ions and estimation of acids and alkali.</td></tr>
<tr><td colspan="3">Course Outcomes:
CO-1 Upon completion of this course the students will have the knowledge and skills to: understand the laboratory methods and tests related to estimation of metals ions and estimation of acids and alkali contents in commercial products.</td></tr>
<tr><td colspan="2">Credits: 2</td><td>Type of Course: Core</td></tr>
<tr><td>Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="2"></td></tr>
<tr><td>Unit I</td><td colspan="2">General – Principle and working of Chemical balance. Calibration of fractional weights and thermometer.</td></tr>
<tr><td>Unit II</td><td colspan="2">Inorganic Chemistry
Qualitative analysis of an inorganic mixture containing five radicals out of the following preferably by semi-micro technque (including insoluble substances):
NH_4^+, Na^+, K^+, Mg^{++}, Ca^{++}, Sr^{++}, Ba^{++}, Zn^{++}, Mn^{++}, Ni^{++}, Co^{++}, Al^{+++}, Fe^{+++}, Cr^{+++}, Cu^{++}, Bi^{++}, Hg^{+}, Hg^{++}, Cd^{++} As^{+++}, Sb^{+++}, Sn^{++}, Pb^{+} ,Pb^{++}, Ag^{+}, CO_3^{2-},NO^{2-}, S^{2-}, SO_3^{2-} ,SO_4^{2-}, F^- , Cl^-, Br^-, NO_3^-, CH_3COO^- , Borate, Oxalate, and Phosphate.</td></tr>
<tr><td colspan="3">Suggested Text Book Readings:
1. Mendham, J. Vogel’s Quantitative Chemical Analysis, Pearson, 2009.
2. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.
3. Harris, D.C . Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.
4. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Edition
Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University
Suggestive digital platforms web links
https://www.labster.com/chemistry-virtual-labs/ https://www.vlab.co.in/broad-area-chemical-sciences http://chemcollective.org/vlabs</td></tr>
<tr><td colspan="3">This course can be opted as an elective by the students of following subjects:</td></tr>
<tr><td colspan="3">Suggested equivalent online courses (MOOCs) for credit transfer: NA</td></tr>
<tr><td colspan="3">Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/ Other electronic and digital contents</td></tr>
<tr><td colspan="2">Name of electronic media: e-SLM</td><td>Year of incorporation: 2021</td></tr>
</table>

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="3">Course prerequisites: 10+2 Chemistry as subject</td></tr>
<tr><td>Programme:B.Sc.</td><td>Year:1</td><td>Semester:2</td></tr>
<tr><td colspan="3">Subject: Chemistry</td></tr>
<tr><td>Course Code: UGCHE-102N</td><td colspan="2">Course Title: ORGANIC CHEMISTRY I (BASIC ORGANIC CHEMISTRY)</td></tr>
<tr><td colspan="3">Course Objectives:
To understand different organic compounds with respect to the functional groups and basics of chemical reactions.
To understand different principles of organic chemistry and predict outcomes and derive mechanism of various types of organic reactions.
To understand the concept of Aromaticity of benzenoids & nonbenzenoids. The preparation, reactivity and structure of aromatic compounds.
To learn the preprations, reactivity & stereochemistry of SN^1 &SN^2 reactions of Halogen compounds.</td></tr>
<tr><td colspan="3">Course Outcomes:
CO-1 Understand different organic compounds with respect to the functional group and thus capable to name the organic compounds as per IUPAC nomenclature.
CO-2 Understand the basics of chemical reactions i.e. Substrate and Reagent, types of Reagents, Electrophilic and Nucleophilic Homolytic and heterolytic fission. Electron mobility, Inductive effect etc.
CO-3 Recognize and draw constitutional isomers, stereoisomers, including enantiomers and diasteromers, racemic mixture and meso compounds.
CO-4. Understand fundamental principles of organic chemistry and predict outcomes and derive mechanism of various types of organic reactions.
CO-5 Understand various types of reactive intermediates and factors affecting their stability
CO-6 Understand the nomenclature, synthesis, isomerism and physical properties of alkanes and cycloalkanes.
CO-7 Understand the concept of Aromaticity of benzenoids & nonbenzenoids. The preparation, reactivity and structure of aromatic compounds.
CO-8 Learn the preprations, reactivity & stereochemistry of SN^1 &SN^2 reactions of Halogen compounds.</td></tr>
<tr><td colspan="2">Credits:2</td><td>Type of Course: Core</td></tr>
<tr><td colspan="2">Max. Marks: 100</td><td>Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="2"></td></tr>
<tr><td>Unit I</td><td colspan="2">Structure and Bonding
Atomic orbitals, hybridization, orbital representation of methane, ethane, ethyne and benzene. Polarity of bonds: Inductive, resonance and steric effects hyperconjugation, and their influence on acidity and basicity of organic compounds. Homolysis and Heterolysis; Concept of Carbocation, Carbanion and Free radicals.</td></tr>
<tr><td>Unit II</td><td colspan="2">Mechanism of Organic Reactions and Reaction Intermediates
Curved arrow notation, drawing electron movements with allows, half-headed and double-headed arrows, hemolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Energy considerations.</td></tr>
</table>

	Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning format charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).
Unit III	**Alkanes and Cycloalkanes** IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom in alkanes, Isomerism in alkanes, sources methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.
Block 2	
Unit IV	**Stereochemistry of Organic Compounds** Concept of isomerism. Types of isomerism. Optical isomerism – elements of symmetry, molecular chirality, enantionmers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and recemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclaute. Geometric isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism -- conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.
Unit V	**Alkenes, Cycloalkenes, Dienes and Alkynes** Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroborationoxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4. Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene. Methods of formation, conformation and chemical reactions of cycloalkenes. Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization, Chemical reaction – 1,2 and 1,4 additions, Diets-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.
Unit VI	**Arenes and Aromaticity** Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and kekule structure. Stability and

	carbon-carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity: the Huckel rule, aromatic ions. Aromatic electrophilic substitution – general pattern of the mechanism, role of σ and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alhylbenzenes, alkynylbenzenes and biphenyl.
Unit VII	**Alkyl and Aryl Halides** Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

Suggested Text Book Readings:
Text Books (Theory Courses):
(a) Organic Chemistry, Vol. I, I.L. Finar, Pearson Education.
(b) Organic Chemistry, M.K. Jain, Shoban Lal& Co.
(c) Pradeep's Organic Chemistry, S.N. Dhawan, Pradeep Publication.
Reference Books:
(a) Organic Chemistry, Morrison and Boyd, Prentice Hall.
(b) Organic Chemistry, L.G. Wade Jr. Prentice Hall.
(c) Fundamentals of Organic Chemistry Solomons, John Wiley.
(d) Organic Chemistry, Vol. I, II, III S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International)
(e) Organic Chemistry, F.A. Carey, McGraw-Hill Inc.
(f) Introduction to Organic Chemistry, Streitwiesser, Hathcock and Kosover, Macmillan.

Suggested online links:
http://heecontent.upsdc.gov.in/Home.aspx
https://nptel.ac.in/courses/104/105/104105124/
https://nptel.ac.in/courses/103/106/105106204/
https://nptel.ac.in/courses/104/105/104105034/
https://nptel.ac.in/courses/104/103/104103121/
https://nptel.ac.in/courses/104/102/104102016/
https://nptel.ac.in/courses/104/106/104106106/
https://nptel.ac.in/courses/104/105/104105120/

This course can be opted as an elective by the students of following subjects:

Suggested equivalent online courses (MOOCs) for credit transfer:

1. **Mechanisms in Organic Chemistry, Prof. Nandita Madhavan, NPTEL, https://onlinecourses.nptel.ac.in/noc22_cy42/preview**

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2021

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="3">Course prerequisites: 10+2 Chemistry as subject</td></tr>
<tr><td>Programme: B.Sc.</td><td>Year:1</td><td>Semester:2</td></tr>
<tr><td colspan="3">Subject: Chemistry</td></tr>
<tr><td>Course Code: UGCHE 102P (N)</td><td colspan="2">Course Title: UGCHE-LAB-WORK-II</td></tr>
<tr><td colspan="3">Course Objectives:
This course will provide basic qualitative and quantitative experimental knowledge of biomolecules such as carbohydrates, proteins, amino acids, nucleic acids drug molecules. Upon successful completion of this course students may get job opportunities in food, beverage and pharmaceutical industries.</td></tr>
<tr><td colspan="3">Course Outcomes:
CO1- Preparation of organic compounds
CO2- Crystallization and determination of melting points.</td></tr>
<tr><td colspan="2">Credits:2</td><td>Type of Course: Core</td></tr>
<tr><td>Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="2"></td></tr>
<tr><td>Unit I</td><td colspan="2">Organic Chemistry-I
(a) Preparation of organic compounds:
1. Acetanilide
2. p-bromoacetanilide
3. picrates</td></tr>
<tr><td>Unit II</td><td colspan="2">Organic Chemistry-II
(b) Crystallization and determination of melting point.
1. Phthalic acid from hot water (using fluted filter paper and stemless funnel)
2. Acetanilide from boiling water
3. Naphthalene from ethanol
4. Benzoic acid from water</td></tr>
<tr><td colspan="3">Suggested Text Book Readings:
1. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012).
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry</i, Pearson Education.
3. Vogel’s Qualitative Inorganic Analysis, Revised by G. Svehla.
4. Vogel, A.I. A Textbook of Quantitative Analysis, ELBS. 1986
5. Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. Vogel’s Textbook of Practical Organic Chemistry</i, ELBS.
6. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry</i,Universities Pres
7. Cooper, T.G. Tool of Biochemistry. Wiley-Blackwell (1977).
8. Wilson, K. & Walker, J. Practical Biochemistry. Cambridge University Press (2009).
9. Varley, H., Gowenlock, A.H & Bell, M.: Practical Clinical Biochemistry, Heinemann,
Suggestive digital platforms web links
1. https://www.labster.com/chemistry-virtual-labs/
2. https://www.vlab.co.in/broad-area-chemical-sciences
3. http://chemcollective.org/vlabs</td></tr>
<tr><td colspan="3">This course can be opted as an elective by the students of following subjects:</td></tr>
<tr><td colspan="3">Suggested equivalent online courses (MOOCs) for credit transfer:</td></tr>
<tr><td colspan="3">Electronic media and other digital components in the curriculum:
Choose any one or more than:e-SLM/ Other electronic and digital contents</td></tr>
<tr><td colspan="2">Name of electronic media: e-SLM</td><td>Year of incorporation: 2021</td></tr>
</table>

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="4">Course prerequisites: 10+2 Chemistry as subject</td></tr>
<tr><td colspan="2">Programme: B.Sc.</td><td>Year:1</td><td>Semester:2</td></tr>
<tr><td colspan="4">Subject: Chemistry</td></tr>
<tr><td colspan="2">Course Code: SBSCHE -02N</td><td colspan="2">Course Title: ADVANCED ANALYTICAL TECHNIQUES</td></tr>
<tr><td colspan="4">Course Objectives:
To gain basics about analytical chemistry plays an enormous role in our society, such as in drug manufacturing, process control in industry, environmental monitoring, medical diagnostics, food production, and forensic surveys. It is also of great importance in different research areas.</td></tr>
<tr><td colspan="4">Course Outcomes:
CO1- Students will be able to explore Analytical chemistry is a science that is directed towards creating new knowledge so that chemical analysis can be improved to respond to increasing or new demands.
CO2- Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
CO3- Students will be able to function as a member of an interdisciplinary problem solving team.
CO4- Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems
CO5- Students will gain an understanding of how to determine the structure of organic molecules using IR and NMR spectroscopic techniques
CO6- To develop basic skills required for purification, solvent extraction, TLC and column chromatography</td></tr>
<tr><td colspan="3">Credits: 4</td><td>Type of Course: Core</td></tr>
<tr><td colspan="3">Category of Course</td><td>Value-added / employability/</td></tr>
<tr><td colspan="2">Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="3"></td></tr>
<tr><td>Unit I</td><td colspan="3">Statistical Analysis
Definition of terms mean and median, precision, standard deviation, relative standard deviation, accuracy, absolute error, types of error in experimental data, determinate (systematic), indeterminate (or random) and gross, sources of errors and effects upon the analytical results, methods for reporting analytical data, statistical evaluation of data, indeterminate errors, uses of statistics.</td></tr>
<tr><td>Unit II</td><td colspan="3">Volumetric analysis
General principles of acid – base titration, precipitation titration, oxidation-reduction titration, iodimetry and iodometry, complexometric titrations, use of EDTA for the determination of Ca^{2+} and Mg^{2+} and hardness of water, types of EDTA titrations, metal ion indicators.</td></tr>
<tr><td>Unit III</td><td colspan="3">Gravimetric analysis
Precipitation from homogeneous medium, purity of precipitates, co-precipitation, post-precipitation, washing and ignition of precipitates, contamination and their removal.</td></tr>
<tr><td>Block 2</td><td colspan="3"></td></tr>
<tr><td>Unit IV</td><td colspan="3">Separation techniques
Principle, technique and analytical applications of the following:
(a) Solvent extraction
(b) Chromatography (Paper, Thin Layer, Column and HPLC)
(c) Ion exchange</td></tr>
<tr><td>Unit V</td><td colspan="3">Nano Chemistry</td></tr>
</table>

	Nanomaterials – An Introduction, Size Effects, Defining Nanodimensional Materials, Potential Uses for Nanodimensional Materials, The General Methods Available for the Synthesis of Nanodimensional Materials, Precipitative Methods, Reactive Methods in High Boiling Point Solvents, Hydrothermal and Solvothermal Methods, Gas-Phase Synthesis of Semiconductor Nanoparticles, Synthesis in a Structured Medium, The Suitability of Such Methods for Scaling, Conclusions and Perspectives on the Future, Oxide Nanoparticles, Nanotubes and Nanowires. Study of different characterization tools (XRD, TEM, SEM, AFM, etc.) for Nanomaterials.

Suggested Text Book Readings:

1. Alberty,R A, Physical Chemistry,4 th editionWiley Eastern Ltd ,2001.
2. Atkins,P W,the elements of physical chemistry,Oxford ,1991
3. Barrow,G .M,International student Edition .McGraw Hill, McGraw-Hill,1973.
4. Cotton,F.A, Wilkinson,G and Gaus,P. L ,Basic Inorganic Chemistry,3rd Edition ,Wiley 1995
5. Lee,J.D, Concise Inorganic Chemistry 4th Edition ELBS,1977
6. Clayden, J., Greeves, N., Warren, S., *Organic Chemistry,* Second edition, Oxford University Press 2012.
7. Silverstein, R. M., Bassler, G. C., Morrill, T. C. *Spectrometric Identification of Organic Compounds*, John
Wiley and Sons, INC, Fifth edition.
8. Pavia, D. L. *et al. Introduction to Spectroscopy,* 5th Ed. Cengage Learning India Ed.
9. Willard, H.H. *et al.*: *Instrumental Methods of Analysis*, 7th Ed. Wardsworth Publishing Company, Belmont,
California, USA, 1988.
10. Christian, G.D. *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.
11. Harris, D.C.: *Exploring Chemical Analysis*, 9th Ed. New York, W.H. Freeman, 2016.
12. Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age International Publisher, 2009.

This course can be opted as an elective by the students of following subjects:

Suggested equivalent online courses (MOOCs) for credit transfer:

1. **Analytical Chemistry, Prof. Debashis Ray, https://onlinecourses.nptel.ac.in/noc22_cy61/preview**
2. **Spectroscopic Techniques for Pharmaceutical and Biopharmaceutical Industries, Prof. Shashank Deep, https://onlinecourses.nptel.ac.in/noc22_cy54/preview**

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2021

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="3">Course prerequisites: Chemistry in 10+2 Level</td></tr>
<tr><td>Programme: B.Sc.</td><td>Year:2</td><td>Semester:3</td></tr>
<tr><td colspan="3">Subject: Chemistry</td></tr>
<tr><td>Course Code: UGCHE -103N</td><td colspan="2">Course Title: PHYSICAL CHEMISTRY I (BASIC PHYSICAL CHEMISTRY)</td></tr>
<tr><td colspan="3">Course Objectives:
To get basic knowledge about computers and mathematical functions and understanding of gaseous state, critical phenomenon, liquid state, solid state, colloidal state and liquid crystals.</td></tr>
<tr><td colspan="3">Course Outcomes:
CO-1- Students would gain knowledge regarding the basic of computers and mathematical concepts of log, permutation and combination, differential and integration of some relevant functions.
CO-2- Student would gain understanding of gaseous state, critical phenomenon, liquid state, solid state, colloidal state and liquid crystals.
CO-3- It would help students recognize the importance of chemical kinetics and catalysis.</td></tr>
<tr><td colspan="2">Credits:2</td><td>Type of Course: Core</td></tr>
<tr><td colspan="2">Category of Course</td><td>Value-added / employability/</td></tr>
<tr><td>Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="2"></td></tr>
<tr><td>Unit I</td><td colspan="2">Mathematical Concepts and Computers
Unit 1: Mathematical Concepts and Computers
(A) Mathematical Concepts
Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like $f_{(x)}$, e_x, x_n, sin x, log x; maxima and minima, partial differentiation and eciprocity relations. Integration of some useful/relevant functions; permutations and combinations, Factorials, Probability and Regrrations.
(B) Computers
General introduction to computers, different components of a computer, hardware and software, input-output devices; binary numbers and arithmetic; introduction to computer languages. Programming, operating systems. Use and application of different software in the Chemistry.</td></tr>
<tr><td>Unit II</td><td colspan="2">Gaseous and Liquid States
(A) Gaseous States
Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of state.
Critical Phenomena : PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.
Molecular Velocities : Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases.
(B) Liquid State
Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases.</td></tr>
</table>

	Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic, smectic and cholesteric phases and applications.
Unit III	**Solid State** Definition of space lattice and unit cell. **Laws of crystallography**: (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry - Symmetry elements in crystals. **X-ray diffraction:** Derivation of Bragg's equation. Determination of crystal structure of NaCl, CsCl and KCl. A brief introduction to point defects in crystals, semiconductors, superconductors and nanomaterials (only qualitative idea).
Block 2	
Unit IV	**Thermodynamics – I** Definition of terms: system, surroundings, open system, isolated system, intensive and extensive properties, State and path functions and their differentials, reversible and irreversible processes, Concept of heat and work. *First Law of Thermodynamics*: Concepts of internal energy and enthalpy, heat capacities at constant volume and constant pressure and their relationship. Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for a reversible process. *Thermochemistry :* standard state, standard enthalpy of formation- Hess's Law of constant heat summation and its applications, heat of reaction at constant pressure and at constant volume, Bond dissociation energy and its calculation from thermo-chemical data, Kirchhoff's equation.
Unit V	**Electrochemistry – I and Solution** Electrical transport - conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Activity and activity coefficient. Transport number, definition and determination by Hittorf method and moving boundary method. **Solution** Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.
Unit VI	**Chemical Kinetics and Catalysis** Rate of a reaction- factors influencing the rate of a reaction such as concentration, temperature, pressure, solvent, light and catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions - zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction - differential method, method of integration, method of half life

	period and isolation method. Radioactive decay as a first order phenomenon. Experimental methods for the studies of chemical kinetics. **Theories of chemical kinetics**: Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy, Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects. **Catalysis:** Characteristics of catalyzed reactions, classification of catalysis, Industrial catalysts and enzyme kinetics.

Suggested Text Book Readings:

Text Books (Theory Courses):

a. Physical Chemistry, Puri Sharma & Pathania.

b. Pradeep Physical Chemistry, Khetrapal, Pradeep Publication.

c. Computers and Common Sense, R. Hunt and Shelly, Prentice Hall.

Reference Books:

a. Physical Chemistry. G.M. Barrow. International Student Edition, McGrawHill

b. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.

c. The Elements of Physical Chemistry, P.W. Atkins, Oxford.

d. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.

e. Basic Programming with Application, V.K. Jain, Tata McGraw Hill.

f. Physical Chemistry, Glasstone

Suggestive digital platforms web links

1. https://www.coursera.org/courses?query=chemistry&languages=en
2. https://www.mooc-list.com/tags/physical-chemistry
3. https://www.coursera.org/learn/physical-chemistry
4. https://ocw.mit.edu/courses/chemistry/5-61-physical-chemistry-fall-2017/
5. http://heecontent.upsdc.gov.in/Home.aspx
6. https://nptel.ac.in/courses/104/108/104108078/
7. https://nptel.ac.in/courses/104/108/104108124/
8. https://nptel.ac.in/courses/104/106/104106122/

This course can be opted as an elective by the students of following subjects:

Suggested equivalent online courses (MOOCs) for credit transfer:

1. **Chemical Crystallography, Prof. Angshuman Roy Choudhury, https://onlinecourses.nptel.ac.in/noc22_cy48/preview**

Electronic media and other digital components in the curriculum:

Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2021

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="4">Course prerequisites: Chemistry in 10+2 Level</td></tr>
<tr><td colspan="2">Programme: B.Sc.</td><td>Year:2</td><td>Semester:4</td></tr>
<tr><td colspan="4">Subject: Chemistry</td></tr>
<tr><td colspan="2">Course Code: UGCHE -104N</td><td colspan="2">Course Title: INORGANIC CHEMISTRY II (ADVANCE INORGANIC CHEMISTRY)</td></tr>
<tr><td colspan="4">Course Objectives:
• To give basic knowledge about Chemistry of transition and inner-transition elements.
• To give basic knowledge about Concepts of coordination chemistry and their applications
• To give basic knowledge about Importance and different chemical aspects of non-aqueous solvents</td></tr>
<tr><td colspan="4">Course Outcomes:
CO-1 Chemistry of transition and inner-transition elements. These insights are important as they help in the rational selection of the cations of these elements for tailor-made syntheses of newer complexes
CO-2 Concepts of coordination chemistry and their applications
CO-3 Importance of different acid-base concepts which forms the basis of rational ligand designing and coordination complex formation for specific bioinorganic, materials and optoelectronic applications.
CO-4 Importance and different chemical aspects of non-aqueous solvents which now-a-days are gaining importance in varied targeted syntheses of drugs and materials for technological applications</td></tr>
<tr><td colspan="2">Credits:2</td><td colspan="2">Type of Course: Core</td></tr>
<tr><td colspan="2">Category of Course</td><td colspan="2">value-added / employability/</td></tr>
<tr><td colspan="2">Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="3"></td></tr>
<tr><td>Unit I</td><td colspan="3">Molecular Symmetry
Symmetry Elements, Symmetry Operations and Point groups of different compounds.
Character Tables of H_2O and NH_3.</td></tr>
<tr><td>Unit II</td><td colspan="3">Chemistry of Transition Elements
Position in periodic table, electronic configuration, General Characteristics, viz., atomic and ionic radii, variable oxidation states, ability to form complexes, formation of coloured ions and catalytic behaviour. General comparative treatment of 4d and 5d (Zr/Hf , Nb/Ta , Mo/W) elements with their 3d analogues with respect to ionic radii, oxidation states and magnetic properties.</td></tr>
<tr><td>Unit III</td><td colspan="3">Coordination Compounds
(i) Definition of ligand: Classification with respect to denticity. (Examples of mono- to hexadentate ligands).
(ii) IUPAC-Nomenclature of Transition Metal complexes.
(iii) Werner’s postulates, Sidgwick’s effective atomic number concept and limitations, Valence Bond Theory of coordination compounds, Stereochemistry of coordination numbers two, four, five and six with examples of hybrid orbital participation in the following :</td></tr>
</table>

	$[Ag(NH_3)_2]$+, $[Ag(CN)_2]^-$, $[Ni(CN)_4]^{n-}$ (n=2 and 4), $[Cu(NH3)4]^{2+}$, $[Zn(NH_3)_4]^{2+}$, $[MnO_4]^-$, $[Fe(CN)_6]^{n-}$ (n=3 and 4), $[FeF_6]^{3-}$, $[Fe(H_2O)_6]^{3+}$, $[Fe(C_2O_4)_3]^3$-, $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^3$+, $[Ni(NH_3)_6]^{2+}$, $[PbCl_6]^{2-}$ (iv) Stability Constant of Transition Metal complexes and Chelate effect (v) Various types of isomerism, viz., hydrate, ionisation, linkage, polymerization and coordination position. Stereoisomerism in C.N.-4 and C.N.-6 (only $ML_4L'_2$ and $ML_3L'_3$ complexes).
Block 2	
Unit IV	**Chemistry of Lanthanides and Actinides** i. Electronic Configuration, ii. Atomic, Ionic radii and Lanthanide Contraction. iii. Ionisation energy , iv. Calculation of magnetic moments and correlation with experimental data (specially for lanthanides), v. Colour and spectral behaviour, vi. Oxidation states and their stability, vii. Ability to form complexes and examples of complexes of different coordination numbers. viii. Occurrence and principle of separation of lanthanides. ix. Chemistry of separation of Np, Pu and Am from U and x. One synthesis each of Np to Lr.
Unit V	**Chemistry of Nobel Gases** Properties, Occurrence, Isolations and Applications. Chemistry of Noble Gases, Compounds of Xenon & Krypton and their reactions. Clathrates.
Unit VI	**Acid - Base and Non-aqueous solvents** **Acid - Base concept -**Lewis concept, Concept and classification of hard and soft acids and bases. Applications of HSAB principle. **Non-aqueous solvents-**Classification and characteristic properties of solvents. Types of chemical reactions occurring in liquid ammonia (NH_3) and liquid sulphur dioxide (SO_2).
Suggested Text Book Readings: Text Books (Theory Courses): a. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science Ltd. b. Inorganic Chemistry, Puri, Sharma, Kalia and Kaushal. c. Pradeep's Inorganic Chemistry, K.K. Bhasin, Pradeep Publication. d. Chemistry for degree students, R. L. Madan Reference Books: a. Inorganic Chemistry, J.E. Huheey, Ellen A. Keiter, Richard L. Keiter, Addison Wesley Longman (Singapore) Pvt. Ltd. b. Inorganic Chemistry, D.E. Shriver, P W. Atkins and C.H.L. Langford, Oxford. c. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley. d. Concepts of Models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J Alexander, John Wiley. e. Inorganic Chemistry, W.W. Porterfield, Addison - Wesley. f. Inorganic Chemistry, A.G. Sharpe, ELBS g. Inorganic Chemistry, G.L. Meissler and D.A. Tarr, Prentice-Hall.	

Suggested online links:
http://heecontent.upsdc.gov.in/Home.aspx
https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
https://nptel.ac.in/courses/104/103/104103071/#
https://swayam.gov.in/

This course can be opted as an elective by the students of following subjects:

Suggested equivalent online courses (MOOCs) for credit transfer: Attempt all courses

1. Symmetry and Group Theory , Prof. Anindya Datta NPTEL , https://onlinecourses.nptel.ac.in/noc22_cy40/preview
2. Transition Metal Organometallic Chemistry: Principles To Applications , Prof. P. Ghosh , NPTEL https://onlinecourses.nptel.ac.in/noc22_cy39/preview
3. Advanced Transition Metal , Prof. M S Balakrishna , NPTEL https://onlinecourses.nptel.ac.in/noc22_cy60/preview
4. Chemistry of d-block elements, Quantum Chemistry and Spectroscopy, Dr. Niraj Upadhyay , Dr. Harisingh Gour Vishwavidyalaya, Sagar https://onlinecourses.swayam2.ac.in/cec22_cy05/preview

Electronic media and other digital components in the curriculum:
Choose any one or more than:(Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents**)**

Name of electronic media: e-SLM	Year of incorporation: 2021

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="3">Course prerequisites: Chemistry in 10+2 Level</td></tr>
<tr><td>Programme: B.Sc.</td><td>Year:2</td><td>Semester:3</td></tr>
<tr><td colspan="3">Subject: Chemistry</td></tr>
<tr><td>Course Code: SBSCHE-01N</td><td colspan="2">Course Title: ORGANIC CHEMISTRY II (ADVANCE ORGANIC CHEMISTRY)</td></tr>
<tr><td colspan="3">Course Objectives:
To provide knowledge about preparation and chemical reactions of Alcohols and Epoxides - Alcohols Dihydric alcohols: (Ethylene Glycol)
To provide basic knowledge about the order of reactivity of different carboxylic acid derivatives and the reactivity of different carboxylic acid derivatives.
To provide knowledge about mechanism of named reactions of carbonyl compounds and condensation reactions as well as their use in food and pharmaceuticals.</td></tr>
<tr><td colspan="3">Course Outcomes:
CO-1 The preparation and chemical reactions of Alcohols and Epoxides - Alcohols Dihydric alcohols: (Ethylene Glycol)
CO-2 Understanding the order of reactivity of different carboxylic acid derivatives and the reactivity of different carboxylic acid derivatives.
CO-3 Able to recognize structures of acid halides, esters, amides, acid anhydrides.
CO-4 Able to write down structure of phenol and phenoxide ion and chemical reactions of phenols.
CO-5 Know the mechanism of named reactions of carbonyl compounds and condensation reactions as well as their use in food and pharmaceuticals.</td></tr>
<tr><td colspan="2">Credits:4</td><td>Type of Course: Core</td></tr>
<tr><td colspan="2">Max. Marks: 100</td><td>Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="2"></td></tr>
<tr><td>Unit I</td><td colspan="2">Electromagnetic Absorption Spectra
Electromagnetic Radiations, Electromagnetic spectrum and absorption of radiations. The Absorption Laws. UV-Visible spectrophotometer, formation of Absorption Band. Chromatophore Concept, Calculation of Absorption Maximum. Infra Red Spectroscopy Fundamental and Applications.</td></tr>
<tr><td>Unit II</td><td colspan="2">Alcohols and Phenols
Classification and nomenclature. Monohydric alcohols – nomenclature, methods of formation by reduction of aldehydes, Ketones, Carboxylic acids and Esters, Hydrogen bonding, Acidic nature, Reactions of alcohols. Dihydric alcohols – nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacolo-pinacolone rearrangement. Trihydric alcohols – nomenclature and methods of formation, chemical reactions of glycerol.
Phenols
Nomenclature, structure and bonding, Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries</td></tr>
</table>

	rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer- Tiemann reaction.
Unit III	**Ethers and Epoxide** **Ethers** Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions – cleavage and autoxidation, Ziesel's method. Williamson's synthesis, formation and cleavage of oxonium salts, elementary idea about crown ethers. **Epoxides** Synthesis of epoxides, Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.
Block 2	
Unit IV	**Aldehydes and Ketones** Nomenclature and structure of the carbonyl groups, synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of alkedydes and ketones using 1,3-dithianes, synthesis of ketones from nitrites and from carboxylic acids. Physical properties. Mechnism of nucleophillic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Use of acetals as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones. An introduction to α,β unsaturated alkehydes and ketones.
Unit V	**Carboxylic Acids and Derivatives** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction, Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids, Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids, Hydroxy acids: malic, tartaric and citric acids. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents. **Carboxylic Acid Derivatives** Structure and nomenclature of acid chlorides, esters, amides(urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).
Unit VI	**Organic Compounds of Nitrogen** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. Halonitroarenes: reactivity, Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural

	features effecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitrites), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

Suggested Text Book Readings:
a) Organic Chemistry, Morrison and Boyd, Prentice Hall.
b) Organic Chemistry, L.G. Wade Jr. Prentice Hall
c) Fundamentals of Organic Chemistry Solomons, John Wiley.
d) Organic Chemistry, Vol. I, II, III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
e) Organic Chemistry, F.A. Carey, McGraw-Hill Inc.
f) Introduction to Organic Chemistry, Streitwiesser, Hathcock and Kosover, Macmillan.
g) Organic Chemistry, Vol. I, II, I.L. Finar
h) Spectrometric Identification of organic compounds. Robert M. Silverstein, Clayton G. Bassler, Terence C. Morril, John Wiley.

Suggested online links:
http://heecontent.upsdc.gov.in/Home.aspx
https://nptel.ac.in/courses/104/105/104105124/
https://nptel.ac.in/courses/103/106/105106204/
https://nptel.ac.in/courses/104/105/104105034/
https://nptel.ac.in/courses/104/103/104103121/
https://nptel.ac.in/courses/104/102/104102016/
https://nptel.ac.in/courses/104/106/104106106/
https://nptel.ac.in/courses/104/105/104105120/

This course can be opted as an elective by the students of following subjects:

Suggested equivalent online courses (MOOCs) for credit transfer:

1. **Organic Chemistry-1, Dr. B. S. Balaji,** Jawaharlal Nehru University, https://onlinecourses.swayam2.ac.in/cec22_cy06/preview
2. **Reagents In Organic Synthesis, Prof. Subhas Chandra Pan, https://onlinecourses.nptel.ac.in/noc22_cy55/preview**
3. **Introductory Organic Chemistry II, Prof. Neeraja DashaputreProf. Harinath Chakrapani, https://onlinecourses.nptel.ac.in/noc22_cy46/preview**

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2021

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="4">Course prerequisites: Chemistry in 10+2 Level</td></tr>
<tr><td colspan="2">Programme: B.Sc.</td><td>Year: 3</td><td>Semester:5</td></tr>
<tr><td colspan="4">Subject: Chemistry</td></tr>
<tr><td colspan="2">Course Code: DCECHE -105N</td><td colspan="2">Course Title: PHYSICAL CHEMISTRY II (ADVANCE PHYSICAL CHEMISTRY)</td></tr>
<tr><td colspan="4">Course Objectives:
To undersand basic knowledge about first law and second law of thermodynamics, thermochemistry, entropy enthalpy etc.</td></tr>
<tr><td colspan="4">Course Outcomes:
CO-1- After the completion of the semester, student will acquire knowledge of first law and second law of thermodynamics, thermochemistry, entropy enthalpy etc.
CO-2- It will also make them familiar with conductance, equivalent conductance, Kohlrausch’s law, Ostwald dilution law, Deby-Huckel Onsagar equation, e.m.f. of cell, types of cell, liquid junction potential, pH and pka, Henderson- Hazel equation etc.</td></tr>
<tr><td colspan="2">Credits: 2</td><td colspan="2">Type of Course: Core</td></tr>
<tr><td colspan="2">Category of Course(Please mention category of course; It may have more than one option)</td><td colspan="2">employability/ skill development/</td></tr>
<tr><td colspan="2">Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="3"></td></tr>
<tr><td>Unit I</td><td colspan="3">Chemical Equilibrium and Phase Equlibrium
Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chattelier's principle.
Phase Equilibrium
Statement and meaning of the terms - phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system - water, Sulpher and Hellium. First and second order phase transitions. Phase equilibria of two component systems - solid-liquid equilibria, simple eutectic - Pb-Ag system, desilverisation of lead, Systems involving compound formation with a congruent melting point (Mg-Zn) and an incongruent melting point (CuSO4-H2O). Nernst distribution law and its thermodynamic derivation</td></tr>
<tr><td>Unit II</td><td colspan="3">Thermodynamics –II
Second law of thermodynamics: concept of entropy, entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical process.
Gibbs and Helmholtz functions; Criteria for thermodynamic equilibrium and spontaneity in term of changes in entropy, Gibbs and Helmholtz functions. Concept of chemical potential.</td></tr>
<tr><td>Unit III</td><td colspan="3">Electrochemistry – II
Types of reversible electrodes - gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference</td></tr>
</table>

	electrodes-standard electrode potential, sign conventions, electrochemical series and its significance. **Electrolytic and Galvanic cells -** reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K). Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations. Definition of pH and pKa determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. **Buffers -** mechanism of buffer action, Henderson-Hazel equation. Hydrolysis of salts. Electrochemical corrosion and its prevention.
Block 2	
Unit IV	**Colloidal State and Macromolecules** Definition of colloids and classification of colloids. Donnan membrane theory and its application. Electrokinetic Potential (Zeta potential). **Solids in liquids (sols):** properties - kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. **Liquids in liquids (emulsions**): types of emulsions, preparation, Emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids. **Macromolecules :** Determination of molecular weight of macromolecules by osmotic pressure and viscosity methods. Concepts of micelles and critical micelle concentrations. A brief introduction to conducting and light emitting polymers.
Unit V	**Surface Phenomenon** **Surface Chemistry** Adsorption, difference between Physical adsorption and chemisorption, Adsorption isotherms - Langmuir adsorption isotherm and Freundlich adsorption isotherm, Gibbs adsorption equation, BET equation, Determination of surface area.
Unit VI	**Physical Properties and Chemical Constitution** Molar volume, Parachor Molar refraction and Polarisation, Dipolemoment, Debey equation (derivation not required) and Clausius-Mosotti equation.
Suggested Text Book Readings: a. Physical Chemistry. G.M. Barrow. International Student Edition, McGraw Hill. b. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd. c. The Elements of Physical Chemistry, P.W. Atkins, Oxford. d. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd. e. Graduate physical Chemistry, Volume I-III By L.R. Sharma and M.S. Pathania f. Principles of Physical Chemistry by B.R. Puri, L.P Sharma and M.S. Pathania, Vishal publication, Jalandhar. **Suggestive digital platforms web links** 1. https://www.coursera.org/courses?query=chemistry&languages=en 2. https://www.mooc-list.com/tags/physical-chemistry 3. https://www.coursera.org/learn/physical-chemistry	

4. https://ocw.mit.edu/courses/chemistry/5-61-physical-chemistry-fall-2017/
5. http://heecontent.upsdc.gov.in/Home.aspx
6. https://nptel.ac.in/courses/104/108/104108078/
7. https://nptel.ac.in/courses/104/108/104108124/
8. https://nptel.ac.in/courses/104/106/104106122/

This course can be opted as an elective by the students of following subjects:

Suggested equivalent online courses (MOOCs) for credit transfer:

1. **Chemistry and Physics of Surfaces and Interfaces, Prof. Thiruvancheril G. Gopakumar, NPTEL, https://onlinecourses.nptel.ac.in/noc22_cy57/preview**
2. **Introduction to Chemical Thermodynamics and Kinetics, Prof. Arijit Kumar De, NPTEL, https://onlinecourses.nptel.ac.in/noc22_cy58/preview**

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2021

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="3">Course prerequisites: Chemistry in 10+2 Level</td></tr>
<tr><td>Programme: B.Sc.</td><td>Year:3</td><td>Semester:5</td></tr>
<tr><td colspan="3">Subject: Chemistry</td></tr>
<tr><td>Course Code: DCECHE -106</td><td colspan="2">Course Title: INORGANIC CHEMISTRY III (SELECTED TOPICS IN INORGANIC CHEMISTRY)</td></tr>
<tr><td colspan="3">Course Objectives:
• To provide basic knowledge about chemistry of transition and inner-transition elements, Concepts of coordination chemistry and their applications
• To provide basic knowledge about importance of different acid-base concepts.</td></tr>
<tr><td colspan="3">Course Outcomes:
CO-1 Chemistry of transition and inner-transition elements. These insights are important as they help in the rational selection of the cations of these elements for tailor-made syntheses of newer complexes
CO-2 Concepts of coordination chemistry and their applications
CO-3 Importance of different acid-base concepts which forms the basis of rational ligand designing and coordination complex formation for specific bioinorganic, materials and optoelectronic applications.
CO-4 Importance and different chemical aspects of non-aqueous solvents which now-a-days are gaining importance in varied targeted syntheses of drugs and materials for technological applications</td></tr>
<tr><td colspan="2">Credits: 2</td><td>Type of Course: Elective</td></tr>
<tr><td>Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="2"></td></tr>
<tr><td>Unit I</td><td colspan="2">Metal-ligand Bonding in Transition Metal Complexes
Limitations of valance bond theory, an elementary idea of crystal field theory, Crystal Field Stabilization Energy (CFSE), crystal field splitting in octahedral, tetrahedral and square planner complexes, factors affecting the crystal-field parameters.
Thermodynamic and Kinetic Aspects of Metal Complexes
A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes and trans effect.</td></tr>
<tr><td>Unit II</td><td colspan="2">Magnetic and Electronic spectra of Transition Metal Complexes
(a) Electronic spectra of Transition Metal Complexes
Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.
(b) Magnetic Properties of Transition Metal Complexes
Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μs and μeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.</td></tr>
<tr><td>Unit III</td><td colspan="2">Organometallic Chemistry
Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and catalytic applications of alkyls and aryls of Li, Al, Hg, Sn.</td></tr>
<tr><td>Block 2</td><td colspan="2"></td></tr>
</table>

Unit IV	**Metal Carbonyls and Nitrosyls** **(a) Metal Carbonyls :** Ligand behaviour of CO, General methods of preparation, 18 electron rule, nature of bonding (Synergic effect) in the mononuclear carbonyls, Representation of structures of the binary carbonyls of all nuclearities of V, Cr, Mn, Fe, Co and Ni. **(b) Metal Nitrosyls :** Ligand behaviour of NO (NO^+, NO^- and bridging NO), preparation and structures of nitrosyls of Cr, Fe and Ru; carbonyl nitrosyls and cyano nitrosyls
Unit V	**Inorganic Polymers** **Silicones and Phosphazenes** Silicons and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.
Unit VI	**Inorganic Biochemistry** Essential and trace elements in biological processes, metalloporphyrins with special reference to oxygen carrieres hemoglobin chemistry and myoglobin. Vitamin B-12, Nitogenase and Chlorophyll structure and applications. Biological role of alkali and alkaline earth metal ions with special reference to Na^+, K^+ and Ca^{2+}.
Unit VII	**Environmental Chemistry and Green Chemistry** (a) **Environmental Chemistry** :The earth's atmosphere and its components, Lapse rate, Types of pollutants and their sources (in water, Air and Soil). Green house effect and global warming. Acid rains, Ozone layer (Importance and its protection). **(b) Green Chemistry** Principles and concept of green chemistry, atom economic and noneconomic reactions, reducing toxicity, a few examples of environmental friendly reactions and reaction media.
Unit VIII	**Metal and Metallurgy** General principles of extraction and purification of metals. Occurrence and isolation of elements, Extraction and isolation of Metals (Y, La, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe, Co, Ni and platinum) from their minerals.

Suggested Text Book Readings:

a. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science Ltd.

b. Inorganic Chemistry, Puri, Sharma, Kalia and Kaushal.

c. Pradeep's Inorganic Chemistry, K.K. Bhasin, Pradeep Publication.

d. Chemistry for degree students, R. L. Madan

Reference Books:

a. Inorganic Chemistry, J.E. Huheey, Ellen A. Keiter, Richard
L. Keiter, Addison Wesley Longman (Singapore) Pvt. Ltd.

b. Inorganic Chemistry, D.E. Shriver, P W. Atkins and C.H.L. Langford, Oxford.

c. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson and P.L. Gaus, Wiley.

d. Concepts of Models of Inorganic Chemistry, B. Douglas, D.
Mc Daniel and J Alexander, John Wiley.

e. Inorganic Chemistry, W.W. Porterfield, Addison - Wesley.

f. Inorganic Chemistry, A.G. Sharpe, ELBS

g. Inorganic Chemistry, G.L. Meissler and D.A. Tarr, Prentice-Hall.

Suggestive digital platforms web links:

https://swayam.gov.in/

https://www.coursera.org/learn/physical-chemistry https://www.mooc-list.com/tags/physical-chemistry https://www.openlearning.com/courses/introduction-to-physical-chemistry/ https://www.my-mooc.com/en/categorie/chemistry https://onlinecourses.swayam2.ac.in/nce19_sc15/preview https://www.coursera.org/browse/physical-science-and-engineering/chemistry
This course can be opted as an elective by the students of following subjects:
Suggested equivalent online courses (MOOCs) for credit transfer:
Electronic media and other digital components in the curriculum: **Choose any one or more than:**e-SLM/Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2022

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="3">Course prerequisites: Chemistry in 10+2 Level</td></tr>
<tr><td>Programme: B.Sc.</td><td>Year:3</td><td>Semester:6</td></tr>
<tr><td colspan="3">Subject: Chemistry</td></tr>
<tr><td>Course Code: DCECHE -108</td><td colspan="2">Course Title: ORGANIC CHEMISTRY III (SELECTED TOPICS IN ORGANIC CHEMISTRY)</td></tr>
<tr><td colspan="3">Course Objectives: This course will provide basic qualitative and quantitative experimental knowledge of biomolecules such as carbohydrates, proteins, amino acids, nucleic acids drug molecules. Upon successful completion of this course students may get job opportunities in food, beverage and pharmaceutical industries.</td></tr>
<tr><td colspan="3">Course Outcomes:
CO1: To gain knowledge about qualitative and quantitative experimental knowledge of biomolecules such as carbohydrates, proteins, amino acids, nucleic acids drug molecules.
CO2: To provide knowledge about Organometallic Compounds, Sulphur Containing Compounds and NMR Spectroscopy.</td></tr>
<tr><td colspan="2">Credits:2</td><td>Type of Course: Elective</td></tr>
<tr><td>Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td>Block 1</td><td colspan="2"></td></tr>
<tr><td>Unit I</td><td colspan="2">NMR (PMR) Spectroscopy
Proton magnetic resonance (1H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of 1H NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structures elucidation of simple organic compounds using UV, IR and 1H NMR spectroscopic techniques.</td></tr>
<tr><td>Unit II</td><td colspan="2">Organometallic Compounds
Organomagnesium compounds: the Grignard reagents, formation, structure and Chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.</td></tr>
<tr><td>Unit III</td><td colspan="2">Sulphur Containing Compounds
Nomenclature, structural formation, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides & Sulphaguamidine.</td></tr>
<tr><td>Block 2</td><td colspan="2"></td></tr>
<tr><td>Unit IV</td><td colspan="2">Amino Acids, Peptides, Proteins and Nucleic Acids
Classification, structure and stereochemistry of amino acids. Acid-base behaviour, Isoelectric point and electrophoresis, Preparation and reactions of α–amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins, Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure, Protein denaturation/renaturation.
Nucleic acids: Introduction. Constituents of ncleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.</td></tr>
<tr><td>Unit V</td><td colspan="2">Active Methylene Group</td></tr>
</table>

	Preparation and synthetic applications of ethyl acetoacetate and diethyl malonate, Tautomerism.
Unit VI	**Carbohydrates** Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers, Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+)-glucose. Mechanism of mutarotation. Structures of ribose and deoxyribose. An introduction to disaccarides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.
Unit VII	Problem based on Spectroscopy (UV-Vis., IR and PMR)

Suggested Text Book Readings:

1. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson
(2012).
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education.
3. Vogel's Qualitative Inorganic Analysis, Revised by G. Svehla.
4. Vogel, A.I. A Textbook of Quantitative Analysis, ELBS. 1986
5. Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, ELBS.
6. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry,Universities Pres
7. Cooper, T.G. Tool of Biochemistry. Wiley-Blackwell (1977).
8. Wilson, K. & Walker, J. Practical Biochemistry. Cambridge University Press (2009).
9. Varley, H., Gowenlock, A.H & Bell, M.: Practical Clinical Biochemistry, Heinemann,

Suggestive digital platforms web links

1. https://www.labster.com/chemistry-virtual-labs/
2. https://www.vlab.co.in/broad-area-chemical-sciences
3. http://chemcollective.org/vlabs

This course can be opted as an elective by the students of following subjects:

Suggested equivalent online courses (MOOCs) for credit transfer: Attempt all courses

1. **Application of Spectroscopic Methods in Molecular Structure Determination, Prof. S. Sankararaman, https://onlinecourses.nptel.ac.in/noc22_cy45/preview**
2. **NMR spectroscopy, Prof. R. V Hosur, https://onlinecourses.nptel.ac.in/noc22_cy59/preview**
3. **Organic Chemistry In Biology, Prof. Amit Basak, https://onlinecourses.nptel.ac.in/noc22_cy62/preview**

Electronic media and other digital components in the curriculum:
Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: 2022	Year of incorporation: 2022

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="3">Course prerequisites: Chemistry in 10+2 Level</td></tr>
<tr><td>Programme: B.Sc.</td><td>Year:3</td><td>Semester:6</td></tr>
<tr><td colspan="3">Subject: Chemistry</td></tr>
<tr><td>Course Code: DCECHE -109</td><td colspan="2">Course Title: PHYSICAL CHEMISTRY III (SELECTED TOPICS IN PHYSICAL CHEMISTRY)</td></tr>
<tr><td colspan="3">Course Objectives:
• To provide knowledge about Quantum mechanics as well as of spectroscopy with comprehensive understanding of valence bond model and molecular orbital model.
• To provide knowledge about Ultraviolet absorption spectroscopy, Vibrational, Rotational and Electronic Spectroscopy, Infrared spectroscopy and Bioenergetics</td></tr>
<tr><td colspan="3">Course Outcomes:
CO-1 Quantum mechanics as well as of spectroscopy. They will have comprehensive understanding of valence bond model and molecular orbital model.
CO-2 Ultraviolet absorption spectroscopy, Beer Lambert Law, types of electronic transitions and the effect of conjugation and concept of chromophore and auxochrome.
CO-3 Vibrational, Rotational and Electronic Spectroscopy of simple molecule.
CO-4 Infrared spectroscopy in which characteristic absorptions of various functional groups.
CO-5 Bioenergetics-Gibbs and Helmholtz energies with special emphasis on biological applications</td></tr>
<tr><td colspan="2">Credits:2</td><td>Type of Course: Core</td></tr>
<tr><td colspan="2">Category of Course</td><td>value-added / employability</td></tr>
<tr><td>Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td colspan="3">(Syllabi should be framed block wise/unit wise; No of blocks and units may change)</td></tr>
<tr><td>Block 1</td><td colspan="2"></td></tr>
<tr><td>Unit I</td><td colspan="2">Elementary Quantum Mechanics
Black-body radiation, Planck’s radiation law, photoelectric effect, heat capacity of solids, Bohr’s model of hydrogen atom (no derivation) and its defects, Compton effect. de Broglie’s hypothesis, the Heisenberg’s uncertainty principle, Hamiltonian operator. Statement of the Born- Oppenheimer approximation, degrees of freedom.</td></tr>
<tr><td>Unit II</td><td colspan="2">Molecular Statistics
The Boltzmann distribution. Maxwell distribution law for distribution of molecular speeds. The Maxwell-Boltzmann distribution law for the distribution of molecular energies. The partition functions. Thermodynamic quantities from partition functions. The Sackur-Tetrode equation for molar entropy of monatomic gases. Rotational and vibrational partition functions. The characteristic temperature. The calculation of Gibbs free energy changes and equilibrium constant in terms of partition functions.</td></tr>
<tr><td>Unit III</td><td colspan="2">Laws of Photochemistry
Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus – Drapper law, Stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, nonradiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple examples).</td></tr>
</table>

Block 2	
Unit IV	**Vibrational, Rotational and Electronic Spectroscopy** **Rotational Spectrum:** Diatomic molecules: Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect. **Vibrational Spectrum:** *Infrared spectrum*: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of of different functional groups. **Raman Spectrum**: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules. **Electronic Spectrum**: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. **Qualitative description of σ, π-** and n M.O., their energy levels and the respective transitions.
Unit V	**Nuclear Chemistry** Nuclear reactions: Bethe notation, types of nuclear reactions (n, p, α, d and γ), conservation of quantities (mass-energy and linear momentum) in nuclear reactions, reaction cross-section, compound nucleus theory and nuclear reactions. Nuclear fission: the process, fragments, mass distribution, and fission energy. Nuclear reactor: the natural uranium reactor, classification of reactors, breeder reactor. Nuclear fusion and stellar energy. **Radiation chemistry:** Elementary ideas of radiation chemistry, radiolysis of water and aqueous solutions, unit of radiation chemical yield (G-value), radiation dosimetry (Fricke's dosimeter), units of radiation energy (Rad, Gray, Rontgen, RBE, Rcm, Sievert).
Unit VI	**Bioenergetics** Gibbs and Helmholtz energies with special emphasis on biological applications: study of energy transformations in living systems (bioenergetics): standard state in biochemistry, ATP-the currency of energy, Glycolysis, limitation of applicability of thermodynamics in biology.
Suggested Text Book Readings: 1. Skoog .D.A., West. D.M and Holler .F.J., "Analytical Chemistry: An Introduction", 7th edition, Saunders college publishing, Philadelphia,(2010). 2. Larry Hargis.G" Analytical Chemistry: Principles and Techniques" Pearson©(1988) Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University Suggestive digital platforms web links 1. https://www.labster.com/chemistry-virtual-labs/ 2. https://www.vlab.co.in/broad-area-chemical-sciences 3. http://chemcollective.org/vlabs	
This course can be opted as an elective by the students of following subjects:	

Suggested equivalent online courses (MOOCs) for credit transfer: 1. **Quantum Chemistry of Atoms and Molecules, Prof. Anindya Datta, https://onlinecourses.nptel.ac.in/noc22_cy41/preview**	
Electronic media and other digital components in the curriculum: **Choose any one or more than:**e-SLM/ Other electronic and digital contents	
Name of electronic media: e-SLM	Year of incorporation: 2022

Syllabus for [B.Sc.]: Subject: [Chemistry]

<table>
<tr><td colspan="3">Course prerequisites: Chemistry in 10+2 Level</td></tr>
<tr><td>Programme: B.Sc.</td><td>Year:3</td><td>Semester: 6th</td></tr>
<tr><td colspan="3">Subject: Chemistry</td></tr>
<tr><td>Course Code: SBSCHE-02N</td><td colspan="2">Course Title: ADVANCED ANALYTICAL TECHNIQUES</td></tr>
<tr><td colspan="3">Course Objectives:
• To provide knowledge about Statistical Analysis
• To provide basic knowledge about Volumetric analysis, Gravimetric analysis and Separation techniques.
• To provide basic knowledge about Nano Chemistry.</td></tr>
<tr><td colspan="3">Course Outcomes:
CO1: To gain knowledge about Statistical Analysis
CO2: To gain basic knowledge about Volumetric analysis, Gravimetric analysis and Separation techniques and about basic knowledge of Nano Chemistry.</td></tr>
<tr><td colspan="2">Credits:4</td><td>Type of Course: Core</td></tr>
<tr><td colspan="2">Category of Course</td><td>value-added / employability/</td></tr>
<tr><td>Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td colspan="3">(Syllabi should be framed block wise/unit wise; No of blocks and units may change)</td></tr>
<tr><td>Block 1</td><td colspan="2"></td></tr>
<tr><td>Unit I</td><td colspan="2">BLOCK-1
Unit 1: Statistical Analysis
Definition of terms mean and median, precision, standard deviation, relative standard deviation, accuracy, absolute error, types of error in experimental data, determinate (systematic), indeterminate (or random) and gross, sources of errors and effects upon the analytical results, methods for reporting analytical data, statistical evaluation of data, indeterminate errors, uses of statistics.</td></tr>
<tr><td>Unit II</td><td colspan="2">Unit 2: Volumetric analysis
General principles of acid – base titration, precipitation titration, oxidation-reduction titration, iodimetry and iodometry, complexometric titrations, use of EDTA for the determination of Ca2+ and Mg2+ and hardness of water, types of EDTA titrations, metal ion indicators.</td></tr>
<tr><td>Unit III</td><td colspan="2">Unit 3: Gravimetric analysis
Precipitation from homogeneous medium, purity of precipitates, co-precipitation, post- precipitation, washing and ignition of precipitates, contamination and their removal.</td></tr>
<tr><td>Block 2</td><td colspan="2"></td></tr>
<tr><td>Unit IV</td><td colspan="2">Unit 4: Separation techniques
Principle, technique and analytical applications of the following:
(a) Solvent extraction
(b) Chromatography (Paper, Thin Layer, Column and HPLC)
(c) Ion exchange</td></tr>
</table>

Unit V	Unit 5: Nano Chemistry Nanomaterials – An Introduction, Size Effects, Defining Nanodimensional Materials, Potential Uses for Nanodimensional Materials, The General Methods Available for theSynthesis of Nanodimensional Materials, Precipitative Methods, Reactive Methods in High Boiling Point Solvents, Hydrothermal and Solvothermal Methods, Gas-Phase Synthesis of Semiconductor Nanoparticles, Synthesis in a Structured Medium, The Suitability of Such Methods for Scaling, Conclusions and Perspectives on the Future, Oxide Nanoparticles, Nanotubes and Nanowires. Study of different characterization tools (XRD, TEM, SEM, AFM, etc.) for Nanomaterials.
Suggested Text Book Readings: 1. Skoog .D.A., West. D.M and Holler .F.J., "Analytical Chemistry: An Introduction", 7th edition, Saunders college publishing, Philadelphia,(2010). 2. Larry Hargis.G" Analytical Chemistry: Principles and Techniques" Pearson©(1988) Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University Suggestive digital platforms web links 1. https://www.labster.com/chemistry-virtual-labs/ 2. https://www.vlab.co.in/broad-area-chemical-sciences 3. http://chemcollective.org/vlabs	
This course can be opted as an elective by the students of following subjects:	
Suggested equivalent online courses (MOOCs) for credit transfer: NA	
Electronic media and other digital components in the curriculum: **Choose any one or more than:**e-SLM/ / Other electronic and digital contents	
Name of electronic media: e-SLM	Year of incorporation 2022

Syllabus for [B.Sc.]: Subject: [Chemistry]

Course prerequisites: Chemistry in 10+2 Level		
Programme: B.Sc.	Year:3	Semester: 6th
Subject: **Chemistry**		
Course Code: **SBSCHE-02N**	Course Title: **ADVANCED ANALYTICAL TECHNIQUES**	

Course Objectives:

- To provide knowledge about Statistical Analysis
- To provide basic knowledge about Volumetric analysis, Gravimetric analysis and Separation techniques.
- To provide basic knowledge about Nano Chemistry.

Course Outcomes:

CO1: To gain knowledge about Statistical Analysis

CO2: To gain basic knowledge about Volumetric analysis, Gravimetric analysis and Separation techniques and about basic knowledge of Nano Chemistry.

Credits:4	Type of Course: Core
Category of Course	value-added / employability/
Max. Marks: 100	Min. Passing Marks: 36

(Syllabi should be framed block wise/unit wise; No of blocks and units may change)

Block 1	
Unit I	BLOCK-1 Unit 1: Statistical Analysis Definition of terms mean and median, precision, standard deviation, relative standard deviation, accuracy, absolute error, types of error in experimental data, determinate (systematic), indeterminate (or random) and gross, sources of errors and effects upon the analytical results, methods for reporting analytical data, statistical evaluation of data, indeterminate errors, uses of statistics.
Unit II	Unit 2: Volumetric analysis General principles of acid – base titration, precipitation titration, oxidation-reduction titration, iodimetry and iodometry, complexometric titrations, use of EDTA for the determination of Ca2+ and Mg2+ and hardness of water, types of EDTA titrations, metal ion indicators.
Unit III	Unit 3: Gravimetric analysis Precipitation from homogeneous medium, purity of precipitates, co-precipitation, post- precipitation, washing and ignition of precipitates, contamination and their removal.
Block 2	
Unit IV	Unit 4: Separation techniques Principle, technique and analytical applications of the following: (a) Solvent extraction (b) Chromatography (Paper, Thin Layer, Column and HPLC) (c) Ion exchange

Unit V	Unit 5: Nano Chemistry Nanomaterials – An Introduction, Size Effects, Defining Nanodimensional Materials, Potential Uses for Nanodimensional Materials, The General Methods Available for theSynthesis of Nanodimensional Materials, Precipitative Methods, Reactive Methods in High Boiling Point Solvents, Hydrothermal and Solvothermal Methods, Gas-Phase Synthesis of Semiconductor Nanoparticles, Synthesis in a Structured Medium, The Suitability of Such Methods for Scaling, Conclusions and Perspectives on the Future, Oxide Nanoparticles, Nanotubes and Nanowires. Study of different characterization tools (XRD, TEM, SEM, AFM, etc.) for Nanomaterials.
Suggested Text Book Readings: 1. Skoog .D.A., West. D.M and Holler .F.J., "Analytical Chemistry: An Introduction", 7th edition, Saunders college publishing, Philadelphia,(2010). 2. Larry Hargis.G" Analytical Chemistry: Principles and Techniques" Pearson©(1988) Note: For the promotion of Hindi language, course books published in Hindi may be prescribed by the University Suggestive digital platforms web links 1. https://www.labster.com/chemistry-virtual-labs/ 2. https://www.vlab.co.in/broad-area-chemical-sciences 3. http://chemcollective.org/vlabs	
This course can be opted as an elective by the students of following subjects:	
Suggested equivalent online courses (MOOCs) for credit transfer: NA	
Electronic media and other digital components in the curriculum: **Choose any one or more than:**e-SLM/ / Other electronic and digital contents	
Name of electronic media: e-SLM	Year of incorporation 2022

Syllabus for [B.Sc.]: Subject: [Computer science]

Course prerequisites: 10+2 with Computer science, Mathematics		
Programme: B.Sc.	Year: 1	Semester: 2
Subject: **Computer science**		
Course Code: SBSCS-02N	Course Title: Python Programming	
Course Objectives: 1. To acquire programming skills in core Python. 2. To explore the use of data structures, strings, text files, lists and dictionaries. 3. To acquire Object Oriented Skills in Python. 4. To understand to solve the problems with Python database, Python multithreading. 5. To work with Django framework, Numpy and other libraries.		
Course Outcomes: CO1. Understand and comprehend the Basics of Python programming. CO2. Describe and explain the use of the built-in data structures list, sets, tuples and dictionary. CO3. Make use of functions, modules and its applications. CO4. Demonstrate the principles of OOPs and identify real-world applications using OOPs, files and exception handling provided by Python.		
Credits: 4	**Type of Course:** Core	
Category of Course	Value-added / employability/	
Max. Marks: 100	Min. Passing Marks: 36	

Block 1	**BASICS OF PYTHON**
Unit I	**UNIT – 1: Introduction:** History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Python IDLE.
Unit II	**Tokens and Statements**: Variables, Constants, Assignment, Multiple Assignment, Keywords, Punctuators, Identifiers, Input-Output, Indentation, Statements, Comments, Single Comment and Multiline Comment.
Unit III	**Data Types, Operators & Expressions:** Types – Integers, Strings, Booleans; Operators-Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Operators precedence, Expressions and order of evaluations Control Flow- if, if-else, if-elif-else, for, while, break, continue, pass.
Block 2	**DATA STRUCTURE IN PYTHON**
Unit IV	**Data Structures:** Stack & Queue, Lists – Operations, Slicing, Methods; Tuples – Operations, Methods , Sets– Operations , Methods, Dictionaries– Operations , Methods, Sequences– Operations, Methods. Comprehensions– Operations , Methods.
Unit V	**Functions** – Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function-Global and Local Variables
Unit VI	**Modules &Packages**: Modules: Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages.
BLOCK 3	**OOPS IN PYTHON**
Unit VII	**UNIT – 7: Object-Oriented Programming OOP in Python**: Classes, ' self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.
Unit VIII	**UNIT – 8: Exception Handling** :Error, and Exceptions: Difference between an error and

	Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions
Unit IX	**UNIT – 9: Python Libraries:** Brief Tour of the Standard Library – Operating System Interface – String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression
Unit X	**UNIT – 10: GUI Programming and Testing** : Multithreading, GUI Programming, Turtle Graphics Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.
BLOCK 4:	**MACHINE LEARNING IN PYTHON**
Unit XI	**UNIT – 11: Machine Learning Using Python** :Machine Learning Basics, Features and Labels, Supervised and Unsupervised Learning.
Unit XII	**UNIT – 12: Regression and Classification in Machine Learning:** Simple Linear Regression, Multiple Regression, Data Collection for Machine Learning, Classification – Features and Types

Suggested Text Book Readings:

1. Kenneth A. Lambert, Martin, Juneja "Fundamentals of Python", Cengage Learning.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
3. Learning Python, Mark Lutz, Orielly.
4. Harsh Bhasin, "Python for Beginners", New Age International.
5. Ashok Namdev Kamthane , Programming and Problem Solving with Python, TMH.
6. Allen Downey, Learning with Python, Dreamtech.

Suggestive digital platforms web links-

http://docs.python.org/3/tutorial/index.html
http://interactivepython.org/courselib/static/pythonds
http://www.ibiblio.org/g2swap/byteofpython/read/

Electronic media and other digital components in the curriculum:

Name of electronic media: e-SLM	Year of incorporation: 2021

Syllabus for [B.Sc.]: Subject: [Computer science]

Course prerequisites: 10+2 with Computer science, Mathematics		
Programme: B.Sc.	Year:2	Semester:3
Subject: **Computer science**		
Course Code: **SBSCS-01N**	Course Title: **Discrete Mathematics**	

Course Objectives:

- To perform operations on discrete structures such as sets, functions, relations.
- To apply mathematical arguments using logical connectives and quantifiers.
- To identify and prove properties of Algebraic Structures.
- To formulate and solve recurrences and recursive functions.
- To apply the concept of combinatorics to solve basic problems in discrete mathematics.

Course Outcomes:

CO1. Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Function

CO2. Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic

CO3. Identify and prove properties of Algebraic Structures like Groups, Rings and Fields

CO4. Formulate and solve recurrences and recursive functions

CO5. Apply the concept of combinatorics to solve basic problems in discrete mathematics

Credits: 4	**Type of Course:** Core
Category of Course	Skill development
Max. Marks: 100	Min. Passing Marks: 36

Block 1	**Language of Mathematics and its application**
Unit I	**Mathematical Logic:** statements, operations, truth values, tautology and quantifiers.
Unit II	**Arguments:** Rule of Detachment, Validity of a compound statement by using Truth Table , Validity using Simplification Methods, Validity using Rules of Inference, Invalidity of an Argument, Indirect Method of proof and Proof by Counter-Example.
Unit III	**Boolean Algebra:** Boolean Algbera, Principle of Duality, Isomorphic Boolean Algebras, Boolean Algebra as Lattices, Boolean Functions, Disjunctive Normal Form, Conjunctive Normal Form, Minimization of Boolean Functions (Karnaugh Map)
	Switching circuits and logical Circuits : Switching Circuits, Simplification of circuit, Non-Series Parallel Circuits, Relay Circuits, Logic Circuits
Block 2	**Set theory and its application**
Unit I	**Set theory:** sets, Subsets, Operations on Sets, Complementation, Intersection and Union, Laws Relating Operations, Distributive Laws and De Morgan's Laws
Unit II	**Relation:** Relation, binary relations in a Set, Domain and Range of a Relation, Total number of Distinct Relations, Relations as Sets of Ordered Pairs, Types of Relations, Composition of Relations, Equivalence relation in a set, Partition of a Set, Equivalence Class and Quotient set of a set.
Unit III	**Partitions and Distributions:** Equivalence Relations, Equivalence Classes, Properties of Equivalence Classes, Quotient set and Partition.
Unit IV	**Function:** Functions, Direct and Inverse image, Inverse Functions, Operations on Functions, Composite of functions, Types of Functions and Connection between Equivalence relation and mapping.
Block – 03	**Counting Process**

Unit I	**Mathematical Induction:** Principle of Mathematical Induction, Second Principle of Induction and Well ordering property.
Unit II	**Combinatorics:** Basic counting principles, Principle of Disjunctive counting, Principle of Sequential counting and Ordered and Unordered Partitions.
Unit III	**Permutation**
Unit IV	**Combination**
Block – 04	**Probability theory and application**
Unit I	**Binomial theorem:** Binomial theorem, General term in a binomial expansion, Middle term in a binomial expansion and Binomial expansion for rational exponents
Unit II	**Probability:** Definition of Probability, Addition law for counting and Product law for counting.
Unit III	**General Counting methods:** General Counting method is the extension part of counting process. It discusses Sum and Product Rulesand The Pigeonhole Principle .
Unit IV	**The Inclusion- Exclusion Principle:** inclusion-exclusion principle, Alternative form of the inclusion-exclusion principle and Onto Functions.

Suggested Text Book Readings:

Suggested online links:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", McGraw Hill.
2. B. Kolman, R.C Busby and S.C Ross, "Discrete Mathematics Structures", Prentice Hall.
3. R.P Girimaldi, "Discrete and Combinatorial Mathematics", Addison Wesley.
4. Y.N. Singh, "Discrete Mathematical Structures", Wiley- India.
5. Swapankumar Sarkar, "A Textbook of Discrete Mathematics", S. Chand & Company PVT. LTD.V.
6. Krishnamurthy, "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New Delhi.
7. Liptschutz, Seymour, "Discrete Mathematics", McGraw Hill.
8. J.P. Trembely&R.Manohar, "Discrete Mathematical Structure with application to Computer Science", McGraw Hill.

Electronic media and other digital components in the curriculum:

Choose any one or more than: e-SLM/ Other electronic and digital contents

Name of electronic media: e-SLM	Year of incorporation: 2021

Programme: **B.Sc.**	Year: **2023-24**	Semester: **I**
Subject: **Environmental Sciences**		
Course Code: SBSEVS-01N	Course Title: **Energy Resources and Green Technology**	

Course Objectives:

- To understand the concept of energy and its sources
- To understand fossil fuel energy
- To learn about biomass energy production
- To know about green technology

Course Outcomes:

CO1: Able to known about structure and composition of sun.
CO2: Learn about solar energy
CO3: Gain the knowledge of fuel energy resource
CO4: Learn about energy production by water and wind
CO5: Able to know the concept of green technology and green building

Credits**: 4**	Type of Course**: Skill Enhancement Course**
Max. Marks: **100**	Min. Passing Marks: **36**

Block 1	**Solar and Fossil Fuel**
Unit I	**Sun as Source of Energy:** Concept of energy, energy use from a historical perspective, solar energy, solar radiation, Solar shell, status of solar energy in India.
Unit II	**Fossil Fuel**: Classification and composition of fossil fuel, physico-chemical properties of fuel, origin, composition and types of coal, origin, composition and types of liquid fuel (crude oil), classification of gaseous fossil fuels, gross calorific value and net calorific value of different fuels, oil and gas reservoirs and reserves.
Unit III	**Renewable Energy Resources:** Solar energy, hydro energy or water power, wind energy, ocean energy (ocean tidal and wave energy and ocean thermal energy conversion (OTEC)), geothermal energy, Indian scenario of renewable energy consumption.
Block 2	**Biomass Energy and Energy Polices**
Unit IV	**Biomass as energy source:** Biomass resources, dedicated bioenergy crops, characteristics of bioenergy crops, bioenergy routes from biomass, conversion of biomass into fuelschallenges in bioenergy utilization, biomass states energy in India.
Unit V	**Other Source of Energy:** Conventional and nonconventional energy sources, nuclear fusion for energy, Ethanol and methanol production, pyrolysis and sources gasification, composition of biogas, Urban waste to resource recovery and recycling for energy.
Unit VI	**Energy Policies:** Indian emission norms in transportation sector, national programmes to promote biomass energy production in India, solar photovoltaic programmes in India,

	energy resources available in India, urban and rural energy consumption, national green tribunal (NGT) act, NGT activities.
Block 3	**Energy Conservation and Green Energy**
Unit VII	**Energy Conservation and Green Building:** Definition of energy conservation, need for energy conservation in India, benefits of energy conservation, principles of energy conservation, government initiatives for energy conservation; concepts, scope and components of green building, green buildings in India, certification of green building.
Unit VIII	**Green Energy:** Aim and scope of green technology, concept of green energy and green technology, biomass energy production, solar and green battery technology; Fuel cell technologies and application to waste-to-energy conversion.
Unit IX	**Green Nanotechnology**: Understanding green tech, sectors using green tech, green nanotechnology necessity of green technology, categories of green technology; environmental profits of green building, economic benefits of green building, goals of green technology, limitations of green processes and technology.

Suggested Text Book Readings:

1. S.C. Bhatia and R. K. Gupta, Textbook of Renewable Energy", WPI Publishing-2019
2. Renu, Dhupper, "Textbook on Energy Resources and Management" CBS Publishers & Distributors-2015
3. Mahmood Zohoori, Advantages and Disadvantages of Green Technology; Goals, Challenges and Strengths, International Journal of Science and Engineering Applications, ISSN-2319-7560
4. G.D. Rai, Non conventional energy sources, Khanna publication.
5. Sameer Sarkar, Fuel Technology, New Delhi, orient longman.

Suggested online links:

1. Energy from the Sun: EnergyfromtheSunStudentGuide.pdf (need.org)
2. Energy Conservation, Renewable Energy: Introduction: (ernet.in)
3. Renewable Energy and Green Growth in India: Project ReportTemplate (teriin.org)
4. What is Biomass: https://youtu.be/DueF2df52IE
   Energy sources and Conversion Process - YouTube

This course can be opted as an elective by the students of following subjects: NO

Suggested equivalent online courses (MOOCs) for credit transfer;

1. Energy Resources and conversion processes - Course (swayam2.ac.in)

Electronic media and other digital components in the curriculum:

Electronic media and other digital components in the curriculum: Choose any one or more than:(Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)

Name of electronic media:	Year of incorporation: 2023-24

Programme: **B.Sc.**	Year: **2023-24**	Semester: **II**
Subject: **Environmental Sciences**		
Course Code: **SBSEVS-02N**	Course Title: **Environmental Impact Assessment and Legislation**	
Course Objectives: ➢ To understand the basic concept of EIA ➢ To understand methodology of data collection ➢ To learn about environmental impact and social impact ➢ To know environmental legislation and policy		
Course Outcomes: CO1: Learn the concept of EIA and why it is useful in environmental clearance. CO2: Learn the components of EIA and its methodology to use CO3: Able to know the role of EIA in water, soil and air analysis. CO4: Learn about EIA regulation of in India CO5: Also learn about environmental law and its implementation of conservation of nature.		
Credits:**4**	Type of Course**: Skill Enhancement Course**	
Max. Marks: **100**	Min. Passing Marks: **36**	

Block 1	**EIA Components and Data Collections**
Unit I	**Basic Concept of EIA:** Definition, principle and objectives of EIA, need for EIA, Types of EIA, Hierarchy in EIA, Advantages of EIA, application form of EIA, composition of expert committee for EIA process.
Unit II	**Components of EIA**: EIA process, screening, scoping, baseline data, impact prediction, assessment of alternatives, delineation of mitigation measure and EIA report, public hearing, decision making, monitoring, environmental clearance conditions.
Unit III	**Impact Assessment and Data Collections:** Environmental impact, social impact, impact identification and prediction, baseline data collection, construction stage impacts, post project impacts.
Block 2	**EIA Policies and Life Cycle Assessment (LCA)**
Unit IV	**EIA policies**: EIA notifications, Government of India Ministry of Environment and Forest Notification (2000), list of projects requiring, environmental clearance.
Unit V	**EIA Regulations in India:** Status of EIA in India; current issues in EIA; case study of hydropower projects/ thermal projects, salient features of 2006 amendments to EIA notification
Unit VI	**Life Cycle Assessment (LCA):** Life cycle analysis, methodology, management, flow of materials-cost criteria-case studies, introduction to ISO 14000.
Block 3	**Environmental Management, Act and Polices**
Unit VII	**Environmental Management**:

	Environmental appraisal, environmental impact statement (EIS), environmental management plan (EMP), environmental audit; sustainable development.
Unit VIII	**Environmental Act**: Environmental laws and protection acts, existing provision of central and state government on environment protection, the Environment (protection) act (1986), the water act (1974), the air act (1981), wild life act (1972).
Unit IX	**Guidelines and Policies:** Guidelines and policies for control of environmental pollution, Environmental Policy of India, solid and hazardous waste management, handling and management rules.

Suggested Text Book Readings:

1. S.R. Khandeshwar, N.S. Raman and A.R. Gajbhiye , Environmental Impact Assessment, Dreamtech Press-2019.

2. Anjaneyulu Yerramilli, Environmental Impact Assessment Methodologies, BS Publications-2020.

3. George Alex, Environmental Impact Assessment (EIA), Blue Rose Publishers-2020.

4. Teacher_manual_master_EIA.pdf (iitr.ac.in)

5. N. Maheshwara Swamy, Text Book on Environmental Law, Asia Law House-2022

Suggested online links:

1. (187) Everything About EIA - Environmental Impact Assessment 2006 - Draft 2020 - YouTube
2. (187) Environmental Impact Assessment | EIA Process | Its Components | Benefits of EIA | Environmental Sci - YouTube
3. Environmental Science II Environmental Assessment ,Management & Legislation II UGC NET II PAPER-2 - YouTube
4. (187) Lecture 13: EIA – Law, Policy and Institutional arrangements for EIA system - YouTube
5. Environmental Management - ISO 14000 - 20 Nov, 6 PM - YouTube

(187) Environment Law (पर्यावरण विधि) - YouTube

This course can be opted as an elective by the students of following subjects: Any one

Suggested equivalent online courses (MOOCs) for credit transfer:

1. Environmental Impact Assessment - Course (nptel.ac.in)

Electronic media and other digital components in the curriculum:

Choose any one or more than:(Electronic Media: Audio/Video Lectures, Online Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents)

Name of electronic media:	Year of incorporation: 2023-24

Course prerequisites: 10+2 with Mathematics		
Programme: B.Sc.	**Year:** 2023-24	**Semester:** V
Subject: MATHEMATICS		
Course Code: SBSMM -03(N)	**Course Title:** Elementary Analysis	

Course Objectives:

- To understand the logical connectives, tautology and quantifiers.
- To learn about relation, equivalence relation and mapping with their properties.
- To understand the real number system and division in Integers, sequences and infinite series.
- To know about the multiple integral and their applications in areas and volume.

Course Outcomes:

CO1: The student will get to know about the concepts of logical connectives, tautology and quantifiers.

CO2: The student shall understand the relations and its types, equivalence relations and mapping.

CO3: The student shall understand the real number system and division in Integers, sequences and infinite series.

CO4: The student will get to know about multiple integral and its applications in finding areas, surface and volumes.

Credits: 4	**Type of Course:** Core
Max. Marks: 100	**Min. Passing Marks:** 36

Block 1	**Language of Mathematics, Relation and Mapping**
Unit I	**Language of Mathematics:** Language of Mathematics, Mathematical statements, logical connectives, Tautology, quantifiers.
Unit II	**Relation:** Relations (definition and examples), types of relation, composite of relations, equivalence relation, equivalence class, partition of a set and order relation.
Unit III	**Mapping:** Mapping (definition and examples), types of map, inverse map, composition of maps, direct and Inverse images of a set.
Block 2	**Real number system and Division in Integers**
Unit IV	**Real number system:** Axiomatic definition of real number system as a complete ordered field. Archimedean principle, relational and irrational density theorem.
Unit V	**Division in Integers:** Division in Z, Division algorithm, greatest common divisor, and least common multiple. Euclidean algorithm. Prime integers. Fundamental theorem of arithmetic's.
Block 3	**Sequence and Infinite Series**
Unit VI	**Sequence of Real Number:** Sequences, bounded and unbounded sequences, Subsequence, convergent, divergent and oscillatory sequences. Limit of a sequence. Algebra of convergent sequences, Cauchy's sequences, and Cauchy's criterion for convergence of a sequence.
Unit VII	**Infinite Series**: Partial sums of a series. Convergence and divergence of series. Series of nonnegative terms. Necessary and sufficient condition for convergence. P-series theorem. Comparison tests. D'Alembert's ratio test, Raabe's ratio test, Logarithmic test, Cauchy's condenses test and Root test, Alternating series.

	Leibnitz's theorem. Absolute convergence and conditional convergence of a series.
Block 4	**Multiple Integral and Its Applications**
Unit VIII	Double and Triple integrals, Change of order of integration, surface and volume integration and their applications in areas and volume.

Suggested Text Book Readings:

1. Elementary Analysis: The Theory of Calculus by Kenneth. A. Ross.
2. Sharma and Vashishtha, Real Analysis, Krishna Publication, 2014.
3. S C Malik, Mathematical Analysis, New Age International Publishers, 2017.

Suggested online link:

1. https://archive.nptel.ac.in/courses/111/105/111105122

This course can be opted as an elective by the students of following subjects: NA

Suggested equivalent online courses (MOOCs) for credit transfer: NA

Programme: B.Sc.	Year:2nd	Semester:4th
Subject: **PHYSICS**		
Course Code: SBSPHS-02	Course Title: **MODERN PHYSICS**	

Course Objectives:

The aim of this course is to make the students learn and discuss about the Modern Physics.

Course Outcomes:

CO-1 Understand the concept of Reference point.

CO-2 Understands the concept of Special and General theories of relativity.

CO-3 To establish a relationship between mass and energy.

CO-4 Describe the series of spectra and know Frank-Hertz experiment

Credits: 4	**Type of Course: Skill Enhancement Course**
Max. Marks: 100	Min. Passing Marks: 36

(Syllabi framed block wise/unit wise)

Block I	**Special Theory of Relativity**
Unit I	**Emergence of special relativity:** • Frame of reference (inertial and non-inertial), Events (simultaneous, colocal andcoincidence) • Centripetal force, centrifugal force, and Coriolis force. • Classical relativity, Galilean variant and Galilean in-variant. • Compatibility of electromagnetism with principle of relativity and mechanics. • Michel Jon-Morley experiment-significance of negative result. • Postulates of special theory of relativity.
Unit II	**Relativistic kinematics:** • Lorentz transformations (statements and derivation). • Relativity of simultaneity and length contraction. • Relativity of co locality and time dilation. • Experimental verification of length contraction and time dilation. • Relativistic transformation of velocity, resultant of two successive Lorentz transformations. • Relativistic velocity addition theorem (statement, derivations and applications). • Aberration of stars (statement, derivation and comparison with classical result). • Relativistic Doppler effect (statement, derivation and discussion of result).
Unit III	**Relativistic dynamics:** • Non-relativistic and relativistic particles. • Einstein's mass and energy equivalence relation, relativistic kinetics energy. • Variation of mass with velocity (only qualitative) and its importance. • Fundamental equations of relativistic motion, longitudinal and transverse mass. • Momentum and energy transformation equations. • Minkowski time space diagram and its applications.

Block II	**Atomic Physics**
Unit IV	**Atomic models:** • Bohr's theory of hydrogen likes atoms, Bohr radius, Sommerfeld fine structure constant,Rydberg & Rydberg Constant, Binding energy. • Spectral series of hydrogen atom, H_α, H_β, H_γ, H Balmer lines • Reduced mass, effect of nuclear motion, isotopic shift, • Ground, Excited and ionized state, emission and absorption spectra • Excitation, resonance and ionization potential, ionization energy of atom • Bohr's correspondence principle (statement, proof and importance) • Qualitative discussion of sommerfeld atom model.
Unit V	**X-Ray spectra** • Production of X-rays (qualitative discussion of Roentgen tube and Coolidge tube) • Properties and application of X-rays • Continuous and characteristic X-rays, Bremstrahlung radiation • Continuous and line X-ray spectra (K-series, L-series, M-series) • Duane-Hunt's law, cutoff frequency and cutoff wavelength, • Moseley's law (statement, derivation and applications), absorption edge • Comparison of optical and X-rays spectra
Unit VI	**Atomic structure:** • Vector atom model (need, statement and importance) • Space quantization, concept of electron spin and quantum numbers • Stern-Gerlach experiment (principal theory and importance of results) • Magnetic moment of atom, Bohr magneton, Gyro magnetic ratio,Larmor precession andfrequency • Intensity rules, selection rules, spectral terms, sodium D_1 and D_2 lines, Fine structure of Hαlines, • Coupling scheme (L-S and j-j), spectra of alkali and alkaline earth elements.
Unit VII	**Dualism nature:** • Planck's quantum theory and Einstein modifications, Photon and its characteristics • Photoelectric effect (statements laws and mathematical explanation), quantum efficiency • Compton effect (statement and explanation, expression for Compton shift and recoil energy), • Dualism in nature, de-Broglie hypothesis, matter waves and its importance. • Comparison of matter waves with electromagnetic waves and mechanical waves • Davisson-Germen experiment (principle, working and importance of result) • Wave packet, phase velocity and group velocity, wave and particle velocity, relation amongthem • Uncertainty principle (statement, significance and application)
Block III	**Nuclear physics**
Unit VIII	**Radioactivity:** • Natural and artificial radioactivity, emission of alpha particle, electron, positron and gammaparticles

	• Size of nucleus, classification of nuclei (isotopes, isobars, isotones, isomers andisodiapheres). • Radioactive series, successive radioactive decay, radioactive equilibrium • Earth dating and carbon dating, artificial nuclear transmutation • Discovery of neutrons and radioisotope in everyday life • Nuclear force and its Yukawa (Meson) theory.
Unit IX	**Nuclear energy:** • Mass defect, packing fraction, binding energy, specific binding energy, • Binding energy curve, explanation of nuclear fission, nuclear fusion and release of nuclearenergy, • Kinematics of nuclear reaction, Q-value of reactions • Bohr's-Wheeler model, activation and excitation energy, normal and enriched Uranium, • Liquid drop model, semi-empirical mass formula, • Shell model, magic number, collective model
Unit X	**Elementary particles** • Classification of elementary particles on the basis of mass, spin and interaction, • Particles and anti-particles. • Process of annihilation and process of production of matters, • Quantum number (Lepton number, Baryon number, iso-spin number, hyper charge number,strange number) • Conservation laws and concept of Quarks.

Suggested Text Book Readings:

1. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
4. Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
5. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
6. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
7. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
8. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).

This course can be opted as an elective by the students of following subjects:NA

Suggested equivalent online courses (MOOCs) for credit transfer: NA

Name of electronic media: e-SLM	Year of incorporation: 2021

Foundation Course in Hindi [AECHE]

fgUnh esa vk/kkj ikB~;Øe

Hkk’kk rRo vkSj cks/ku

fgUnh dh fyfi vkSj orZuh d ifjp; &

Hkk’kk vkSj fyfi] nsoukxjh fyfi] orZuh ds dqN fu;eA

fgUnh dh /ofu;k¡ &

/ofu;k¡ vkSj “kCn] /ofu;k¡ vkSj mPpkj.k dh fo”ks’krk,¡] ygtk ;k vuqrku] /ofu vkSj ys[ku ds fofo/k lEcU/k] mPpkj.k] fHkUurk ds dkj.k orZuh dh leL;k,¡] mPpkj.k esa vUrj] fyfi esa vUrj] /ofu vkSj fyfi esa vlkeatL;A

foKku ds fo’k; dk cks/ku &

ekuo dh mRifÙk vkSj fodkl] Hkk’kk dh ljy vfHkO;fDr] mnqZ ds “kCn] O;kdjf.kd foospu ¼laHkkouk’kZd okD;] lansgk’kZd okD;½A

laLd`fr fo’k; dk cks/ku vkSj “kCndks”k dk mi;ksx &

Hkkr ds R;ksgkj] “kCndks”k dk mi;ksxA

lekt foKku fo’k;ksa dk cks/ku vkSj fucU/k jpuk dk ifjp; &

ifjokj] fucU/ku jpuk] O;kdjf.kd foospu ¼izR;; ^Ro* ^rk*] ^;*] ^dj.k*½A

Hkk’k.k “kSyh &

Hkk’k.k dk mnkgj.k] mldh “kSyhxr fo”ks’krk,¡] lacks/ku dkjdA

Okpu vkSj fofo/k fo’k;

Lkkekftd foKkuksa dh Hkk’kk ¼bfrgkl ds lUnHkZ esa½ rFkk orZuh ds dqN fu;e &

i``BHkwfe] ¼bZLV bafM;k dEiuh] vafre eqxy ckn”kkg] jktuhfr ij vaxzsth dk vf/kdkj ,oa “kks’k.k uhfr] 1857 dh ØkfUr] lkaLd`frd tkxj.k½] dkaxzsl dh Lfkkiuk] xk¡/kh th dk vkxeu] Hkkjr NksM+ks vkUnksyu] orZuh lEcU/kh dqN fu;e ¼izR;;ksa ls “kCn&jpuk

orZuh ds nks :i ¼tSls&u;s] u,½] ikB esa iz;qDr “kCn “kCnksa dh orZuh dh fo”ks’krk,¡½] “kCnkoyhA

Lkekftd foKkuksa dh Hkk’kk ¼jktuhfr foKku½ rFkk “kCn jpuk &

jpuk yksdrU= ¼jktuhfrd] vkfFkZd lekurk] /keZ fujis{krk½] ifjHkkf’kd “kCnkoyh dk iz;ksx] O;kdjf.kd foospu ¼^fo* milxZ] foykse “kCn] milxZ yxkdj foykse “kCn cukuk] laf/k] lekl½A

Ekufodh dh Hkk’kk ¼yfyr dyk½ rFkk fo”ks’k.k &

Hkkjr dh yfyr dyk,¡] O;kdjf.kd foospu ¼fo”ks’k.k dks laKk esa cnyuk] izfo”ks’k.k½] okD; jpukA

foKku dh Hkk’kk rFkk ifjHkkf’kd “kCn &

iSVªksfy;e] ¼i`Foh dk tUe] izFke thoksa dk l`f’V] pV~Vkuksae ds Hksn] iSVªksfy; ds ewy L=ksr] fuL;anu rsy] rsydq.Mksa dh [kkst] rsydwiksa dk [kuu] rsy dk “kks/ku] Hkkjrh; fLFkfr½] ifjHkkf’krd “kCnA

foKku dh Hkk’kk dk Lo:i &

ekuo izxfr vkSj i;kZoj.k] ikfjHkkf’kd “kCn] Hkkf’kd foospuA

fof/k ,oa iz”kklu dh Hkk’kk rfkk ikfjHkkf’kd “kCn vkSj vFkZ &

jktHkk’kk fgUnh] fgUnh dk lafo/kkfud fLFkfr] lafo/kku dh O;oLFkk ds vk/kkj ij dh xbZ dk;ZokbZ] jktHkk’kk vf/kfu;e ¼;Fkk la”kksf/kr½ 1967] jktHkk’kk fu;e 1976] Hkk’kk foospu ¼jk’VªHkk’kk] lEidZ Hkk’kk] jktHkk’kk fgUnh dk Lo:i½] “kCnkoyh] Hkkf’kd foospuA

lkfgR; dk vkLoknu

dgkuh % iwl dh jkt &

dgkuh dk lkj] lUnHkZ lfgr O;k[;k] dFkkoLrq] pfj=&fp=.k] ifjos”k] lajpuk f”kYi] izfrik|A

miU;kl % ekul dk gal ¼ve`r yky uxj½ &

dFkklkj] dFkkoLrq] pfj=&fp=.k] ifjos”k] lajpuk f”kYi] izfrik|A

ukVd % pUæxqlr ¼t;"kadj çlkn½ &

dFkklkj] dFkkoLrq] pfj=&fp=.k] ifjos"k] lajpuk f"kYi] izfrik|A

fucU/k % Øks/k ¼jkepUæ "kqDy½ &

fucU/k dk lkj] varoZLrq ¼fopkji{k] Hkkoi{k½] ys[kdh; O;fDrRo dh vfHkO;fDr lajpuk f"kYi ¼"kSyh] Hkk'kk½] izfrik|A

vkRedFkk % xk¡/kh dh vkRedFkk &

varoZlrq] pfj=] fo"ys'k.k] ifjos"k] lajpuk f"kYi] izfrik|A

dfork,¡ % lwjnkl &

dkO;okpu ¼ckyo.kZu] fou; vkSj fo;ksx & Hkzejxhr½] Hkkoi{k] lajpuk f"kYi] izfrik|] lanHkZ lfgr O;k[;k ¼"kksfHkr dj uouhr] pju dey cUnkS gfj jkbZ] fujxqu dkSu nsl dks cklh½A

rqylhnkl &

dkO;okpu ¼jkepfj= ekul] fou; if=dk] xhrkoyh½] Hkkoi{k] lajpuk f"kYi] izfrik|] lanHkZ lfgr O;k[;k ¼efu ekfud eqdyk Nfo tSlh] dcgq¡d gkS ;fg jgfu jgkSxks] esjh lc iq:'kkjFk Fkkdks½A

eSfFkyh"kj.k xqlr &

dkO;okpu ¼egkdkO; lkdsr½] Hkkoi}k] lajpuk] f"kYi] izfrik|] lUnHkZ lfgr O;k[;k ¼lf[k] irax Hkh tyrk gS gk! nhid Hkh tyrk gSA lf[k] uhy uHkLlj esa mrjk½A

lw;ZdkUr f=ikBh ^fujkyk* &

dkO; okpu] Hkkoi}k] lajpuk f"kYi] izfrik|] lanHkZ lfgr O;k[;k ¼rksM+rh iRFkj½A

egknsoh oekZ &

dkO; okpu] ¼xhr½] Hkkoi{k] lajpuk f"kYi] izfrik|] lanHkZ lfgr O;k[;k ¼eSa uhy Hkjh nq[k dh cnyh½A

O;kogkfjd fgUnh vkSj ys[ku

"kCn vkSj eqgkojs &

“kCnksa dk egRo] Hkk’kk ds lkekftd Lrj Hksn] “kcnksa ds fofHkUu L=ksr ¼rRle] rn~Hko] ns”kt] fons”kh “kCn½] “kCnksa dk vFkZ i{k ¼le:ih “kCn] i;kZ; foykse] vusdkFkhZ] lgiz;ksx½] “kCn fuekZ.k “kcn jpuk ¼ewy “kCn] O;qRiUu “kCn] milxZ] izR;;] Hkkookpd izR;;] y?kqrklwpd izR;;] fyax lwpd izR;;] lekt] iqu:Dr “kCn] izfrfcafcr “kCn] vuqdj.kkRed “kCn½ eqgkojs vkSj yksdksfDr;k¡ ¼vFkZ vkSj okD;&iz;ksx½A

laokn “kSyh &

okD; rkrkZyki dh fo”ksrk,¡ okD; ¼okD; esa inØe] vuqrku] lEizs’k.k dk mnñs”; okd; ls Åij dk Lrj¼izksfDr½] fojke fpugksa dk iz;ksx½ okrkZyki & ,d mnkgj.k] mnkgj.k ij ppkZ ¼vuqrku] cyk?kkr dksM fefDlax] izkUrh; fo”ks’krk,¡] fgUnh “kSyh] mnwZ “kSyh] feyhtqyh “kSyh½A

ljdkjh i=kpkj rFkk fVIi.k vkSj izk:i.k &

i=&ys[ku ds izdkj ¼vukSipkfjd] ¼O;fDrxr½ i=] vkSipkfjd i=½ ljdkjh i=kpkj dh izfØ;k ¼fVIi.k] izk:i.k½ ljdkjh i=kpkj ds fofHkUu izdkj o muds uewus ¼ljdkjh i=] v/kZ ljdkjh i=] dk;kZy; kkiu] dk;kZy; vkns”k] vkns”k] i`’Bkadu] vf/klwpuk] ladYi] izsl foKfIr] izsl usV] varfoZHkkxh; fVIi.kh] rkj] VsysDl lans”k] rqjUr i=½ “kCnkoyhA

lekpkj ys[ku vkSj lEikndh; &

lekpkj D;k gS\ lekpkj ys[ku vkSj laiknu] lekpkj dh Hkk’kk] lEikndh; ys[kuA

vuqokn &

^vuqokn* “kCn dk vFkZ vkSj O;k[;k] vuqokn dh izfØ;k ¼vFkZxzg.k] laizs’k.k½] vuqokn djus dk O;kogkfjd KkuA

la{ksi.k] Hkko&iYyou vkSj fucU/k & ys[ku & egRo] Lo:i] izfØ;kA

Foundation Course in English-I

Block-1 English-I

Unit-1 Reading Comprehension – Passage for reading from George Orwell : Animal form, Glossary Vocabulary, Grammar and usage – concord of number and person be, do, have, writing.

Unit-2 Passage for reading. Human Environment by India Gandhi, Vocabulary.

Unit-3 Passage for reading : The Nightingle and the rose, by oscawild, vocabulary, Grammar : The past indefinite, Past continuous, Present perfect tense, present perfect continuous tense.

Unit-4 Passage for reading : Deth in the Kichen by milward Kennedy, Grammar : Past Indefinite tense, Past perfect tense.

Unit-5 Listening comprehension, conversation, pronunciation-letters and sounds, word stress.

Unit-6 Listening Comprehension : Talk : the Scientific method, conversation, pronunciation, English novels.

Block-2 English-I

Unit-7 Reading Comprehension – Story Norah Burke : the Baby sister, Grammar and usage – use of the past perfect tense.

Unit-8 Reading Comprehension : Story O, theory : Witches leaves, Grammar and usage – simple present tense, present continuous tense, Rewriting a story in an abridged form.

Unit-9 Reading comprehension : Autobiography – passage from India Gandhi : A page from the book of memory, Grammar and usage: Articles, writing : Essay – should the death penalty by abolished ?

Unit-10 Reading comprehension : The time kinds of workers, vocabulary. The suffixes –er-or-ary-cer, ier, grammer and usage, types of sentences, writing. Essay based on diagram : Classification of vertebrates.

Unit-11 Listening Comprehension : A lecture on the burden of women in the villages. Conversation. A dialogue between two passengers on a railway train. Pronunciation : English Consonants.

Unit-12 Listening Comprehension : A talk on dreams. Conversation: Dialogues taking about the dreams one had recently, Pronunciation : stress and rhythm, vowed contrasts, reading words from phonetic. transcription.

Block-3 English-I

Unit-13 Reading Comprehension – Detective story Agatha Christie, The Jewel Robbery at the grand metropolitan, grammar and usage- Question patterns, writing – Rewriting a story from the point of view of one of the characters.

Unit-14 Reading Comprehension – Autobiography Ved Mehta : A world of four senses, Grammar and usage : Prepositional phrases, participial phrases : Phrasal verbs, relative clauses, writing : A short composition based on the passage read.

Unit-15 Reading Comprehension – Doris Lessing : A mild attack of locusts, Grammar and usage – Adverbial clauses, writing. Descriptive composition based on the passage read.

Unit-16 Reading Comprehension : Myster story Wibla Cather : The affair at grover station, Exercise on vocabulary, Grammar and usage : Direct and Indirect speech, writing : Narrative composition.

Unit-17 Listening Comprehension : Talk Life of Albert Einstein, Conversation. A dialogue between a teacher and a student who has just passed the higher secondary examination.

Unit-18 Listening Comprehension : Talk Authony R. Michaelis Science and politics, conversation Asking for permission, Pronunciation, consonants, contracted forms.

UGFEG-02

Foundation Course in English-II

Block-1 English-II

Unit-1 Writing paragraphs 1 – The topic sentence, developing the topic, coherence, punctuation : the full stop.

Unit-2 Writing paragraphs 2 – The development of a paragraph – description, cause and effect, definition, comparison and contrast.

Unit-3 Writing a composition – A model composition for study, types of composition, what you must do before writing your compassion, Factors to keep in mind when writing your composition.

Unit-4 Expository composition – Development of an expository composition, A model composition.

Unit-5 Note-Taking-1- How to read, specimen notes, Reduction devices, Passage four note taking, Headings and subordinate points.

Unit-6 Writing reports 1- Reporting events- Different Stages in writing impart, types of report, reporting an event.

Block-2 English-II

Unit-7 Argumentative composition-1- Persuasive and argumentative composition, composition and argument.

Unit-8 Argumentative composition-2- Inductive and deductive methods, Fallacies, Non rational ways of writing, A model passage.

Unit-9 Note taking -2 use of tables and Diagrams – Organisation of notes : Tables, organization of note : Diagrams.

Unit-10 Writing reports-2 Reporting meetings and speeches – reporting a meeting, Reporting a speech, Punctuation: Quotation marks.

Unit-11 Writing summaries -1 – The technique of summarizing.

Unit-12 Writing Summaries – 2

Block-3 English-II

Unit-13 Writing paragraphs-3 – Chronological sequence, spatial Relationships, class relationships.

Unit-14 Narrative Composition-1- Writing a narrative composition, Factual report.

Unit-15 Narrative composition-2- Samples of writing, style.

Unit-16 Writing reports-3 – Reporting interviews – Different stages in conducting interviews, Reporting an interview, punctuation : The apostrophe, Usage, Word study.

Unit-17 Writing reports-4 Reporting Surveys – Various stages in conducting a survey, collection of data, Reporting a survey.

Unit-18 Writing summaries-3- Techniques of summarizing.

Block-4 English-II

Unit-19 Descriptive Composition-1 – Describing persons size. Build and Age, Educational Qualifications and work experience, Facial features and expression, Gestures and Gait, Habits, Dress, Likes, Dislikes and general nature, activity.

Unit-20 Descriptive Composition-2- Describing plans and objects- Location and size, sounds and smells. The objects Associated with a place, Describing particular objects, Activity.

Unit-21 Descriptive composition-3 – Describing conditions and processes.

Unit-22 Note taking-3- A good listener, Some basic equipment for note taking parts of a lecture, taking notes from a lecture, Reconstructing notes.

Unit-23 Writing reports-5- Reporting experiments- various steps in conducting an experiment, Reporting and experiment, examples of reports, punctuation : commas.

Unit-24 Summing Up-writing paragraph, composition, note taking writing reports, writing

summaries.

Foundation Course in Environment Awareness [CHEQ/ AECEA]

i;kZoj.k v/;;u

[k.M & 01 % i;kZoj.k vkSj ikfjfLFkfrdh

bdkbZ & 01 % i;kZoj.k & vo/kkj.kk] la?kVu ,oa çdkj

bdkbZ & 02 % ikfjfLFkfrdh & vo/kkj.kk] çdkj ,oa fl)kUr

bdkbZ & 03 % ikfjfLFkfrdh ra= & vo/kkj.kk] la?kVu] dk;Z"khyrk ,oa fLFkjrk

bdkbZ & 04 % fo"o ds çeq[k ikfjfLFkfrd ra=

[k.M & 02 % çkd`frd lalk/ku % mi;ksx ,oa laj{k.k

bdkbZ & 01 % çkd`frd lalk/ku & vo/kkj.kk] oxhZdj.k ,oa laj{k.k ds fl)kUr

bdkbZ & 02 % tSo lalk/ku & ou lalk/ku] tSo fofo/krk] jk'Vªh; m|ku

bdkbZ & 03 % ty lalk/ku & typØ] miyC/krk] mi;ksx ,oa laj{k.k

bdkbZ & 04 % e`nk lalk/ku & fodkl çfØ;k] mi;ksx ,oa laj{k.k

bdkbZ & 05 % ÅtkZ lalk/ku & mRiknu] mi;ksx ,oa laj{k.k

bdkbZ & 06 % [kfut lalk/ku & laekO;fuf/k] mRiknu] mi;ksx ,oa laj{k.k

[k.M & 03 % çkd`frd vkink] i;kZoj.k çnw'k.k ,oa çcU/ku

bdkbZ & 01 % çkd`frd vkink & vo/kkj.kk ,oa çdkj

bdkbZ & 02 % çeq[k çkd`frd vkink;sa

bdkbZ & 03 % ty çnw'k.k ,oa çcU/ku

bdkbZ & 04 % ok;q çnw'k.k ,oa çcU/ku

bdkbZ & 05 % Bksl vif'k'V & çnw'k.k ,oa çcU/ku

[k.M & 04 % tula[;k ,oa i;kZoj.k

bdkbZ & 01 % fo”o tula[;k o`f) ,oa forj.k

bdkbZ & 02 % Hkkjr esa tula[;k o`f) ,oa lkekftd&vkfFkZd lajpuk

bdkbZ & 03 % tula[;k o`f) ,oa ?kuRo ds i;kZoj.kh; çHkko

bdkbZ & 04 % uxjh; tula[;k] i;kZoj.k ,oa LokLF;

bdkbZ & 05 % tu thou ij i;kZoj.kh; nq?kZVukvksa ds çHkko

[k.M & 05 % i;kZoj.k ds lkekftd&vkfFkZd lanHkZ

bdkbZ & 01 % oguh; fodkl & ladYiuk] mnHko ,oa çlkj

bdkbZ & 02 % lkekftd O;oLFkk ,oa i;kZoj.k

bdkbZ & 03 % i;kZoj.kh; uSfrdrk ,oa çkd`frd lalk/kuksa dh lqyHkrk

bdkbZ & 04 % oSfÜod i;kZoj.kh; leL;k;sa ,oa nq?kZVuk;sa

bdkbZ & 05 % Hkkjr esa i;kZoj.k laj{kj.k ,oa lEcfU/kr vf/kfu;e

[k.M & 01 % eqDr ,oa nwjLFk f”k{kk dh vo/kkj.kk ,oa ,sfrgkfld ifjçs{;

bdkbZ % 01 & eqDr ,oa nwjLFk f”k{kk dk Lo:i ,oa vko”;drk
bdkbZ % 02 & eqDr ,oa nwjLFk f”k{kk dk fodkl
bdkbZ % 03 & nwjLFk f”k{kd
bdkbZ % 04 & nwjLFk fo/kkFkhZ

[k.M & 02 % eqDr ,oa nwjLFk f”k{kk esa Nk= lgk;rk lsok;sa

bdkbZ % 05 & Lo&vf/kxe lkexzh
bdkbZ % 06 & ijke”kZ lsok;sa
bdkbZ % 07 & vf/kU;kl
bdkbZ % 08 & lwpuk ,oa lEizs’k.k izkS|ksfxdh

[k.M & 03 % eqDr ,oa nwjLFk f”k{kk dh laxBukRed lajpuk
bdkbZ % 09 & jk’Vªh; eqDr fo”ofo|ky;
bdkbZ % 10 & jkT; eqDr fo”ofo|ky;
bdkbZ % 11 & jk’Vªh; eqDr fo|ky;h laLFkku
bdkbZ % 12 & nwjLFk f”k{kk ifj’kn~

[k.M & 04 % eqDr ,oa nwjLFk f”k{kk esa pqukSfr;k¡

bdkbZ % 13 & eqDr ,oa nwjLFk f”k{kk dh leL;k;sa
bdkbZ % 14 & eqDr ,oa nwjLFk f”k{kk esa izf”k{k.k
bdkbZ % 15 & eqDr ,oa nwjLFk f”k{kk esa ewY;kadu
bdkbZ % 16 & eqDr ,oa nwjLFk f”k{kk esa vuqla/kku

Foundation Course in Information Technology [OEIT]

lwpuk izkS|ksfxdh esa vk/kkj ikB~Øe

[k.M & 01 % dEI;wVj dk bfrgkl

bdkbZ % 01 & dEI;wVj ,d ifjp;

bdkbZ % 02 & dEI;wVj ds izdkj

bdkbZ % 03 & dEI;wVj lkW¶Vos;j

bdkbZ % 04 & vkijsfVax flLVe

[k.M & 02 % dEI;wVj ,lyhds”ku

bdkbZ % 01 & oMZ izkslsflax **(**WOrd Processing**)**

bdkbZ % 02 & LizsM”khV~l (Spreadsheet)

bdkbZ % 03 & MkVkcsl eSustesUV lk¶Vos;j (Database Management Software)

[k.M & 03 % bUVjusV vkSj osc VsDuksykWth

bdkbZ % 01 & lax.kd tky ra=

bdkbZ % 02 & bUVjusV ds fl)kUr

bdkbZ % 03 & bUVjusV dk lkekU; mi;ksfxrk@vuqiz;ksfxrk

bdkbZ % 04 & bUVjusV ds iz;ksx esa lqj{kk lacks/k ,oa vf/kurk

[k.M & 04 % bZ&esy] bZ dkelZ vkSj bZ cSfdax

bdkbZ % 01 & bZ&esy] pSfVax Cykx vkfn] (E-mail, Chatting, Bblog etc.)

bdkbZ % 02 & bZ dkelZ okf.kT; (E- Commerce)

bdkbZ % 03 & bZ cSafdax (E-Banking)

Nutrition for the Community [OECNC]

Lkeqnkf;d iks"k.k ,oa LokLF; f’k{kk

[k.M&01
Lkeqnk; dk iks"k.k vkSj LokLF; Lrj

- UNIT-01 leqnk; ds ckjs esa tkuuk vkSj mlds lkFk dke djuk
- UNIT-02 leqnk; iks"k.k vkSj LokLF;
- UNIT-03 leqnk; ds LokLF; vkSj iks"k.k dks izHkkfor djus okys dkjd

[k.M&02
lkks"k.k o LokLF; f’k{kk ls lca/kh fo"k;oLrq

- UNIT-04 iks"k.k laca/kh fo"k; oLrq
- UNIT-05 LokLF; f’k{kk laca/kh fo"k; oLrq
- UNIT-06 iks"k.k ,oa LOkkLF; f’k{kk lEcU/kh lans’k

[k.M&03
lkks"k.k ,oa LokLF; f’k{kk ds fy, lapkj dh fof/k;k¡

- UNIT-07 lewg lapkj dh fof/k;k¡
- UNIT-08 tulapkj ek/;e
- UNIT-09 pqus gq;s lapkj ek/;keksa dk izLrqfrdj.k
- UNIT-10 xSj e’khuh ek/;e % ;kstuk o fuekZ.k
- UNIT-11 e’khupfyr midj.k % ;kstuk o fuekZ.k

[k.M&04
iks"k.k ,oa LokLF; f’k{kk ds mikxe

- UNIT-12 ikjEifjd mikxe
- UNIT-13 ikjEifjd mikxeksa dk izLrqfrdj.k
- UNIT-14 vk/kqfud mikxe
- UNIT-15 xSj e’khuh ek/;e % ;kstuk o fuekZ.k
- UNIT-16 vk/kqfud mikxeksa dk izLrqfrdj.k

[k.M&05
iks"k.k ,oa LokLF; f’k{kk dh lkeqnkf;d dk;Zuhfr;k¡

- UNIT-17 O;fDrxr dk;Zuhfr;k¡

- UNIT-18 lkeqnkf;d dk;Zuhfr;k¡
- UNIT-19 pquh gqbZ dk;Zuhfr;k¡ ds izpkyu dh izLrqfr
- UNIT-20 xSj e'khuh ek/;e % ;kstuk o fuekZ.k
- UNIT-21 vk/kqfud mikxeksa dk izLrqfrdj.k

[k.M&06
iks"k.k dk;ZØe

- UNIT-22 foxr rFkk orZeku iks"k.k dk;ZØe
- UNIT-23 iks"k.k f'k{kk dk;ZØe % vk;kstu] fØ;kUo;u rFkk eqY;kadu
- UNIT-24 iks"k.k rFkk LOkkLF; dk;ZØe dk lQy vk;kstu % pqus gq;s izfØ;k ekWMy

lkzk;ksfxd fu;ekoyh % Hkkx & III

Foundation course in Disaster Management [DM] OEDM

vkink çcU/ku esa vk/kkj ikB~Øe

[k.M 01 % & egŸo ,oa dkjdksa dh le>
bdkbZ &1 vkink% ,d ifjp;
bdkbZ &2 vkink fo'o vkSj Hkkjrh; lUnHkZ esa
bdkbZ &3 vkink% ljdkjh rFkk xSj ljdkjh laxBuksa dh Hkwfedk
bdkbZ &4 vUrjkZ"Vªh; vfHkdj.kksa dh Hkwfedk
[k.M 02 vkink dk oxhZdj.k
bdkbZ &05 HkwdEi] ck<+ ,oa ty fudklh
bdkbZ &06 pØokr] lw[kk vkSj vdky
bdkbZ &07 HkwL[kyu] fgeL[kyu] vkx vkSj taxy dh vkx
bdkbZ &08 vkS|ksfxd vkSj izkS|ksfxdh; vkink vkSj egkekjh

[k.M 03 vkink rS;kjh ds vk/kkjHkwr rF;

bdkbZ &09 fu;kstu

bdkbZ &10 lapkj

bdkbZ & 11 usr`Ro ,oa la;kstu

bdkbZ &12 Hk.Mkj.k ,oa lEHkj.k

[k.M 04 vkink çcU/ku ,oa tkx#drk

bdkbZ &13 ekuo O;ogkj ,oa vuqfØ;k O;fDrxr lkeqnkf;d laLFkkxr

bdkbZ &14 lkeqnkf;d Hkkxhnkjh ,oa tkx:drk

bdkbZ &15 tu tkx:drk dk;ZØe

bdkbZ &16 lwpuk laxBu ,oa çlkj

Syllabus for [M.A. in Geography (MAGO): Subject: [Geography]

<table>
<tr><td colspan="3">Course prerequisites: Bachelor degree in any subject OR Any 4 year Graduate Degree</td></tr>
<tr><td>Programme : MAGO</td><td>Year: 1</td><td>Semester: 1</td></tr>
<tr><td colspan="3">Subject: Geography</td></tr>
<tr><td>Course Code: MAGO-101N</td><td colspan="2">Course Title: Geomorphology</td></tr>
<tr><td colspan="3">Course Objectives:
1. Learners will understand the concept of place and how it is connected to people's sense of belonging to the physical environment, landscape and culture.
2. Learners will understand the fundamental concepts of spatial interaction and diffusion, which explain how human activities are influenced by the concept of distance.
3. Learners will be exposed to the nature of physical systems such as geomorphologic processes and natural hazards.
4. Learners will be able to read and interpret information on different types of physical features maps.
5. Learners will learn how human, physical and environmental components of the world interact.</td></tr>
<tr><td colspan="3">Course Outcomes:
CO1-Describing human-environment, and nature-society interactions as well as global human and environmental issues.
CO2-Identifying and explaining the planet’s human and physical characteristics and processes, from global to local scales.
CO3-Evaluating the impacts of human activities on natural environments.
CO4-Applying knowledge of global issues to local circumstances to evaluate the local effects of the issues.
CO5-Showing an awareness and responsibility for the environment.</td></tr>
<tr><td colspan="2">Credits: 4</td><td>Type of Course: Core</td></tr>
<tr><td colspan="2">Category of Course</td><td>Value-added / employability</td></tr>
<tr><td>Max. Marks: 100</td><td colspan="2">Min. Passing Marks: 36</td></tr>
<tr><td colspan="3">Syllabi framed block wise/unit wise</td></tr>
<tr><td colspan="3">Unit- 01Definition and Scope of Geomorphology
Unit - 02Structure of the Earth’s Interior, Theories of Origin of Continents and Oceans

Unit – 03 Forces Affecting the Earth’s Crust.</td></tr>
</table>

Unit – 04 Earthquake and Volcano, Volcanicity and Landscapes.
Unit – 05 Rocks and their Classification.
Unit – 06 Theory of Plate Tectonics
Unit – 07 Theories of Mountain Building.
Unit – 08 Weathering and Erosion.
Unit – 09 Penk and Davis Erosion Cycle
Unit – 10 Drainage System and Drainage Pattern.
Unit – 11 Fluvial Geomorphology and Karst Geomorphology.
Unit – 12 Costal Geomorphology
Unit - 13 Arid Geomorphology and Glacial Geomorphology.
Unit – 14 Regional Geomorphology- Kumaun Himalaya, Ganga Plain, Chota Nagpur Plateau
Unit – 15 Slope Analysis –Classification of Slope, Models of Slope Development.
Unit – 16 Applied Geomorphology, Anthropogenic Geomorphology

Suggested Text Book Readings:

1. 1. Singh, Jagdish & Singh K.N. :Physical Geography, Gyanodya Publication, Gorakhpur.
2. Thornbury, W.D. : Principles of Geomorphology, New Age International (p) Ltd., New Delhi.
3. Singh, Savindra : Geomorphology, Prayag Pustak Bhawan, Allahabad.
4. Bloom. A.L. : Geomorphology, Prentice Hall, New Jersery, USA.
5. King, C.A.M : Techniques in Geomorphology, Edward Arnold, London.
6. Kale, V.S. and Gupta, A. : Introduction to Geomorphology, Orient Longman, Hyderabad.
7. Dayal, P. : Geomorphology, Patna

This course can be opted as an elective by the Learners of following subjects: N.A.

Suggested equivalent online courses (MOOCs) for credit transfer: N.A.

Note: School may revise list of electronic media and other digital components in the curriculum time to time and shall be updated in website also.

1. Production Management by Telsang Martand S Chand Publication	
This course can be opted as an elective by the students of following subjects: Any one	
Suggested equivalent online courses (MOOCs) for credit transfer: Any course offered in MOOCS/ Swayam Portal conducted by UGC, IIMS or IGNOU shall be considering for the credit transfer. The title of the course must be same as the one in which credit transfer is applied for.	
Electronic media and other digital components in the curriculum: **Choose any one or more than one:**(Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents**)**	
Name of electronic media	Year of incorporation

Course prerequisites: **None**		
Programme: BBA	Year: 2023	Semester: III
Subject: Business Administration		
Course Code: BBA-110 N	Course Title: Entrepreneurship and small Business	
Course Objectives: The objective of the course is to develop the entrepreneurial capability in the learners.		
Course Outcomes: CO_1: Become aware of entrepreneurship opportunities available in the society for the entrepreneur. CO_2: Acquaint them with the challenges faced by the entrepreneur. CO_3: Develop the motivation to enhance entrepreneurial competency.		
Credits: 4	**Type of Course:** Core	
Category of Course **(Please mention category of course; It may have more than one option)**	**Awareness/ life skills / soft skills/ value-added / employability/ entrepreneurship/ skill development/ MOOCs or OER**	
Max. Marks: 100	Min. Passing Marks: 36	
(Syllabi should be framed block wise/unit wise; No of blocks and units may change)		
Block 1	**Basic Concepts**	
Unit I	Meaning, Definition and concept of Enterprise, Entrepreneurship and Entrepreneurship Development,	
Unit II	Evolution of Entrepreneurship, Theories of Entrepreneurship. Characteristics and Skills of Entrepreneurship,	
Unit III	Concepts of Entrepreneurship, Entrepreneur v/s Entrepreneur, Entrepreneur Vs. Entrepreneurship, Entrepreneur Vs. Manager,	
Unit IV	Role of Entrepreneurship in Economic Development, Factors affecting Entrepreneurship, Problems of Entrepreneurship	
Block 2	**Entrepreneurial Competency, Mobility and Motivation**	
Unit V	Meaning and Concept of Entrepreneurial Competency, Developing Entrepreneurial	

	Competencies, Entrepreneurial Culture,
Unit VI	Entrepreneurial Mobility, Factors affecting Entrepreneurial mobility, Types of Entrepreneurial Mobility.
Unit VII	Entrepreneurial Motivation: Meaning and concept of Motivation, Motivation theories,
Unit VIII	Entrepreneurship Development Program: Needs and Objectives of EDPs, Phases of EDPs, Evaluation of EDPs
Block III	**Role of Government and its Organization**
Unit IX	Role of Government in promoting Entrepreneurship, MSME Policy in India,
Unit X	Agencies for Policy Formulation and Implementation: District Industries Centres (DIC),
Unit XI	Small Industries Service Institute (SISI), Entrepreneurship Development Institute of India (EDII),
Unit XII	Financial Support System: Forms of Financial support, Long term and Short term financial support, Sources of Financial support, Development Financial Institutions, Investment Institutions
Block IV	**Women Entrepreneurship**
Unit XIII	Women Entrepreneurship: Meaning, Characteristic features, Problems of Women Entrepreneurship in India, Developing Women Entrepreneurship in India,
Unit XIV	Concept of Social Enterprise and Social Entrepreneurship, Social Entrepreneurs, Sustainability Issues in Social Entrepreneurship, Rural Entrepreneurship, Family Business
Unit XV	Entrepreneurship, Concepts of Entrepreneurship Failure, Issues of Entrepreneurialfailure, Fading of Entrepreneurial success among once leading corporate groups,
Unit XVI	Entrepreneurial Resurgence, Reasons of Entrepreneurial Failure, Essentials to Avoid Unsuccessful Entrepreneurship

Suggested Text Book Readings:

1. Entrepreneurship 10th Ed (Indian Edition) 2016 by Robert Hisrich Michael Peters Dean Shepherd, McGraw Hill
2. Khanka, S.S.; Entrepreneurial Development; S. Chand and Co.
3. Kumar, Arya; Entrepreneurship; Pearson Education.
4. Desai, Vasant; Dynamics of Entrepreneurial Development and Management; Himalaya Publishing
5. Blundel, R. and Lockett, N.; Exploring Entrepreneurship Practices and Perspectives; Oxford Publications.

This course can be opted as an elective by the students of following subjects: Any one

Suggested equivalent online courses (MOOCs) for credit transfer:

Any course offered in MOOCS/ Swayam Portal conducted by UGC, IIMS or IGNOU shall be considering for the credit transfer. The title of the course must be same as the one in which credit transfer is applied for.

Electronic media and other digital components in the curriculum:

Choose any one or more than one:(Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents**)**

Name of electronic media	Year of incorporation

Counseling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents**)**	
Name of electronic media	Year of incorporation

Course prerequisites: **None**		
Programme:M.Com	Year: 2022	Semester: I
Subject: Entrepreneurship and Small Business Management		
Course Code: M.Com 103	Course Title: Entrepreneurship and Small Business Management	

Course Objectives:

To acquaint a student with conventional as well as contemporary areas in the discipline of commerce.
To enable a student well versed in national as well as international trends.
To enhance the working culture of entrepreneurs
Increasing profitability of the organization with the help of statistical methods.
To ensure the better financial position of organization by effective financial management.
To develop the understanding of futures affecting the business. For the efficient and effective understanding of principles and practice of management.
To find out the appropriate commercial activities with the help of effective communications and research methods.

Course Outcomes:

After studying of this course, learners outcomes are:
CO_1 Become aware of entrepreneurship opportunities available in the society for the entrepreneur.
CO_2 Acquaint them with the challenges faced by the entrepreneur.
CO_3 Develop the motivation to enhance entrepreneurial competency.

Credits: 4	**Type of Course:** Core/Elective (Core)
Category of Course: Compulsory	Value addition/ Skill development
Max. Marks: 70	Min. Passing Marks: 24

(Syllabi should be framed block wise/unit wise; No of blocks and units may change)

Block 1	**introduction**
Unit I	**ENTREPRENEURSHIP**
Unit II	**ENTREPRENEUR**
Unit III	**FUNCTIONS AND TYPES OF ENTREPRENEUR**
Unit IV	**THEORIES OF ENTREPRENEURSHIP**
Block 2	**EDP**
Unit V	**ENTREPRENEURSHIP DEVELOPMENT PROGRAMME**
Unit VI	**ENTREPRENEURSHIP DEVELOPMENT IN INDIA**
Unit VII	**WOMEN ENTREPRENEURSHIP**
Unit VIII	**PROMOTION OF VENTURES**
UNIT IX	**PROJECT MANAGEMENT**
UNIT X	**RAISING FUNDS**
UNIT XI	**LEGAL REQUIREMENTS FOR ESTABLISHMENT OF NEW BUSINESS UNIT**
UNIT XII	**FINANCIAL INSTITUTION'S AID TO ENTREPRENEURS**
UNIT XIII	**NETWORK ANALYSIS**
UNIT XIV	**MARKETING ASSISTANCE TO ENTREPRENEURS**
UNIT XV	**ENTREPRENEURSHIP DEVELOPMENT: INTELLECTUAL PROPERTY RIGHTS AND MSME**
UNIT XVI	**SMALL BUSINESS**
UNIT XVII	**PROJECT BUDGETING/CAPITAL BUDGETING**
UNIT XVIII	**PROJECT CONTROL**
UNIT XIX	**ENTREPRENEURIAL CONSULTANCY**
UNIT XX	**E COMMERCE AND ENTREPRENEURSHIP**

Suggested Text Book Readings: **Entrepreneurship by Dr G.K.Varshney Sahitya Bhawan Publication** **Entrepreneurship and Small Business Management by Jagroop Singh** **Entrepreneurship and Small Business Management by Dr Praveen Agarwal (HINDI) Sahitya Bhawan Publication Agra**
This course can be opted as an elective by the students of following subjects: Any one
Suggested equivalent online courses (MOOCs) for credit transfer: Any course offered in MOOCS/ Swayam Portal conducted by UGC, IIMS or IGNOU shall be consider for the credit transfer. The title of the course must be same as the one in which credit transfer is applied for.

Course prerequisites: **None**		
Programme:M.Com	Year: 2023	Semester: I
Subject: Marketing Management 1		
Course Code: M.Com 104	Course Title: Marketing Management 1	
Course Objectives: To acquaint a student with conventional as well as contemporary areas in the discipline of commerce. To enable a student well versed in national as well as international trends. To enhance the working culture of entrepreneurs by application of principles of management accounting. Increasing profitability of the organization with the help of statistical methods. To ensure the better financial position of organization by effective financial management. To develop the understanding of futures affecting the business. For the efficient and effective understanding of principles and practice of management. To find out the appropriate commercial activities with the help of effective communications and research methods. To ensure the availability of goods and services by use of marketing management principles. To correlation the managerial economics with labor economics and international economics. To operate the enterprises and small business units by effective use of human resource management.		
Course Outcomes: After studying of this course, learners outcomes are: CO_1 Become aware of entrepreneurship opportunities available in the society for the Marketing management . CO_2 Acquaint them with the challenges faced by the marketing managers. CO_3 Develop the motivation to enhance marketing competency.		
Credits: 4		**Type of Course:** Core/Elective (Core)
Category of Course: Discipline Specific Elective Course (DEC)		Value addition/ Skill development
Max. Marks: 70	Min. Passing Marks: 24	
(Syllabi should be framed block wise/unit wise; No of blocks and units may change)		

Block 1	BASICS OF MARKETING
Unit I	INTRODUCTION TO MARKETING
Unit II	MARKETING IN A DEVELOPING ECONOMY
Unit III	MARKETING FOR SERVICES
Unit IV	NEW CONCEPTS OF MARKETING
Block II	MARKETING DIMENSIONS
Unit V	PLANNING MARKETING MIX
Unit VI	MARKET SEGMENTATION
Unit VII	MARKET ORGANIZATION
Unit VIII	MARKETING RESEARCH AND ITS APPLICATION
BLOCK III	CONSUMER BEHAVIOR
UNIT IX	ANALYSIS OF CONSUMER BEHAVIOR
UNIT X	MODELS OF CONSUMER BEHAVIOR

Format of Syllabus for [MBA]: Subject: [Entrepreneurship Development]

Course prerequisites: **None**		
Programme: MBA	Year: 2022	Semester: IV
Course Code: MBA 4.1	Course Title: Entrepreneurship Development	

Course Objectives:

- To understand the concepts of business and its environment.
- To analyse the overall business environment and evaluate its various components in business decision making.
- To discuss the contemporary issues in business.
- To examine and evaluate business in International Environment.
- To qualify Learners to analyse the various aspects, scope and challenges under an entrepreneurial venture
- To explain classification and types of entrepreneurs and the process of entrepreneurial project development.

Course Outcomes:

CO1: Learners will pick up about Foundation of Entrepreneurship Development and its theories.

CO2: Learners will explore entrepreneurial skills and management function of a company with special reference to SME sector

CO3: Learners will identify the type of entrepreneur and the steps involved in an entrepreneurial venture

CO4: Learners will understand various steps involved in starting a venture and to explore marketing methods & new trends in entrepreneurship.

CO5: Understand various schemes supporting entrepreneurship.

Credits: 6	**Type of Course:** Core/~~Elective~~ **(Core)**
Category of Course **(Please mention category of course; It may have more than one option)**	~~Awareness/ life skills / soft skills/ value-added / employability/ entrepreneurship/ skill development/ MOOCs or~~ OER
Max. Marks: 70	Min. Passing Marks: 24

(Syllabi should be framed block wise/unit wise; No of blocks and units may change)

Block 1	**Basic Concepts**
Unit I	Meaning, Definition And Concept Of Enterprise Entrepreneurship And Entrepreneurship Development
Unit II	Evolution Of Entrepreneurship, Theories Of Entrepreneurship, Characteristics And Skills Of Entrepreneurship
Unit III	Concept Of Entrepreneurship Entrepreneur V/S Entrepreneur Entrepreneur V/S Entrepreneurship Entrepreneur V/S Manager
Unit IV	Role Of Entrepreneurship In Economic Development, Factors Affecting Entrepreneurship, Problems Of Entrepreneurship
Block 2	**Entrepreneurial Competency Mobility And Motivation**
Unit V	Meaning And Concept Of Entrepreneurial Competency, Developing Entrepreneurial Competencies Entrepreneurial Culture
Unit VI	Entrepreneur Mobility, Factors Affecting Entrepreneurial Mobility, Types Of Entrepreneurial Mobility
Unit VII	Entrepreneurial Motivation: Meaning And Concept Of Motivation, Motivation Theories
Unit VIII	Entrepreneurship Development Program:Needs An Objective Of EDPs Phases Of EDPs And Evaluation Of EDPs
Block 3	**Role Of Government And Its Organization**

Unit IX	Role Of Government in promoting Entrepreneurship, MSME policy in India
Unit X	Agencies For Policy Formulation And Implementation District Industries Centre(DIC)
Unit XI	Small Industry Service Institute (SISI), Entrepreneurship Development Institute Of India (EDII)
Unit XII	National Institute Of Entrepreneurship And Small Business Development (NIESBUD) National Entrepreneurship Development Board (NEDB)
Unit XIII	Financial Support System: Forms Of Financial Support, Long Term And Short Term Financial Support, Sources Of Financial Support, Development Financial Institutions, Investment Institutions
Block 4	**Women Entrepreneurship**
Unit XIV	Women Entrepreneurship: Meaning, Characteristic features, Problems of Women Entrepreneurship in India, Developing Women Entrepreneurship in India
Unit XV	Concept of Social Enterprise and Social Entrepreneurship, Social Entrepreneurs, Sustainability Issues in Social Entrepreneurship, Rural Entrepreneurship, Family Business
Unit XVI	Entrepreneurship, Concepts of Entrepreneurship Failure, Issues of Entrepreneurial failure, Fading of Entrepreneurial success among once leading corporate groups
Unit XVII	Entrepreneurial resurgence, Reasons of Entrepreneurial Failure, Essentials to Avoid Unsuccessful Entrepreneurship.
Block 5	**Project Management And Evaluation**
Unit XVIII	Forms of Business Ownership, Issues in selecting forms of Ownership
Unit XIX	Environmental Analysis, Identifying problems and opportunities, Defining Business Idea, Planning Business Process,
Unit XX	Project Management: Concept, Features, Classification of projects, Issues in Project Management, Project Identification, Project Formulation, Project Design and Network Analysis.
Unit XXI	Project Evaluation, Project Appraisal, Project Report Preparation, Specimen of a Project Report

Suggested Text Book Readings:

1. S.S. Khanka, 2006, Entrepreneurial Development, S. Chand L td
2. Dr S.S. Khanka, Dr C B Gupta,2022 Entrepreneurship And Small Business Management, Sultan Chand and Sons
3. Neeta Baporikar, (2020)Handbook Of Research On Entrepreneurship Development And Opportunities In Circular Economy, IGI Global
4. Dr A.K Singh (2009), Entrepreneurship Development And Management, Laxmi Publication Pvt ltd
5. Dr O.P Gupta (2021) ,Fundamentals Of Entrepreneurship, SBPD Publishing House

This course can be opted as an elective by the Learners of following subjects: Any one

Suggested equivalent online courses (MOOCs) for credit transfer:

1. https://onlinecourses.nptel.ac.in/noc22_mg81/preview

Electronic media and other digital components in the curriculum:
Choose any one or more than one: (Electronic Media: Audio/Video Lectures, Online Counselling/Virtual Classes/E-Contents/e-SLM/OER/supplementary links for reference/Video Conferencing/Radio broadcast/Web Conferencing/ Other electronic and digital contents**)**

1. https://www.youtube.com/watch?v=Hgj_kRrvbhQ&list=PL7oBzLzHZ1wXW3mtolxV5nIGn48NLKwrb

2. https://www.youtube.com/watch?v=p7vhcob-YkI&list=PLHRLZtgrF2jnPlrlU1k8y8LdLhmm4eaeO 3. https://www.pdfdrive.com/entrepreneurship-development-directorate-of-distance-education-e7748053.html 4. http://www.freebookcentre.net/business-books-download/Entrepreneurial-Development.html

Name of electronic media	Year of incorporation

Note: School may revise list of electronic media and other digital components in the curriculum time to time and shall be updated in website also.