List of Multidisciplinary Courses for Model Curriculum

sl no.	Multidisciplinary Courses
a. 1.	Philosophy of Bhagavad Gita
2.	An Introduction of Public Administration
3.	State Administration
4.	Economics
5.	Vector Borne Diseases and Epidemiology
6.	Vermitechnology
7.	Bio fertilizers and Bio pesticides
8.	History of Science, Technology, and Medicine in India (HISTM)
9.	Organisational Behaviour
10.	Human Rights Education
11.	Environmental Education
12.	Computer Fundamentals
13.	Nano Materials and Applications
14.	Bio Physics
15.	Principles of Human Resource Management
16.	Corporate Social Responsibility
17.	Linear Programing Problem
18.	Numerical Methods
19.	Indian Knowledge System
20.	Biochemistry
21.	Environment al Chemistry
22.	**Tulanatmaka Sahitya(Odia)**
23.	**Kala Bisaya & Sahitya(Odia)**

Philosophy of Bhagavad Gita

Introduction:

This course on the philosophy of the Bhagavad Gita will offer a comprehensive exploration of the profound philosophical and spiritual teachings found within this ancient Indian text, and provide its applications in Modern life situations, particularly when guidance is required for very many problems in life.

Course Outcomes:

- Understanding of the ideal of dharma and its role in a civilized society,
- Understanding of the role and importance of knowledge, action, and devotion in life.
- Knowledge of leading life with a sense of detachment.

Learning Outcome

Unit-I Yoga is to purify our actions, Yoga is to control the mind and senses and Yoga is to link oneself to Supreme with devotion. Yoga is the path of selfless actions without expecting the consequences or results. the spiritual seeker acts according to Dharma (righteousness).

Unit-II An important philosophical concept in Karma yoga, it means to act unselfishly, or without personal gain in mind. When acting out of Nishkama Karma, an individual is acting or acting without any expectation that good will be returned to him/her or without attachment to its fruits.

Unit-III Jnana yoga encourages its adepts to think and speak of themselves in the third person as a way to distance themselves from the Ego and detach their eternal self (atman) from the body-related one (*māyā*).

- **Unit-IV** the Bhagavad Gita places great emphasis on devotion to God. Through devotion, an individual can attain the ultimate truth and realize their unity with the divine. This path of devotion is accessible to all, irrespective of their social standing or spiritual knowledge.

Unit-I:

Dharma:-Varnadharma, Svabhava, Sadharma- Paradharma

Unit-II:

Karma:-Classification of Karma; Sense of Agency, Niṣkāma

Karma, Lokasaṁgraha, Relation between Karma Yoga and Jñāna yoga.

Unit-III:

Jnana:- Distinction between Jnana and Vijñāna. Criteria of True Knowledge (Buddhi Yoga & JñānaYoga), Kṣetra, Kṣetrajña, Puruṣottama.Sāttvika, Rājasika and Tāmasika Jñāna

Unit-IV:

Bhakti Yoga:- Four kinds of devotees, Characteristics of Ideal Bhakti- Saraṇāgati & Prapattikrupa (grace); Relation between Bhakti Yoga & Jñāna Yoga

Prescribed Books

- S. Radhakrishnan, the Bhagavad Gītā (Trs.&Ed.)
- S. C. Panigrahi, the Concept of Yoga in the Gita, Prajnaloka, Puri

Reference Books

- *K. M. Munshi & R. R. Diwakar, Bhagavad Gītā & Modern Life*
- Basanta Kumar Dash, Philosophy of Isopanisad and the Gita, Gyanajuga Publication, Bhubaneswar
- *G. K. Warrier, Śrimad Bhagavad Gītā Bhāsya of Sri Sankarāchārya: (Trs), Advaita Ashram, Ramakrishna Math.*
- *P. N. Srinivasachari, the Ethical Philosophy of Gītā.,*
- *Pandita Nilakantha Das, Srimad Bhagavad Gītā, New Students Store Binod Vihari, Cuttack.*
- *VIharilal Pandits ed., Śrimad Bhagavad Gītā, (Odia) DharmaGrantha Store, Cuttack..*

E- Recourses

1. https://youtu.be/bedsn7xIn0w?si=VW5iQdLgDu5UDhA6
2. https://anubooks.com/uploads/session_pdf/16623612876.pdf
3. https://ijcrt.org/papers/IJCRT2101218.pdf
4. https://youtu.be/HHIv6qJlRjI?si=MML5aslZRwUvE1Rl
5. https://en.wikipedia.org/wiki/Jnana-Vijnana_Yoga
6. https://en.wikipedia.org/wiki/Bhakti_yoga

An Introduction to Public Administration

Course Outcomes:

Students will be able to

- To provide the students a basic understanding of the principles of public administration.
- To know evolution of the discipline and approaches to study public administration
- To understand about organizations in public administration
- To define the concept of public administration and the basic principles of the discipline.
- To explain the difference between Public Administration and Private Administration

Unit 1: Introduction

- Public Administration: Meaning, Nature, Scope & Significance
- Evolution of the Discipline
- Public Administration and Private Administration

Unit 2: Approaches to the study of Public Administration

- Classical Approach: Historical, Legal, Bureaucratic
- Modern Approach: Behavioral, System, Ecological

Unit 3: Organisations and Public Administration

- Formal and informal, Government and Non -Government organizations
- Line, Staff, and Auxiliary Agencies

Unit 4: Principles in Public Administration

- Hierarchy, Unity of Command, Span of Control, Coordination
- Centralization and Decentralization
- Supervision and Delegation

Textbooks:

- ✓ "*Public Administration: Concepts and Theories" by Prof. Ramesh K. Arora and Prof. Rajni Goyal (Publisher: New Age International)*
- ✓ *"Public Administration in India: Theories and Practices" by Dr. Mohit Bhattacharya (Publisher: Prentice-Hall of India)*
- ✓ *RumkiBasu (2004), Public Administration: Concepts and Theories, Sterling Publishers Pvt. Ltd., New Delhi*
- ✓ *Mohit Bhattacharya (1997) Restructuring Public Administration, Jawahar Book Centre, New Delhi.*
- ✓ Reference Books •BidyutChakravorty (2013), Public Administration", Sage, New Delhi. •Amita Singh 2002, "Public Administration: Roots and Wings" Galgotia Publishers, New Delhi • L.D. White (1948) Introduction to the study of Public Administration, New Delhi, Macmillan Publication.

Reference Books:

- ✓ *"Modern Public Administration: Theories and Practices" by Padma Ramachandran (Publisher: PHI Learning Private Limited)*
- ✓ *"Public Administration: Trends, Issues, and Practices" by Dr. B.L. Fadia and Dr. KuldeepFadia (Publisher: SahityaBhawan Publications)*
- ✓ *"Public Administration: Concepts and Cases" by Prof. Hoshiar Singh and Dr. Meenu Agrawal (Publisher: McGraw-Hill Education)*

- ✓ *Dr. VishnooBhagawan, Dr. VidyaBhusan, Dr. VandanaMohala: Public Administration, S.Chand Publishing Ltd.*

State Administration

Course Outcomes:
Students will be able to

- To help the students to understand the relation between Centre and state in Indian federation.
- To gather knowledge about the structural and functional dynamics of State administration.
- Understand the functioning of executive and administrative institutions in a state.
- Explain the structure and function of administrative institutions at state and district level.

UNIT 1: Introduction to State Administration

- Overview of State Administration
- Structure of State Administration

UNIT 2: Executive Power at the State Level

- Role and Responsibilities of the Governor and Chief Minister
- Role of State Cabinet

UNIT 3: State Administration in Odisha

- Line Departments in Odisha
- Chief Secretary, State Secretary and Different departments

UNIT 4: District Administration

- Structure of District administration
- Role of District Collector and Block Development Officer

Text Books:

- ✓ *B.L. Fadia and Kuldeep Fadia (2014), Indian Administration, Sahitya Bhawan, Agra..*
- ✓ *Bidyut Chakrabarty, Prakash Chand (2016), Indian Administration: Evolution and Practice, SAGE Publications, New Delhi.*

Reference Books:

- ✓ *Kuldeep Mathur,(2009),Policy-Making in India: Who Speaks? Who Listens?, Hindustan Publishing corporation.*
- ✓ *Hoshiar Singh and Pankaj Singh (2011), Indian Administration, Pearson, Delhi.*
- ✓ *S.R. Maheswari (2011), Indian Administration, New Delhi, Orient Longman.*
- ✓ *Pratap Bhanu Mehta & Nirja Gopal Jayal (2011), The Oxford Companion to Politics in India, Oxford University Press, New Delhi.*

- ✓ *Padmalaya Mahapatra (2013), Indian Administration: Central – State – District, Gyanayuga, Bhubaneswar*

Economics

Course Objectives

Course Objectives

- To provide knowledge to students about the concepts of Economics dealing with consumer behaviour, producer's strategy, and make them understand regarding the behaviour of firms under different market structures.
- To provide the students with the knowledge of basic concepts of Marco economics and modern tools of Macro-economic analysis.

Course Outcomes

After completing the course, the student shall be able to

- To understand the basic economic concepts like demand, supply, determination of price.
- To Understand how consumer will maximize satisfaction by spending on different goods
- To understand how producer will maximize profit by minimizing the cost.
- To Analyse the behaviour of firms and response of firms to different market situations.
- To understand the different macro-economic issues and analyse the sector specific policies.

Unit-1: Demand, Supply & Consumer Behaviour:

- Concepts Of Demand and Law of Demand, Change in Demand and Change in Quantity Demand, Concepts of Supply and Law of Supply, Change in Supply and Change in Quantity Supply, Market Equilibrium, Elasticity of Demand and Elasticity of Supply.
- Concepts Of Utility, Measurement of Utility, The Indifference Curve, Budget Line, Consumer's Equilibrium, Income and Substitution Effects, Price Consumption Curve (PCC), Income Consumption Curve (ICC), Engel Curve.

Unit-2: Production Function, Cost & Market Structure

Derivation of Production function, Law of Variable Proportion, Isoquants, Producer's Equilibrium, returns to scale, Cost: short run and long run. Different forms of Market, Perfect competition: equilibrium of firm and industry, Monopoly: short run and long run equilibrium, allocative inefficiency and deadweight loss, Monopolistic competition: short run and long run equilibrium, excess capacity, oligopoly market: kinked demand curve.

Unit-3: National Income Accounting

Introduction of different Macro-Economic variables, Concepts of National income, Measurement of National income, Circular Flow of Income and Expenditure in Closed Economy and Open Economy.

Unit-4: National Income Equilibrium & Macro Economic Problems

Consumption Function, APC & MPC, Concept of Investment & Investment Multiplier, Business Cycle and Its Phases, RBI & Monetary Policy. Inflation, Interest Rate, Foreign Exchange Rates and Balance of Payment.

Suggested Readings

- ✓ *Microeconomics: Theory and Applications" by K. N. Modi - published by Kalyani Publishers, Cuttack, Odisha.*
- ✓ *"Principles of Economics" by S. K. Misra and V. K. Puri - published by Himalaya Publishing House, Cuttack, Odisha.*
- ✓ *"Indian Economy: Policies and Performance" by M. L. Jhingan - published by Sultan Chand & Sons, Bhubaneswar, Odisha.*
- ✓ *"Development Economics" by P. T. Joseph - published by VK Publications, Bhubaneswar, Odisha*
- ✓ *Principle of micro economics by Gregory Mankiw*
- ✓ *Advanced economic theory by Dr. H.L Ahuja*
- ✓ *Managerial economics by Dr. D.M Mithani*
- ✓ *Macroeconomics by M.L Jhingan*
- ✓ *Principle of Macroeconomics by Gregory Mankiw*
- ✓ *Economics by Paul Samuelson and William Nordhaus*

Vector Borne Diseases and Epidemiology

Prorogram Outcomes

- The multidisciplinary programme is incorporated for the students to acquire the knowledge on various vector borne disease and their outbreak.
- The students will learn about role of various insects in causal behaviour towards disease manifestation.
- The target learners will be able to understand the concept of disease outbreak, spread and epidemiology.

Course Outcomes:

- Student will be able to understand the concepts of vector borne disease, vectors and host-vector relationship with specificity and their various modes of transmission.
- Target population will learn the types of insect vectors and disease caused by them.
- Students will be able to gain the knowledge on objectives and core functions ofepidemiology.
- Students will gain the in-depth knowledge on epidemiological parameters like communicable and non-communicable disease and about their control measures.

Learning Outcomes:

- Knowledge gain on principles and concepts of vector borne disease.
- Student will be well acquainted with the various types of vectors for causal and spreadof disease.
- Learners will be able to disseminate the gained knowledge on epidemiological functions and significant role in public health management system.
- Students will be able to distinguish and initiate control measures towards various types of communicable and non-communicable diseases.

Unit 1: Insects, Concept of Vectors, Insects as Vectors

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts with reference to feeding habits, Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity, Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera.

Unit 2: Vectors and diseases

Important insect vectors – Mosquitoes, Sandfly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes, Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sandfly, Study of house fly as important mechanical vector, Myiasis, Control of house fly

Unit 3: Epidemiology-an introduction

Definition, Objective and uses and core functions of epidemiology, Epidemiologic approach, Historical evolution of epidemiology, Concept of health and disease, Determinants of health and diseases, Difference

between epidemiology and clinical/preventive medicine, Epidemiology as the cornerstone of public health/health - for example: contribution of Nurses' Health study, British Doctors' study and Framingham Heart Study to public health etc.

Unit 4: Disease types, mode of transmission and management

Difference between infectious and communicable diseases vs. non communicable diseases, Natural history of disease, Chain of infection, Mode and route of transmission of diseases, Meaning of outbreak or epidemic, endemic and pandemic, incubation period, latency period, clinical case, subclinical case, carrier, infectivity, pathogenicity and virulence, theories and principles of causation- epidemiological triad, web of causation, Bradford Hill criteria and Rothman's Causal pies, levels of prevention and modes of intervention.

Text Books

- ✓ *Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malariaand Other Insect Vector Borne Diseases. Wiley-Blackwell*
- ✓ *Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, CambridgeUniversity Press, UK.*

Suggested Readings

- ✓ *Mike Service (2012) Medical Entomology for Students Cambridge University Press;5th edition.*
- ✓ *Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication*
- ✓ *Understanding the fundamentals of Epidemiology- An evolving text. Victor Schoenbackand Wayne B.Rosamond (2000).*
- ✓ *Modern Epidemiology- Kenneth Rothman, Sebastien Haneuse , Timothy L. Lash , Tyler J.VanderWeele (2021).*

Vermitechnology

Program Outcomes

- The students will gain the knowledge on methods of vermin culture and itseconomic importance.
- Students will well acquaint with usefulness of various species of earthworms andtheir life cycles.
- The target learners will gain knowledge on earthworm farming and practices ofvermicomposting and its applications.

Course Outcomes

- Gain basic knowledge on history of vermicomposting and its technology of biotransformation of anthropogenic residues.
- Understand the role and importance of earthworms maintaining soil texture andtheir types, reproduction and life cycle.
- Get acquainted with small scale earthworm farming and types ofvermicomposting practices in Odisha.
- Gain knowledge on application and economic importance of vermicomposting, and learn the characteristics of earthworm suitability.

Learning Outcomes

- Strengthens student's knowledge on vermin culture and its importance of four R`s (i.e. reduce, reuse, recycle and restore).
- Gain knowledge on identifying utility of key species of earthworms towardsproduction of good quality vermin compost.
- Gain knowledge on vermin composting methods in Odisha.
- Disseminate knowledge on benefits of vermicomposting in various sectors.

Unit 1: Introduction to vermin culture

Definition, meaning, history, economic importance, value in the maintenance of soil structure, role as four R's of recycling (reduce, reuse, recycle and restore). Role in bio- transformation of the residues generated by human activity and production of organic fertilizers; matter and humus cycle (product, qualities); ground population, transformation process in organic matter; useful species of earthworms, local and exotic species; complementary activities of auto-evaluation; key to identify the species of earthworms.

Unit 2: Biology of *Eisenia fetida* and *Eudrilus eugeniae*

Taxonomy Anatomy, physiology and reproduction of Lumbricidae and Eudrilidae; life cycle of *Eisenia fetida* and *Eudrilus eugeniae*: alimentation, fecundity, annual reproducer potential and limit factors (gases, diet, humidity, temperature, pH, light, and climatic factors); complementary activities of auto evaluation.

Unit 3: Vermicomposting

Small-scale earthworm farming for home gardens - earthworm compost for home gardens; conventional commercial composting - earthworm composting larger scale (pit, brick and, heap systems, and Kadapa slab method); types of vermicomposting practised in Odisha; earthworm farming, extraction (harvest), vermicomposting harvest and processing; products; vermiwash collection, composition and use; enemies of earthworms, sickness and worm's enemies; frequent problems – prevention and fixation; complementary activities of autoevaluation.

Unit 4: Applications of vermiculture

Benefits of vermicompost, use of vermicompost in agriculture; basic characteristics of earthworm suitable for vermicomposting; problems in vermicomposting, vermicomposting of dairy waste; economics and marketing of vermicompost and vermi wash.

Text Books

- ✓ *Bhatt J.V. & S.R. Khambata (1959) "Role of Earthworms in Agriculture" Indian Council of Agricultural Research, New Delhi*
- ✓ *Edwards, C.A. and J.R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd., London.*
- ✓ *Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use" Academic Press, Sydney.*
- ✓ *Dash, M.C., B.K. Senapati, P.C. Mishra (1980) — Verms and Vermicomposting¦ Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, Jyoti Vihar, Orissa.*
- ✓ *Wallwork, J.A. (1983) "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.*
- ✓ *Kevin, A and K.E.Lee (1989) "Earthworm for Gardeners and Fisherman" (CSIRO, Australia, Division of Soils).*
- ✓ *Satchel, J.E. (1983) —Earthworm Ecology Chapman Hall, London.*

BIOFERTILIZERS AND BIOPESTICIDES

Unit 1 Biofertilizers

- General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.
- SymbioticN2ixers:Rhizobium -Isolation,characteristics,types,inoculum production and field application, legume/pulses plants.
- Frankia - Isolation, characteristics, Alder, Casurina plants, non-leguminous crop
- symbiosis.
- Cyanobacteria, Azolla - Isolation, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.

Unit 2 Non - Symbiotic Nitrogen Fixers, Phosphate Solubilizers and Mycorrhizal Biofertilizers

- Free living Azospirillum, Azotobacter - free isolation, characteristics, mass inoculums, production and field application.
- Phosphatesolubilizing microbes - Isolation,characterization,massinoculum production, field application
- Importance of mycorrizal inoculum, types of mycorrhizae and associated plants, Mass inoculums production of VAM, field applications of Ectomycorrhizae and VAM.

Unit 3 Bioinsecticides

General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, Bacillus thuringiensis, production, Field applications, Viruses – cultivation and field applications.

Suggested Readings

- ✓ *Kannaiyan, S. (2003). Bioetchnology of Biofertilizers, CHIPS, Texas.*
- ✓ *Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.*
- ✓ *Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.*
- ✓ *Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.*
- ✓ *Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG*
- ✓ *Aggarwal SK (2005) Advanced Environmental Biotechnology, APH publication.*

History of Science, Technology, and Medicine in India (HISTM)

Course Objectives:

- Students will be able to understand and appreciate those material sciences, medicines, mathematics, and astronomy has a long history in India.
- The emergence of modern science and scientism has led to the emergence of hegemonic knowledge disciplinary on account of different pedagogic practices which were fundamentally different from the pedagogic practices.
- While ancient knowledge system emphasises on illumination based on mediation and reflexive quest and learning, the modern scientism emerges from the emergence of the western knowledge system that recognises sensory experiences as the only basis of knowledge formation.
- Students will be encouraged to read Sulabhsutras, Charakasamhita, modern analysis of ayurveda and material sciences advancement in pre-colonial India.

Course Outcomes:

- Appreciate the indigenous knowledge base of India.
- Develop a critical aptitude to analyse ancient texts such as Sulabhsutras, Charaka Samhita and appreciate their nature.
- Recognize the difference between western approach and Indian approach to body and mind.
- Understand and appreciate the approaches of HISTEM.

Unit I: Introduction:

1. What is Science? Traditions of Gyan, Vigyan, and Ilma, in Pre-Modern India
2. What is Scientific Revolution? Historiography and Debates
3. Approaches to HISTEM

Unit II: Science and Medicine in Ancient India

1. Diseases and their cure in the Atharvaveda
2. Metal casting in ancient India: Copper, Bronze and Iron
3. Science and technological advancements under the Guptas- Aryabhatta, Varahamihira and Brahmagupta

Unit III: Science, Technology and Medicine in Medieval India

1. Arabic medicine and astronomy in India
2. Boat and Ship-building activities in India:
3. Manufacturing of textile and ceramics in India

Unit IV: Science and Technology in colonial and Post-colonial India

1. Science and the Raj: Policies, Institutions, and Practices
2. Western Medicine: Practitioners, Epidemics, and Challenges of Public Health
3. Science and the Indian Awakening: Mahendralal Sarkar, Prafulla Chandra Ray, Jagdish Bose, CV Raman, and others.

Unit I:

Students will learn and realise that Science can be studied historically, and in fact, how most of the science that they read in their school and early college curriculum was, in fact, history of science. They will be introduced to tools and techniques to do History of Science from an outsiders' perspective.

Unit II:

Students will learn about the tradition of medicine and technological advances in early India. By doing so they will realise that every society in some way is a society based on science. This will also help in dispelling the myth that the pursuits of science and technology are only a modern activity.

Unit III:

Continuing the discussion of Unit II, students will learn about the similar themes and tropes in Unit III, by focussing on Medieval India.

Unit IV:

In Unit IV, students will learn about the shaping of modern science with the advent of industrialization and colonialism. How modern science played a key role in the making of the modern nation-state?

Suggested Readings:

- ✓ *Deepak Kumar, Science and the Raj (Delhi, 1995)*

- ✓ *DM Bose, SN Sen, and BV Subbarayappa (eds.), A Concise History of Science in India (New Delhi, 1971)*
- ✓ *Zaheer Baber, The Science of Empire: Scientific Knowledge, Civilisation, and Colonial Rule in India (Delhi, 1998)*
- ✓ *Deepak Kumar, Science and Empire: Essays in the Indian Context: 1700-1947 (Delhi, 1992)*
- ✓ *David Arnold, Science, Technology, and Medicine in Colonial India (Cambridge: 2004)*
- ✓ *Dhruv Raina, Images and Contexts: The Historiography of Science and Modernity in India, Oxford University Press: Delhi, 2003*

Reference Reading

- ✓ *Debiprasad Chattopadhyaya (ed.), Studies in the History of Science in India, (New Delhi: 1982)*
- ✓ *Rahman on 'Science and Technology in Medieval India' (pp. 805-815) in DebiprasadChattopadhyaya (ed.), Studies in the History of Science in India, (New Delhi: 1982)*
- ✓ *Bridget Allchin, Origins of a Civilization: The Prehistory and Early Archaeology of South Asia. New Delhi and New York: Viking, 1997.*
- ✓ *HC Bhardwaj, Aspects of Ancient Indian Technology, Motilal Banarasi Das, Varanasi, 1979.*
- ✓ *Irfan Habib, Technology in Medieval India, c. 650-1750, (Tulika Books)*

Internet Resources

1. Consult different issues of *Journal of Science and Technology in India*, published by National Academy of Sciences, India. Example: https://nasi.org.in/wp-content/uploads/2020/08/Journey-of-Science-Technology-in-India-A-Historical-Perspective.pdf

Activities to Do

1. Collection and compilation of the names of scientists and their contribution in every period of history of India. Moreover, collating the information with already published compendiums.

Collection and compilation of photographs of scientists and their different writings from every period of history of India

Nano Materials and Applications (3 credits)
Theory: 2 credits

CO-1: Basic understanding of nanostructured shape, application of Schrodingerequation in nanostructured

CO-2: Understanding of nanomaterial synthesis
CO-3: Understanding of nanomaterials different Characterization

CO-4: Understating of different optical properties of nanomaterials

CO-5: Apply the above concepts in Experiments

UNIT 1: NANOSCALE SYSTEMS:

Length scales in physics, Nanostructures: 1D, 2D and 3Dnanostructures (nano dots, thin films, nanowires, nano rods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences. (10 Lectures)

UNIT 2:

SYNTHESIS OF NANOSTRUCTURE MATERIALS: Top down and Bottom up approach Photolithography. Ball milling. Gas phase condensation. Vacuum deposition Physical vapordeposition (PVD): Thermalevaporation-beam evaporation, Pulsed Laser deposition Chemical vapor deposition (CVD). Sol-Gel. Electro deposition. Spray pyrolysis. Hydrothermalsynthesis. Preparation through colloidal methods. MBE growth of quantum dots. (8 Lectures)

UNIT 3:

CHARACTERIZATION: X-Ray Diffraction.OpticalMicroscopy.Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning TunnelingMicroscopy. (8 Lectures)

UNIT 4:

OPTICAL PROPERTIES: Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particlesand excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging effects. Radiative processes: General formalization-absorption, emission and luminescence. Optical properties of heterostrctures and nanostructures. (14

Lectures)

Reference books:

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company)
3. K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology(PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
5. M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook(Elsevier, 2007).
6. Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin, 2004).

LABORATORY: 1 credit

1. Synthesis of metal nanoparticles by chemical route.
2. Synthesis of semiconductor nanoparticles.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.4. XRD pattern of nanomaterials and estimation of particle size.
5. 5. To study the effect of size on color of nanomaterial.6. Growth of quantum dots by thermal evaporation.
7. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and studytransmittance spectra in UV-Visible region.

Reference Books:

1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
3. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience & Technology(PHI Learning Private Limited).
4. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

BIO PHYSICS

CO-1: Basic fundamentals of living organism and its interactions in domains of Physics inbiology
CO-2: Understating of heat transfer in biomaterials and its mechanism CO-3: Diversifying of thermal, statistical physics in biological domain.
CO-4 : Understating fluid mechanisms in living organism in the domain of Physics

UNIT 1:

Building Blocks & Structure of Living State: Atoms and ions, molecules essential for life, what is life.Living state interactions: Forces and molecular bonds, electric &thermal interactions, electric dipoles,casimir interactions, domains of physics in biology. (18Lectures)

UNIT 2:

Heat Transfer in biomaterials: Heat Transfer Mechanism, The Heat equation, Joule heating of tissue. Living State Thermodynamics: Thermodynamic equilibrium, first law of thermodynamics and conservation of energy. Entropy and second law of thermodynamics, Physics of many particle systems, Two state systems, continuous energy distribution, Composite systems, Casimir contribution of free energy, Protein folding and unfolding. (19 Lectures)

UNIT 3:

Open systems and chemical thermodynamics: Enthalpy, Gibbs free energy and chemical potential, activation energy and rate constants, enzymatic reactions, ATP hydrolysis & synthesis, Entropy of mixing, the grand canonical ensemble, Hemoglobin. Diffusion and transport Maxwell-Boltzmann statistics, Fick's law of diffusion, sedimentation of Cell Cultures, diffusion in a centrifuge, diffusionin an electric field, Lateral diffusion in membranes, Navier stokes equation, low Reynold's Number Transport, Active andpassive membrane transport. (19 Lectures)

UNIT 4

Fluids: Laminar and turbulent fluid flow, Bernoulli's equation equation of continuity,venture effect, Fluid dynamics of circulatory systems, capillary action. Bioenergetics and Molecular motors: Kinesins, Dyneins,and microtubule dynamics, Brownian motion, ATP synthesisin Mitochondria, Photosynthesis in Chloroplasts, Light absorption in biomolecules, vibrational spectra of bio-biomolecules. (19 Lectures) *Reference Books:*

1. Introductory Biophysics, J. Clay comb, JQP Tran, Jones & Bartelett Publishers2. Aspects of Biophysics, Hughe S W, John Willy and Sons.
3. Essentials of Biophysics by P Narayanan, New Age International

Introduction to Spectroscopy

CO-1: Basic understanding of atomic models and its spectroscopy nature

CO-2: Conceptual understanding of Spectra of Alkali elementsCO-3: Understating the basic of X-ray and its applications

CO-4: Understating molecular spectroscopy

UNIT 1:

Vector Atomic Model: Inadequacies of Bohr and Bohr-Sommerfeld atomic models w.r.t. spectrum of Hydrogen atom (fine structure of H-alpha line). Modification is due to the finite mass of the nucleus and the Deuteron spectrum. Vector atomic model (Stern-Gerlach experiment included) and physical & geometrical

interpretations of various quantum numbers for single & many valence electron systems. LS & JJ couplings, spectroscopic notation for energy states, selection rules for transition of electrons and intensity rules for spectral lines. Fine structure of H- alpha line based on vector atomic model.(1 0 lectures)

UNIT 2:

Spectra of Alkali & Alkaline Elements: Spectra of alkali elements: Screening constants for s, p, d& amp; f orbitals; sharp, principle, diffuse & amp; fundamental Series; doublet structure of spectra and fine structure of Sodium D line. Spectra of alkaline elements: Singlet and triplet structure of spectra.(6 lectures)

UNIT 3:

X-rays & X-Ray Spectra: Nature & production, Continuous X-ray spectrum & Duane- Hunt' s law, Characteristic X-ray spectrum & Mosley's law, Fine structure of Characteristic X-ray spectrum, and X-ray absorption spectrum.(7 lectures)

UNIT 4:

Molecular Spectra: Discrete set of a molecule's electronic, vibrational and rotational energies. Quantization of vibrational energies, transition rules and pure vibrational spectra. Quantization of rotational energies, transition rules, pure rotational spectra and determination of inter nuclear distance. Basics of UV Visible & photoluminescence spectroscopy (7 lectures)

Reference Books:

1. H.E. White, "Introduction to Atomic Spectra", McGraw Hill, 1934 8.
2. C.N. Banwell, E.M. McCash, "Fundamentals of Molecular Spectroscopy", McGrawHill,2017, 4e 9.
3. R Murugeshan, Kiruthiga Sivaprasath, "Modern Physics", S. ChandPublishing,2019, 18e 10.
4. S.L. Gupta, V. Kumar, R.C. Sharma, "Elements of Spectroscopy", PragatiPrakashan, Meerut, 2015, 27

Organisational Behaviour

Course Objectives:

- To learn the basic concepts of Organizational Behaviour and its applications in contemporaryorganizations
- To understand how individual, groups and structure have impacts on the organizational effectivenessand efficiency.
- To appreciate the theories and models of organizations in the workplace
- To creatively and innovatively engage in solving organizational challenges

Course outcomes (COs)

- To understand the conceptual framework of the discipline of OB and its practical applicationsin the organizational set up
- To deeply understand the role of individual, groups and structure in achieving organizational goalseffectively and efficiently
- To critically evaluate and analyze various theories and models that contributes in the overallunderstanding of the discipline
- To develop creative and innovative ideas that could positively shape the organizations

Unit I Organizational Behavior:

Learning objectives, Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager LEARNING: Nature of learning, How learning occurs, Learning, Theories of learning- Classical conditioning ,Operant conditioning, social learning, cognitive learning & OB Case Study Analysis

Unit II PERSONALITY:

Meaning & Definition, Determinants of Personality, Personality Traits, Personality & OB PERCEPTION: Meaning & Definition, Perceptual process, Importance of Perception in OB MOTIVATION: Nature & Importance, Herzberg's Two Factor theory, Maslow's Need Hierarchy theory, Alderfer's ERG theory Case Study Analysis.

Unit III

- **COMMUNICATION:** Importance, Types, Barriers to communication, Communication as a tool for improving Interpersonal Effectiveness GROUPS IN ORGANISATION: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team
- **Building LEADERSHIP**:
  Leadership & management, Theories of leadership- Trait theory, Behavioural Theory, ContingencyTheory, Leadership & Followership, How to be an Effective

- **Leader CONFLICT**:
  Nature of Conflict & Conflict Resolution TRANSACTIONAL ANALYSIS: An Introduction toTransactional Analysis Case Study Analysis

Unit IV Organizational Culture:

- Meaning & Definition, Culture & Organisational Effectiveness HUMAN RESOURCE MANAGEMENT: Introduction to HRM, Selection, Orientation, Training & Development, Performance Appraisal, Incentives ORGANISATIONAL CHANGE: Importance of Change,

  Planned Change & OB Techniques .
- ORGANISATIONAL DEVELOPMENT: Pre-requisites for OD,OD interventions.

Text Books

- ✓ *Organisation Behaviour- K. Aswathappa- Himalaya Publisher*
- ✓ *Essential of Organisation Behaviour –Robins –PHP*

References

- ✓ *Organisation Theory and behavior - S KGupta& R.Joshi-Kalyani Publishers*

Human Rights Education

COURSE OUTCOMES (COs):

On completion of this course, the learners will be able to:

- Explain the concept and historical evolution of human rights.
- Understand relationship between rights and duties.
- Identify the major international declarations, treaties and covenants governing human rights.
- Summarize the constitutional provisions with regard to fundamental human rights and duties.
- Recognize the importance of various human rights documents
- Exhibit skills for human rights advocacy and lawful protests.

UNIT I: Human Rights and Duties

LO: *Understand human rights and duties.*

- Concept of human rights and duties, concepts of liberty, equality, fraternity and justice
- Classifications of human rights and duties
- Interrelationship of rights and duties.

UNIT II: Constitutional Perspective

LO: *Understand growth and evolution of human rights in both national and international perspectives.*

- Historical evolution of human rights.
- United Nations for Promotion of Human Rights- - Economic and Social Council, ILO, UNESCO, WHO, FAO.
- Human Rights and Duties in India- Fundamental Rights, Directive Principal of State Policy, Fundamental Duties.

UNIT III: Society and Human Rights

LO: *Understand special rights of women and children.*

LO: *Explain roles of NGOs and education in promoting human rights.*

- Rights of Women- physical assault and sexual harassment, domestic violence, violence at work place, remedial measures.
- Rights of Children- child labour, role of trade union in protecting the rights of labourers.
- Role of NGOs and mass media, role of education.

UNIT-IV: Transaction of Human Rights Education

LO: *Explain how human rights can be promoted.*

LO: *Sensitize to the needs of human rights through field visits.*

- Methods of teaching human rights-drama and role play, brainstorming, discussion, seminars and workshops, projects.
- Becoming peace teacher – acquisition of relevant knowledge, attitudes, values and skills.
- Visits to orphanage and old age home, celebration of international days, collecting and displaying human rights materials on bulletin board and organizing debate.

Sample Questions

1. What do you mean by Human Rights? (1 Mark)
2. Mention any two types of Human Rights. (2 Marks, Within 50 words)
3. Discuss the role of NGOs and Mass Media in promotion of human rights.(5 Marks, Within 300 words)
4. Give an account of Rights of women and violence at work place with suitable examples. (8 Marks, Within 500 to 800 words).

Mode of Course Transaction: Seminar, Team Teaching, Dialogue, Peer-Teaching, Collaborative and Cooperative Learning, Field Trip, Concept Mapping, Self-Learning

Suggested Activities

Each student will be required to prepare and submit a report on any one of the following**:**

- Review a secondary class textbook and find out chapters relating to human rights education. Prepare report.
- Organise an awareness in camp on any social issue and prepare report.
- Find out the Constitutional provisions on human rights and duties in India. Write a report by comparing it with other Constitutions.
- Identify a case of child labour/domestic violence or any other social issue in your locality and write a report.

Text Books

- ✓ *Sergio, B. and Ghosh, S. (2009).Teaching of Human Rights. New Delhi: Dominant Publishers and distributors.*
- ✓ *Das, A.K. and Mohanty, P.K.(2007). Human Rights in India. New Delhi: Sarup and Sons.*

Reference Books

- ✓ *Meena, P.K.(2008). Human Rights: Theory and Practice. New Delhi: Murali Lal and Sons.*
- ✓ *Nirmal, C. J. (2002, ed.), Human Rights in India: Historical, Social and Political Perspective. Oxford University Press.*
- ✓ *GUPTA, D.N. and Singh, S. (2003). Human Rights Acts, Statutes and Constitutional Provisions. Kalpaz Publications.*
- ✓ *Agarwal, H. O.(2018). Human Rights. Central Law Publications.*

Web Resources

- **https://www.tandfonline.com/journals/fjhr20#:~:text=The%20International%20Journal%20of%20Human%20Rights%20covers%20an%20exceptionally%20broad.%2C%20class%2C%20refugees%20and%20immigration.**
- **https://link.springer.com/journal/12142?gad_source=1&gclid=Cj0KCQjwudexBhDKARIsAI-GWYVe89d-w2M5Rx6rS6zd81AuBNIDZ7o2uCNox5wiC8v_baX_2QZxTe4aAtgyEALw_wcB**

Environmental Education

Course Learning Outcomes (CLOs)

On completion of the course, the students will be able to

- Understand the natural environment, different cycles related to Ecology & Ecosystem.
- Identity different causes of Environmental Pollution, Climate Change and need for Sustainable Development.
- Acquire comprehensive knowledge about Population Ecology, population Growth and Public Health.
- Learn about Environmental Movements and Laws.
- Acquire the knowledge about State pollution Control Board and Central pollution Control Board.

Unit-I: Introduction to Environment

Learning Outcomes

LO: *Understand basic concepts of Environment , Ecology, Eco-System and Biodiversity.*

- The Environment: Atmosphere, Hydrosphere, Lithosphere, Biosphere.
- Ecology, Ecosystem, major eco-system, Biogeochemical Cycle (Carbon Cycle, Nitrogen Cycle).
- Biodiversity-Values and Services, Global Environmental Issues.

Unit-II: Climate Change and Sustainable Development

Learning Outcomes

LO: *Identify factors of pollution and climate change.*

LO: *Learn basics of wild life conservation and Sustainable Development Goals.*

- Environment Pollution: Air Pollution, Water Pollution, Soil Pollution, Noise Pollution, Thermal Pollution, Radiation Pollution.
- Climate Change, causes and consequences, Natural Resources: Conservation of Natural Resources, Soil Erosion and Conservation.
- Management and Conservation of Wildlife, Sustainable Development and its Goals.

Unit-III: Population and Public Health

Learning Outcomes

LO: *Understand the correlation between population growth and issues of public health.*

LO: *Learn how to manage pandemic in modern times.*

- Population dividend and population liability.
- Population Ecology: Individuals, Species, role of different sector in managing health disaster.
- Population Growth and Control, Community, Urbanization and its effects on Society.
- Communicable Diseases, Non-Communicable Diseases, Transmission and its effects.

Unit-IV: Environmental Movements and Environmental Laws

Learning Outcomes

LO: *Trace environmental movements of India.*

LO: *Understand functions and role of Pollution Control Boards and know the basic laws of India relating to environment.*

- Environmental Movements in India: Grass root Environmental movements in India, Role of women, Environmental Movements in Odisha.
- State Pollution Control Board, Central Pollution Control Board.
- Environmental Laws: Water Act, 1974, Air Act, 1981, The Wildlife (Protection) Act,1972, Environment Protection Act 1986.

Sample Questions

1. What is meant by environment? (1 Mark)
2. Write any two causes of noise pollution. (2 Marks, Within 50 words))
3. Discuss the causes and consequences of climate change (5 Marks, Within 300 words))
4. Critically reflect on the importance and purpose of SDGs with reference to the contemporary society.(8 Marks, 500 to 800 words).

Transaction Mode:

Workshop, ICT-Lab Learning, Lecture method, Seminar, Team teaching, Tutoring, Peer group discussion, Mobile teaching, Self-learning, Collaborative learning, Co-operative learning.

Practical/ Activities

Each student is required to submit Practical/Project report/Assignments selecting any one of the following:

1. Investigation of Major sources of micro- plastic pollutants in urban habitats.
2. Detection and characterisation of major water pollutants in river water.
3. Impact of growing urbanisation on wildlife habitat.

* It will be evaluated by both internal and external examiners.

Text Books

- ✓ *Anubha Kaushik and CP Kaushik, "Perspectives in Environmental Studies", 5th edition,*
- ✓ *2016.*
- ✓ *Benny Joseph, "Environmental studies", 2nd edition, McGraw Hill Education, 2015.*
- ✓ *Basics of Environmental Studies by Dr. N. S. Varandani, Books India Publications.*
- ✓ *Disaster Management by MukeshDhunna, Vayu Education of India, Delhi Publication.*

Reference Books

- ✓ *Dr. M. Chandrasekhar, "A Text book of Environmental Studies", HI-TECH publications,2006.*
- ✓ *Dr. M. Anji Reddy, "A Text book of environmental science and Technology", B S Publications, 2008.*
- ✓ *Dr. K. Mukkanti, "A Text book of Environmental Studies", S.CHAND and Company Ltd, 2009.*
- ✓ *EHILRS and ST, "Text book of Municipal and Rural Sanitation", M.S Hill, 1998.*

- ✓ *C. S. Rao, Wiley Eastern Ltd, "Environmental Pollution Control Engineering", New Age International Ltd, 2001.*
- ✓ *Dr. M. Anji Reddy, "Introduction to Remote Sensing", BS Publications, 2004.*
- ✓ *EHILRS and ST, "Text book of Municipal and Rural Sanitation", M.S Hill, 1998.*
- ✓ *Dr. M. Anji Reddy, "Introduction to Remote Sensing", BS Publications, 2004.*
- ✓ *Environmental Studies by R. Rajagopalan, Oxford University Press Publication.*
- ✓ *Environmental Science by Richard T Wright & Bernard J Nebel, Prentice Hall India Publication.*
- ✓ *Environmental Science by Daniel B Botkin & Edward A Keller, Wiley Publications.*

Computer Fundamentals

Course Objectives:

- Introduce number systems and data representation
- Understand functional units and components of computer
- Introduce the emerging technologies

Learning Outcomes:

Upon completion of this course, students will be able to:

- Understand the basic organization of a computer and the number system
- Learn about the working of commonly used input-output and memory devices
- Understand the role of Operating system and Computer Networks
- Know about some of the emerging computing technologies and web services

UNIT-1:

Computer Basics: Simple Model of a Computer, Characteristics of Computers, Hardware and Software, working of a Computer, Stored Program Concept, Problem Solving with computer: Flowchart, Algorithms, Programming,
Computer Software: Introduction to computer software, classification of computer software, system software, application software, firmware, middleware

UNIT-2:

Input/output Units: Input devices, Output devices, Computer Memory: Introduction, Read Only Memory, Serial Access Memory, Cache memory, primary memory, secondary storage devices, magnetic tapes, hard disks, SSD, optical drives, USB flash drivers, Memory cards, Mass storage devices, Memory Hierarchy.

UNIT-3:

Operating Systems: Definition, Batch Operating System, Multiprogramming Operating System, Time Sharing Operating System, Multiprocessing Operating System. Services of OS.
Computer Networks: Concepts of Networking-LAN, WAN, MAN, Network topologies. Internet and the World Wide Web.

UNIT-4:

Emerging Computing Environments: Peer to Peer Computing, Grid computing, distributed computing, Cloud Computing: Introduction, cloud services, cloud deployment models.
Email, video conferencing, e-Learning, e-Banking, UPI, e-commerce, e-Governance, social networking, emerging computer applications.

Text Book:

- ✓ *Fundamentals of Computers by V Rajaraman 6th edition PHI Learning Private Limited*

Reference Books:

- ✓ *A First Course in Computers by Sanjay Saxena, Vikas Publishing House.*
- ✓ *Computer Fundamentals by Anita Goel, Pearson pub*

Principles of Human Resource Management

Course Objectives:

- Understand HRM Fundamentals
- Master Recruitment and Selection
- Excel in Training and Development

Learning Outcomes:

- Students will articulate the fundamental concepts and scope of HRM.
- Students will demonstrate proficiency in job analysis and description.
- Students will effectively utilize recruitment methods and sources.
- Students will implement diverse training methods and techniques.

Unit I: Introduction to HRM:

Definition, Meaning, Objective and Scope of HRM, Historical Evolution ofHRM, Role of HRM in Organizational Success, HRM Trends and Challenges.

Unit II: Recruitment and Selection:

Job Analysis and Description, Recruitment Methods and Sources,Selection meaning, process, Techniques and Interview process and its limitations**.**

Unit III: Training and Development:

Meaning, Objectives, Importance Training Needs Analysis, TrainingMethods and Techniques, Employee Development Programs, Evaluating Training Effectiveness

Unit IV: Performance Management:

Meaning, Objectives, Importance, Methods of Performance AppraisalSystems, Challenges and best practices in Performance appraisal.

Books Recommended:

- ✓ **T.V. Rao**: A pioneering figure in the field of HRM in India, T.V. Rao has authored several books including "Handbook of Indian Psychology" and "The Future of HRD: Strategies andPractices".
- ✓ **P. Subba Rao**: Author of "Essentials of Human Resource Management and Industrial Relations", Subba Rao's work focuses on HRM practices in the Indian context.
- ✓ **V.S.P. Rao**: Known for his book "Human Resource Management: Text and Cases", V.S.P. Rao's work provides a comprehensive overview of HRM practices with a focus on Indian casestudies.
- ✓ **P. C. Tripathi and P. N. Reddy**: Authors of "Principles of Management", this book covers various management principles including HRM concepts applicable in Indian organizations.

- ✓ **Dipak Kumar Bhattacharyya**: Known for his book "Human Resource Management: Text andCases", Bhattacharyya's work provides insights into HRM practices in Indian organizations through case studies and theoretical frameworks.
- ✓ **N. K. Jain**: Author of "Personnel Management and Human Resource Management", Jain's work explores the evolution of HRM practices in India and their impact on organizational effectiveness.

Model Questions

1. What is HRM?
2. Define job analysis.
3. What is recruitment?
4. Explain the purpose of performance appraisal.
5. Define employee turnover.
6. What is a job description?
7. Define employee engagement.
8. What is the purpose of training programs?

Long Questions

1. Define Human Resource Management and explain its significance in modern organizations.
2. Describe the process of recruitment and its importance in building a capable workforce.
3. Explain the concept of job analysis and its role in effective HRM practices.
4. Discuss the significance of employee training and development in organizational success.
5. Outline the steps involved in the performance appraisal process and its impact on employee performance.

Corporate Social Responsibility

Course Objectives:

- The course aims to define CSR and explore its significance, theoretical foundations, and role in promoting sustainable business practices.

- By integrating CSR into organizational operations, students will develop strategic skills to implement sustainable practices that create value for both the organization and society.

Learning Outcomes:

- By exploring CSR's ethical, social, and economic implications, students will develop a holistic understanding of its importance in fostering corporate responsibility and long-term business success.
- By implementing CSR initiatives that create shared value for the organization and society, students will develop leadership abilities and contribute to building sustainable, resilient businesses.

Unit 1:

Introduction to Corporate Social Responsibility: Definition and Concept of Corporate Social Responsibility (CSR), Historical Evolution of CSR, Importance and Benefits of CSR for Businesses.

Unit 2:

CSR Strategy and Implementation in Organisation: Developing a CSR Strategy: Setting Goals and Objectives, Stakeholder Engagement and Management in CSR, Integration of CSR into Business Operations, Corporate Governance and Ethics in CSR

Unit 3:

CSR Initiatives and Best Practices: Environmental Sustainability Initiatives (e.g., Sustainable sourcing, Renewable energy adoption), Social Impact Initiatives (e.g., Community development programs, Employee volunteering), Ethical Business Practices (e.g., Fair labour practices, Anti-corruption measures), Corporate Philanthropy and Charitable Giving

Unit 4:

CSR Reporting and Accountability: Transparency and Disclosure in CSR Reporting, Global Reporting Initiatives (GRI) Standards, Assurance and Verification of CSR Reports, Stakeholder Communication an Engagement through CSR Reporting

Books recommended

- ✓ ***"Corporate Social Responsibility: Indian Perspectives"*** *by Sanjay K. Agarwal*
- ✓ *"Corporate Social Responsibility in India: Cases and Developments After theLegal Mandate" by Pushpa Sundar*
- ✓ ***"Corporate Social Responsibility in India: An Evaluation"*** *by C. B. Mamoria and Preeti Mamoria*
- ✓ ***"Corporate Social Responsibility: A Case Study Approach"*** *by Satya Ranjan Acharya and Gauri Shankar Gupta*
- ✓ ***"Corporate Social Responsibility: Strategy, Communication, Governance"*** *by André Habisch, Jan Jonker, and Martina Wegner*
- ✓ ***"Strategic Corporate Social Responsibility: Sustainable Value Creation"*** *by David Chandler and William B. Werther Jr.*
- ✓ ***"Corporate Social Responsibility: Readings and Cases in a Global Context"*** *editedby Andrew Crane and Dirk Matten*
- ✓ ***"Business Ethics and Corporate Governance"*** *by A.C. Fernando*

1 Mark Questions:

1. Define CSR in one sentence.
2. Name one theoretical framework of CSR.
3. What is the significance of CSR for businesses?
4. State one principle of CSR reporting.
5. What does GRI stand for in CSR reporting?

2 Marks Questions:

1. Explain the importance of CSR in promoting sustainable business practices.
2. Discuss two stakeholders involved in CSR initiatives.
3. Compare and contrast ethical considerations and corporate governance principles in CSR.
4. Name two benefits of transparent CSR reporting.

5. Briefly explain two emerging trends in CSR reporting.

4 Marks Questions:

1. Analyze the role of CSR in enhancing corporate reputation and brand image.
2. Evaluate the effectiveness of CSR strategies in addressing societal challenges.
3. Discuss four components of an effective CSR reporting framework.
4. Explain how CSR initiatives can create shared value for both organizations and society, providing examples.
5. Critically assess the challenges organizations may face when implementing CSR strategies, proposing solutions for each challenge.

8 Marks Questions:

1. Discuss the evolution of CSR and its theoretical foundations, emphasizing its significance in modern business practices.
2. Evaluate the role of stakeholders in influencing CSR strategies and outcomes, citing examples from real-world cases.
3. Design a comprehensive CSR strategy for a multinational corporation, including goal-setting, stakeholder engagement, and implementation plans.
4. Analyze the impact of CSR reporting on organizational transparency, accountability, and stakeholder trust, providing examples.
5. Propose recommendations for enhancing the effectiveness of CSR reporting practices, considering emerging trends and best practices in the field.

DISCRETE MATHEMATICS

Course Objectives:

The main objectives of this course are to introduce topics and techniques of counting principles, combinatorics, and graph theory to understand problems in almost all areas of knowledge.

Learning Outcomes: On the completion of this course, students will be able to

- Learn core ideas in logic and relations.
- Know the concept of the Pigeon-hole principle and solve recurrence relations.
- Learn lattices and Boolean algebra.
- Get a good knowledge of the basics of Graph theory.

UNIT-I

Propositional logic, proportional equivalences, predicates and quantifiers, nested quantifiers, rules of inference, methods of proof, relations and their properties, n- ary relations and their applications.

UNIT-II

The basic counting principle, The Pigeon-hole principle, generalized permutations and combinations, recurrence relations, counting using recurrence relations, solving linear homogeneous recurrence relations with constant coefficients, generating functions, solving recurrence relations using generating functions.

UNIT-III

Partially ordered sets, Hasse diagram of partially ordered sets, maps between ordered sets, duality principle, lattices, Boolean algebra .

UNIT-IV

Graphs, basic concepts and graph terminology, representing graphs and graph isomorphism, distance in a graph, cut vertices and cut edges, connectivity, Euler and Hamiltonian path, shortest-path problems, planar graphs and graph coloring.

Books Recommended:

- ✓ *Kenneth H. Rosen, Discrete Mathematics and Applications (Sixth Edition), Tata McGraw Hill Publications, 2007.*
- ✓ *Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory (2nd Edition), Pearson Education (Singapore) Pte. Ltd., Indian Reprint 2003.*

Books for Reference:

- ✓ *1. B A. Davey and H. A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.*
- ✓ *2. Rudolf Lidl and Gnter Pilz, Applied Abstract Algebra (2nd Edition), Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.*
- ✓ *3. Kevin Ferland-Discrete Mathematical Structures, Cengage Learning India Pvt. Ltd.,2009.*
- ✓ *Suggested digital platform: NPTEL/SWAYAM/MOOCs*
- ✓ *e-Learning Source http://ndl.iitkgp.ac.in ; http://ocw.mit.edu ; http://mathforum.org*

Course Objective:

Linear Programing

The objective of this course is to familiarize industrial problems to students with various methods of solving linear programming problems, transportation problems, assignment problems and their applications. Also, students will know the application of linear programming method in Game theory.

Learning Outcomes: On the completion of this course, students will be able to

- Know how to solve the two dimensional problems graphically and learn algorithms for higher dimensional problems.
- Know fundamental theorem of duality, dual simplex method and revised simplex algorithm.
- Solve the transportation problems in business sectors and job oriented assignment problems. Also, students will be aware of game theory with different problems and formulation of solutions.
- Design the programing for the linear programing problems which are essential in industrial sectors.

UNIT-I

Introduction to linear programming problems(LPP), solution of LPP by graphical method, canonical forms, theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, two-phase method, Big-M method.

UNIT-II

Duality, formulation of the dual problem, primal-dual relationships, examples, fundamental theorem of duality, dual simplex method, revised simplex method with examples.

UNIT-III

Transportation problem and its mathematical formulation, methods for initial basic feasible solution. Vogel approximation algorithm for solving transportation problem, assignment problems and its mathematical formulation, Hungarian method for solving assignment problem, game theory, formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure and LPP method.

UNIT-IV (PRACTICAL)

Practical / Lab work to be perform in Computer Lab:

Use of computer algebra system (CAS) software: Python/ Sage Math / Mathematica/ MATLAB/ Maple/ Maxima/ Scilab/ R or any other (open source) software etc., for developing at least the following:

1) Graphical method
2) LPP method

3) Two-phase method
4) Primal-dual problem
5) Dual simplex method
6) Revised simplex method
7) Vogel's approximation method
8) Hungarian method for assignment problem
9) Two-person zero-sum game
10) Graphical method for (*2 x m*) and (*n x 2*) games
11) LPP method for (*m x n*) game.

Books Recommended:

- ✓ *Kanti Swarup, Operations Research, Sultan Chand & Sons, New Delhi. Books.*
- ✓ *Hamdy A.Taha, Operations Research: An Introduction (10th edition), Pearson*, 2017

Books For Reference:

- ✓ *Mokhtar S.Bazaraa, John J.Jarvis and Hanif D.Sherali, Linear Programming and Network Flows (2nd edition), John Wiley and Sons, India, 2004.*
- ✓ *Hillier and G.J. Lieberman, Introduction to Operations Research-Concepts and Cases (9th Edition), Tata Mc Graw Hill, 2010.*
- ✓ *G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.*
- ✓ *Suggested digital platform: NPTEL/SWAYAM/MOOCs*
- ✓ *e-Learning Source http://ndl.iitkgp.ac.in ; http://ocw.mit.edu ; http://mathforum.org*

Numerical Methods

Course Objective:

Calculation of error and approximation is necessity in all real life, industrial and scientific computing. The objective of this course is to acquaint students with various numerical methods of finding solution of different type of problems, which arises in different branches of science like locating roots of equations, finding solution of nonlinear equations, systems of linear equations, differential equations, Interpolation, differentiation, evaluating integration.

Learning Outcomes: Completing this course, a student will be able to

- Learn different techniques to find the zeros of algebraic and transcendental equations, numerical solutions of system of equations.
- Get the idea to find the numerical solutions of polynomial equations
- Learn to find the numerical differentiation by means of different operators.
- Learn to find numerical integration which will help to find the numerical solution of ODE and PDE

UNIT-I

Algorithms, convergence, Bisection method, false position method, fixed point iteration method, Newton's method, Secant method. Gauss elimination and Gauss Jordan methods, LU decomposition, Gauss-Jacobi, Gauss-Siedel.

UNIT-II

Lagrange and Newton interpolation: linear and higher order, finite difference operators.

UNIT-III

Numerical differentiation: forward difference, backward difference and central difference operators.

UNIT-IV

Integration: trapezoidal rule, Simpson's rule, Euler's method, Runge-Kutta methods of orders two and four.

Books Recommended:

- ✓ M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 5th Ed.

Books For Reference:

- ✓ *S.S. Sastry, Introductory method for Numerical Analysis, PHI New Delhi, 2012.*
- ✓ *S.D. Conte and Carl De Boor, Elementary Numerical Analysis, Mc Graw Hill,*
- ✓ *e-Learning Source http://ndl.iitkgp.ac.in ; http://ocw.mit.edu ; http://mathforum.org*
- ✓ *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Biochemistry

Course Objectives:

The objective of this course is to familiarize the student with various biomolecules interacting with metal ions, biomolecular catalysis, and to get knowledge about the metabolism of various biomolecules.

Course Outcomes

- Imparting knowledge on various metal ions involved in biological processes.
- Understanding the principle of catalysis and energetics in complex biochemical reactions.
- Understanding of various enzymes and their functions in biology.
- Gaining knowledge on metabolism of dietary and endogenous bio-macromolecules.

Unit-I: Metal ions in biology

General introduction to important metal ions (Na, K, Mg, Ca, Cu, Fe, Zn, Co and Mo) and their functions, passive and active transport processes, Na+ /K+ pump, calcium pump, ionophores. Storage and transport of iron copper and zinc. Siderophores, ferritin and transferrin in regard to iron-storage and transportation. Chemistry of porphyrin, iron porphyrins (heme proteins): hemoglobin (Hb), myoglobin (Mb) and their behavior as oxygen carrier, O2 affinity, cooperativity and Bohr's effect, heme protein as electron carrier with particular reference to cytochrome-c and cytochrome-450, and cytochrome oxidase. Non-heme iron-sulphur protein as electron carrier (rubredoxins and ferredoxin). Non-heme oxygen uptake protein (hemerythrin and hemocyanin). Chemistry of chlorophyll: Photosynthesis, the light and dark reaction.

Unit-II: Biomolecular Catalysis

Metal-activated enzyme and metalloenzyme. Biological significance and mechanistic aspects of carboxypeptidase, carbonic anhydrase, blue-oxidases, non-blue oxidases, superoxide dismutase, Catalases, peroxidases, structure and biological functions of molybdenum nitrogenase.

Unit-III: Basic Bioorganic chemistry

- Basic considerations, proximity effects in organic chemistry, molecular adaptation- Bio-isosterism, molecular recognition at the supra molecular level. Examples of some typical enzyme mechanism: chymotrypsin, ribonuclease, lysozyme. Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, Thiamine pyrophosphate, pyridoxal phosphate, NAD^+, $NADP^+$, FMN, FAD,

lipoic acid, Vitamin B12.

- Mechanism of reactions catalyzed by cofactors. A Nucleophilic displacement on a phosphorous atom, multiple displacement reaction and coupling of ATP cleavage to endergonic processes, transfer of sulphate, addition and elimination reactions, enolic intermediates in the isomerization reactions, β cleavage and condensation, isomerization, rearrangement, carboxylation, decarboxylation.

Unit-IV: Metabolism of biomolecules

Nutritive roles of carbohydrates, lipids, amino acids and proteins and their sources in various foods. Digestion, absorption, transportation and metabolism of carbohydrates (glycolysis, citric acid cycle, glycogenesis, glycogenolysis, gluconeogenesis, hexose monophosphate pathway, Blood sugar level and equilibrium), lipids (oxidation of fatty acids, fatty acid synthesis), proteins (transamination and deamination of protein, urea cycle, nitrogen balance, biosynthesis of proteins) Importance of cholesterol, phospholipids and lipoproteins in human health. Energy metabolism energy requirement, respiratory quotient, calorific value of food, standard calorific content of food types.

Textbooks

- ✓ *A. Das, A. K. Das, Mahua Das, Bioinorganic Chemistry, Books and Allied Pvt. Ltd., 2017.*
- ✓ *P. S. Kalsi and J. P. Kalsi, Bioorganic, Bioinorganic and Supramolecular Chemistry, New Age Publications 3rd Edition 2017*
- ✓ *Bio-organic Chemistry, Harish Kumar and Parmjit S. Panesar, published by Narosa Publishing House Pvt. Ltd., New Delhi, 2012.*

Reference Books:

- ✓ *John E. McMurry and Tadhg P. Begley, The Organic Chemistry of Biological Pathways, 2nd Editions*
- ✓ *Kurt Faber, Bio-transformations in Organic Chemistry, 7th Edition, Springer*
- ✓ *An Introduction to Medicinal Chemistry- Vth Edition Graham L Patrick (Qxford 2013).*
- ✓ *Burger's Medicinal Chemistry & Drug discovery, Vol 1-3, 15th Ed, 2014.*
- ✓ *Bioorganic Chemistry, A chemical Approach to Enzyme action, Hermann Dugas and C. Penny Springer Verlag*

Environmental Chemistry

Course Objectives:

The objectives of a course in environmental chemistry typically aim to provide students with a deep understanding of the chemical processes occurring in the environment and their impacts on ecosystems, human health, and the planet as a whole with a comprehensive understanding of the components and processes of environmental systems, including the atmosphere, hydrosphere, lithosphere, and biosphere, and their interactions. Investigation of the chemical composition of environmental compartments, including the atmosphere (air pollutants), hydrosphere (water pollutants), and lithosphere (soil pollutants), and the sources, fate, and transport of pollutants in these compartments. To examine the chemical properties and toxicological effects of environmental pollutants on ecosystems and human health, including acute and chronic toxicity, bioaccumulation, biomagnification, and risk assessment.

Course outcomes:

- Gain a comprehensive understanding of the chemical processes occurring in the environment, including the sources, fate, and transport of pollutants
- Develop analytical skills in environmental chemistry, and apply a range of analytical techniques for the detection, and characterization of environmental pollutants.
- Aware of global environmental issues and challenges such as climate change, pollution, biodiversity loss, and resource depletion.
- Apply the principles of environmental chemistry for mitigating environmental pollution, promoting environmental conservation, and contributing to the development of environmentally friendly technologies and policies.

UNIT I

Environment Introduction, Composition of atmosphere, vertical temperature, heat budget of the earth atmospheric system, vertical stability atmosphere, Biogeochemical Cycles of C, N, P, S and O. Biodistribution of elements. Hydrosphere Chemical composition of water bodies-takes, streams, rivers and wet lands etc. Hydrological cycle. Aquatic pollution-inorganic, organic, pesticide agricultural, industrial and sewage, detergents, oil spills and oil pollutants. Water quality parameters- dissolved oxygen, biochemical oxygen demand, solids, metals, content of chloride, sulphate, phosphate, nitrate and mocro-organisms. Water quality standards, Analytical methods for measuring BOD, DO, COD, F, oils, metals (As, Cd, Cr, Hg, Pb, Se etc) residual chloride and chlorine demand. Purification and treatment of water.

UNIT II

Soils composition, micro and macro nutrients, pollution-fertilizers, pesticides, plastics and metals, waste treatment Atmosphere Chemical composition of atmosphere-particles, ions and radicals and their formation. Chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S, O and their effect, pollution by chemicals, petroleum, minerals, chlorofluorohydrocarbons. Greenhouse effect, acid rain, air pollution controls and their chemistry. Analytical methods for measuring air pollutants. Continuous monitoring instruments.

UNIT III

Industrial Pollution Cement, Sugar, distillery, drug, paper and pulp, thermal power plants, nuclear power plants, metallurgy. Polymers, drugs etc. Radionuclide analysis. Disposal of wastes and their management.

UNIT IV

Environmental Toxicology, Chemical solutions to environmental problems, biodegradability, principles of decomposition.

Text Books

- ✓ *Environmental Chemistry, A. K. De, Wiley Eastern*
- ✓ *Environmental Chemistry, S.E. Manahan, Lewis Publishers*
- ✓ *Environmental Chemistry with Green Chemistry, A. K. Das, Books & Allied (P) Ltd., Kolkata, 1st Edn, 2010*

References Books

- ✓ *Environmental Chemistry, S.E. Manahan, Lewis Publishers*
- ✓ *Environmental Chemistry with Green Chemistry, A. K. Das, Books & Allied (P) Ltd.,Kolkata, 1st Edn, 2010*
- ✓ *Environmental Toxicology, Ed. J. Rose, Gordon and Breach Science Publication*
- ✓ *Erach Bharucha. Textbook of Environmental Studies, Universities Press, 2005*

- ✓ *Kamra, K. K., and Chand, M. (2007). Basics of Tourism: Theory, Operation and Practise. Pune, India: Kanishka Publishers.*

- ✓ *Milton, D. (1993). Geography of World Tourism. NY, USA: Prentice. Hall.*

- ✓ *Nelson, V. (2017): An Introduction to the Geography of Tourism. NY, USA: Rowman & Littlefield.*

- ✓ *Nigel, D. (2007). Morpeth Religious Tourism and Pilgrimage Festivals Management: An International perspective by CABI. USA: Cambridge.*
- ✓ *Page, S. J. (2011). Tourism Management: An Introduction. USA: Butterworth Heinemann.*
- ✓ *Ritchie, J R Brent and Crouch, Geoffrey I (2003). The competitive destination: a sustainable tourism perspective. CABI Pub*
- ✓ *Robinson, H. A. (1996). Geography of Tourism. London, UK: Macdonald and Evans.*
- ✓ *Weaver, D. (2006) Sustainable Tourism: Theory and Practice. Great Britain, Elsevier*

Tulanatmaka Sahitya(Odia) (It is available in Odia Core Syllabus)

Kala Bisaya & Sahitya(Odia) (It is available in Odia Core Syllabus)